# 1 CHEMICAL REACTIONS AND EQUATIONS

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [I] Questions [2 Marks]**

**1. What is observed after about 1 hour of adding strips of Cu and Al suspended in $FeSO_4$ solution in two beakers. Name the reaction and change observed. Also write the chemical equation.** **[AI Panchkula]**

**Ans.** Put Cu strip in $FeSO_4$ solution. No reaction will take place. Put Al strip in $FeSO_4$ solution. Pale green colour will become colourless and greyish black iron metal will get deposited.

$$2Al(s) + 3FeSO_4(aq) \longrightarrow Al_2(SO_4)_3(aq) + 3Fe(s)$$

It is displacement reaction.

READERS VENUE

**2. What happens when NaCl solution reacts with $AgNO_3$ solution? Name the two types of reaction to which does it belong.** **[CBSE for Blind]**

**Ans.** White precipitate of AgCl is formed.

$$AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$$

It is classified as (*i*) Double displacement reaction

(*ii*) Precipitation reaction.

**Short Answer Type [II] Questions [3 Marks]**

**3. 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for sometime. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction.** **[Delhi]**

**Ans.** Yellowish green chlorine gas with pungent smell will be formed and white AgCl(*s*) will change to grey coloured silver (solid) in sunlight due to photochemical decomposition.

$$2AgCl(s) \xrightarrow[\text{light}]{\text{Sun}} 2Ag(s) + Cl_2(g)$$

**4. Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.** **[Delhi]**

**(*a*) Zinc reacts with silver nitrate to produce zinc nitrate and silver.**

**(*b*) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.**

**Ans.** (*a*) Zinc reacts with silver nitrate to produce zinc nitrate and silver.

$Zn(s) + 2AgNO_3(aq) \longrightarrow Zn(NO_3)_2(aq) + 2Ag(s)$

It is displacement reaction.

(*b*) $2KI(aq) + Pb(NO_3)_2(aq) \longrightarrow PbI_2(s) + 2KNO_3(aq)$

It is double displacement reaction. It is also called precipitation reaction.

**5. On heating blue coloured powder of copper (II) nitrate in a boiling tube, black copper oxide, $O_2$ and a brown gas X is formed.** **[AI Allahabad]**

**(*a*) Identify the type of reaction and the gas 'X'.**

**(*b*) Write balanced chemical equation of the reaction.**

**(*c*) Write the pH range of aqueous solution of the gas X.**

**Ans.** (*a*) This reaction is thermal decomposition reaction. Brown gas is nitrogen dioxide ($NO_2$).

(*b*) $\underset{\text{Copper nitrate (Blue)}}{2Cu(NO_3)_2} \xrightarrow{\text{Heat}} \underset{\text{Copper(II) oxide (Black)}}{2CuO} + \underset{\text{Nitrogen dioxide (Brown)}}{4NO_2} + \underset{\text{Oxygen (Colourless)}}{O_2}$

(*c*) The pH range of aqueous solution of gas 'X' will be 0 to 6.9 i.e., less than 7. It will be between 2 to 3.

**6. (*a*) Classify the following reactions in different types:** **[AI Uttarakhand]**

**(*i*) $AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$**

**(*ii*) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$**

**(*iii*) $2KClO_3(s) \xrightarrow{\text{heat}} 2KCl(s) + 3O_2(g)$**

**(*iv*) $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$**

**(*b*) Translate the following statements into balanced chemical equation:**

**Barium chloride reacts with aluminium sulphate to give aluminium chloride and barium sulphate.**

**Ans.** (*a*) (*i*) Double displacement, (*ii*) Combination

(*iii*) Decomposition (*iv*) Displacement reaction.

(*b*) $3BaCl_2(aq) + Al_2(SO_4)_3(aq) \longrightarrow 3BaSO_4(s) + 2AlCl_3(aq)$

**7. You might have noted when copper powder is heated in a china dish, the reddish brown surface of copper powder becomes coated with a black substance:** **[AI Chandigarh]**

**(*a*) Why has the black substance formed?** **(*b*) What is the black substance?**

**(*c*) Write the chemical equation of the reaction.**

**(*d*) How can the black coating be turned reddish brown?**

**Ans.** (*a*) Copper gets oxidised and black substance is formed.

(*b*) Copper oxide (CuO) is a black substance.

(*c*) $2Cu(s) + O_2(g) \longrightarrow \underset{\text{(Black)}}{2CuO(s)}$

(*d*) Copper oxide reacts with hydrogen to form reddish brown copper metal, on heating.

$$CuO(s) + H_2(g) \xrightarrow{\text{heat}} \underset{\text{(Reddish brown)}}{Cu(s)} + H_2O(g)$$

## Long Answer Type Question [5 Marks]

**8.** **(*a*) What is double displacement reaction? Explain with the help of example.**

**(*b*) A small amount of quick lime is added to water in a beaker:**

**(*i*) Name and define the type of reaction that has taken place.**

**(*ii*) Write balanced equation for the reaction and chemical name of the products formed.**

**(*iii*) List two main observations of reaction.** **[AI Panchkula]**

**Ans.** (*a*) The reaction in which exchange of ions take place between two compounds to form two new compounds is called double displacement reaction, e.g.

$$Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$$

(*b*) (*i*) **Combination reaction:** The reaction in which two or more elements or compounds combine to form new compound is called combination reaction.

(*ii*) $CaO(s) + H_2O(l) \longrightarrow \underset{\text{Calcium hydroxide}}{Ca(OH)_2(aq)}$

(*iii*) • Hissing sound is produced.

• The solution becomes hot because heat is evolved.

READERS VENUE

**9.** **(*a*) Describe the activity to demonstrate decomposition reaction of lead nitrate.**

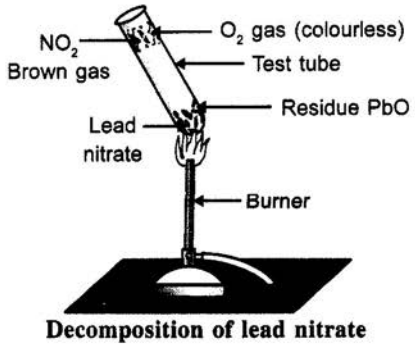
**(*b*) Draw a labelled diagram of experimental set up and list two main observations.**

**(*c*) Write the balanced chemical equation for the reaction stating the physical states of reactants and products.** **[AI Panchkula]**

**Ans.** (*a*) • Take 2g of lead nitrate powder in a test tube.

• Heat it over flame.

• Keep the mouth of test tube away from you and do not inhale brown gas because it is poisonous.




**Decomposition of lead nitrate**

(*b*) **Observations:**

- Emission of brown fumes of $NO_2$.
- Reddish brown colour of residue (PbO).

(*c*) $\underset{\text{Lead nitrate}}{2Pb(NO_3)_2(s)} \xrightarrow{\text{heat}} \underset{\substack{\text{Lead(II)}\\\text{oxide}}}{2PbO(s)} + \underset{\substack{\text{Nitrogen}\\\text{dioxide}}}{4NO_2(g)} + \underset{\text{Oxygen}}{O_2(g)}$

## 2018

### Short Answer Type [II] Questions [3 Marks]

**10. Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity.** **[CBSE]**

**Ans.** (*a*) Decomposition by heat: $CaCO_3 \xrightarrow{\text{heat}} CaO + CO_2$

(*b*) Decomposition by light: $2AgBr \xrightarrow{\text{sunlight}} 2Ag + Br_2$

(*c*) Decomposition by electricity: $2H_2O \xrightarrow{\text{electrolysis}} 2H_2 + O_2$

## 2018 (Compartment)

READERS VENUE

### Short Answer Type [II] Questions [3 Marks]

**11. In the reaction:** **[CBSE]**

$$MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$$

**(*a*) Name the compound (*i*) oxidised, (*ii*) reduced.**

**(*a*) Define oxidation and reduction on its basis.**

**Ans.** (*a*) (*i*) HCl is getting oxidised.

(*ii*) $MnO_2$ is getting reduced.

(*b*) The removal of hydrogen from a substance is called oxidation. The removal of oxygen from a substance is called reduction.

## 2016

### Short Answer Type [II] Questions [3 Marks]

**12. Define the term decomposition reaction. Give one example each of thermal decomposition and electrolytic decomposition.** **[CBSE]**

**Ans.** **Decomposition reaction:** A reaction in which a single compound splits up into two or more simpler substances is called decomposition reaction.

Thermal decomposition: $CaCO_3(s) \xrightarrow{Heat} CaO(s) + CO_2(g)$

Electrolytic decomposition: $2H_2O(l) \xrightarrow{Electricity} 2H_2(g) + O_2(g)$

## 2015

### Short Answer Type [I] Questions [2 Marks]

**13. "We need to balance a skeletal chemical equation." Give reason to justify the statement.** [CBSE]

**Ans.** Skeletal chemical equation is unbalanced. We need to balance chemical equation because of law of conservation of mass. It states that 'matter can neither be created nor be destroyed'. It means the number of atoms in both reactant and product side in a chemical reaction should remain same. Therefore, chemical equation must be balanced in each and every chemical reaction.

**14. Giving an example list two information which make a chemical equation more useful (informative).** [CBSE]

**Ans.** (*i*) Physical state of reactants and products must be mentioned, e.g.

$$CaCO_3(s) + 2HCl(aq) \longrightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$$

(*ii*) Condition in which reaction takes place are written on the arrow head, e.g.

$$6CO_2(aq) + 12H_2O \xrightarrow[Chlorophyll]{Sunlight} C_6H_{12}O_6(aq) + 6O_2(aq) + 6H_2O(l)$$

READERS VENUE

**15. Consider the following chemical reaction** [CBSE]

**X + Barium chloride $\longrightarrow$ Y (White ppt) + Sodium chloride**

**(*a*) Identify 'X' and 'Y'**

**(*b*) The type of reaction**

**Ans.** (*a*) 'X' is $Na_2SO_4$ and Y is $BaSO_4$.

(*b*) It is called double displacement reaction.

$$Na_2SO_4\ (aq) + BaCl_2\ (aq) \longrightarrow \underset{\text{(White ppt)}}{BaSO_4\ (s)} + 2NaCl\ (aq)$$

This reaction is also known as precipitation reaction.

**16. Name the reducing agent in the following reaction:**

$$3MnO_2 + 4Al \longrightarrow 3Mn + 2Al_2O_3$$

**State which is more reactive, Mn or Al and why?** [CBSE]

**Ans.** 'Al' is reducing agent.

'Al' is more reactive than Mn.

$\because$ 'Al' displaces Mn from its oxide.

## Short Answer Type [II] Questions [3 Marks]

**17. Name the type of chemical reaction represented by the following equation:**

**(*i*) $CaO + H_2O \longrightarrow Ca(OH)_2$**

**(*ii*) $3BaCl_2 + Al_2(SO_4)_3 \longrightarrow 3BaSO_4 + 2AlCl_3$**

**(*iii*) $2FeSO_4 \xrightarrow{heat} Fe_2O_3 + SO_2 + SO_3$** **[CBSE]**

**Ans.** (*i*) Combination reaction

(*ii*) Double displacement reaction (Precipitation reaction)

(*iii*) Decomposition reaction.

**18. Write the chemical equation of the reaction in which the following changes have taken place with an example of each:** **[CBSE]**

**(*i*) Change in colour**

**(*ii*) Change in temperature**

**(*iii*) Formation of precipitate**

**Ans.** (*i*) $Cu\ (s) + 2AgNO_3\ (aq) \longrightarrow Cu(NO_3)_2\ (aq) + 2Ag$

The solution will become blue in colour and shiny silver metal will be deposited.

(*ii*) $NaOH + HCl \longrightarrow NaCl + H_2O + heat$

The temperature will increase because heat will be evolved.

(*iii*) $Pb(NO_3)_2\ (aq) + 2KI\ (aq) \longrightarrow \underset{\text{(Yellow ppt)}}{PbI_2\ (s)} + 2KNO_3\ (aq)$

Yellow precipitate of $PbI_2$ will be formed.

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**19. State the type of chemical reactions and chemical equations that take place in the following:**

**(*i*) Magnesium wire is burnt in air.**

**(*ii*) Electric current is passed through water.**

**(*iii*) Ammonia and hydrogen chloride gases are mixed.** **[CBSE]**

**Ans.** (*i*) $2Mg\ (s) + O_2\ (g) \longrightarrow 2MgO\ (s)$

Combination reaction (Redox reaction).

(*ii*) $2H_2O\ (l) \xrightarrow{electrolysis} 2H_2\ (g) + O_2\ (g)$

Electrical decomposition reaction.

(*iii*) $NH_3\ (g) + HCl\ (g) \longrightarrow NH_4Cl\ (s)$

Combination reaction.

**20. (*a*) Write the essential condition for the following reaction to take place:**

**$2AgBr \longrightarrow 2Ag + Br_2$**

**Write one application of this reaction.**

**(*b*) Complete the following chemical equation of a chemical reaction**

**$2FeSO_4 \xrightarrow{heat} Fe_2O_3 +$ _____ + _____**

**(*c*) What happens when water is added to quick line. Write chemical equation.** **[CBSE]**

**Ans.** (*a*) $2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$

Sunlight is essential to decompose silver bromide into metallic silver and bromine gas.

This reaction is used in black and white photography.

(*b*) $2FeSO_4 \xrightarrow{\text{heat}} Fe_2O_3 + SO_2 + SO_3$

(*c*) Slaked lime is formed with hissing sound and lot of heat is evolved.

$CaO + H_2O \longrightarrow Ca(OH)_2 + \text{heat}$

**21. 2 g of ferrous sulphate crystals are heated in a dry boiling tube.**

**(*i*) List any two observations.**

**(*ii*) Name the type of chemical reaction taking place.**

**(*iii*) Write the chemical equation for the reaction.** **[CBSE]**

**Ans.** (*i*) • Green colour of ferrous sulphate crystals disappears and reddish brown solid is formed.

• Smell of burning sulphur is produced.

(*ii*) Decomposition reaction

(*iii*) $2FeSO_4\,(s) \xrightarrow{\text{heat}} Fe_2O_3\,(s) + SO_2\,(g) + SO_3\,(g)$

## Long Answer Type Questions [5 Marks]

**22. (*a*) Define a balanced chemical equation. Why should an equation be balanced?**

**(*b*) Write the balanced chemical equation for the following reaction:**

**(*i*) Phosphorus burns in presence of chlorine to form phosphorus penta- chloride.**

**(*ii*) Burning of natural gas.**

**(*iii*) The process of respiration.** **[CBSE]**

**Ans.** (*a*) It is a chemical equation in which the number of atoms of different elements in the reactant side is equal to that on product side. To obey law of conservation of mass, i.e., mass is neither created nor destroyed, an equation need to be balanced.

(*b*) (*i*) $P_4\,(s) + 10Cl_2\,(g) \longrightarrow 4PCl_5\,(s)$

(*ii*) $CH_4\,(g) + 2O_2\,(g) \longrightarrow CO_2\,(g) + 2H_2O\,(l) + \text{heat energy}$

(*iii*) $C_6H_{12}O_6\,(aq) + 6O_2\,(aq) + 6H_2O(l) \longrightarrow 6CO_2\,(aq) + 12H_2O\,(l) + \text{energy}$

**23. (*a*) Explain two ways by which food industries prevent rancidity.**

**(*b*) Discuss the importance of decomposition reaction in metal industry with three points.** **[CBSE]**

**Ans.** (*a*) (*i*) Rancidity can be prevented by adding antioxidants to food containing fat and oil, e.g. butylated hydroxy anisole (BHA) is added to butter as antioxidant.

(*ii*) It can be prevented by packaging fat and oil containing foods in nitrogen gas.

(*b*) (*i*) Molten NaCl is electrolytically decomposed to form sodium metal.

(*ii*) Aluminium metal is obtained by electric decomposition of bauxite ore mixed with cryolite.

(*iii*) Carbonate ores are thermally decomposed to give metal oxide which on reduction give metal.

## 2014

### Short Answer Type [I] Questions [2 Marks]

**24. What is observed when a solution of potassium iodide solution is added to a solution of lead nitrate? Name the type of reaction. Write a balanced chemical equation to represent the above chemical reaction.** **[CBSE]**

**Ans.** Yellow precipitate of lead iodide is formed. It is precipitation reaction.

$$Pb(NO_3)_2\ (aq) + 2KI\ (aq) \longrightarrow PbI_2\ (s) + 2KNO_3\ (aq)$$

It is also called double displacement reaction.

### Short Answer Type [II] Questions [3 Marks]

**25. Write chemical equation reactions taking place when carried out with the help of**

**(*a*) Iron reacts with steam**

**(*b*) Magnesium reacts with dil HCl**

**(*c*) Copper is heated in air.** **[CBSE]**

**Ans.** (*a*) $3Fe\ (s) + 4H_2O\ (g) \longrightarrow Fe_3O_4\ (s) + 4H_2\ (g)$

(*b*) $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

(*c*) $2Cu + O_2 \xrightarrow{heat} 2CuO\ (s)$

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### Long Answer Type Questions [5 Marks]

**26. (*a*) Write one example for each of decomposion reaction carried out with help of**

**(*i*) Electricity (*ii*) Heat (*iii*) Light**

**(*b*) Which of the following statements is correct and why copper can displace silver from silver nitrate and silver can displace copper from copper sulphate solution.** **[CBSE]**

**Ans.** (*a*) (*i*) $2H_2O\ (l) \xrightarrow{electricity} 2H_2\ (g) + O_2\ (g)$

(*ii*) $CaCO_3\ (s) \xrightarrow{heat} CaO\ (s) + CO_2\ (g)$

(*iii*) $2AgBr\ (s) \xrightarrow{Sunlight} 2Ag\ (s) + Br_2\ (g)$

(*b*) Copper can displace silver from $AgNO_3$ because copper is more reactive than Ag.

$$Cu\ (s) + 2AgNO_3\ (aq) \longrightarrow Cu(NO_3)_2\ (aq) + 2Ag\ (s)$$

## 2013

### Short Answer Type [II] Questions [3 Marks]

**27. Which products will be obtained when lead nitrate is heated simply. Write balanced chemical equation for the reaction? State the type of chemical reaction that occur in the change.** [CBSE]

**Ans.** Lead monoxide, nitrogen dioxide and oxygen gas will be liberated.

$$2Pb(NO_3)_2\ (s) \xrightarrow{\text{heat}} 2PbO\ (s) + 4NO_2\ (g) + O_2\ (g)$$

It is thermal decomposition reaction.

**28. What is meant by skeltal type chemical equation? What does it represent? Using the equation for electrolytic decomposition of water, differentiate between a skeltal chemical equation and a balanced chemical equation.** [CBSE]

**Ans.** The equations in which gaseous elements are written in atomic form instead of molecular form and equation is not balanced, are called skeltal type equation. They represent gaseous elements formed in atomic state and equation is not balanced

$$H_2O \xrightarrow{\text{electrolysis}} H + O \text{ (Skeltal equation)}$$

Hydrogen and oxygen are written in atomic forms and equation is not balanced.

$H_2O \longrightarrow H_2 + O_2$ is also skeltal equation.

$2H_2O \longrightarrow 2H_2 + O_2$ (Balanced chemical equation)

## 2012

READERS VENUE

### Short Answer Type [I] Questions [2 Marks]

**29. Write balanced chemical equations for the following reactions.**

**(*i*) Silver bromide on exposure to sunlight decomposes into silver and bromine.**

**(*ii*) Sodium metal reacts with water to form sodium hydroxide and hydrogen gas.** [CBSE]

**Ans.** (*i*) $2AgBr(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Br_2(g)$

(*ii*) $2Na(s) + 2H_2O(l) \longrightarrow 2NaOH(aq) + H_2(g)$

**30. Identify the type of reaction(s) in the following equations.**

**(*i*) $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$**

**(*ii*) $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$**

**(*iii*) $CaO + H_2O \rightarrow Ca(OH)_2$**

**(*iv*) $CuSO_4 + Zn \rightarrow ZnSO_4 + Cu$** [CBSE]

**Ans.** (*i*) Combination reaction and exothermic reaction.

(*ii*) Double displacement reaction and precipitation reaction.

(*iii*) Combination reaction.

(*iv*) Displacement reaction.

**31. Write balanced equation for the reaction between magnesium and hydrochloric acid. Name the product obtained, identify the type of reaction.** [CBSE]

**Ans.** $Mg(s) + 2HCl(dil.) \longrightarrow MgCl_2(aq) + H_2(g)$

The product formed is magnesium chloride and hydrogen gas.

It is a displacement reaction.

**32. What is the colour of ferrous sulphate crystals? How does this colour change after heating?** [CBSE]

**Ans.** The colour of ferrous sulphate is pale green. The colour changes to reddish brown on heating due to formation of iron (III) oxide.

**33. Give an example each for thermal decomposition and photochemical decomposition reactions. Write relevant balanced chemical equations also.** [CBSE]

**Ans.** **Thermal decomposition reaction:** On heating, copper carbonate (green) decomposes into copper oxide (black) and carbon dioxide.

$$\underset{\text{Copper carbonate (Green)}}{CuCO_3(s)} \xrightarrow{\text{Heat}} \underset{\text{Copper oxide (Black)}}{CuO(s)} + CO_2(g)$$

**Photochemical decomposition reaction:** When white colour silver chloride is exposed to sunlight, it turns grey and decompose to give metallic silver and chlorine gas.

$$2AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl_2(g)$$

**34. Why does the colour of copper sulphate solution change when an iron nail is dipped in it? Write two observations.** [CBSE]

**Ans.** Iron metal is more reactive than copper. Displacement reaction takes place.

Iron displaces copper from copper sulphate solution and forms pale green coloured solution of $FeSO_4$ and reddish brown copper metal gets deposited.

$$Fe(s) + CuSO_4(aq) \rightarrow FeSO_4(aq) + Cu(s)$$

**35. Translate the following statement into chemical equation and then balance it:**

**Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate. State the two types in which this reaction can be classified.**

**Ans.** Skeletal chemical equation. [CBSE]

$$BaCl_2 + Al_2SO_4 \longrightarrow BaSO_4 + 2AlCl_3$$

Balanced chemical equation.

$$3BaCl_2(aq) + Al_2(SO_4)_3(aq) \longrightarrow 3BaSO_4(s) + 2AlCl_3(aq)$$

It can be classified as double displacement as well as precipitation reaction.

**36. Why are decomposition reactions called the opposite of combination reactions? Write equations for these reactions.** [CBSE]

**Ans.** In decomposition reaction, a single compound is splits into two or simpler compounds or elements, e.g.

$$CuCO_3(s) \xrightarrow{\text{heat}} CuO(s) + CO_2(g)$$

Combination reaction is a reaction in which two or more elements or compounds combine to form a new compound, e.g.

$$N_2(g) + 3H_2(g) \longrightarrow 2NH_3(g)$$

Thus, decomposition and combination reactions are opposite to each other.

## Short Answer Type [II] Questions [3 Marks]

**37. The following diagram displays a chemical reaction. Observe carefully and answer the following questions.**

**(*a*) Identify the type of chemical reaction that will take place and define it. How will the colour of the salt change?**

**(*b*) Write the chemical equation of the reaction that takes place.**

**(*c*) Mention one commercial use of this salt.** **[CBSE]**

**Ans.** (*a*) **Photochemical decomposition reaction:** Those reactions in which a compound breaks down into simple substances in presence of light are called photochemical decomposition reaction. The colour of salt will change from white to grey.

(*b*) $2AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl_2(g)$

(*c*) Silver salts are used in black and white photography.

**38. What is rancidity? Mention any two ways by which rancidity can be prevented.** **[CBSE]**

**Ans.** The process in which oxidation of oils or fats in food take place due to which the taste and smell of food gets spoiled is called **rancidity**.

**Prevention from rancidity:**

(*i*) Antioxidants are added to fatty acids to prevent oxidation, e.g. vitamin C, vitamin E, butylated hydroxy anisole (BHA), etc added to foods containing fats.

(*ii*) Chips are packed in presence of nitrogen gas which prevents spoilage by oxidation.

**39. Write balanced chemical equation for the reactions that take place during respiration. Identify the type of combination reaction that takes place during this process and justify the name. Give one more example of this type of reaction.** **[CBSE]**

**Ans.** $$C_6H_{12}O_6(aq) + 6O_2(g) \longrightarrow 6CO_2(g) + 6H_2O(l) + \text{heat energy}$$

It is an exothermic combination reaction because heat is evolved.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O$$

Combustion of methane is another example of exothermic combination reaction.

**40. What is redox reaction? Identify the substance oxidised and the substance reduced in the following reactions.** **[CBSE]**

**(*i*) $2PbO + C \longrightarrow 2Pb + CO_2$**

**(*ii*) $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$**

**Ans.** Those reactions in which oxidation and reduction takes place simultaneously are called redox reactions.

(*i*) PbO is getting reduced and C is getting oxidised.

(*ii*) $MnO_2$ is getting reduced and HCl is getting oxidised.

**41. Write the balanced chemical equations for the following reactions and identify the type of reaction in each case.**

**Thermite reaction, iron (III) oxide reacts with aluminium and gives molten iron and aluminium oxide.** **[CBSE]**

**Ans.** $Fe_2O_3(s) + 2Al(s) \longrightarrow Al_2O_3(s) + 2Fe(l) + \text{heat}$

Iron (III) oxide — Aluminium — Aluminium oxide — Molten iron

It is a displacement reaction because Al is displacing Fe from $Fe_2O_3$.

Molten iron is used for repairing broken railway tracks.

**42. A solution of potassium chloride when mixed with silver nitrate solution, an insoluble white substance is formed. Write the chemical reaction involved and also mention the type of the chemical reaction?** **[CBSE]**

**Ans.** $KCl(aq) + AgNO_3(aq) \longrightarrow AgCl(s) + KNO_3(aq)$

Potassium chloride — Silver nitrate — Silver chloride (White ppt.) — Potassium nitrate

It is a double displacement reaction. It is also a precipitation reaction as AgCl is a white precipitate.

## Long Answer Type Questions [5 Marks]

**43. Describe an activity to observe what happens when quick lime is added to water taken in a beaker. State two important observations and name the type of reaction taking place.** **[CBSE]**

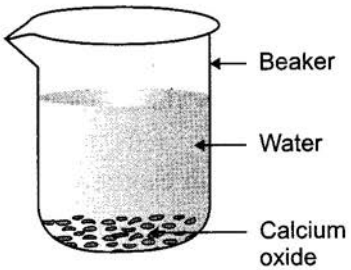
**Ans.** **Aim:** To observe what happens when quicklime is added to water taken in a beaker.

**Materials Required:** Quicklime (calcium oxide), water, beaker.

**Procedure:**

1. Take 5 g of calcium oxide in a beaker.
2. Add water to it slowly.
3. Touch the beaker.
4. Note down the observations.

**Observation:** Calcium oxide reacts with water vigorously to form calcium hydroxide with the evolution of heat.




**Formation of slaked lime by the reaction of quicklime with water**

**Chemical Reaction:**

$$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + \text{Heat}$$

Quicklime — Water — Slaked lime

**Conclusion:** The reaction between CaO (Calcium oxide) and $H_2O$ is a combination reaction. It is an exothermic process because heat is evolved.

## 2011

### Very Short Answer Type Questions [1 Mark]

**44. State one basic difference between a physical change and a chemical change.** [CBSE]

**Ans.** In physical change, no new substance is formed, whereas in a chemical change, new substance(s) is/are formed.

**45. What is meant by a chemical reaction?** [CBSE]

**Ans.** The reaction representing a chemical change is called a chemical reaction.

**46.** $AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s)\downarrow + NaNO_3(aq)$

$FeS + H_2SO_4 \longrightarrow FeSO_4 + H_2S\uparrow$

**Consider the above-mentioned two chemical equations with two different kinds of arrows ( ↑ and ↓ ) along with product. What do these two different arrows indicate?** [CBSE]

**Ans.** ↑ shows the gas is evolved whereas ↓ shows insoluble substance (precipitate) is formed.

**47. Hydrogen being a highly inflammable gas and oxygen being a supporter of combustion, yet water which is a compound made up of hydrogen and oxygen is used to extinguish fire. Why?** [CBSE]

**Ans.** It is because properties of compound ($H_2O$) are different from properties of its constituting elements, i.e. $H_2$ and $O_2$.

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### Short Answer Type [I] Questions [2 Marks]

**48. Using a suitable chemical equation, justify that some chemical reactions are determined by:**

**(*i*) change in colour, (*ii*) change in temperature.** [CBSE]

**Ans.** (*i*) $\underset{\text{Colourless}}{Pb(NO_3)_2(aq)} + \underset{\text{Colourless}}{2KI(aq)} \longrightarrow \underset{\text{Yellow ppt.}}{PbI_2(s)} + 2KNO_3(aq)$

(*ii*) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(s) + \text{heat}$

**49. (*a*) A solution of substance 'X' is used for white washing. What is the substance 'X'? State the chemical reaction of 'X' with water.**

**(*b*) Why does the colour of copper sulphate solution change when an iron nail is dipped in it?** [CBSE]

**Ans.** (*a*) 'X' is calcium oxide (CaO).

$$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + \text{heat}$$

(*b*) It is because iron displaces copper from $CuSO_4$ to form $FeSO_4$ which is pale green.

$$\underset{\text{Blue}}{Fe(s) + CuSO_4(aq)} \longrightarrow \underset{\text{Pale green}}{FeSO_4(aq)} + Cu(s)$$

**50. Balance the following chemical equations.**

(*i*) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + HCl$

(*ii*) $Ca(OH)_2 + HNO_3 \longrightarrow Ca(NO_3)_2 + H_2O$

(*iii*) $Pb(NO_3)_2 \longrightarrow PbO + NO_2 + O_2$

(*iv*) $MnO_2 + HCl \longrightarrow MnCl_2 + H_2O + Cl_2$ **[CBSE]**

**Ans.** (*i*) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

(*ii*) $Ca(OH)_2 + 2HNO_3 \longrightarrow Ca(NO_3)_2 + 2H_2O$

(*iii*) $2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2$

(*iv*) $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$

**51. Write the balanced equation for the following reaction and identify the type of reaction in each case.**

(*i*) **Potassium bromide + Barium iodide ⟶ Potassium iodide + Barium bromide.** **[CBSE]**

(*ii*) **Hydrogen(*g*) + Chlorine(*g*) ⟶ Hydrogen chloride(*g*)**

**Ans.** (*i*) $2KBr(aq) + BaI_2(aq) \longrightarrow 2KI(aq) + BaBr_2(aq)$ (Double displacement reaction)

(*ii*) $H_2(g) + Cl_2(g) \longrightarrow 2HCl(g)$ (Combination reaction)

**52. A zinc plate was put into a solution of copper sulphate kept in a glass container. It was found that blue colour of the solution gets fader and fader with the passage of time. After a few days, when zinc plate was taken out of the solution, a number of holes were observed on it.**

(*i*) **State the reason for changes observed on the zinc plate.**

(*ii*) **Write the chemical equation for the reaction involved.** **[CBSE]**

**Ans.** (*i*) It is because zinc has displaced copper from $CuSO_4$. Zinc metal has been used to form zinc sulphate, therefore, number of holes were observed.

(*ii*) $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$

Blue Colourless

**53. A white salt on heating decomposes to give brown fumes and a residue is left behind.**

(*i*) **Name the salt.**

(*ii*) **Write the equation for the decomposition reaction.** **[CBSE; HOTS]**

**Ans.** (*i*) Lead nitrate is the white salt.

(*ii*) $2Pb(NO_3)_2(s) \xrightarrow{\text{heat}} 2PbO(s) + 4NO_2(g) + O_2(g)$

**54. When a solution of potassium iodide is added to a solution of lead nitrate in a test tube, a reaction takes place.**

(*a*) **What type of reaction is this?**

(*b*) **Write a balanced chemical equation to represent the above reaction.** **[CBSE]**

**Ans.** (*a*) Double displacement as well as precipitation reaction.

(*b*) $Pb(NO_3)_2(aq) + 2KI(aq) \longrightarrow \underset{\text{Yellow ppt.}}{PbI_2(s)} + 2KNO_3(aq)$

**55. Define combination reaction. Give one example of a combination reaction which is also exothermic.** **[CBSE]**

**Ans.** A reaction in which two elements or compounds combine to form a single compound is called combination reaction.

$$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + \text{heat}$$

It is also an exothermic reaction along with a combination reaction because heat is evolved.

## Short Answer Type [II] Questions [3 Marks]

**56. Write balanced equations for the following by mentioning the type of reaction involved.**

**(*i*) Aluminium + Bromine ⟶ Aluminium bromide**

**(*ii*) Calcium carbonate ⟶ Calcium oxide + Carbon dioxide**

**(*iii*) Silver chloride ⟶ Silver + Chlorine** **[CBSE]**

**Ans.** (*i*) Combination reaction

$2Al(s) + 3Br_2(g) \longrightarrow 2AlBr_3(s)$

(*ii*) Thermal decomposition reaction

$CaCO_3(s) \xrightarrow{\text{Heat}} CaO(s) + CO_2(g)$

(*iii*) Photo decomposition reaction

$2AgCl(s) \xrightarrow{\text{Sunlight}} 2Ag(s) + Cl_2(g)$

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**57. (*a*) Why is respiration considered as an exothermic reaction?**

**(*b*) Define the terms oxidation and reduction.**

**(*c*) Identify the substance that is oxidised and reduced in the following reaction.**

**$CuO(s) + Zn(s) \longrightarrow Cu(s) + ZnO(s)$** **[CBSE]**

**Ans.** (*a*) It is because heat is evolved during respiration.

(*b*) Oxidation is a process in which $O_2$ is added or $H_2$ is removed or loss of electrons take place. Reduction is a process in which $H_2$ is added or $O_2$ is removed or gain of electrons take place.

(*c*) Zn is getting oxidised, CuO is getting reduced.

**58. What is meant by**

**(*i*) precipitation reaction,**

**(*ii*) exothermic reaction,**

**(*iii*) oxidation reaction?**

**Write balanced chemical equations for an example of each.** **[CBSE]**

**Ans.** (*i*) **Precipitation reaction:** The reaction in which two compounds exchange their ions and produces a precipitate which is insoluble in water is called precipitation reaction.

$$AgNO_3(aq) + KI(aq) \longrightarrow AgI(s) + KNO_3(aq)$$

(*ii*) **Exothermic reaction:** The reaction in which heat is evolved is known as exothermic reaction.

$$C + O_2 \longrightarrow CO_2 + \text{heat}$$

(*iii*) **Oxidation reaction:** The reaction in which $O_2$ is added or $H_2$ is removed or loss of electrons takes place is called oxidation reaction.

$$2Cu + O_2 \longrightarrow 2CuO$$

**59. You might have noted that when copper powder is heated in a china dish, the surface of copper powder becomes coated with a black colour substance.**

**(*i*) How has this black-coloured substance formed?**

**(*ii*) What is that black substance?**

**(*iii*) Write the chemical equation of the reaction that takes place.** **[CBSE]**

**Ans.** (*i*) Copper reacts with oxygen to form copper oxide which is black, i.e. oxidation of copper takes place.

(*ii*) Copper oxide

(*iii*) $2Cu(s) + O_2(g) \longrightarrow 2CuO(s)$

## Long Answer Type Questions [5 Marks]

**60. (*a*) Classify the following reactions into different types.**

**(*i*)** $\mathbf{AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)}$

**(*ii*)** $\mathbf{CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)}$

**(*iii*)** $\mathbf{2KClO_3(s) \xrightarrow{\Delta} 2KCl(aq) + 3O_2(g)}$

**(*b*) Which of the above reaction(s) is/are precipitation reaction(s)? Why is a reaction called precipitation reaction?** **[CBSE]**

**Ans.** (*a*) (*i*) Precipitation reaction (Double displacement reaction)

(*ii*) Combination reaction

(*iii*) Decomposition reaction

(*b*) Reaction (*i*) is a precipitation reaction because one of the products formed is a precipitate which is insoluble in water.

## 2010

## Very Short Answer Type Questions [1 Mark]

**61. What happens chemically when quicklime is added to water filled in a bucket?** **[CBSE]**

**Ans.** Quicklime reacts with water to form slaked lime and produces lot of heat and hissing sound.

$$\underset{\text{Quicklime (Calcium oxide)}}{CaO(s)} + \underset{\text{Water}}{H_2O(l)} \longrightarrow \underset{\text{Slaked lime (Calcium hydroxide)}}{Ca(OH)_2(s)} + \text{heat} + \text{hissing sound}$$

**62. On what basis is a chemical equation balanced?** [CBSE]

**Ans.** A chemical reaction is balanced on the basis of law of conservation of mass.

**63. What change in colour is observed when white silver chloride is left exposed to sunlight? State the type of chemical reaction in this change.** [CBSE]

**Ans.** Silver chloride becomes grey. It is a photochemical decomposition reaction.

**64. Write a balanced chemical equation for the reaction between sodium chloride and silver nitrate indicating the physical state of the reactants and the products.** [CBSE]

**Ans.** $AgNO_3(aq) + NaCl(aq) \longrightarrow AgCl(s) + NaNO_3(aq)$

## Short Answer Type [I] Questions [2 Marks]

**65. What happens when an aqueous solution of sodium sulphate reacts with an aqueous solution of barium chloride? State the physical conditions of reactants in which the reaction between them will not take place. Write the balanced chemical equation for the reaction and name the type of reaction.** [CBSE]

**Ans.** White precipitate of barium sulphate is formed.

If both reactants are in solid state, then the reaction will not take place between them.

$$BaCl_2(aq) + Na_2SO_4(aq) \longrightarrow BaSO_4(s) + 2NaCl(aq)$$

It is a double displacement as well as a precipitation reaction.

**66. What is a redox reaction? When a magnesium ribbon burns in air with a dazzling flame and forms a white ash, is magnesium oxidised or reduced? Why?** [CBSE]

**Ans.** The reactions in which oxidation (loss of electrons) and reduction (gain of electrons) take place simultaneously are called redox reactions.

$$\underset{\text{Magnesium}}{2Mg(s)} + \underset{\text{Oxygen}}{O_2(g)} \longrightarrow \underset{\text{Magnesium oxide}}{2MgO(s)}$$

Magnesium is getting oxidised because it is losing electrons to form $Mg^{2+}$ and oxygen is gaining electrons to form $O^{2-}$, therefore it is getting reduced.

**67. Write any two observations in an activity which may suggest that a chemical reaction has taken place. Give an example in support of your answer.** [CBSE]

**Ans.** Any two of these observations will suggest chemical reaction has taken place.

(*i*) Change in state.

(*ii*) Change in colour.

(*iii*) Evolution of gas.

(*iv*) Change in temperature.

For example, lead nitrate is white crystalline solid which on heating gives yellowish brown solid (lead monoxide). A brown gas and a colourless gas is also evolved. It shows chemical reaction has taken place.

$$\underset{\text{(White)}}{2Pb(NO_3)_2(s)} \xrightarrow{\text{heat}} \underset{\text{(Yellowish brown)}}{2PbO(s)} + \underset{\text{(Brown)}}{4NO_2(g)} + \underset{\text{(Colourless)}}{O_2(g)}$$

**68. When the powder of a common metal is heated in an open china dish, its colour turns black. However, when hydrogen is passed over the hot black substance so formed, it regains its original colour. Based on the above information, answer the following questions.**

**(*i*) What type of chemical reaction takes place in each of the two given steps?**

**(*ii*) Name the metal initially taken in the powder form. Write balanced chemical equations for both reactions.** **[CBSE]**

**Ans.** (*i*) In first step, oxidation takes place.

In second step, redox reaction takes place.

(*ii*) Metal in the powder form is copper.

$$2Cu(s) + O_2(g) \longrightarrow 2CuO(s)$$

$$CuO(s) + H_2(g) \xrightarrow{\text{heat}} Cu(s) + H_2O(g)$$

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# 2 ACIDS, BASES AND SALTS

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [I] Questions [2 Marks]**

1. **Out of HCl and $CH_3COOH$, which one is weak acid and why? Explain with the help of example.** **[AI Chandigarh]**

**Ans.** Acetic acid is a weak acid because it has less concentration of $H^+$ or $H_3O^+$.

$$CH_3COOH(l) + H_2O(l) \rightleftharpoons CH_3COO^-(aq) + H_3O^+(aq)$$

**Example:** Zinc granules react with dil. HCl very vigorously and liberate hydrogen gas but in acetic acid, it reacts slowly to liberate $H_2$ gas.

2. **Sodium hydrogen carbonate is basic salt. Justify this statement. How is it converted into washing soda?** **[AI Chandigarh]**

**Ans.** Sodium hydrogen carbonate is salt of strong base NaOH and weak acid $H_2CO_3$, that is why it is basic in nature. When it is dissolved in water, $OH^-$ are more than $H^+$ in aqueous solution.

Sodium hydrogen carbonate, on heating gives sodium carbonate which on crystallisation gives washing soda.

$$2NaHCO_3 \xrightarrow{heat} Na_2CO_3 + CO_2 + H_2O$$

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

3. **Name the acid present in ant sting and gives its chemical formula. Also give the common method to get relief from the discomfort caused by ant sting.** **[AI Uttarakhand]**

**Ans.**
- Methanoic acid (Formic acid), $H-\overset{\overset{O}{\|}}{C}-OH$ is present in ant sting.
- Putting a solution of weak/mild base like baking soda will give relief.

4. **A student prepared solution of (*i*) acid and (*ii*) base in two separate beakers but forgot to label the solutions and litmus paper is not available in the lab. Since both the solutions are colourless, how will you distinguish between the two using (*a*) phenolphthalein (*b*) Methyl orange.** **[AI Uttarakhand]**

**Ans.** (*a*) When we add phenolphthalein to acid, it will be colourless.
If we add phenolphthalein to base, it will turn pink.
(*b*) If we add methyl orange to acid, it will turn red.
If we add methyl orange to base, it will turn yellow.

## Short Answer Type [II] Questions [3 Marks]

**5. Identify the acid and the base from which sodium chloride is obtained. Which type of salt is it? When is it called rock salt? How is rock salt formed?** **[Delhi]**

**Ans.** Acid is HCl (Hydrochloric acid), Base is NaOH (Sodium hydroxide)

$HCl(aq) + NaOH(aq) \longrightarrow NaCl(aq) + H_2O(l)$

It is neutral salt.

It is called rock salt because it is found in the form of rocks.

It is formed by slow evaporation of sea water.

**6. Identify the acid and base which form sodium hydrogen carbonate. Write chemical equation in support of your answer. State whether this compound is acidic, basic or neutral. Also write its pH value.** **[Delhi]**

**Ans.** Acid–$H_2CO_3$, Base–NaOH

$NaOH + H_2CO_3 \longrightarrow NaHCO_3 + H_2O$

This compound is basic in nature because NaOH is strong base and $H_2CO_3$ is weak acid. Its pH is 8.4.

**7. Salt 'P' is commonly used in bakery products, on heating gets converted into another salt 'Q' which is itself used in removal of hardness of water and a gas 'R' is evolved. The gas 'R' when passed through freshly prepared lime water, it turns milky. Identify P, Q, 'R' giving chemical equation for justification of your answer.** **[AI Uttarakhand]**

**Ans.**

$$\underset{\text{'P'}}{2NaHCO_3(s)} \xrightarrow{\text{heat}} \underset{\text{'Q'}}{Na_2CO_3(s)} + \underset{\text{'R'}}{CO_2(g)} + H_2O(l)$$

$$\underset{\text{'Q'}}{Na_2CO_3} + \underset{\text{(hard water)}}{CaCl_2} \longrightarrow CaCO_3(s) + 2NaCl(aq)$$

$$\underset{\text{lime water}}{Ca(OH)_2(aq)} + CO_2(g) \longrightarrow \underset{\text{(white ppt)}}{CaCO_3(s)} + H_2O(l)$$

'P' is $NaHCO_3$ (sodium hydrogen carbonate), used in bakery products, gives $Na_2CO_3$ on heating.

'Q' is $Na_2CO_3$ used in removal of hardness of water containing $Ca^{2+}$ and $Mg^{2+}$.

'R' is $CO_2$ gas which turns lime water milky due to formation of $CaCO_3$.

**8. (*a*) While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?** **[AI Allahabad]**

**(*b*) Dry hydrogen chloride gas does not change the colour of dry litmus paper. Why?**

**Ans.** (*a*) It is because reaction is highly exothermic. If water is added to acid, the bottle or beaker will break due to excess of heat evolved therefore, acid should be added to water very slowly with constant cooling.

(*b*) Dry HCl gas does not form $H^+$ and $Cl^-$, therefore, it does not change colour of dry litmus paper.

**9. How is sodium hydroxide manufactured in industries? Name the process. In this process a gas 'X' is formed as by-product. This gas reacts with lime water to give a compound 'Y', which is used as a bleaching agent in the chemical industry, Identify 'X' and 'Y' and write the chemical equation of the reactions involved.** **[AI Allahabad]**

**Ans.** Sodium hydroxide is obtained by electrolysis of Brine solution (NaCl solution)

$$2NaCl + 2H_2O \xrightarrow{\text{electrolysis}} 2NaOH + H_2 + Cl_2$$

It is also called Chlor-alkali process.

'X' is chlorine. It reacts with lime water to form 'Y' bleaching powder.

$$\underset{\text{(Lime water) 'X'}}{Ca(OH)_2} + Cl_2 \longrightarrow \underset{\text{(Bleaching powder) 'Y'}}{CaOCl_2} + H_2O$$

**10. What are amphoteric oxides? Give an example. Write balanced chemical equations to justify your answer.** **[AI Allahabad]**

**Ans.** Those oxides which can react with acids as well as bases are called amphoteric oxides e.g. $Al_2O_3$, ZnO

$$ZnO + 2HCl \longrightarrow ZnCl_2 + H_2O$$

$$ZnO + 2NaOH \longrightarrow Na_2ZnO_2 + H_2O$$

ZnO reacts with acid as well as base.

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**11. State the effect of concentration of $H^+(aq)$ on the nature of solution. Do basic solutions also have $H^+(aq)$ ions? If yes, then why are these basic?** **[AI Panchkula]**

**Ans.** If $H^+$ conc. is more, pH will be less than 7, solution will be acidic.

If $H^+$ conc. is less, pH will be more than 7, then solution will be basic.

Yes. Basic solutions also have $H^+$ ions.

They are basic because $OH^-$ are more than $H^+$.

**12. Write the chemical formula of washing soda. How can it be obtained from baking soda? List two industries in which washing soda is used for other purpose than washing clothes.** **[AI Panchkula]**

**Ans.** Washing soda – $Na_2CO_3.10H_2O$

It is obtained from baking soda by heating and then recrystallisation.

$$2NaHCO_3(s) \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$$

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

It is used in glass, soap and paper industry.

**13. What happens when $CO_2$ gas is passed through lime water? What will happen when excess of $CO_2$ is passed through lime water? Write chemical reactions involved.** **[CBSE for Blind]**

**Ans.** Lime water will turn milky due to formation of $CaCO_3$, insoluble in water

$$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3(s) + H_2O(l)$$

When excess of $CO_2(g)$ is passed, milkiness disappears due to formation of $Ca(HCO_3)_2$, which is soluble in water.

$$CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_2$$

## Long Answer Type Questions [5 Marks]

**14. Write the main difference between an acid and a base. With the help of suitable examples explain the term neutralisation and the formation of:** **[Delhi]**
**(*i*) acidic, (*ii*) basic and (*iii*) neutral salts**

**Ans.** **Acids** are those substances which give $H^+$ in aqueous solution.
**Bases** are those substances which give $OH^-$ in aqueous solution.
**Neutralisation reaction:** The reaction in which acid reacts with base to form salt and water is called neutralisation reaction, e.g.,

(*i*) $\underset{\text{Weak base}}{NH_4OH} + \underset{\text{Strong acid}}{HCl} \longrightarrow \underset{\text{Acidic salt}}{NH_4Cl} + \underset{\text{Water}}{H_2O}$

(*ii*) $\underset{\text{Weak acid}}{CH_3COOH} + \underset{\text{Strong base}}{NaOH} \longrightarrow \underset{\text{Basic salt}}{CH_3COONa} + \underset{\text{Water}}{H_2O}$

(*iii*) $\underset{\text{Strong base}}{NaOH} + \underset{\text{Strong acid}}{HCl} \longrightarrow \underset{\text{Neutral salt}}{NaCl} + \underset{\text{Water}}{H_2O}$

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## 2018

## Short Answer Type [II] Questions [3 Marks]

**15. 2 mL of sodium hydroxide solution is added to a few pieces of granulated zinc metal taken in a test tube. When the contents are warmed, a gas evolves which is bubbled through a soap solution before testing. Write the equation of the chemical reaction involved and the test to detect the gas. Name the gas which will be evolved when the same metal reacts with dilute solution of a strong acid.** **[CBSE]**

**Ans.** (*a*) Zinc reacts with NaOH to form sodium zincate and hydrogen gas.

$$Zn + 2NaOH \longrightarrow \underset{\text{Sodium zincate}}{Na_2ZnO_2} + \underset{\text{Hydrogen gas}}{H_2}$$

(*b*) When a burning splinter is brought near the gas, the gas will burn with 'pop' sound which shows the gas evolved is hydrogen.

(*c*) Hydrogen gas will be evolved when Zn metal reacts with dilute solution of strong acid.

$$Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4(aq) + H_2\uparrow$$

**16. The pH of a salt used to make tasty and crispy pakoras is 14. Identify the salt and write a chemical equation for its formation. List its two uses.** **[CBSE]**

**Ans.** (*a*) The salt is sodium hydrogen carbonate ($NaHCO_3$) or sodium bicarbonate.

(*b*) Manufacture of baking soda is as follows:

$$NaCl + H_2O + CO_2 + NH_3 \longrightarrow NH_4Cl + NaHCO_3$$

(*c*) **Uses:** (*i*) It is used for making baking powder.

(*ii*) It is used in soda acid fire extinguishers.

(*iii*) It is used as ingredient of antacid. (*any two*)

**Note:** No salt can have pH = 14. It was given wrong in the question paper.

## 2018 (Compartment)

### Short Answer Type [II] Questions [3 Marks]

**17. 1 g of solid sodium chloride is taken in a clean and dry test tube and 2 mL of conc. sulphuric acid is added to it. If the gas evolved is tested first with dry and then with wet blue litmus paper, in which case will the litmus paper change colour? Give reason for your answer. What inference can be drawn about the nature of the gas evolved.** **[CBSE]**

**Ans.** The colour change will observed in wet blue litmus paper because moisture/water is needed for the formation of hydronium ions due to which colour change of litmus paper take place. It shows $HCl(g)$ is acidic in nature.

$$NaCl + H_2SO_4(conc.) \longrightarrow NaHSO_4 + HCl(g)$$

or

$$2NaCl + H_2SO_4(conc.) \longrightarrow Na_2SO_4 + 2HCl(g)$$

**18. (*a*) For the preparation of cakes, baking powder is used. If at home your mother uses baking soda instead of baking powder, how will it affect the taste of the cake and why?**

**(*b*) How is baking soda be converted into baking powder?**

**(*c*) What makes the cake soft and spongy?** **[CBSE]**

**Ans.** (*a*) Baking powder consists of sodium hydrogen-carbonate (baking soda) and tartaric acid. If only baking soda is used in making cake, then sodium carbonate is formed on heating which will give a bitter taste to cake.

(*b*) Baking soda can be converted into baking powder by adding starch and tartaric acid.

(*c*) Sodium hydrogen carbonate gives carbon dioxide ($CO_2$) gas which makes the cakes soft and spongy.

**19. Write the chemical formula of bleaching powder. How is it prepared? Write balanced chemical equation for the reaction involved. Write one important use of bleaching powder.** **[CBSE]**

**Ans.**

- Bleaching powder is $CaOCl_2$.
- It is prepared by reaction of dry slaked lime with dry chlorine gas.

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

- It is used as disinfectant for drinking water.

## 2016

### Short Answer Type [I] Question [2 Marks]

**20. The soil in a field is highly acidic. List any two materials which can be added to this soil to reduce its acidity. Give the reason for your choice.** [CBSE]

**Ans.** (*i*) Lime (CaO) can be added to neutralise acidity.

(*ii*) Chalk ($CaCO_3$) can also be added to neutralise acidity.

It is because CaO and $CaCO_3$ are basic in nature which neutralise acid present in soil.

### Short Answer Type [II] Question [3 Marks]

**21. Answer the following questions:**

**(*i*) Sate the colour of phenolphthalein in soap solution.**

**(*ii*) Name the by - product of chlor-alkali process which is used for the manufacture of bleaching powder.**

**(*iii*) Name one indicator which specifies the various levels of $H^+$ ion concentration.**

**[CBSE]**

**Ans.** (*i*) Pink (*ii*) Chlorine (*iii*) Universal indicator

### Long Answer Type Questions [5 Marks]

**22. (*a*) The pH of soil A is 7.5 while that of soil B is 4.5. Which of the two soils A or B should be treated with powdered chalk to adjust its pH and why?**

**(*b*) Name the chemical which is injected into the skin of a person:**

**(*i*) During an ant's sting**

**(*ii*) During the nettle leaf sting.**

**How can the effect of these stings be neutralised?**

**(*c*) Explain how the pH change in the river water can endanger the lives of aquatic animals like fish?** [CBSE]

**Ans.** (*a*) Soil 'B' is acidic. It should be treated with powdered chalk which is basic so as to adjust its pH.

(*b*) (*i*) Formic acid (HCOOH) (*ii*) Formic acid (HCOOH)

The effect of these stings neutralized by rubbing the skin with mild base like baking soda ($NaHCO_3$).

(*c*) If pH of river water changes, amount of oxygen dissolved in water may decrease. Acidic and basic water is harmful for the survival of aquatic animals like fish.

**23. State reasons for the following statements:**

**(*i*) Stain of curry on a white cloth becomes reddish brown when soap is scrubbed on it and turns yellow again when the cloth in washed with plenty of water.**

**(*ii*) Curd should not be kept in copper or brass vessels. What is done to protect it?**

**[CBSE]**

**Ans.** (*i*) Turmeric reacts with sodium hydroxide present in soap to form red coloured compound. It turns yellow again because sodium hydroxide becomes very dilute on adding lot of water and reaction stops.

(*ii*) Curd contains lactic acid which reacts with copper or brass vessels and taste changes.

Curd should be kept in glass, steel or ceramic container which does not react with lactic acid present in it.

## 2015

### Short Answer Type [I] Questions [2 Marks]

**24. Name the acid present in the following:** [CBSE]

**(*i*) Tomato** **(*ii*) Vinegar** **(*iii*) Tamarind**

**Ans.** (*i*) Oxalic acid (*ii*) Acetic acid (*iii*) Tartaric acid

**25. 15 mL of water and 10 mL of sulphuric acid are to be mixed in a beaker.**

**(*i*) State the method that should be followed with reason.**

**(*ii*) What is this process called?** [CBSE]

**Ans.** (*i*) The acid must be added slowly to water with constant stirring prevent the mixture to be splashed out. The reaction is highly exothermic, therefore, glass container may also break due to excessive heating.

(*ii*) The process is called dilution.

**26. Explain how antacid works.** [CBSE]

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**Ans.** Hyperacidity is caused by excess of hydrochloric acid in stomach. Antacid is basic in nature. Antacids produce bicarbonate ions which neutralises excess of acid and gives relief from pain caused by hyperacidity.

### Short Answer Type [II] Questions [3 Marks]

**27. (*a*) Define olfactory indicators. Name two subtances which can be used as olfactory indicator.**

**(*b*) Choose strong acids from the following:** [CBSE]

$$CH_3COOH,\ H_2SO_4,\ H_2CO_3,\ HNO_3$$

**Ans.** (*a*) Those substances whose smell (odour) changes in acidic or basic solution are called olfactory indicators, e.g. onion and vanilla.

(*b*) $H_2SO_4$ and $HNO_3$ are strong acids.

**28. A white coloured powder is used by doctors for supporting fractured bones.** [CBSE]

**(*a*) Write chemical name and formula of the powder.**

**(*b*) When this white powder is mixed with water a hard solid mass is obtained. Write balanced chemical equation for the change.**

**Ans.** (*a*) Calcium sulphate hemihydrate

$$CaSO_4 \cdot \frac{1}{2}H_2O$$

(*b*) $CaSO_4 \cdot \frac{1}{2}H_2O + \frac{3}{2}H_2O \longrightarrow \underset{\text{Gypsum}}{CaSO_4 \cdot 2H_2O}$

**29. Explain the action of dilute hydrochloric acid on the following with chemical equation:**

**(*i*) Magnesium ribbon** **(*ii*) Sodium hydroxide**

**(*iii*) Crushed egg shells** **[CBSE]**

**Ans.** (*i*) Dilute HCl reacts with magnesium ribbon to form magnesium chloride and hydrogen gas is liberated.

$$Mg\ (s) + 2HCl\ (aq) \longrightarrow MgCl_2\ (aq) + H_2\ (s)$$

(*ii*) Dilute HCl reacts with sodium hydroxide to form sodium chloride and water. It is a neutralisation reaction.

$$NaOH(aq) + HCl(aq) \longrightarrow NaCl(l) + H_2O(l)$$

(*iii*) Crushed egg shells are made up of $CaCO_3$ which reacts with dil. HCl to give brisk effervescence due to $CO_2$.

$$CaCO_3\ (s) + 2HCl(aq) \longrightarrow CaCl_2(s) + H_2O(l) + CO_2(g)$$

## Long Answer Type Questions [5 Marks]

**30. State reason for the following statements:**

**(*i*) Tap water conducts electricity whereas distilled water does not.**

**(*ii*) Dry hydrogen chloride gas does not turn blue litmus red whereas dilute hydrochloric acid does.**

**(*iii*) During summer season, a milk man usually adds a very small amount of baking soda to fresh milk.**

**(*iv*) For a dilution of acid, acid is added into water and not water into acid.**

**(*v*) Ammonia is a base but does not contain hydroxyl group.** **[CBSE]**

**Ans.** (*i*) Tap water contains ions of acids and bases which conduct electricity, whereas distilled water does not contain such ions.

(*ii*) Acids produces ions only in aqueous solution which is responsible to turn blue litmus red. Dry HCl gas has no ions in it.

(*iii*) Baking soda does not allow milk to change to curd which makes milk sour.

(*iv*) Adding water to acid is highly exothermic. Therefore, water is added to acid very slowly with constant stirring.

(*v*) Ammonia dissolves in water and forms $OH^-$. Therefore, it is basic in nature.

$$NH_3 + H_2O \longrightarrow NH_4^+ + OH^-$$

**31. (*a*) Write the chemical formula of hydrated copper sulphate and anhydrous copper sulphate. Giving an activity illustrate how these are interconvertible.**

**(*b*) Write chemical names and formula of plaster of paris and gypsum.** **[CBSE]**

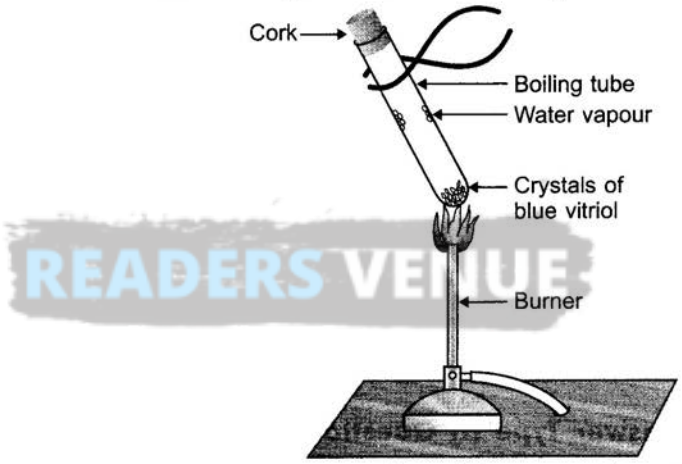
**Ans.** (*a*) $CuSO_4 . 5H_2O$ is hydrated copper sulphate. $CuSO_4$ is anhydrous copper sulphate.

***Aim*** : To show crystalline salts contain water of crystallization.

***Materials Required*** : $CuSO_4.5H_2O$ (Blue vitriol), boiling tube, burner, cork, delivery tube, test tube, clamp stand.

***Procedure*** :

1. Take 2g of $CuSO_4.5H_2O$ in a boiling tube fitted in a clamp stand.
2. Observe its colour. Fit it with cork and delivery tube bent at two right angles which dips into a test tube.
3. Heat crystals in boiling tube.
4. Observe vapours being condensed in test tube.
5. Cool the crystals and add few drops of water into it.




READERS VENUE

***Observation*** : Water vapours get condensed in a test tube and colour of blue crystals changes into white. On adding water to anhydrous copper sulphate it changes into blue again.

***Chemical Reaction*** : $\underset{\text{Blue vitriol}}{CuSO_4.5H_2O} \xrightarrow{\text{heat}} \underset{\text{White}}{CuSO_4} + 5H_2O$

***Conclusion*** : Crystalline substances have water of crystallization which are lost on heating.

When we add water in $CuSO_4$ till a saturated solution is formed, on cooling it gets converted into $CuSO_4.5H_2O$ crystals and it shows that both are interconvertible.

(*b*) **Plaster of Paris:** $CaSO_4.\frac{1}{2}H_2O$; calcium sulphate hemihydrate.

**Gypsum:** $CaSO_4.2H_2O$; calcium sulphate dihydrate.

**32. (*a*) State the chemical properties on which the following uses of baking soda are based:**
**(*i*) as an antacid**
**(*ii*) as a soda acid fire extiguisher**
**(*iii*) to make bread and cake soft and spongy.**
**(*b*) How is washing soda is obtained from baking soda? Write balanced chemical equation.** **[CBSE]**

**Ans.** (*a*) (*i*) It is weakly basic in nature and naturalize hyperacidity.
(*ii*) It liberates $CO_2$ with $H_2SO_4$, which extinguish fire.
(*iii*) It liberates $CO_2$ on heating which makes bread and cake soft and sponge.
(*b*) Sodium carbonate is obtained by heating baking soda. When sodium carbonate is recrystallised by dissolving water in it, washing soda is obtained.

$$2NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + CO_2 + H_2O$$
$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

## 2014

### Short Answer Type [I] Question [2 Marks]

**33. Name the natural source of each of the following acid.** **[CBSE]**
**(*i*) Citric acid.** **(*ii*) Oxalic acid.**
**(*iii*) Lactic acid.** **(*iv*) Tartaric acid.**

**Ans.** (*i*) Lemon and orange. (*ii*) Tomatoes and guava.
(*iii*) Sour milk (curd). (*iv*) Tamarind.

READERS VENUE

## 2013

### Short Answer Type [I] Question [2 Marks]

**34. A student detected the pH of four unknown solution A, B, C and D as follows 11, 5, 7 and 2. Predict the nature of the solution.** **[CBSE]**

**Ans.** 'A' is basic, 'B' is acidic, 'C' is neutral and 'D' is strongly acidic.

### Short Answer Type [II] Question [3 Marks]

**35. (*i*) Give the constituents of baking powder.**
**(*ii*) Why does cake or bread swell on adding baking powder? Write chemical equation.** **[CBSE]**

**Ans.** (*i*) Baking powder contains sodium hydrogen carbonate and tartaric acid.
(*ii*) When baking powder is added to the dough and heated, sodium bicarbonate decomposes to give carbon dioxide which causes cakes or bread to swell.

$$2NaHCO_3\,(s) \xrightarrow{\text{heat}} Na_2CO_3\,(s) + CO_2\,(g) + H_2O\,(l)$$

### Long Answer Type Question [5 Marks]

**36. Equal length of magnesium ribbon are taken in two test tubes 'A' and 'B'. $H_2SO_4$ is added to test tube 'A' and $H_2CO_3$ in the test tube 'B' in equal amounts:**

**(*a*) Identify the test tube showing vigorous reaction.**

**(*b*) Give reason to support your answer.**

**(*c*) Name the gas liberated in both the tubes. How will you prove its liberation?**

**(*d*) Write chemical equations for both reactions.**

**(*e*) Out of the two acids taken above**

**(*i*) which one will have lower pH value.**

**(*ii*) lower $H^+$ concentration respectively.** **[CBSE]**

**Ans.** (*a*) 'A' will show vigorous reaction.

(*b*) It is because $H_2SO_4$ is strong acid.

(*c*) Hydrogen gas will be formed. Bring a burning splinter near the gas. It will burn with 'pop' sound. It shows gas liberated is hydrogen.

(*d*) $Mg + H_2SO_4 \longrightarrow MgSO_4 + H_2$

$Mg + H_2CO_3 \longrightarrow MgCO_3 + H_2$

(*e*) 'A' ($H_2SO_4$) will have lower pH.

'B' ($H_2CO_3$) will have lower concentration of $H^+$.

## 2012

READERS VENUE

### Very Short Answer Type Question [1 Mark]

**37. How will you test for the gas which is liberated when hydrochloric acid reacts with an active metal?** **[CBSE]**

**Ans.** Bring a burning matchstick near the gas. It burns with 'pop' sound showing that it is hydrogen.

### Short Answer Type [II] Questions [3 Marks]

**38. (*a*) Write the name given to bases that are highly soluble in water. Give an example.**

**(*b*) How is tooth decay related to pH? How can it be prevented?**

**(*c*) Why does bee sting cause pain and irritation? Rubbing of baking soda on the sting area gives relief. How?** **[CBSE]**

**Ans.** (*a*) Alkali, e.g. NaOH (Sodium hydroxide).

(*b*) Lower the pH, more will be tooth decay. Acid reacts with enamel made up of $Ca_3(PO_4)_2$ and cause tooth decay.

It can be prevented by brushing teeth with toothpaste after every meal. Toothpaste are generally basic in nature.

(*c*) It is due to formic acid. Sodium hydrogencarbonate (Baking soda) neutralises the formic acid giving relief.

**39. A white powder is added while baking breads and cakes to make them soft and fluffy. Write the name of the powder. Name its main ingredients. Explain the function of each ingredient. Write the chemical reaction taking place when the powder is heated during baking.** **[CBSE]**

**Ans.** Baking powder.

It consists of sodium hyrogencarbonate and tartaric acid.

Sodium hydrogencarbonate gives off $CO_2$ which makes cake soft and fluffy. Tartaric acid neutralizes the bitterness due to sodium carbonate present in it.

$$2NaHCO_3(s) \xrightarrow{\text{heat}} Na_2CO_3(s) + CO_2(g) + H_2O(l)$$

**40. "Sodium hydrogencarbonate is a basic salt." Justify the statement. How is it converted into washing soda? Explain.** **[CBSE]**

**Ans.** Sodium hydrogencarbonate is a salt of sodium hydroxide (strong base) and carbonic acid (weak acid). ∴ It is basic salt.

When baking powder is added to the dough and heated, sodium bicarbonate decomposes to give carbon dioxide which causes cakes or bread to swell.

$$2NaHCO_3(aq) \xrightarrow{\text{heat}} Na_2CO_3 + CO_2 + H_2O$$

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

**41. What are strong and weak acids? In the following list of acids, separate strong acids from weak acids.**

**Hydrochloric acid, citric acid, acetic acid, nitric acid, formic acid, sulphuric acid.** **[CBSE]**

**Ans.** Strong acids are those acids which are completely ionised in aqueous solution. Weak acids are those which do not ionise completely in aqueous solution.

**Strong acid:** Hydrochloric acid, nitric acid and sulphuric acid.

**Weak acid:** Citric acid, acetic acid and formic acid.

## Long Answer Type Questions [5 Marks]

**42. Describe an activity with diagram to illustrate that the reaction of metal carbonates and metal bicarbonates with acids produces carbon dioxide. Write the relevant equations of all the reactions that take place. Name any two forms in which calcium carbonate is found in nature.** **[CBSE]**

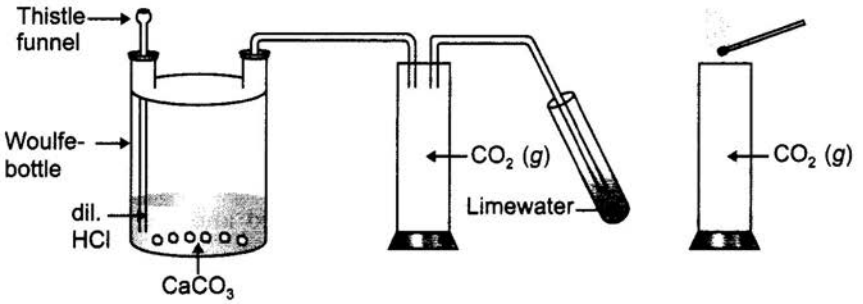
**Ans.** **Aim:** To show acid reacts with metal carbonate to liberate carbon dioxide.

**Materials Required:** $CaCO_3$ (marble chips), Woulfe-bottle, thistle funnel, dil. HCl, gas jar, matchbox, delivery tube bent at two right angles, lime water.

**Procedure:**

1. Take marble chips in a Woulfe-bottle.

2. Set the apparatus as shown in diagram.




**Reaction of calcium carbonate with dilute hydrochloric acid to liberate carbon dioxide gas which turns lime water milky and extinguishes burning matchstick**

3. Add dil. HCl with the help of thistle funnel.
4. Collect the gas in gas jar by upward displacement of air.
5. Bring a burning matchstick near the gas jar and record your observations.
6. Pass the gas evolved through lime water and note down your observations.

**Observations:** The burning matchstick will get extinguished because carbon dioxide is neither combustible nor supporter of combustion. Lime water will turn milky due to formation of insoluble calcium carbonate. It can be used as test for $CO_2$. The chemical reactions taking place are as follows:

$$\underset{\text{Marble (Calcium carbonate)}}{CaCO_3(s)} + \underset{\text{Hydrochloric acid}}{2HCl(dil.)} \longrightarrow \underset{\text{(White ppt.) Calcium chloride}}{CaCl_2(aq)} + \underset{\text{Water}}{H_2O(l)} + \underset{\text{Carbon dioxide}}{CO_2(g)}$$

$$\underset{\text{Lime water}}{Ca(OH)_2(aq)} + \underset{\text{Carbon dioxide}}{CO_2(g)} \longrightarrow \underset{\text{(White ppt.) Calcium carbonate}}{CaCO_3(s)} + H_2O(l)$$

**Conclusion:** Metal carbonates react with dilute acids to liberate carbon dioxide. Limestone, chalk, marble are different forms of calcium carbonate. All metal carbonates and hydrogen carbonates react with acids to form corresponding salts, water and carbon dioxide.

**43.** **(*a*) Identify the acid and the base whose combination forms the common salt that you use in your food. Write its formula and chemical name of this salt. Name the source from where it is obtained.**

**(*b*) What is rock salt? Mention its colour and the reason due to which it has this colour.**

**(*c*) What happens when electricity is passed through brine? Write the chemical equation for it.** **[CBSE]**

**Ans.** (*a*) HCl is acid and NaOH is base whose combination forms the common salt. Its formula is NaCl (Sodium chloride). It is obtained from sea water.

(*b*) Rock salt is the common name for the mineral "halite". Its chemical formula is NaCl.

It may be white or light blue or yellow depending upon impurities present in it.

(*c*) When electricity is passed through brine, it decomposes to form sodium hydroxide, chlorine gas and hydrogen gas. This process is called the chlor-alkali process.

$$2NaCl(aq) + 2H_2O(l) \xrightarrow{\text{electrolysis}} 2NaOH(aq) + H_2(g) + Cl_2(g)$$

**44.** (*i*) **Explain why is hydrochloric acid a strong acid and acetic acid, a weak acid. How can it be verified?**

(*ii*) **Explain why aqueous solution of an acid conducts electricity.**

(*iii*) **You have four solutions A, B, C and D. The pH of solution A is 6, B is 9, C is 12 and D is 7,**

(*a*) **Identify the most acidic and most basic solutions.**

(*b*) **Arrange the above four solutions in the increasing order of $H^+$ ion concentration.**

(*c*) **State the change in colour of pH paper on dipping in solution C and D.** **[CBSE]**

**Ans.** (*i*) HCl is completely ionised in aqueous solution whereas acetic acid is partially ionised in aqueous solution. HCl gives dark red colour with pH paper whereas $CH_3COOH$ gives orange colour.

(*ii*) It is because acid ionises in aqueous solution and these ions conduct electricity.

(*iii*) (*a*) 'A' is most acidic and 'C' is most basic.

(*b*) C ($10^{-12}$) < B ($10^{-9}$) < D ($10^{-7}$) < A ($10^{-6}$)

(*c*) pH paper will become blue in 'C' and green in 'D'.

**45.** (*i*) **Dry pellets of a base 'X' when kept in open absorbs moisture and turns sticky. The compound is also formed by chlor-alkali process. Write chemical name and formula of X. Describe chlor-alkali process with balanced chemical equation. Name the type of reaction occurs when X is treated with dilute hydrochloric acid. Write the chemical equation.**

(*ii*) **While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?** **[CBSE]**

**Ans.** (*i*) X is sodium hydroxide, NaOH.

When sodium chloride solution (brine solution) is electrolysed, sodium hydroxide solution is formed. $H_2$ and $Cl_2$ gases are liberated. This is chlor-alkali process.

$$2NaCl + 2H_2O \xrightarrow{\text{electrolysis}} 2NaOH + H_2 + Cl_2$$

$$\underset{\text{'X'}}{NaOH} + HCl \longrightarrow NaCl + H_2O$$

The above reaction is neutralisation reaction.

(*ii*) If we add water to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns. The glass container may also break due to exessive heating.

**46. A student dropped few pieces of marble in dilute hydrochloric acid, contained in a test-tube. The evolved gas was then passed through lime water. What change would be observed in lime water? What will happen if excess of gas is passed through lime water? With the help of balanced chemical equations for all the changes explain the observations.** **[CBSE]**

**Ans.** Lime water will turn milky due to liberation of $CO_2$.

$$Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$$

If excess of $CO_2$ gas is passed through lime water, milkiness will disappear due to the formation of $Ca(HCO_3)(aq)$ which is soluble in water.

$$CaCO_3(s) + H_2O(l) + CO_2(g) \longrightarrow Ca(HCO_3)_2(aq)$$

**47. (*a*) Identify the compound of calcium which is yellowish white powder and is used for disinfecting drinking water. Write its chemical name and formula. How is it manufactured? Write the chemical equation for the reaction involved. Also list two other uses of the compound.**

**(*b*) Write the balanced chemical equation of chlor-alkali process.** **[CBSE]**

**Ans.** (*a*) The compound is bleaching powder ($CaOCl_2$). Its chemical name is calcium oxychloride. It is manufactured by reaction of solid slaked lime with dry chlorine gas.

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

READERS VENUE

(*i*) It is used as disinfectant.

(*ii*) It is used for preparation of chloroform.

(*b*) $2NaCl + 2H_2O \xrightarrow{\text{electrolysis}} 2NaOH + H_2 + Cl_2$

**48. (*a*) Mention the pH range within which our body works. Explain how antacids give relief from acidity. Write the name of one such antacid.**

**(*b*) Fresh milk has a pH of 6. How does the pH will change as it turns to curd? Explain your answer.**

**(*c*) A milkman adds a very small amount of baking soda to fresh milk. Why does this milk take a longer time to set as curd?**

**(*d*) Mention the nature of toothpastes. How do they prevent tooth decay?** **[CBSE]**

**Ans.** (*a*) Our stomach has pH equal to 2. Antacids produces bicarbonate ions which neutralises excess of acid in our body and gives relief from hyperacidity. Sodium hydrogencarbonate is one of such antacid.

(*b*) pH will decrease as it turns to curd because curd is acidic due to the presence of lactic acid.

(*c*) It takes longer time to set as curd as bacteria do not work well in presence of sodium hydrogencarbonate, i.e. fermentation will take place slowly.

(*d*) Toothpastes are basic in nature. They neutralize the acid formed in mouth which causes tooth decay.

**49. (*a*) Crystals of a substance changed their colour on heating in a closed test tube but regained it after sometime when they were allowed to cool down. Name the substance and write its formula and explain the phenomenon involved.**

**(*b*) Name the compound whose one formula unit is associated with 10 water molecules. How is it prepared? Give equations of related reactions. Give two uses of the compound.** **[CBSE]**

**Ans.** (*a*) $CuSO_4.5H_2O$ is a blue crystalline solid. It becomes dirty white on heating due to loss of water molecules and it becomes amorphous.

$$\underset{\text{Copper sulphate pentahydrate (Blue)}}{CuSO_4.5H_2O} \xrightarrow{\text{heat}} \underset{\text{Anhydrous copper sulphate (Dirty white)}}{CuSO_4} + 5H_2O$$

It regains its colour by absorbing water from atmosphere and becomes blue in colour.

$$CuSO_4 + 5H_2O \longrightarrow \underset{\text{Blue}}{CuSO_4.5H_2O}$$

(*b*) $Na_2CO_3.10H_2O$. It is called sodium carbonate decahydrate or washing soda. When baking powder is added to the dough and heated, sodium bicarbonate decomposes to give carbon dioxide which causes cakes or bread to swell.

$$2NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + H_2O + CO_2$$

$$Na_2CO_3 + 10H_2O \longrightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O}$$

READERS VIRTUE

**Uses:**

(*i*) It is used in the production of washing powder.

(*ii*) It is used for the manufacture of glass.

**50. (*a*) Explain the following chemical properties of acids with the help of balanced chemical equations only.**

**(*i*) When an acid reacts with a metal carbonate.**

**(*ii*) When an acid reacts with a metal bicarbonate.**

**(*iii*) When an acid reacts with a metal oxide.**

**(*b*) You are given three solutions A, B and C with pH values 2, 10 and 13 respectively. Write which solution has more hydrogen ion concentration among the three and state the nature 'acidic or basic' of each solution.** **[CBSE]**

**Ans.** (*a*) (*i*) $CaCO_3 + 2HCl \longrightarrow CaCl_2 + H_2O + CO_2$

(*ii*) $NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$

(*iii*) $Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$

(*b*) 'A' has maximum $[H_3O^+]$ equal $10^{-2}$ mol $L^{-1}$

'A' is acidic whereas B and C are basic in nature.

**51. (*a*) A metal compound 'X' reacts with dil. $H_2SO_4$ to produce effervescence. The gas evolved extinguishes a burning candle. If one of the compounds formed is calcium sulphate, then what is 'X' and the gas evolved?**

**Also, write a balanced chemical equation for the reaction which occurred.**

**(*b*) (*i*) Name one antacid. How does it help to relieve indigestion in stomach?**

**(*ii*) A farmer treats the soil with quicklime or calcium carbonate. What is the nature of soil? Why does the farmer treat the soil with quicklime?**

**[CBSE]**

**Ans.** (*a*) 'X' is $CaCO_3$ (calcium carbonate). The gas evolved is $CO_2$.

$$CaCO_3 + H_2SO_4(dil.) \longrightarrow \underset{\text{Calcium sulphate}}{CaSO_4} + H_2O + CO_2$$

(*b*) (*i*) Sodium hydrogen carbonate, $NaHCO_3$ is an antacid. Antacids produces bicarbonate ions which neutralises excess of acid formed in the stomach.

(*ii*) The soil is acidic in nature. The farmer wants to make it neutral by adding quicklime, which is good for crops.

## 2011

### Short Answer Type [I] Questions [2 Marks]

**52. State the chemical name of Plaster of Paris. Write a chemical equation to show the reaction between Plaster of Paris and water. [CBSE]**

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**Ans.** Calcium sulphate hemihydrate.

$$CaSO_4 \cdot \frac{1}{2}H_2O + \frac{3}{2}H_2O \longrightarrow \underset{\text{Gypsum}}{CaSO_4.2H_2O}$$

**53. State in brief the preparation of washing soda from baking soda. Write balanced chemical equation of the reaction involved. [CBSE]**

**Ans.** Sodium hydrogencarbonate (baking soda) on heating gives sodium carbonate which on recrystallisation gives washing soda.

$$2NaHCO_3 \xrightarrow{\text{heat}} Na_2CO_3 + CO_2 + H_2O$$

$$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3.10H_2O$$

**54. What is the colour of $FeSO_4.7H_2O$ crystals? How does this colour change upon heating? Give balanced chemical equation for the changes. [CBSE]**

**Ans.** Pale green is the colour of $FeSO_4.7H_2O$ crystals. It becomes dirty white on heating.

$$\underset{\text{Pale green}}{FeSO_4.7H_2O} \xrightarrow{\text{heat}} \underset{\text{Dirty white}}{FeSO_4} + 7H_2O$$

**55. Classify the following salts into acidic, basic and neutral:**
**Potassium sulphate, ammonium chloride, sodium carbonate, sodium chloride.** [CBSE]

**Ans.** **Neutral:** Potassium sulphate, Sodium chloride
**Acidic:** Ammonium chloride
**Basic:** Sodium carbonate

**56. A student dropped a few pieces of marble in dilute HCl contained in a test tube. The evolved gas was passed through lime water.** [CBSE]
**(*i*) What change would be observed in lime water?**
**(*ii*) Write balanced chemical equation for the above change.**

**Ans.** (*i*) Lime water will turn milky due to formation of calcium carbonate.
(*ii*) $Ca(OH)_2(aq) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$

## Short Answer Type [II] Questions [3 Marks]

**57. (*a*) What is universal indicator?**
**(*b*) Write the chemical equation involved in the preparation of sodium hydroxide. Name the process.** [CBSE]

**Ans.** (*a*) Universal indicator is the mixture of synthetic indicators which is used to find pH of solutions. It helps to find strength of acid and bases.

(*b*) $2NaCl(aq) + 2H_2O(l) \xrightarrow{\text{electrolysis}} 2NaOH(aq) + H_2(g) + Cl_2(g)$
It is called chlor-alkali process.

READERS VENUE

**58. A gas 'X' reacts with lime water and forms a compound 'Y' which is used as a bleaching agent in chemical industry. Identify 'X' and 'Y'. Give the chemical equation of the reactions involved.** [CBSE]

**Ans.** 'X' is chlorine; 'Y' is bleaching powder.

$$Ca(OH)_2 + \underset{\text{'X'}}{Cl_2} \longrightarrow \underset{\text{'Y'}}{CaOCl_2} + H_2O$$

**59. (*i*) Name the compound which is obtained from baking soda and is used to remove permanent hardness of water.**
**(*ii*) Write its chemical formulae.**
**(*iii*) What happens when it is recrystallised from its aqueous solution?** [CBSE]

**Ans.** (*i*) Sodium carbonate is obtained from baking soda and is used to remove hardness of water.
(*ii*) $Na_2CO_3$.
(*iii*) It changes to washing soda, $Na_2CO_3.10H_2O$.

**60. What is a neutralisation reaction? Give two examples.** [CBSE]

**Ans.** The reaction between acid and base to form salt and water is called neutralisation reaction, e.g. $KOH + HNO_3 \longrightarrow KNO_3 + H_2O$

$$2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$$

**61. What is tooth enamel chemically? State the condition when it starts corroding. What happens when food particles left in the mouth after eating degrade? Why do doctors suggest use of tooth powder/toothpaste to prevent tooth decay?** [CBSE]

**Ans.** It is made up of calcium phosphate.

It starts corroding due to acid formed in mouth. The food particles which are left in mouth form acids which cause tooth decay. Toothpaste and tooth powder are basic and neutralise acid formed in mouth which prevents tooth decay.

**62. What is Plaster of Paris chemically? How is it prepared? List its two important uses.** [CBSE]

**Ans.** Calcium sulphate hemihydrate.

It is prepared by heating gypsum at 373 K.

$$\underset{\text{Gypsum}}{CaSO_4.2H_2O} \xrightarrow{373\ K} \underset{\text{Plaster of Paris}}{CaSO_4.\frac{1}{2}H_2O} + \frac{3}{2}H_2O$$

(*i*) It is used to prepare chalks.

(*ii*) It is used to make casts and moulds.

**63. What is baking soda chemically called? Give reaction involved in its preparation. Write one of its uses.** [CBSE]

**Ans.** Sodium hydrogencarbonate.

$$NH_3 + CO_2 + H_2O + NaCl \longrightarrow NaHCO_3 + NH_4Cl$$

or

$$Na_2CO_3 + CO_2 + H_2O \longrightarrow 2NaHCO_3$$

It is used as an antacid.

**64. (*a*) What is an alkali? Give an example.**

**(*b*) Why do HCl, $HNO_3$, etc. show acidic characters in aqueous solutions while solutions of compounds like alcohol and glucose do not show acidic character?** [CBSE]

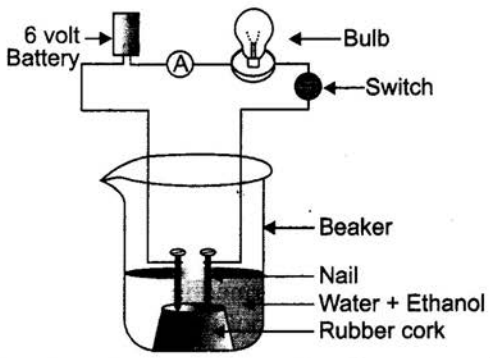
**Ans.** (*a*) Soluble bases are called alkalies, e.g. sodium hydroxide is an alkali.

(*b*) HCl, $HNO_3$ ionise in aqueous solution, whereas alcohol and glucose do not show acidic characters because they do not ionise in aqueous solution.

**65. Compounds like alcohols and glucose also contain hydrogen but are not categorised as acids. Discuss an activity to prove it.** [CBSE]

**Ans.** Take a beaker of 250 ml and place two nails fixed with the help of cork.

- Connect the nails to the two terminals of a 6 volt battery as shown in figure.
- Now add some water containing ethanol and put the switch ON.
- Repeat the experiment with glucose solution.




**Observation:** The bulb will not glow and the needle of ammeter will not show deflection because glucose and ethanol do not conduct electricity.

**Conclusion:** The experiment shows glucose and ethanol do not ionise in aqueous solution, that is, they do not give $H^+$ ions, therefore cannot conduct electricity. Thus, glucose and ethanol are not categorised as acids.

## 2010

### Very Short Answer Type Questions [1 Mark]

**66. The pH of a sample of vegetable soup was found to be 6.5. How is this soup likely to taste?** [CBSE]

**Ans.** The taste will be slightly sour as it is weakly acidic.

**67. Which bases are called alkalies? Give an example of alkalies.** [CBSE]

**Ans.** Soluble bases are called alkalies, e.g. sodium hydroxide (NaOH).

**68. Write a balanced chemical equation for the reaction between sodium carbonate and hydrochloric acid indicating the physical state of the reactants and the products.** [CBSE]

**Ans.** $Na_2CO_3(s) + 2HCl(aq) \longrightarrow 2NaCl(aq) + CO_2(g) + H_2O(l)$

**69. Write a balanced chemical equation for a neutralisation reaction, mentioning the physical state of the reactants and the products.** [CBSE]

**Ans.** $NaOH(aq) + HCl(aq) \longrightarrow NaCl(aq) + H_2O(l)$

### Short Answer Type [I] Question [2 Marks]

**70. What happens when chlorine is passed over slaked lime at 313K? Write chemical equation of the reaction involved and state two uses of the product obtained.** [CBSE]

**Ans.** Bleaching powder is formed.

$$Ca(OH)_2 + Cl_2 \xrightarrow{313\ K} CaOCl_2 + H_2O$$

**Uses:**

(*i*) It is used as bleaching agent in paper and textile industries.

(*ii*) It is used as disinfectant in purification of drinking water.

# 3 METALS AND NON-METALS

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [I] Questions [2 Marks]**

**1. Give reasons:**

**(*a*) Platinum, gold and silver are used to make jewellery.**

**(*b*) Metals like sodium and potassium are stored under oil.** **[AI Allahabad]**

**Ans.** (*a*) Pt, Au, Ag are lustrous, therefore, used to make jewellary.

(*b*) Metals like Na and K are highly reactive and catch fire in presence of moisture, therefore, stored under oil.

**2. Silver articles become black when kept in open for some time, whereas copper vessels lose their shiny brown surfaces and gain a green coat when kept in open. Name the substances present in air with which these metals react and write the name of the products formed.** **[AI Allahabad]**

**Ans.** Silver articles become black due to formation of $Ag_2S$ (silver sulphide).

Silver reacts with $H_2S$ to form $Ag_2S$.

Copper forms green coat of basic copper carbonate ($CuCO_3.Cu(OH)_2$).

Copper reacts with oxygen to form CuO which reacts with $H_2O$ to form $Cu(OH)_2$.

$Cu(OH)_2$ reacts with $CO_2$ to form $CuCO_3$ (green).

**3. Show the formation of $Na_2O$ by transfer of electrons.** **[AI Panchkula]**

**Ans.**

$$\underset{2,8,1}{2Na} \longrightarrow \underset{2,8}{2Na^+} + 2e^-$$

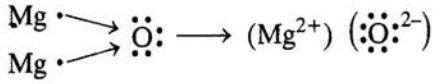
$$\underset{2,6}{O} + 2e^- \longrightarrow \underset{2,8}{O^{2-}}$$

$$Na \cdot \rightarrow \cdot\ddot{O}\cdot \longrightarrow (Na^+)_2 \left[\ddot{O}^{2-}\right]$$
$$Na \cdot \rightarrow$$

**4. Show the formation of MgO by transfer of electrons.** **[AI Panchkula]**

**Ans.** Mg(12) = 2, 8, 2 $\quad Mg \longrightarrow Mg^{2+} + 2e$

O(8) = 2, 6 $\quad O + 2e^- \longrightarrow O^{2-}$



$\longrightarrow (Mg^{2+})\ (:\ddot{O}:^{2-})$

## Short Answer Type [II] Questions [3 Marks]

**5. Explain the following:** **[Delhi]**

**(*a*) Sodium chloride is an ionic compound which does not conduct electricity in solid state where as it does conduct electricity in molten state as well as in aqueous solution.**

**(*b*) Reactivity of aluminium decrease if it is dipped in nitric acid.**

**(*c*) Metals like calcium and magnesium are never found in their free state in nature.**

**Ans.** (*a*)
- Sodium chloride is ionic compound because it is made up of $Na^+$ and $Cl^-$ ions. $(Na^+)\ (:\ddot{Cl}:^-)$
- It does not conduct electricity in solid state because ions are not free to move.
- It conducts electricity in molten state because ions are free to move.

(*b*) It is due to formation of oxide layer on its surface which makes it passive (less reactive) $HNO_3$ is good oxidising agent.

(*c*) It is because Mg and Ca are highly reactive, react with other elements to form compounds therefore, are not found in free state.

**6. An ore, on treatment with dil. HCl produces brisk effervescence. Name the type of ore with one example. What steps would be required to obtain the metal from enriched ore? Also write the chemical equations of the reactions involved in the process.** **[AI Chandigarh]**

**Ans.** Carbonate ore.

Zinc carbonate, $ZnCO_3$(calamine)

**Calcination:** Ore is heated in the absence of air to convert it into oxide.

$$ZnCO_3(s) \xrightarrow{\text{heat}} ZnO(s) + CO_2(g)$$

**Reduction:** Zinc oxide is reduced by heating with coke.

$$ZnO(s) + C(s) \xrightarrow{\text{heat}} Zn(s) + CO(g)$$

Impure zinc is refined by electrolytic refining.

**7. A metal 'X', which is used in thermite process, when heated with oxygen gives an oxide 'Y' which is amphoteric in nature. Identify 'X' and 'Y'. Write balanced chemical equations of the reactions of oxides 'Y' with hydrochloric acid and sodium hydroxide.** **[AI Uttarakhand]**

**Ans.** 'Al' when heated with oxygen it forms $Al_2O_3$. $Al_2O_3$ is amphoteric in nature i.e., reacts with HCl to form $AlCl_3$ and $H_2O$ whereas it reacts with NaOH to form sodium meta aluminate and water.

$$4Al + 3O_2 \xrightarrow{heat} 2Al_2O_3(s)$$

$$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$$

$$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$$

'X' is 'Al', 'Y' is $Al_2O_3$.

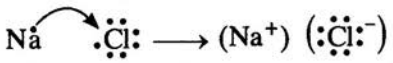
**8. What is meant by ionic bond and covalent bond? Show the bond formation in NaCl. What happens when electricity is passed through aq. solution of ionic salts?**

**[CBSE for Blind]**

**Ans.** **Ionic bond** is formed by complete transfer of electrons while **covalent bond** is formed by sharing of electrons

$$\underset{2,8,1}{Na} \longrightarrow \underset{2,8}{Na^+} + e^-$$

$$\underset{2,8,7}{Cl} + e^- \longrightarrow \underset{2,8,8}{Cl^-}$$



Solution of ionic compounds contain ions which move towards oppositely charged electrodes, when electric current is passed through them.

**9. (*a*) What is corrosion? Name three metals which can corrode. Name two metals which do not corrode.**

**(*b*) Describe an activity to show corrosion takes place in presence of air and water.**

**[CBSE for Blind]**

**Ans.** (*a*) Corrosion is a process in which slow wearing away of metals due to oxidation takes place in presence of moisture and other chemicals.

Ag, Cu, Fe are metals which corrode.

Gold and platinum do not corrode.

(*b*) **Activity:**

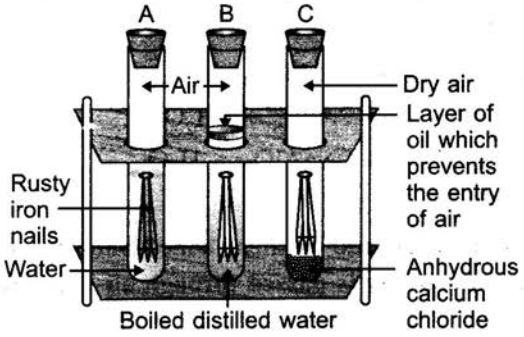
(*i*) Take three boiling tubes A, B and C.

(*ii*) Pour some water in test tube A. Put iron nails in it and cork it.

(*iii*) Pour boiled distilled water in another test tube B and put iron nails in it. Add 1 ml of oil over it such that oil floats over it and prevents the air from entering.

(*iv*) Take some iron nails in test tube C and put some anhydrous calcium chloride in it and cork it.

(*v*) Leave all the three test tubes for one day and then observe.




**Observation:** Iron nails get rusted in test tube A because both air and water are present in it. Iron nails do not get rusted in B because there is water but no air. In C, rusting will not take place because there is neither air nor water.

**Conclusion:** Iron gets rusted in the presence of air and water.

**10. How is method high up in the reactivity series different from that for metals in middle? Why can the same process not to be applied for them. Name the process to be applied for them.** **[AI Uttarakhand]**

**Ans.** The metals which are high up in activity series are highly reactive. Different processes are used due to difference in reactivity.

Highly reactive metals cannot be obtained by chemical reduction which is used for metals in middle of series.

Electrolytic reduction followed by electrolytic refining is used for extraction of highly reactive metals.

**11. Out of three metals 'P', 'Q', 'R', 'P' is less reactive than 'Q' and 'R' is more reactive than 'P' and 'Q' both. Suggest an activity to arrange 'P', 'Q', 'R' in order of decreasing reactivity.** **[AI Panchkula]**

**Ans.**

| Activity | Observation | Inference |
|---|---|---|
| (*i*) Put metal 'R' in solution of sulphate of 'Q' and 'P'. | Solution becomes colourless in both. | 'R' displaces 'P' and 'Q' from salt solution. |
| (*ii*) Put metal 'P' in solution of sulphate of 'Q'. | No reaction | 'P' cannot displace 'Q' from salt solution. |

$\therefore$ P < Q < R is order of reactivity.

## Long Answer Type Questions [5 Marks]

**12. (*a*) List in tabular form three chemical properties on the basis of which we can differentiate between a metal and a non-metal.**

**(*b*) Give reasons for the following:**

**(*i*) Most metals conduct electricity well.**

**(*ii*) The reaction of iron (III) oxide [$Fe_2O_3$] with heated aluminium is used to join cracked machine parts.** **[Delhi]**

**Ans.** (*a*)

| Metals | Non-metals |
|---|---|
| 1. Metals form basic oxides. | 1. Non-metals form acidic oxides. |
| 2. Reactive metals displace hydrogen from dilute acids. | 2. Non-metals do not displace hydrogen from dilute acids. |
| 3. Metallic oxides, when dissolved in water form bases which turn red litmus blue. | 3. Non-metallic oxides, when dissolved in water form acids which turn blue litmus red. |
| 4. Metals lose electrons to form positive ions and act as reducing agents. | 4. Non-metals gain electrons to form negative ions and act as oxidising agents. |

(*b*) (*i*) Metals conduct electricity because they have free electrons which can move easily and carry current.

(*ii*) $Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$

Al is more reactive than iron, therefore, displaces Fe. It is highly exothermic reaction. Molten iron formed is used to join cracked machine part and broken railway tracks.

READERS VENUE

**13. (*a*) Write chemical equations for the following reactions:**

**(*i*) Calcium metal reacts with water.**

**(*ii*) Cinnabar is heated in the presence of air.**

**(*iii*) Manganese dioxide is heated with aluminium powder.**

**(*b*) What are alloys? List two properties of alloys.** **[Delhi]**

**Ans.** (*a*) (*i*) $Ca(s) + 2H_2O(l) \longrightarrow Ca(OH)_2(aq) + H_2(g)$

(*ii*) $HgS + O_2 \xrightarrow{\text{heat}} Hg(l) + SO_2(g)$

(*iii*) $3MnO_2 + 4Al \longrightarrow 3Mn + 2Al_2O_3$

(*b*) Alloys are homogeneous mixture of two or more metals. One of them can be non-metal also.

**Properties:**

(*i*) They are harder than pure metals.

(*ii*) They do not get corroded.

## 2018

### Long Answer Type Questions [5 Marks]

**14. (*a*) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.**

**(*b*) How is copper extracted from its sulphide ore? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.** **[CBSE]**

**Ans.** (*a*) (*i*) Concentration of ore
(*ii*) Calcination
(*iii*) Reduction
(*iv*) Purification are steps involved in extraction of metal.

(*b*) (*i*) Ore of copper is concentrated by froth floatation process.

(*ii*) **Roasting:** $2CuFeS_2 + O_2 \longrightarrow Cu_2S + FeS + SO_2$

$2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

$2FeS + 3O_2 \longrightarrow 2FeO + 2SO_2$

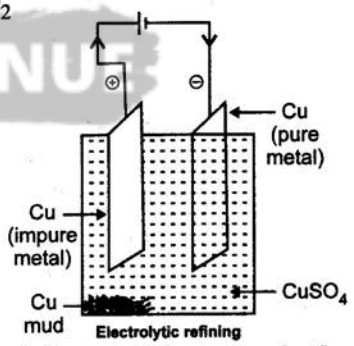
$FeO + SiO_2 \longrightarrow FeSiO_3$

(*iii*) **Smelting:** $2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$

(*iv*) **Electrolytic refining:** Impure copper is taken as anode, pure copper is taken as cathode. Acidified $CuSO_4$ is taken as electrolyte. Impure copper changes into $Cu^{2+}$ which gain electron at cathode forming pure Cu. Impurities are left behind as anode mud.

At anode $Cu\,(impure) \longrightarrow Cu^{2+} + 2e^-$

At cathode $Cu^{2+} + 2e^- \longrightarrow Cu\,(pure)$




**15. (*i*) A non-metal 'P' which is largest constituent of air is heated in hydrogen in the ratio of 1 : 3 in presence of iron as catalyst gives a gas 'Q'.**

**(*ii*) On heating 'P' with $O_2$ an oxide 'R' is formed.**

**(*iii*) If the oxide 'R' is passed into water in presence of air, an acid 'S' is formed which act as strong oxidising agent.**

**(*a*) Identify 'P', 'Q', 'R', 'S' and give chemical equations of reactions to justify your answer.**

**(*b*) To which group and period of modern periodic table does the non-metal 'P' belong?** **[CBSE for Blind]**

**Ans.** (*a*) 'P' is $N_2$, 'Q' is $NH_3$, 'R' is NO, 'S' is $HNO_3$.

$$\underset{\text{'P'}}{N_2(g)} + 3H_2(g) \longrightarrow \underset{\text{'Q'}}{2NH_3(g)}$$

$$N_2(g) + O_2(g) \xrightarrow{\Delta} \underset{\text{'R'}}{2NO(g)}$$

$$\underset{\text{'R'}}{4NO} + 3O_2 + 2H_2O \longrightarrow \underset{\text{'S'}}{4HNO_3}$$

(*b*) 'P' is nitrogen which belongs to group 15 and second period.

## 2018 (Compartment)

### Long Answer Type Questions [5 Marks]

**16. (*a*) List in Tabular form any three chemical properties on the basis of which metals and non-metals are differentiated.**

**(*b*) State two ways to prevent the rusting of iron.** **[CBSE]**

**Ans.** (*a*)

| Metals | Non-metals |
|---|---|
| (*i*) Reactive metals displace hydrogen from dilute acids. | (*i*) Non-metals do not displace $H_2$ from dilute acids. |
| (*ii*) Metallic oxides are basic in nature. | (*ii*) Non-metallic oxides are acidic in nature. |
| (*iii*) Metal can lose electron to form positive ions. | (*iii*) Non-metals can gain electrons to form negative ions. |

READERS VENUE

(*b*) Oiling and painting are the two ways to prevent the rusting of iron.

## 2016

### Short Answer Type [I] Questions [2 Marks]

**17. Which of the following listed metals can displace zinc from its salt solution? Give reason of your answer along with chemical equation.**

**Copper, Lead, Magnesium, Silver.** **[CBSE]**

**Ans.** Metals which are more reactive than zinc can displace Zn from its salt solution. Therefore, magnesium can displace zinc from its salt solution.

$$Mg(s) + ZnSO_4(aq) \longrightarrow MgSO_4(aq) + Zn(s)$$

**18. Name a metal/non-metal:**

**(*i*) Which makes iron hard and strong?**

**(*ii*) Which is alloyed with any other metal to make an amalgam?**

**(*iii*) Which is used to galvanise iron articles?**

**(*iv*) Whose articles when exposed to air form a black coating?** **[CBSE]**

**Ans.** (*i*) Carbon makes iron hard and strong. Tungsten can also make iron hard and strong.
(*ii*) Mercury (*iii*) Zinc (*iv*) Silver

## Short Answer Type [II] Questions [3 Marks]

**19. Explain the following statements:**
**(*a*) Most metal oxides are insoluble in water but some of these dissolve in water. What are these oxides and their solutions in water called?**
**(*b*) At ordinary temperature the surface of metals such as magnesium, aluminium, zinc, etc. is covered with a thin layer. What is the composition of this layer? State its importance.**
**(*c*) Some alkali metals can be cut with a knife.** **[CBSE]**

**Ans.** (*a*) Solution of metal oxides in water is called alkali (soluble base), e.g. sodium hydroxide (NaOH), potassium hydroxide (KOH).
(*b*) This layer is oxide layer. It makes the metal less reactive (passive) and makes it more useful because it cannot corrode further and remains as it is.
(*c*) It is because these metals are very soft, e.g. sodium metal can be cut with a knife.

**20. Write one example of each of the following.** **[CBSE]**
**(*a*) Most malleable metal and most ductile metal.**
**(*b*) The best conductor of heat and the poorest conductor of heat.**
**(*c*) A metal with highest melting point and a metal with lowest melting point.**

**Ans.** (*a*) Gold is the most malleable and ductile.
(*b*) Silver is the best conductor, whereas lead is poor conductor of heat.
(*c*) Tungsten has highest melting point, whereas mercury has the lowest melting point.

READERS VENUE

## Long Answer Type Question [5 Marks]

**21. (*a*) Define corrosion.**
**(*b*) What is corrosion of iron called?**
**(*c*) How will you recognise the corrosion of silver?**
**(*d*) Why corrosion of iron is a serious problem?**
**(*e*) How can we prevent corrosion of iron?** **[CBSE]**

**Ans.** (*a*) It is a process in which a metal reacts with substances present in air to form surface compounds.
(*b*) Rusting.
(*c*) Black layer is formed on the surface of silver due to formation of $Ag_2S$.
(*d*) Iron is slowly eaten up when exposed to atmosphere over a long period of time which makes the metal weak and brittle, which is serious problem.
(*e*) Oiling, painting, greasing, galvanisation, alloying can prevent iron from corrosion.

## 2015

### Short Answer Type [I] Questions [2 Marks]

**22. Write one example of each of**
**(*i*) a metal which is so soft that, it can be cut with knife and a non-metal which is the hardest substance.**
**(*ii*) a metal and a non-metal which exist as liquid at room temperature.** **[CBSE]**

**Ans.** (*i*) Sodium is a metal, whereas carbon (diamond) is the non-metal.
(*ii*) Mercury is a liquid metal, whereas bromine is a liquid non-metal.

**23. Mention the names of the metals for the following:** **[CBSE]**
**(*i*) Two metals which are alloyed with iron to make stainless steel.**
**(*ii*) Two metals which are used to make jewellery.** **[CBSE]**

**Ans.** (*i*) Nickel and chromium. (*ii*) Gold and platinum.

### Short Answer Type [II] Questions [3 Marks]

**24. State three reasons for the following facts:**
**(*i*) Sulphur is a non-metal**
**(*ii*) Magnesium is a metal**
**One of the reasons must be supported with a chemical equation.** **[CBSE]**

**Ans.**

| Sulphur is a non-metal | Magnesium is a metal |
|---|---|
| (*i*) Poor conductor of heat and electricity. | (*i*) Good conductor of heat and electricity. |
| (*ii*) Neither malleable nor ductile. | (*ii*) Malleable and ductile. |
| (*iii*) Sulphur dioxide is acidic oxide. $S + O_2 \longrightarrow SO_2$ $SO_2 + H_2O \longrightarrow H_2SO_3$ (Sulphurous acid) | (*iii*) Magnesium oxide is basic in nature. $2Mg + O_2 \longrightarrow 2MgO$ $MgO + H_2O \longrightarrow Mg(OH)_2$ (Magnesium hydroxide) |

READER'S AVENUE

**25. What is cinnabar? How is metal extracted from cin. ›ar? Explain briefly.** **[CBSE]**

**Ans.** Cinnabar (HgS) is an ore of mercury.
Mercury is obtained by roasting cinnabar. Mercuric oxide, HgO formed is thermally unstable and gives mercury on further heating.

$$2HgS(s) + O_2(g) \longrightarrow 2HgO(s) + SO_2(g)$$

$$2HgO(s) \xrightarrow{\text{heat}} 2Hg(l) + O_2(g)$$

or

$$HgS + O_2 \longrightarrow 2Hg + SO_2$$

Mercury can be purified by distillation.

**26. (*a*) Write the electron dot structures for potassium and chlorine.**
**(*b*) Show the formation of KCl by the transfer of electrons.**
**(*c*) Name the ions present in the compound, KCl.** **[CBSE]**

**Ans.** (*a*) $K^{\cdot}$ $\quad$ $:\ddot{\underset{\cdot}{C}}l:$
2, 8, 8, 1 $\quad$ 2, 8, 7

(*b*) $K \longrightarrow K^+ + e^-$
$Cl + e^- \longrightarrow Cl^-$

$K^{\times}$ $\quad$ $:\ddot{C}l:$ $(K^+)$ $(:\ddot{C}l:^-)$ or KCl

(*c*) KCl has $K^+$ and $Cl^-$ ions.

**27.** **(*a*) State the electron-dot structure for calcium and sulphur.**
**(*b*) Show the formation of CaS by the transfer of electrons.**
**(*c*) Name the ions present in this compound CaS. Atomic number of Ca = 20, O = 16.** **[CBSE]**

**Ans.** (*a*) Ca: $\quad$ $:\ddot{S}:$
2, 8, 8, 2 $\quad$ 2, 8, 6

(*b*) $Ca \longrightarrow Ca^{2+} + 2e^-$
$S + 2e^- \longrightarrow S^{2-}$

$Ca^{\times}_{\times}$ $\quad$ $:\ddot{S}:$ $\quad$ $(Ca^{2+})$ $\quad$ $(:\ddot{S}:^{2-})$

(*c*) $Ca^{2+}$ and $S^{2-}$ ions are present in CaS.

## Long Answer Type Question [5 Marks]

**28.** **(*a*) Write electron dot diagram for chlorine (At No. 17) and calcium (At No. 20). Show the formation of calcium chloride by transfer of electrons.**
**(*b*) Identify the nature of above compound and explain three physical properties of such compound.** **[CBSE]**

**Ans.** (*a*) $:\ddot{\underset{\cdot}{C}}l:$ $\quad$ $Ca^{\times}_{\times}$
2, 8, 7 $\quad$ 2, 8, 8, 2

$Ca \longrightarrow Ca^{2+} + 2e^-$
$2Cl + 2e^- \longrightarrow 2Cl^-$

$Ca^{\times}_{\times} \longrightarrow :\ddot{C}l: \longrightarrow (Ca^{2+})\,(:\ddot{C}l:^-)_2 \longrightarrow CaCl_2$
$\quad\quad\quad

**Ans.** **Activity 1:** Sodium reacts with cold water vigorously to form sodium hydroxide and hydrogen gas

$$2Na(s) + 2H_2O\ (l) \xrightarrow[\text{(cold)}]{} 2NaOH\ (aq) + H_2\ (g)$$

Magnesium does not react with cold water but with hot water to form magnesium hydroxide and hydrogen gas.

$$Mg\ (s) + 2H_2O \xrightarrow[\text{(hot)}]{} Mg(OH)_2\ (aq) + H_2\ (g)$$

Hence, sodium is more reactive than magnesium.

**Activity 2:** $Mg\ (s) + CuSO_4\ (aq) \longrightarrow MgSO_4\ (aq) + Cu\ (s)$

$Cu\ (s) + MgSO_4\ (aq) \longrightarrow$ No reaction

So magnesium is more reactive than copper. Concluding from activity 1 and 2 Na > Mg > Cu.

**30. You are provided with magnesium ribbon and sulphur powder. Explain with the help of an activity that metal oxides are basic and non-metal oxides are acidic in nature.** **[CBSE]**

**Ans.** ***Aim*** : To test the nature of oxides formed by metals and non-metals.

***Materials Required*** : Sulphur powder, Mg ribbon, water, blue litmus paper, red litmus paper.

***Procedure*** :

1. Take magnesium ribbon with a pair of tongs and burn it in flame in the presence of air.
2. Collect the product formed and dissolve it in warm water.
3. Add red litmus paper into it.
4. Observe the change in colour and decide the nature of the oxide formed.
5. Burn sulphur in a deflagrating spoon in the presence of air and dissolve the oxide formed in water.
6. Dip blue litmus paper into the solution and observe the change in the colour and decide the nature of the oxide formed.

***Observation*** : The oxide formed by metal turns red litmus blue whereas oxide of non-metal turns blue litmus red.

***Chemical Reactions*** :

$$2Mg(s) + O_2(g) \xrightarrow{\text{burning}} 2MgO(s)$$

$$MgO(s) + H_2O(\text{hot}) \longrightarrow Mg(OH)_2(aq)$$

Magnesium oxide (Basic oxide) — Water — Magnesium hydroxide

$$S(s) + O_2(g) \longrightarrow SO_2(g)$$

$$SO_2(g) + H_2O(l) \longrightarrow H_2SO_3(aq)$$

Sulphur dioxide (Acidic oxide) — Water — Sulphurous acid

***Conclusion*** : Most of the metallic oxides are basic in nature whereas most of the non-metallic oxides are acidic in nature.

### Long Answer Type Question [5 Marks]

31. **(*a*) An ore on treatment with dilute hydrochloric acid produces brisk effervescence. What type of ore is this? What steps will be required to obtain metal from the enriched ore.**

**(*b*) Copper coin is kept immersed in silver nitrate solution for some time. What change will take place in coin and colour of the solution? Write balanced chemical equation of the reaction involved.** **[CBSE]**

**Ans.** (*a*) **Carbonate ore:** Steps to extract metal are as follows:

(*i*) **Calcination:** Carbonate ore is heated in limited supply of air and oxide is obtained, e.g.

$$ZnCO_3\,(s) \xrightarrow{\text{heat}} ZnO\,(s) + CO_2\,(g)$$

(*ii*) **Reduction with carbon:** Oxide ore is heated with carbon

$$ZnO\,(s) + C\,(s) \longrightarrow Zn\,(s) + CO\,(g)$$

(*b*) Copper, being more reactive than silver will displace silver from silver nitrate solution and there will be deposition of silver on copper coin. The colour of solution will turn to blue.

$$Cu\,(s) + 2AgNO_3\,(aq) \longrightarrow Cu(NO_3)_2\,(aq) + 2Ag\,(s)$$

## 2013

### Short Answer Type [I] Question [2 Marks]

READERS VENUE

32. **Give reason for the following:** **[CBSE]**

**(*a*) School bells are made up of metals.**

**(*b*) Electric wires are made up of copper.**

**Ans.** (*a*) It is because metals are sonorous, i.e. they produce sound when struck with a hard substance.

(*b*) It is because copper is good conductor of electricity.

### Short Answer Type [II] Question [3 Marks]

33. **Suggest a method of reduction for the following metals during their metallurgical processes:** **[CBSE]**

**(*i*) metal 'A' which is one of the last, second or third position in the reactivity.**

**(*ii*) metal 'B' which gives vigorous reaction even with water and air.**

**(*iii*) metal 'C' which is kept in the middle of activity series.**

**Ans.** (*i*) 'A' can be obtained by chemical reduction using carbon or carbon monoxide as reducing agent.

(*ii*) 'B' can be obtained by electrolytic reduction.

(*iii*) 'C' can be reduced by reducing agent like 'Al'.

### Long Answer Type Question [5 Marks]

**34. (*a*) Define activity series of metals. Arrange the metals gold, copper, iron and magnesium in order of their increase in reactivity.**
**(*b*) What will you observe when:**
**(*i*) Some zinc pieces are put in copper sulphate solution.**
**(*ii*) Some silver pieces are put into green coloured ferrous sulphate solution.**
**[CBSE]**

**Ans.** (*a*) The series of metals in which metals are arranged in decreasing order of their reactivity is called activity series of metals.
Au < Cu < Fe < Mg is increasing order of reactivity.

(*b*) (*i*) The blue solution will become colourless and reddish brown copper metal will be deposited.

$$\underset{}{Zn\ (s)} + \underset{\text{(Blue)}}{CuSO_4\ (aq)} \longrightarrow \underset{\text{(colourless)}}{ZnSO_4\ (aq)} + \underset{\text{(reddish brown)}}{Cu\ (s)}$$

(*ii*) $Ag\ (s) + FeSO_4\ (aq) \longrightarrow$ No reaction
Reaction will not take place because 'Ag' is less reactive than iron.

## 2012

### Very Short Answer Type Question [1 Mark]

**35. A green layer is gradually formed on a copper plate left exposed to air for a week in a bathroom. What could this green substance be?** **[CBSE]**

**Ans.** It is due to the formation of basic copper carbonate $[CuCO_3.Cu(OH)_2]$.

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### Short Answer Type [I] Questions [2 Marks]

**36. Name the following:**
**(*a*) A metal, which is preserved in kerosene.**
**(*b*) A lustrous coloured non-metal.**
**(*c*) A metal, which can melt while kept on palm.**
**(*d*) A metal, which is a poor conductor of heat.** **[CBSE]**

**Ans.** (*a*) Sodium is preserved in kerosene.
(*b*) Iodine is a lustrous coloured non-metal.
(*c*) Gallium can melt while kept on palm.
(*d*) Lead is poor conductor of heat.

**37. Explain why calcium metal after reacting with water starts floating on its surface. Write the chemical equation for the reaction. Name one more metal that starts floating after some time when immersed in water.** **[CBSE]**

**Ans.** Calcium starts floating because the bubbles of hydrogen gas formed stick to the surface of metal.

$$Ca(s) + 2H_2O(l) \longrightarrow Ca(OH)_2 + H_2(g)$$

Magnesium reacts with hot water and starts floating due to the bubbles of hydrogen gas sticking to its surface.

**38. Give reason for the following:**

**(*a*) Aluminium oxide is considered as an amphoteric oxide.**

**(*b*) Ionic compounds conduct electricity in molten state.** **[CBSE]**

**Ans.** (*a*) It is because it reacts with acids as well as bases to produce salts and water. 'Al' is less electropositive metal. So, it forms amphoteric oxide which can react with acid as well as base.

(*b*) Ionic compounds can conduct electricity in molten state because ions become free to move in molten state.

**39. Write two differences between calcination and roasting.** **[CBSE]**

**Ans.**

| Calcination | Roasting |
|---|---|
| (*i*) It is carried out by heating ore in the absence of air.<br>(*ii*) It converts carbonate ores into oxides. | (*i*) It is carried out by heating ore in the presence of air.<br>(*ii*) It converts sulphide ores into oxides. |

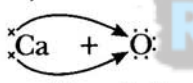
## Short Answer Type [II] Questions [3 Marks]

**40. (*a*) Explain the formation of ionic compound CaO with electron dot structure. Atomic number of calcium and oxygen are 20 and 8 respectively.**

**(*b*) Name the constituent metals of bronze.** **[CBSE]**

**Ans.** (*a*) $\underset{2,8,8,2}{Ca} \longrightarrow \underset{2,8,8}{Ca^{2+}} + 2e^-$

$\underset{2,6}{O} + 2e^- \longrightarrow \underset{2,8}{O^{2-}}$



$(Ca^{2+})\ (\ddot{\underset{\times}{\underset{\times}{O}}}:^{2-})$

(*b*) Bronze is made up of copper and tin.

**41. A metal 'X' acquires a green colour coating on its surface on exposure to air.**

**(*i*) Identify the metal 'X' and name the process responsible for this change.**

**(*ii*) Name and write chemical formula of the green coating formed on the metal.**

**(*iii*) List two important methods to prevent the process.** **[CBSE]**

**Ans.** (*i*) Metal 'X' is copper. The process is corrosion.

(*ii*) Basic copper carbonate $[CuCO_3.Cu(OH)_2]$

(*iii*) • It should be coated with tin.

• It should be mixed with other metals to form alloys.

**42. Write balanced equations for the reaction of:**

**(*i*) aluminium when heated in air. Write the name of the product.**

**(*ii*) iron with steam. Name the product obtained.**

**(*iii*) calcium with water. Why does calcium start floating in water?** **[CBSE]**

**Ans.** (*i*) $4Al + 3O_2 \xrightarrow{heat} 2Al_2O_3$.

The product formed is aluminium oxide.

READERS VENUE

(*ii*) $3Fe + 4H_2O$ (steam) $\longrightarrow Fe_3O_4 + 4H_2$
The product obtained is iron(II) iron (III) oxide.

(*iii*) $Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2$
The bubbles of hydrogen stick to the surface of metal that is why it floats.

**43. Write balanced chemical equations for the following reactions:**
**(*a*) Dilute sulphuric acid reacts with aluminium powder.**
**(*b*) Dilute hydrochloric acid reacts with sodium carbonate.**
**(*c*) Carbon dioxide is passed through lime water.** **[CBSE]**

**Ans.** (*a*) $2Al(s) + 3H_2SO_4(dil.) \longrightarrow Al_2(SO_4)_3\ (aq) + 3H_2(g)$

(*b*) $Na_2CO_3(s) + 2HCl(dil.) \longrightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$

(*c*) $Ca(OH)_2(aq.) + CO_2(g) \longrightarrow CaCO_3(s) + H_2O(l)$
Lime water (white ppt)

**44. What is meant by 'rusting'? With labelled diagrams, describe an activity to find out the conditions under which iron rusts.** **[CBSE]**

**Ans.** The process in which iron reacts with oxygen in the presence of moisture to form reddish brown coating of hydrated ferric oxide [Iron (III) oxide].$Fe_2O_3 \cdot xH_2O$
**Activity:** Refer Ans. 9 (*b*).

**45. (*a*) Show the formation of $Na_2O$ by the transfer of electrons between the combining atoms.**
**(*b*) Why are ionic compounds usually hard?**
**(*c*) How is it that ionic compounds in the solid state do not conduct electricity but they do so when in molten state?** **[CBSE]**

**Ans.** (*a*) $Na^{\times} \rightarrow \dot{O}: \longleftarrow Na^{\times}$ $\longrightarrow (Na^+)_2 [\dot{O}:]^{2-}$

(*b*) It is due to strong force of attraction between oppositely charged ions.

(*c*) In solid state, ions are not free to move whereas in molten state ions are free to move, therefore, they conduct electricity in molten state.

**46. (*a*) Show on a diagram the transfer of electrons between the atoms in the formation of MgO.**
**Write symbols of cation and anion present in MgO.**
**(*b*) Name the solvent in which ionic compounds are generally soluble.**
**(*c*) Why are aqueous solutions of ionic compounds able to conduct electricity?** **[CBSE]**

**Ans.** (*a*) $Mg \rightleftarrows \dot{O}: \longrightarrow (Mg)^{2+} [\dot{O}:]^{2-}$

MgO contains $Mg^{2+}$ as cation and $O^{2-}$ as anion.

(*b*) Ionic compounds are soluble in water.

(*c*) It is because aqueous solutions consist of ions which can move freely in them and carry current.

**47. What are amphoteric oxides? Choose the amphoteric oxides from amongst the following oxides:** **[CBSE]**

$$Na_2O,\ ZnO,\ Al_2O_3,\ CO_2,\ H_2O$$

**Ans.** Those oxides which react with acids as well as bases to produce salts and water are called amphoteric oxides, e.g. $Al_2O_3$, ZnO are amphoteric oxides among given oxides.

**48. Define the terms:**

**(*i*) mineral (*ii*) ore, and (*iii*) gangue.** **[CBSE]**

**Ans.** (*i*) **Mineral:** It is a naturally occurring substance from which metal may or may not be extracted profitably or economically, e.g. Al cannot be extracted profitably from mica.

(*ii*) **Ore:** It is a rocky material which contains sufficient quantity of mineral so that metal can be extracted profitably, e.g. zinc blende is an ore of zinc from which zinc can be extracted profitably.

(*iii*) **Gangue:** These are the unwanted impurities of sand and rocky material which is present along with the mineral in the ore, e.g. FeO is gangue in extraction of copper.

**49. Give reasons for the following:**

**(*i*) Silver and copper lose their shine when they are exposed to air. Name the substance formed on their surface in each case.**

**(*ii*) Tarnished copper vessels are cleaned with tamarind juice.**

**(*iii*) Aluminium is more reactive than iron yet there is less corrosion of aluminium as compared to iron when both are exposed to air.** **[CBSE]**

**Ans.** (*i*) These metals get corroded. Silver forms black $Ag_2S$ (silver sulphide) and copper forms greenish layer of basic copper carbonate $CuCO_3.Cu(OH)_2$.

(*ii*) Tamarind contains acid which reacts with basic copper carbonate and product gets dissolved and removed from copper vessel.

(*iii*) Aluminium forms oxide layer on its surface which does not further react with air.

## Long Answer Type Questions [5 Marks]

**50. (*a*) Write the chemical name of the coating that forms on silver and copper articles when these are left exposed to moist air.**

**(*b*) Explain what is galvanisation. What purpose is served by it?**

**(*c*) Define an alloy. How are alloys prepared? How do the properties of iron change when:**

**(*i*) small quantity of carbon,**

**(*ii*) nickel and chromium are mixed with it.** **[CBSE]**

**Ans.** (*a*) $Ag_2S$ (silver sulphide) is formed on silver, basic copper carbonate $CuCO_3.Cu(OH)_2$ is formed on copper.

(*b*) The process of coating zinc over iron is called galvanisation. It is used to prevent rusting of iron.

(*c*) Alloy is a homogeneous mixture of two or more metals. One of them can be non-metal. An alloy is prepared by mixing the various metals in molten state in appropriate proportions and then cooling the mixture at room temperature.

(*i*) Iron does not rust on adding small quantity of carbon.

(*ii*) When we form alloy of iron with nickel and chromium, we get stainless steel which is malleable and does not get rusted.

**51. (*a*) Differentiate between roasting and calcination. Explain the two with the help of suitable chemical equations. How is zinc extracted from its ore?**

**(*b*) Name two metals that can be used to reduce metal oxides to metals.** **[CBSE]**

**Ans.** (*a*)

| Roasting | Calcination |
|---|---|
| It is a process in which sulphide ore is heated in the presence of oxygen to convert into oxide. $2ZnS + 3O_2 \xrightarrow{\Delta} 2ZnO + 2SO_2$ | It is a process in which carbonate ore is heated in the absence of air to form oxide. $ZnCO_3(s) \xrightarrow{\text{heat}} ZnO(s) + CO_2(g)$ |

**Extraction of zinc from its ore:**

Zinc blende, ZnS is a ore of zinc.

It is first converted into zinc oxide, (ZnO) by heating.

$$2ZnS(s) + 3O_2(g) \xrightarrow{(g)} 2ZnO(s) + 2SO_2(g)$$

ZnO is then reduced to Zn by using suitable reducing agent like carbon.

$$ZnO(s) + C(s) \longrightarrow ZnO(s) + CO(g)$$

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(*b*) Aluminium, Magnesium can be used as reducing agents to get metal from metal oxides.

**52. (*a*) In the formation of compound between two atoms A and B, A loses two electrons and B gains one electron.**

**(*i*) What is the nature of bond between A and B?**

**(*ii*) Suggest the formula of the compound formed between A and B.**

**(*b*) On similar lines explain the formation of $MgCl_2$ molecule.**

**(*c*) Common salt conducts electricity only in the molten state. Why?**

**(*d*) Why is melting point of NaCl high?** **[CBSE]**

**Ans.** (*a*) (*i*) Ionic bond

(*ii*) $(A^{2+})(\dot{\underset{\cdot\cdot}{B}}:^-)_2$, i.e. $AB_2$

(*b*) $Mg \longrightarrow Mg^{2+} + 2e^-$

$2Cl + 2e^- \longrightarrow 2Cl^-$

$(Mg^{2+})\ (\overset{\times}{\underset{\times}{Cl}}:^-)_2$

(*c*) $Na^+$ and $Cl^-$ are free to move in molten state but not in solid state.

(*d*) It is due to strong force of attraction between oppositely charged ions of $Na^+$ and $Cl^-$.

**53. (*a*) Carbon cannot be used as reducing agent to obtain Mg from MgO. Why?**
**(*b*) How is sodium obtained from molten sodium chloride? Give equation of the reactions.**
**(*c*) How is copper obtained from its sulphide ore? Give equations of the reactions.** **[CBSE]**

**Ans.** (*a*) It is because 'Mg' is stronger reducing agent than carbon.

(*b*) Sodium is obtained from molten NaCl by electrolysis.

$$\underset{\text{(Molten)}}{2NaCl} \xrightarrow{\text{electrolysis}} 2Na(s) + Cl_2(g)$$

(*c*) Copper ore is concentrated by froth-floatation process.

**Roasting:** $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$

**Bassemerisation:** Copper oxide reacts with $Cu_2S$ on heating to form Blister copper and $SO_2$.

$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$

Blister copper is purified by electrolytic refining.

**54. How is the method of extraction of metals high up in the reactivity series different from that for metals in the middle? Why cannot the same process be applied for them? Explain, giving equations, the extraction of sodium.** **[CBSE]**

**Ans.** Metals high up in the series are obtained by electrolytic reduction because these metals are strong reducing agents and therefore, cannot be obtained by chemical reduction. Metals in middle of series are less reactive and can be obtained by chemical reduction. The same process cannot be used for both of them as highly reactive metals cannot be obtained by chemical reduction.

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Extraction of sodium is done by electrolysis of molten sodium chloride.

$$\underset{\text{(Molten)}}{2NaCl} \xrightarrow{\text{electrolysis}} 2Na(s) + Cl_2(g)$$

**55. Write the names and symbols of two most reactive metals. Explain by drawing electronic structure how any one of the two metals reacts with a halogen. State any four physical properties of the compound formed.** **[CBSE]**

**Ans.** K (Potassium) and Na (Sodium) are the two most reactive metals. $K^{\cdot}$ and $Na^{\cdot}$ are electronic structures as they have one valence electron.

$$K^{\cdot} + \cdot\ddot{\underset{\cdot\cdot}{F}}\cdot \longrightarrow K^+[:\ddot{\underset{\cdot\cdot}{F}}:]^{\ominus}$$

or

$$Na^{\cdot} + \cdot\ddot{\underset{\cdot\cdot}{F}}\cdot \longrightarrow [Na]^+ [:\ddot{\underset{\cdot\cdot}{F}}:]^{\ominus}$$

where 'F' is a halogen.

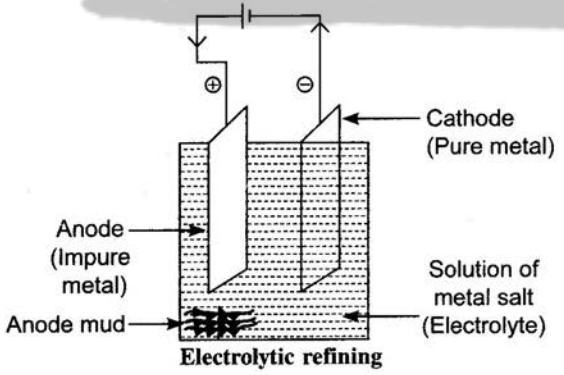
Four physical properties of the compounds formed by these elements and halogens are:

(*i*) They have high melting point.

(*ii*) They are soluble in water.
(*iii*) They conduct electricity in molten state not in solid state.
(*iv*) They are solid and somewhat hard.

**56. A metal 'M' which is one of the best conductors of heat and electricity used in making electric wires is found in nature as sulphide ore $M_2S$?**
**(*i*) Name the metal 'M'.**
**(*ii*) Which process will be suitable for extraction of this metal M from its ore $M_2S$? Write the balanced chemical reactions involved in the process of extraction.**
**(*iii*) With the help of a labelled diagram, explain the process of electrolytic refining of the metal.** **[CBSE]**

**Ans.** (*i*) Copper
(*ii*) It is concentrated by froth-floatation process.
**Roasting:** $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$
**Bassemerisation:** $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$
Impure copper is purified by electrolytic refining.
(*iii*) Impure metal is taken as anode whereas pure metal is taken as cathode. Soluble salt of metal is taken as electrolyte. When electric current is passed, impure metal changes to ions which gain electrons at cathode and change into pure metal. Impurities are left behind as anode mud.
**At anode:** $\underset{\text{Impure}}{M(s)} \longrightarrow M^{n+}(aq) + ne^-$
**At cathode:** $M^{n+}(aq) + ne^- \longrightarrow \underset{\text{Pure}}{M(s)}$



**Electrolytic refining**

**57. (*a*) Write the electron dot structures of sodium, oxygen and magnesium.**
**(*b*) Show the formation of $Na_2O$ and MgO by transfer of electrons. Name the ions present in these compounds.**
**(*c*) List three properties of ionic compounds.** **[CBSE]**

**Ans.** (*a*) Nȧ , :Ö:, Mg:

(*b*) $Na \times \searrow$ $\ddot{O}: \longrightarrow (Na^+)_2 (\ddot{O}:^{2-})$
$Na \times \nearrow$

$Mg \times\times \rightarrow \ddot{O}: \longrightarrow (Mg^{2+})(\ddot{O}:^{2-})$

$Na_2O$ contains $Na^+$ and $O^{2-}$ ions.
MgO contains $Mg^{2+}$ and $O^{2-}$ ions.

(*c*) (*i*) They are solids having high melting point.
(*ii*) They are soluble in water.
(*iii*) They conduct electricity in molten state as well as in aqueous solution.

**58. What are alloys? How are they made? Name the constituents and uses of brass, bronze and solder.** **[CBSE]**

Ans. Alloys are homogeneous mixtures of two or more metals. One of them can be a non-metal also. An alloy is prepared by mixing the various metals in molten state in appropriate proportions and then cooling the mixture at room temperature.
Brass contains copper and zinc. It is used for making decorative articles.
Bronze contains copper and tin. It is used for making statues and medals.
Solder contains lead and tin. It is used for soldering purposes.

**59. A metal (E) is stored under kerosene. When a small piece of it is left open in the air, it catches fire. When the product formed is dissolved in water, it turns red litmus to blue.**
**(*i*) Name the metal (E).**
**(*ii*) Write the chemical equation for the reaction when it is exposed to air and when the product is dissolved in water.**
**(*iii*) Explain the process by which the metal is obtained from its molten chloride.** **[CBSE]**

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**Ans.** (*i*) 'E' is sodium which catches fire in presence of moisture.
(*ii*) $4Na + O_2 \longrightarrow 2Na_2O$
$Na_2O + H_2O \longrightarrow 2NaOH$
(*iii*) Electrolytic reduction: Electric current is passed through molten NaCl. Sodium is formed at cathode and chlorine gas is liberated at anode.

$$\underset{\text{Molten}}{2NaCl} \xrightarrow{\text{electrolysis}} 2Na + Cl_2$$

## 2011

### Very Short Answer Type Questions [1 Mark]

**60. A non-metal X exists in two different forms Y and Z. Y is the hardest natural substance, whereas Z is a good conductor of electricity. Identify X, Y and Z.** **[CBSE]**

**Ans.** 'X' is carbon, 'Y' is diamond as it is the hardest natural substance and 'Z' is graphite as it is good conductor of electricity.

**61. Why does calcium float in water?** [CBSE]

**Ans.** It is because hydrogen gas is formed which sticks to surface of calcium, therefore it floats.

**62. Name a non-metal which is lustrous and a metal which is non-lustrous.** [CBSE]

**Ans.** Iodine is a non-metal which is lustrous, lead is a non-lustrous metal.

**63. Which gas is liberated when a metal reacts with an acid? How will you test the presence of this gas?** [CBSE]

**Ans.** Hydrogen gas is formed. Bring a burning matchstick near to it, $H_2$ will burn explosively with 'pop' sound.

**64. Name the metal which reacts with a very dilute $HNO_3$ to evolve hydrogen gas.** [CBSE]

**Ans.** Magnesium

**65. Name two metals which are found in nature in the free state.** [CBSE]

**Ans.** (*i*) Gold (*ii*) Silver

## Short Answer Type [I] Questions [2 Marks]

**66. The way, metals like sodium, magnesium and iron react with air and water is an indication of their relative positions in the 'reactivity series'. Is this statement true? Justify your answer with examples.** [CBSE]

**Ans.** Yes, sodium reacts explosively even with cold water, it is most reactive. Magnesium reacts with hot water, it is less reactive than Na. Iron reacts only with steam which shows it is least reactive among the three.

**67. $X + YSO_4 \longrightarrow XSO_4 + Y$**
**$Y + XSO_4 \longrightarrow$ No reaction**
**Out of the two elements, 'X' and 'Y', which is more reactive and why?** [CBSE]

**Ans.** 'X' is more reactive than 'Y' because it displaces 'Y' from its salt solution.

**68. What is an alloy? State the constituents of solder. Which property of solder makes it suitable for welding electrical wires?** [CBSE]

**Ans.** Alloy is a homogeneous mixture of two or more metals. One of them can be a non-metal also. Solder consists of lead and tin. It has low melting point which makes it suitable for welding electrical wires.

**69. Using the electronic configurations, explain how magnesium atom combines with oxygen atom to form magnesium oxide by transfer of electrons.** [CBSE]

**Ans.** Refer to Ans. 4.

**70. When a metal X is treated with cold water, it gives a base Y with molecular formula XOH (Molecular mass = 40) and liberates a gas Z which easily catches fire. Identify X, Y and Z.** [CBSE]

**Ans.** $2Na + 2H_2O \longrightarrow 2NaOH + H_2(g)$
'X' 'Y' 'Z'
'X' is sodium, 'Y' is sodium hydroxide, 'Z' is $H_2$ (*g*).

**71. Write chemical equations that shows aluminium oxide reacts with acid as well as base.** [CBSE]

**Ans.** $Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$
$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$

## Long Answer Type Questions [5 Marks]

**72. (*a*) Name the main ore of mercury. How is mercury obtained from its ore? Give balanced chemical equation.**
**(*b*) What is thermite reaction? How is it used to join the railway tracks or cracked machine parts?**
**(*c*) Name the method used to extract metals of high reactivity.** **[CBSE]**

**Ans.** (*a*) Refer to Ans. 24.
(*b*) When aluminium is heated with $Fe_2O_3$ to get molten iron, it is called thermite reaction.

$$Fe_2O_3 + 2Al \longrightarrow Al_2O_3 + 2Fe$$

Molten iron is used to weld broken railway tracks.
(*c*) Electrolytic reduction

**73. (*a*) How can the metals at the top of the reactivity series be extracted from their ores? Explain with an example.**
**(*b*) Name any one alloy made from**
**(*i*) a metal and a non-metal, and**
**(*ii*) two metals.** **[CBSE]**

**Ans.** (*a*) Metals on top of the reactivity series are very reactive. They cannot be obtained by reducing agents like carbon since they have more affinity for oxygen than carbon. These metals are obtained by the process of electrolytic reduction.
**For example:** Sodium is obtained by the electrolysis of its molten chloride. The metals are deposited at the cathode whereas chlorine is liberated at the anode.
At cathode: $Na^+ + e^- \longrightarrow Na$
At anode: $2Cl^- \longrightarrow Cl_2 + 2e^-$
(*b*) (*i*) Steel is made up of iron and carbon.
(*ii*) Brass is made up of copper and zinc.

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**74. (*a*) Give two methods to prevent the rusting of iron.**
**(*b*) Name the ores of the following metals:**
**(*i*) mercury, and (*ii*) zinc**
**(*c*) Explain with the help of a diagram, how copper metal can be refined? Label the important arrangements in the experimental set-up.** **[CBSE]**

**Ans.** (*a*) (*i*) Painting (*ii*) Galvanisation
(*b*) (*i*) Cinnabar (*ii*) Zinc Blende
(*c*) Refer to Ans. 14 (*b*) (*iv*).

**75. With the help of a suitable example, explain how ionic compounds are formed. State any three general properties of ionic compounds.** **[CBSE]**

**Ans.** Refer to Ans. 8.

**General Properties:**
(*i*) They are the solids having high melting point.
(*ii*) They are soluble in water.
(*iii*) They conduct electricity in molten state as well as in aqueous solution.

**76. (*a*) Explain with an example how the metal (X) which is low in reactivity series and metal (Y) which is high in the reactivity series are obtained from their compounds by reduction process.**

**(*b*) Write the electronic configurations of sodium and chlorine. Show the formation of sodium chloride from sodium and chlorine by the transfer of electrons.**

**(*c*) List any two observations when a highly reactive metal is dropped in water.**

**[CBSE]**

**Ans.** (*a*) 'X' is obtained by chemical reduction.
'Y' is obtained by electrolytic reduction.

(*b*) Refer to Ans. 8.

(*c*) (*i*) Metal will catch fire.
(*ii*) Alkali solution is formed which turns red litmus blue.

**77. (*a*) The reaction of metal (X) with ferric oxide is highly exothermic. Metal (X) is obtained from its oxides by electrolytic reduction. Identify (X) and write its reaction with ferric oxide.**

**(*b*) Give reason to justify that aluminium oxide is an amphoteric oxide. Also, give another example of amphoteric oxide.**

**(*c*) Mention constituent metals present in bronze.** **[CBSE]**

**Ans.** (*a*) 'X' is 'Al'.

$$2Al + Fe_2O_3 \longrightarrow Al_2O_3 + 2Fe$$

(*b*) $Al_2O_3$ reacts with acid as well as base therefore it is amphoteric oxide.

$$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$$

$$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2$$

Zinc oxide is also an amphoteric oxide.

(*c*) Bronze contains copper and tin.

## 2010

### Very Short Answer Type Questions [1 Mark]

**78. What is the valency of silicon with atomic number 14?** **[CBSE]**

**Ans.** Its valency is equal to 4.

**79. What is the valency of phosphorus with atomic number 15?** **[CBSE]**

**Ans.** Phosphorus has valency 3.

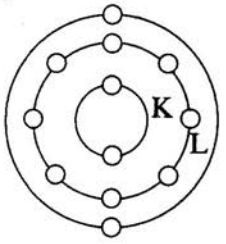
**80. What is the valency of an element with atomic number 35?** **[CBSE]**

**Ans.** Its valency is 1.

## Short Answer Type [I] Question [2 Marks]

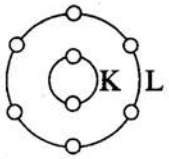
**81. Elements magnesium and oxygen respectively belong to group 2 and group 16 of the Modern Periodic Table. If the atomic numbers of magnesium and oxygen are 12 and 8 respectively, draw their electronic configurations and show the process of formation of their compound by transfer of electrons.** **[CBSE]**

**Ans.** Mg(12) = 2, 8, 2




K = 2, L = 8, M = 2

O(8) = 2, 6




K = 2, L = 6

$Mg \overset{\times}{\underset{\times}{::}} \rightarrow \ddot{O}: \; (Mg^{2+}) \; (\overset{\times}{\underset{\times}{::}}\ddot{O}\overset{\times}{\underset{\times}{::}}^{2-})$

## ong Answer Type Question [5 Marks]

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**82. No reaction takes place when granules of a solid 'A' are mixed with a powder of solid 'B'. However, when the mixture is heated, a reaction starts with evolution of much heat. Product 'C' of the reaction settles down as a liquid metal and solid product 'D' keeps floating over the liquid 'C'. This reaction is sometimes used for making metals for ready use in odd places.**

**(*i*) Based on this information, make assumptions about 'A' and 'B' and corresponding deductions about 'C' and 'D' and write a balanced chemical equation for the reaction. Include in the chemical equation about physical states of the reactants and products, need of heating for starting the reaction and the reaction being exothermic.**

**(*ii*) Name two types of chemical reactions to which this reaction can belong.** **[CBSE]**

**Ans.** (*i*) 'A' is aluminum, 'B' is ferric oxide [Iron(III) oxide].

$$\underset{\text{'A'}}{2Al(s)} + \underset{\text{'B'}}{Fe_2O_3(s)} \xrightarrow{\text{heat}} \underset{\text{'D'}}{Al_2O_3(s)} + \underset{\text{'C'}}{2Fe(l)} + \text{heat}$$

(*ii*) This reaction is displacement reaction because 'Al' is displacing 'Fe'. It is also a redox reaction because 'Al' is reducing agent and $Fe_2O_3$ is oxidising agent.

# 4 CARBON AND ITS COMPOUNDS

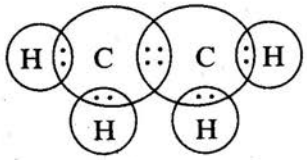
## PREVIOUS YEARS' QUESTIONS

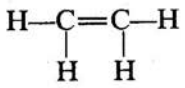
**2019**

### Short Answer Type [I] Questions [2 Marks]

**1. Write the molecular formula of ethene and draw its electron dot structure.**
**[AI Allahabad]**

**Ans.** Ethene($C_2H_4$):




**2. "Conversion of ethanol to ethanoic acid is an oxidation reaction." Justify this statement giving the relevant equation for the chemical reaction involved.** **[AI Uttarakhand]**

**Ans.** Alkaline $KMnO_4$ oxidises ethanol to ethanoic acid. It is oxidation reaction because oxygen is being added.

$$CH_3CH_2OH + 2[O] \xrightarrow{\text{Alkaline } KMnO_4} CH_3-\overset{\overset{O}{\|}}{C}-OH + H_2O$$

**3. What happens when 5% alkaline solution of $KMnO_4$ is added drop by drop to warm propyl alcohol (propanol) taken in a test tube? Explain with the help of chemical equation.** **[AI Uttarakhand]**

**Ans.** Propyl alcohol gets oxidised to propanoic acid.

$$CH_3CH_2CH_2OH + 2[O] \xrightarrow{\text{Alkaline } KMnO_4} CH_3CH_2COOH$$

Alkaline $KMnO_4$ acts as oxidising agent.

### Short Answer Type [II] Questions [3 Marks]

**4. What is a homologous series of carbon compounds? Give an example and list its three characteristics.** **[AI Allahabad]**

**Ans.** The series of organic compounds having same functional group and similar chemical properties is called homologous series.

$C_2H_4$, $CH_2{=}CH_2$, Ethene is first member of alkene series.

**Characteristics:**

(*i*) It has same general formula, from which, all members can be derived.

(*ii*) They have similar chemical properties.

(*iii*) They have same general methods of preparation.

**5. What happens when 'X' reacts with $H_2$ in presence of Ni or Pd to form 'Y'. 'Y' on reaction with chlorine in presence of sunlight gives 'Z'. Identify X, Y and Z. What type of reaction is Y to 'Z'? [CBSE for Blind]**

**Ans.** 'X' is $CH_2{=}CH_2$ (Ethene) 'Y' is Ethane 'Z' is Chloroethane.

$$\underset{\text{'X'}}{CH_2{=}CH_2} + H_2 \xrightarrow[\text{or Pd}]{\text{Ni}} \underset{\text{Ethane (Y)}}{CH_3{-}CH_3}$$

$$\underset{\text{'Y'}}{CH_3{-}CH_3} + Cl_2 \xrightarrow[\text{light}]{\text{Sun}} \underset{\substack{\text{Chloroethane}\\ \text{'Z'}}}{C_2H_5Cl} + HCl$$

'Y' to 'Z', reaction is called substitution reaction.

**6. (*a*) What are saturated hydrocarbons? Give one example.**

**(*b*) What happens when methane reacts with $Cl_2$ in presence of sunlight? Write the chemical reactions and type of reaction. [CBSE for Blind]**

**Ans.** (*a*) Those hydrocarbons which have only single bonds are called saturated hydrocarbons, i.e. $CH_4$.

READERS VENUE

(*b*)
$$CH_4 + Cl_2 \xrightarrow[\text{light}]{\text{Sun}} CH_3Cl + HCl$$

$$CH_3Cl + Cl_2 \xrightarrow{h\nu} CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{h\nu} CHCl_3 + HCl$$

These are substitution reactions.

## Long Answer Type Questions [5 Marks]

**7. Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with — [Delhi]**

**(*i*) sodium metal**

**(*ii*) hot concentrated sulphuric acid.**

**Ans.** $CH_3CH_2OH$, Ethanol (IUPAC name), Ethyl alcohol (common name) is active ingredient of all alcoholic drinks.

- It is used in cough syrups and tonics.
- It is used as antiseptic.

(*i*) $2CH_3CH_2OH + 2Na \longrightarrow 2CH_3CH_2ONa + H_2$

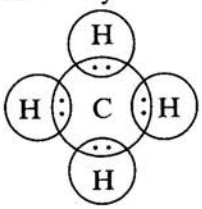
(*ii*) $CH_3CH_2OH \xrightarrow[\text{heat}]{\text{conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$

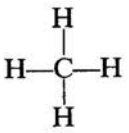
**8. What is methane? Draw its electron dot structure. Name the type of bonds formed in this compound. Why are such compounds:**

**(*i*) poor conductors of electricity? and**

**(*ii*) have low melting and boiling points? What happens when this compound burns in oxygen?** **[Delhi]**

**Ans.** Methane ($CH_4$) is saturated hydrocarbon, first member of alkane series.




(*i*) Such compounds are poor conductors of electricity because they do not form ions which can carry current.

(*ii*) They have low melting and boiling points due to weak van der Waals' forces of attraction.

When this compound burns in air, $CO_2$ and water are produced.

$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

READERS VENUE

**9. (*a*) Distinguish between esterification and saponification reactions with the help of chemical equations for each.**

**(*b*) With a labelled diagram describe in brief an activity to show the formation of an ester.** **[Uttarakhand; Panchkula]**

**Ans.** (*a*) **Esterification:** It is the process in which carboxylic acid react with alcohol in presence of conc. $H_2SO_4$ to form a pleasant fruity smelling compound called ester.

$$CH_3COOH + C_2H_5OH \xrightarrow{\text{conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$$

**Saponification:** It is the process in which ester react with sodium hydroxide to form sodium salt of acid and alcohol.

$$CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$$

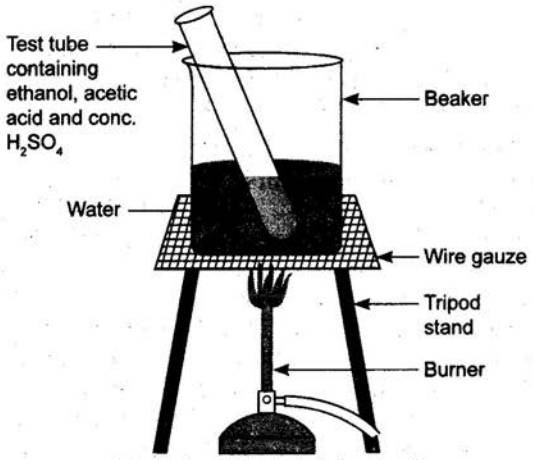
(*b*) **Aim :**

**Materials Required :** Beaker, water, test tube, ethanol, acetic acid, conc. $H_2SO_4$, tripod stand, burner, wire gauze, etc.

**Method :**

1. Take 2 ml of ethanol in a test tube.
2. Add 2 ml of ethanoic acid (acetic acid) into it.

3. Add few drops of conc. $H_2SO_4$.
4. Warm it in a beaker containing water.
5. Observe the smell of the products formed.




**Formation of ester (ethyl acetate)**

**Observations :** Pleasant fruity smelling compound (called ester) is formed.

**Chemical Reaction Involved :**

$$\underset{\text{Ethanoic acid}}{CH_3COOH\ (l)} + \underset{\text{Ethanol}}{C_2H_5OH\ (l)} \xrightarrow{\text{conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5(l)} + \underset{\text{Water}}{H_2O(l)}$$

**Conclusion :** Carboxylic acid reacts with alcohol in presence of conc. $H_2SO_4$, which acts as a dehydrating agent to form esters.

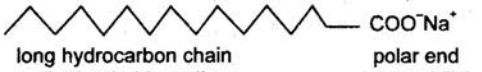
**10. What is difference between soaps and detergents? State in brief the cleansing action of soaps in removing an oily spots from the fabric. Why are soaps not effective when a fabric is washing in hard water? How is this problem resolved?** **[AI Uttarakhand]**

**Ans.** • **Difference between soaps and detergents.**

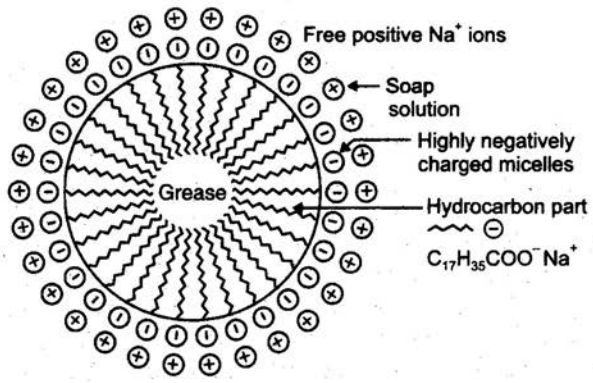
| Soaps | Detergents |
|---|---|
| (*i*) Soaps are sodium salts of fatty acids. | (*i*) Detergents are sodium salts of sulphonic acids. |
| (*ii*) Soaps do not work well in hard water due to formation of scum. | (*ii*) Detergents can work well in hard water also, so problem can be resolved by using detergent. |

• **Cleansing action of soap:**

The carbon chain of soap dissolves oil and ionic end dissolves in water to form micels and oil is washed away.




long hydrocarbon chain (hydrophobic end) (water-repellent) — polar end (hydrophilic) (water-loving)




- Hard water contains $Ca^{2+}$ and $Mg^{2+}$ which react with soap to form precipitate called **scum** that is why soaps are not effective when a fabric is washing in hard water.
- Boiling hard water or using detergent can solve this problem.

**11. (*a*) What is hydrocarbon? Give one example.**

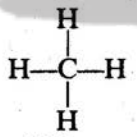
**(*b*) Give the structural formula of saturated and unsaturated hydrocarbons with two examples of each.**

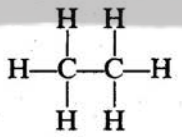
**(*c*) Write IUPAC names of the following:**

**(*i*) $CH_3OH$ (*ii*) $CH_3-\overset{\overset{O}{\|}}{C}-H$ (*iii*) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (*iv*) $CH_3COOH$** [AI Panchkula]

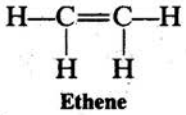
**Ans.** (*a*) The compounds of carbon and hydrogen are called **hydrocarbons**, e.g. $CH_4$(methane)

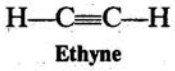
(*b*) **Saturated hydrocarbons:** They have single bonds only.


Methane


Ethane

**Unsaturated hydrocarbons:** They have double or triple bonds.


Ethene


Ethyne

(*c*) (*i*) $CH_3OH$ is Methanol. (*ii*) $CH_3-\overset{\overset{O}{\|}}{C}-H$ is Ethanal.

(*iii*) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ is Propanone. (*iv*) $CH_3COOH$ is Ethanoic acid.

**12. (*a*) State the reason why carbon can neither form $C^{4+}$ cation, nor $C^{4-}$ anion but form covalent bonds. Also state the reasons to explain why covalent compounds (*i*) are bad conductors of electricity (*ii*) have low melting and boiling points.**

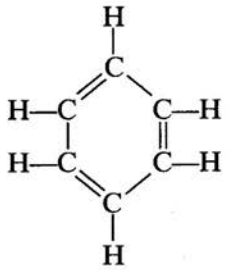
**(*b*) Write the structural formula of Benzene.** [AI Chandigarh]

**Ans.** (*a*) Carobn cannot lose 4 electrons because very high energy is needed. Carbon can not gain 4 electrons because 6 protons cannot hold 10 electrons. Carbon can share four electrons to form covalent bonds.

(*i*) Carbon compounds do not conduct electricity because they do not form ions in aqueous solution and do not have free electrons.

(*ii*) They have low melting and boiling points. due to weak van der Waals' forces of attraction between molecules, thus less energy is needed to break the bonds.

(*b*)



**Benzene**

**13. (*a*) Define the term isomer.**

**(*b*) Two compounds have same molecular formula $C_3H_6O$. Write the names of these compounds and their structural formula.**

**(*c*) How would you bring about the following conversions:**

**(*i*) Ethanol to Ethene (*ii*) Propanol to propanoic acid.** **[AI Chandigarh]**

**Ans.** (*a*) Those compounds which has same molecular formula but different structural formula are called isomers.

(*b*) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3$ (Propanone) $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-H$ (Propanal)

(*c*) (*i*) $\underset{\text{Ehtanol}}{CH_3CH_2OH} \xrightarrow[443\,K]{\text{conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$

(*ii*) $\underset{\text{Propanol}}{CH_3CH_2CH_2OH} \xrightarrow[\Delta]{KMnO_4/KOH} \underset{\text{Propanoic acid}}{CH_3-CH_2-\overset{\overset{O}{\|}}{C}-OH} + H_2O$

## 2018

### Short Answer Type [I] Questions [2 Marks]

**14. A compound 'X' on heating with excess conc. sulphuric acid at 443 K gives an unsaturated compound 'Y'. 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction of formation of 'Y' and also write the role of sulphuric acid in the reaction.** **[CBSE]**

**Ans.** 'X' is $CH_3CH_2OH$ (Ethyl alcohol). Its IUPAC name is Ethanol.

'Y' is $CH_2{=}CH_2$, Ethene

'Z' is $H_2$ gas

Conc. $H_2SO_4$ acts as dehydrating agent.

$$CH_3CH_2OH \xrightarrow[443\ K]{\text{conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$$

$$2CH_3CH_2OH + 2Na \longrightarrow \underset{\text{Sodium ethoxide}}{2CH_3CH_2ONa} + H_2$$

## Short Answer Type [II] Questions [3 Marks]

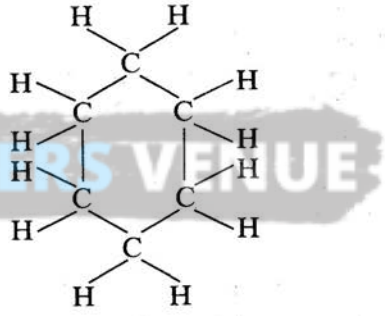
**15. (*a*) Why are most carbon compounds poor conductors of electricity?**

**(*b*) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound. [CBSE]**

**Ans.** (*a*) Carbon compounds are covalent in nature and do not dissociate to form ions because of which they are poor conductor of electricity.

(*b*) Cyclohexane is the saturated compound in which the carbon atoms are arranged in a ring.

Cyclohexane



Structural formula

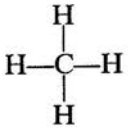
It has 18 single bonds.

## 2018 (Compartment)

## Short Answer Type [I] Questions [2 Marks]

**16. Carbon has four electrons in its valence shell. Which type of compounds can be formed by carbon atom and why? Give any one example of such compounds. [CBSE]**

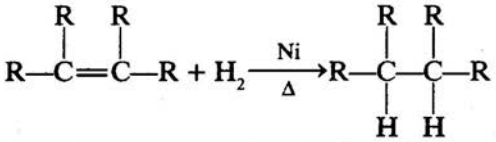
**Ans.** Refer to Ans. 12(*a*).

Example: 

## Short Answer Type [II] Questions [3 Marks]

**17. What happens when hydrogen is added to a vegetable oil in the presence of nickel? Name the reaction and write one difference between the physical property of the vegetable oil and the product obtained in this reaction. Write the role of nickel in this reaction.** **[CBSE]**

**Ans.** The reaction is called hydrogenation.



- Vegetable oil is liquid whereas vegetable ghee is solid (Physical property.)
- Nickel acts as catalyst in this reaction.

## 2017

## Very Short Answer Type Questions [1 Mark]

**18. Write the molecular formula of first two members of homologous series having functional group —Cl.** **[Delhi]**

**Ans.** $CH_3Cl$ and $C_2H_5Cl$

**19. Write the molecular formula of first two members of homologous series having functional group —Br.** **[Delhi]**

**Ans.** $CH_3Br$ and $C_2H_5Br$.

**20. Write the molecular formula of first two members of homologous series having functional group —OH.** **[Delhi]**

**Ans.** $CH_3OH$ and $C_2H_5OH$

**21. Write the molecular formula of the 2nd and the 3rd member of the homologous series whose first member is methane.** **[All India]**

**Ans.** $C_2H_6$ and $C_3H_8$ are molecular formula of 2nd and 3rd member of alkanes.

**22. Write the molecular formula of the 2nd and 3rd member of the homologous series whose first member is ethene.** **[All India]**

**Ans.** $C_3H_6$ and $C_4H_8$ are 2nd and 3rd member.

**23. Write the molecular formula of the 2nd and 3rd member of the homologous series where the first member is ethyne.** **[All India]**

**Ans.** $C_3H_4$ and $C_4H_6$ are 2nd and 3rd member of Alkynes.
Propyne 1-Butyne

**24. Write the molecular formula of the first two members of the homologous series having functional group —COOH.** **[Foreign]**

**Ans.** HCOOH — Methanoic acid
$CH_3COOH$ — Ethanoic acid

**25. Write the molecular formula of the first two members of the homologous series whose functional group is —CHO.** **[Foreign]**

**Ans.** HCHO and $CH_3CHO$ are the two members of the homologous series whose functional group is —CHO.

**26. Write the molecular formula of the first two members of the homologous series having functional group $\diagdown C{=}O \diagup$.** **[Foreign]**

**Ans.** $CH_3COCH_3$ (Propanone) $\qquad$ $CH_3COCH_2CH_3$ (Butanone)

are the first two members of the homologous series having functional group $\diagdown C{=}O \diagup$.

## Short Answer Type [II] Questions [3 Marks]

**27. Two carbon compounds X and Y have the molecular formula $C_4H_8$ and $C_5H_{12}$ respectively. Which one of these is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.** **[Delhi]**

**Ans.** 'X' ($C_4H_8$) will show addition reaction because it is unsaturated, i.e. it has a double bond e.g.

$$\underset{\text{Butene}}{CH_2{=}CH{-}CH_2{-}CH_3} + H_2 \xrightarrow[\text{heat}]{\text{Ni}} \underset{\text{Butane}}{CH_3{-}CH_2{-}CH_2{-}CH_3}$$

When a molecule of $H_2$ is added to unsaturated compound to form saturated compound, this reaction is called addition reaction.

READERS VENUE

**28. Complete the following chemical equations:**

(*i*) $CH_3COOC_2H_5 + NaOH \longrightarrow$

(*ii*) $CH_3COOH + NaOH \longrightarrow$

(*iii*) $C_2H_5OH + CH_3COOH \xrightarrow{\text{Conc. } H_2SO_4}$ **[Delhi]**

**Ans.** (*i*) $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$

(*ii*) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

(*iii*) $C_2H_5OH + CH_3COOH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$

**29. Complete the following chemical equations:**

(*i*) $CH_3COOH + Na_2CO_3 \longrightarrow$

(*ii*) $CH_4 + O_2 \longrightarrow$

(*iii*) $C_2H_5OH + Na \longrightarrow$ **[Delhi]**

**Ans.** (*i*) $2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$

(*ii*) $CH_4 + 2O_2 \longrightarrow CO_2 + 2H_2O$

(*iii*) $2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2$

**30. Two carbon compounds X and Y have the molecular formula $C_3H_6$ and $C_4H_{10}$ respectively. Which one of the two is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.** **[Delhi]**

**Ans.** Compound 'X', i.e. $C_3H_6$ will show addition reactions because it is unsaturated hydrocarbon due to the presence of double bond.

$$CH_3—CH=CH_2 + Br_2 \longrightarrow CH_3—\underset{\displaystyle Br}{\underset{|}{CH}}—CH_2Br$$

When a molecule is added to unsaturated compound to form saturated compound, it is called addition reaction.

**31. Complete the following chemical equations:**

**(*i*) $C_2H_5OH + O_2 \longrightarrow$**

**(*ii*) $C_2H_5OH \xrightarrow[443\ K]{Conc.\ H_2SO_4}$**

**(*iii*) $CH_3COOH + NaHCO_3 \longrightarrow$** **[Delhi]**

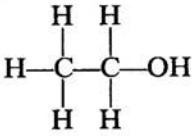
**Ans.** (*i*) $C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$

(*ii*) $C_2H_5OH \xrightarrow[443\ K]{Conc.\ H_2SO_4} CH_2=CH_2 + H_2O$

(*iii*) $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$

**32. Write the structural formula of ethanol. What happens when it is heated with excess of conc. $H_2SO_4$ at 443 K? Write the chemical equation for the reaction stating the role of conc. $H_2SO_4$ in this reaction.** **[All India]**

**Ans.** Structural formula of ethanol $CH_3CH_2OH$ is



Ethene is formed, when it is heated with conc. $H_2SO_4$ at 443 K.

$$CH_3CH_2OH \xrightarrow[443\,K]{conc.\ H_2SO_4} CH_2=CH_2 + H_2O$$

Conc. $H_2SO_4$ acts as dehydrating agent.

**33. Distinguish between esterification and saponification reactions with the help of the chemical equations for each. State one use of each (*i*) esters, and (*ii*) saponification process.** **[All India]**

**Ans.** Refer to Ans. 9 (*a*).

**Uses:** (*i*) **Esters:** They are used in cold drinks, ice creams and perfumes.

(*ii*) **Saponification:** It is used for preparation of soap.

**34. What happens when**
**(write chemical equation in each case)**
**(*a*) ethanol is burnt in air?**
**(*b*) ethanol is heated with excess conc. $H_2SO_4$ at 443 K?**
**(*c*) a piece of sodium is dropped into ethanol?** **[All India]**

**Ans.** (*a*) $CO_2$ and $H_2O$ are formed.

$$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$$

(*b*) Ethene is formed.

$$C_2H_5OH \xrightarrow[443\ K]{\text{conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$$

(*c*) Sodium ethoxide and hydrogen gas is formed.

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2$$

**35. Explain esterification reaction with the help of a chemical equation. Describe an activity to show esterification.** **[All India]**

**Ans.** Refer to Ans. 9 (*b*).

**36. Name two oxidising agents that are used for the conversion of alcohols to acids. Distinguish between ethanol and ethanoic acid on the basis of (*a*) litmus test, and (*b*) reaction with sodium hydrogen carbonate.** **[Foreign]**

**Ans.** Acidified $KMnO_4/H_2SO_4$ (Potassium permanganate) and Acidified $K_2Cr_2O_7/H_2SO_4$ (Potassium dichromate).

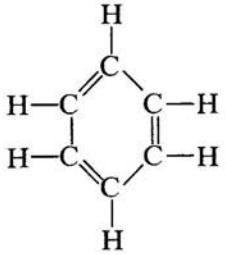
| Ethanol | Ethanoic acid |
|---|---|
| (*a*) Litmus test: No effect | (*a*) Litmus test: Blue litmus changes to red. |
| (*b*) $NaHCO_3$ test: No effect | (*b*) $NaHCO_3$ test: Brisk effervescence due to the evolution of colourless odour less gas $CO_2$. |

**37. Explain, giving reason, why carbon neither forms $C^{4+}$ cations nor $C^{4-}$ anions, but forms covalent compounds which are bad conductors of electricity have low melting point and low boiling point.** **[Foreign]**

**Ans.** Refer to Ans. 12 (*a*).

**38. Write the molecular formula of benzene and draw its structure. List in tabular form the two properties in which covalent compounds differ from ionic compounds.** **[Foreign]**

**Ans.** $C_6H_6$ is molecular formula of benzene. Its structure is as follows:



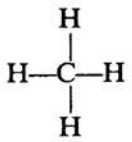
| Covalent compounds | Ionic compounds |
|---|---|
| (*a*) They do not conduct electricity. | (*a*) They conduct electricity in molten state and in aqueous solution. |
| (*b*) They have low melting and boiling points. | (*b*) They have high melting and boiling points. |

**39. What are hydrocarbons? Write the general formula of (*i*) saturated hydrocarbons, and (*ii*) unsaturated hydrocarbons and draw the structure of one hydrocarbon of each type.** **[Foreign]**

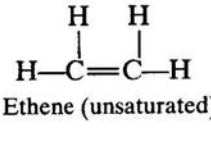
**Ans.** Compounds of carbon and hydrogen only are called hydrocarbons

(*a*) $C_nH_{2n+2}$ is general formula of saturated hydrocarbon.

(*b*) $C_nH_{2n}$ and $C_nH_{2n-2}$ are the general formula of unsaturated hydrocarbons.



Methane (saturated)



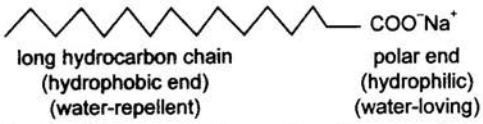
Ethene (unsaturated)

## Long Answer Type Questions [5 Marks]

**40. Soaps and detergents are both types of salts. State the difference between the two. Write the mechanism of the cleansing action of soaps. Why do soaps not form lather (foam) with hard water? Mention any two problems that arise due to the use of detergents instead of soaps.** **[Delhi]**

**Ans.** Soaps are sodium or potassium salts of fatty acids having —COONa group. Detergents are sodium or potassium salts of sulphonic acids having $—SO_3Na$ and $—SO_4Na$ group.

**Cleansing Action of Soap.** Soaps consist of a large hydrocarbon tail which is hydrophobic (water-hating or water repelling) with a negatively charged head which is hydrophilic (water-loving) as shown in figure.




When a soap is dissolved in water, the molecules associate together as clusters called micelles in which, water molecules being polar in nature, surround the ions and the hydrocarbon part of the molecule attracts grease, oil and dirt.

Hard water has $Ca^{2+}$ and $Mg^{2+}$ ions when react with soap to form insoluble compound and soap goes waste.

**Disadvantages of Detergents**

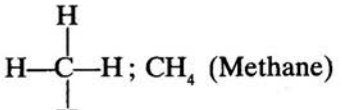
(*i*) Detergents are expensive.

(*ii*) Many detergents are branched chain hydrocarbon which are not biodegradable and create water pollution.

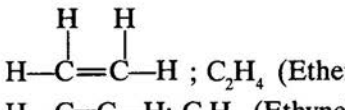
**41. Why are certain compounds called hydrocarbons? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.** **[All India]**

**Ans.** Compounds which are made up of carbon and hydrogen only are called hydrocarbons.

General formula of alkanes $C_nH_{2n+2}$, alkene $C_nH_{2n}$ and alkyne $C_nH_{2n-2}$.



$CH_4$ (Methane)

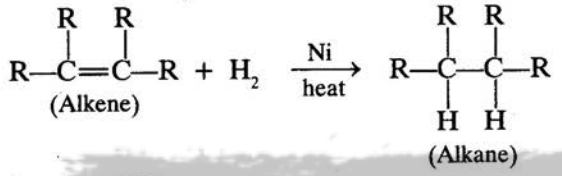


$C_2H_4$ (Ethene)

$H-C\equiv C-H$; $C_2H_2$ (Ethyne)

are first member of each series.

Hydrogenation is a reaction by which alkenes can be converted into alkanes.



where R is alkyl group $C_nH_{2n+1}$.

READERS VENUE

## 2017 (Compartment)

### Very Short Answer Type Questions [1 Mark]

**42. Write the molecular formula of (*i*) Methane and (*ii*) Ethanol.** **[Delhi]**

**Ans.** (*i*) Methane — $CH_4$

(*ii*) Ethanol — $C_2H_5OH$

### Short Answer Type [II] Questions [3 Marks]

**43. What is a homologous series of carbon compounds? List its any two characteristics. Write the name and formula of next higher homologous of HCOOH.** **[Delhi]**

**Ans.** Refer to Ans. 4.

Ethanoic acid ($CH_3COOH$) is next higher homologous of HCOOH.

**44. What are covalent compounds? How are they different from ionic compounds? List any two properties of covalent compounds.** **[All India]**

**Ans. Covalent compounds:** Those compounds in which elements shared electrons are called covalent compounds.

**Ionic compounds** are formed by complete transfer of electrons from one atom to another. Ionic compounds are soluble in water whereas covalent compounds are insoluble in water.

**Properties of covalent compounds:**

(*i*) They do not form ions in aqueous solution and do not conduct electricity.

(*ii*) They have low melting and boiling points.

(*iii*) They are mostly insoluble in water but soluble in organic solvents. (*any two*)

**45. Ethanoic acid reacts with absolute ethanol in the presence of conc. $H_2SO_4$ to form a compound.**

**(*i*) Write the smell and class of compounds to which this compound belong.**

**(*ii*) Write the chemical equation for the reaction and state the role of conc. $H_2SO_4$ in the reaction.**

**(*iii*) Write one use of the product of this reaction.** **[All India]**

**Ans.** (*i*) The compound formed belong to 'Esters'.

It has pleasant fruity smell.

(*ii*) $CH_3COOH + C_2H_5OH \xrightarrow{\text{conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$

conc. $H_2SO_4$ acts as dehydrating agent.

(*iii*) It is used as a solvent in glues, nail polish removers and decaffeinating tea and coffee.

It is used as solvent in printing to modify its drying rate.

## Long Answer Type Questions [5 Marks]

**46. (*a*) Write a chemical equation of each of the following types of chemical reactions of organic compounds.**

**(*i*) Oxidation reaction** **(*ii*) Addition reaction**

**(*iii*) Substitution reaction**

**(*b*) What is ethanol? What happens when it is heated with excess conc. $H_2SO_4$ at 443 K? Write the role of conc. $H_2SO_4$ in this reaction.** **[Delhi]**

**Ans.** (*a*) (*i*) **Oxidation reaction:**

$$\underset{\text{Ethanol}}{CH_3CH_2OH} + 2[O] \xrightarrow[KMnO_4]{\text{Alkaline}} \underset{\text{Ethanoic acid}}{CH_3COOH} + H_2O$$

(*ii*) **Addition reaction:**

$$\underset{\text{Ethene}}{CH_2{=}CH_2} + H_2 \xrightarrow[573\,K]{Ni} \underset{\text{Ethane}}{CH_3{-}CH_3}$$

(*iii*) **Substitution reaction:**

$$\underset{\text{Methane}}{CH_4} + Cl_2 \xrightarrow{\text{Sunlight}} \underset{\substack{\text{Methyl}\\ \text{chloride}}}{CH_3Cl} + HCl$$

(*b*) Refer to Ans. 32.

**47. (*a*) Write a chemical test to distinguish between saturated and unsaturated hydrocarbons.**
**(*b*) Name the products formed when ethane burns in air. Write chemical equation for the reaction showing various types of energies liberated.**
**(*c*) Write the reaction between methane and chlorine in the presence of sunlight. Why is this reaction considered a substitution reaction?** **[All India]**

**Ans.** (*a*) Add Bromine water. Saturated hydrocarbons will not react. Unsaturated hydrocarbons will decolourise bromine water because these will react to form addition product which is colourless.

(*b*) Carbon dioxide and water are formed.

$2C_2H_6 + 7O_2 \longrightarrow 4CO_2 + 6H_2O$ + heat + light

Heat and light energy will be liberated.

(*c*) $CH_4(g) + Cl_2(g) \xrightarrow{\text{Sunlight}} CH_3Cl(g) + HCl(g)$

It is because hydrogen atom of methane gets substituted by chlorine atom to form chloromethane, therefore, it is called substitution reaction.

## 2016

### Very Short Answer Type Questions [1 Mark]

**48. Write the next homologue of each of the following:** **[Delhi]**

**(*i*) $C_2H_4$** **(*ii*) $C_4H_6$**

**Ans.** (*i*) $C_3H_6$ (*ii*) $C_5H_8$

READERS VENUE

**49. Name the following compounds:** **[Delhi]**

**(*a*) $CH_3—CH_2—OH$,** **(*b*) $CH_3—\overset{\overset{H}{|}}{C}=O$**

**Ans.** (*a*) Ethanol (*b*) Ethanal

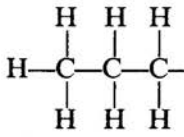
**50. Select saturated hydrocarbons from the following:** **[Delhi]**

**$C_3H_6$, $C_5H_{10}$, $C_4H_{10}$, $C_6H_{14}$, $C_2H_4$.**

**Ans.** $C_6H_{14}$ and $C_4H_{10}$ are saturated hydrocarbons.

**51. Write the name and structure of an alcohol with three carbon atoms in its molecules.** **[All India]**

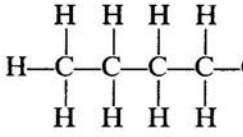
**Ans.**



Propanol.

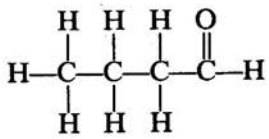
**52. Write the name and structure of an alcohol with four carbon atoms in its molecule.** **[All India]**

**Ans.**



Butanol.

**53. Write the name and structure of an aldehyde with four carbon atoms in its molecule.** **[All India]**

**Ans.** Butanal, 

**54. Which element exhibits the property of catenation to maximum extent and why?** **[Foreign]**

**Ans.** Carbon because it forms strong covalent bond.

**55. Write the name and molecular formula of the fourth member of alkane series.** **[Foreign]**

**Ans.** $C_4H_{10}$, Butane.

**56. What is a homologous series of carbon compounds?** **[Foreign]**

**Ans.** It is series of organic compounds which have same functional group, similar chemical properties.

**57. Write the molecular formula of alcohol which can be derived from Butane.**

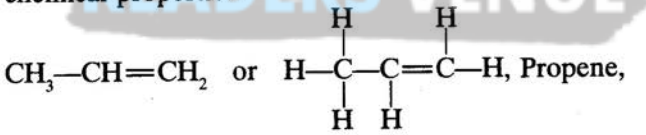
**Ans.** $C_4H_9OH$ or $CH_3CH_2CH_2CH_2OH$.

## Short Answer Type [I] Questions [2 Marks]

**58. What is a homologous series? Write the name and draw the structure of the second member of alkene series.**

**Ans.** Homologous series is a series of organic compound having same functional group and similar chemical properties.

LEADERS VENUE



## Short Answer Type [II] Questions [3 Marks]

**59. What is an oxidising agent? What happens when an oxidising agent is added to propanol? Explain with the help of a chemical equation.** **[Delhi]**

**Ans.** Those substances which add oxygen are called oxidising agent. For example: Alkaline potassium permanganate, acidified potassium dichromate, etc.

When an oxidising agent is added to propanal, propanoic acid is formed.

$$\underset{\text{Propanol}}{CH_3CH_2CH_2OH} + 2[O] \xrightarrow{\text{Alk. } KMnO_4/H_2SO_4} \underset{\text{Propanoic acid}}{CH_3CH_2COOH} + H_2O$$

**60. What are covalent compounds? Why are they different from ionic compounds? List their three characteristic properties.** **[Delhi]**

Ans. Refer to Ans. 44.

**61. When ethanol reacts with ethanoic acid in the presence of conc. $H_2SO_4$, a substance with fruity smell is produced. Answer the following:**
**(*i*) State the class of compounds to which the fruity smelling compounds belong. Write the chemical equation for the reaction and write the chemical name of the product formed.**
**(*ii*) State the role of conc. $H_2SO_4$ in this reaction.** **[Delhi]**

**Ans.** (*i*) Esters are the class of compounds which have pleasant fruity smell.

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + \underset{\text{Water}}{H_2O}$$

(*ii*) Conc. $H_2SO_4$ acts as dehydrating agent. It helps in removing water molecule formed in the reaction.

**62. Name the compound formed when ethanol is heated in excess of conc. sulphuric acid at 443 K. Also write the chemical equation of the reaction stating the role of conc. sulphuric acid in it. What would happen if hydrogen is added to the product of this reaction in the presence of catalysts such as palladium or nickel?** **[Delhi]**

**Ans.** Refer to Ans. 32.

**63. Write chemical equation of the reaction of ethanoic acid with the following: (*a*) Sodium; (*b*) Sodium hydroxide; (*c*) Ethanol.**
**Write the name of one main product of each reaction.** **[All India]**

**Ans.** (*a*) $2CH_3COOH + 2Na \longrightarrow \underset{\text{Sodium ethanoate}}{2CH_3COONa} + H_2$

(*b*) $CH_3COOH + NaOH \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + H_2O$

(*c*) $CH_3COOH + C_2H_5OH \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + H_2O$

**64. An aldehyde as well as ketone can be represented by the same molecular formula, say $C_3H_6O$. Write their structures and name them. State the relation between the two in the language of science.** **[All India]**

**Ans.** $\underset{\text{Propanal}}{CH_3—CH_2—\overset{\overset{O}{\|}}{C}—H}$ (Aldehyde) $\underset{\text{Propanone}}{CH_3—\overset{\overset{O}{\|}}{C}—CH_3}$ (Ketone)

They are functional isomers because they have same molecular formula but different structural formula (functional group).

**65. On dropping a small piece of sodium in a test tube containing carbon compound 'X' with molecular formula $C_2H_6O$, a brisk effervescence is observed and a gas 'Y' is produced. On bringing a burning splinter at the mouth of the test tube the gas evolved burns with a pop sound. Identify 'X' and 'Y'. Also write the chemical equation for the reaction. Write the name and structure of the product formed, when you heat 'X' with excess conc. sulphuric acid.** **[All India]**

**Ans.** 'X' is ethanol, $C_2H_5OH$

$$\underset{\text{Ethanol 'X'}}{2C_2H_5OH} + \underset{\text{Sodium}}{2Na} \longrightarrow \underset{\text{Sodium Ethoxide}}{C_2H_5ONa} + \underset{\text{Hydrogen 'Y'}}{H_2}$$

'Y' is hydrogen gas, which burns with 'pop' sound.

Ethane, $C_2H_4$ is formed when 'X' is heated with conc. $H_2SO_4$.

$$\underset{\text{Ethanol 'X'}}{CH_3CH_2OH} \xrightarrow[\text{Heat}]{\text{Conc } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + \underset{\text{Water}}{H_2O}$$

**66. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other than ethanoic acid and sodium ethanoate in each case.** **[All India]**

**Ans.** (*i*) $2CH_3COOH + \underset{\text{Sodium}}{2Na} \longrightarrow 2CH_3COONa + \underset{\text{Hydrogen}}{H_2}$

(*ii*) $CH_3COOH + \underset{\substack{\text{Sodium}\\\text{hydroxide}}}{NaOH} \longrightarrow CH_3COONa + \underset{\text{Water}}{H_2O}$

(*iii*) $CH_3COOH + \underset{\substack{\text{Sodium}\\\text{hydrogen carbonate}}}{NaHCO_3} \longrightarrow CH_3COONa + \underset{\text{Water}}{H_2O} + \underset{\substack{\text{Carbon}\\\text{dioxide}}}{CO_2}$

**67. Write the name and molecular formula of an organic compound having its name suffixed with 'ol' and having two carbon atoms in its molecule. Write balanced chemical equation to indicate what happens when this compound is heated with excess conc. $H_2SO_4$ and the name of main product formed. Also state the role of conc. $H_2SO_4$ in the reaction.** **[Foreign]**

**Ans.** Refer to Ans. 32.

**68. An organic compound 'P' is a constituent of wine. 'P' on reacting with acidified $K_2Cr_2O_7$ forms another compound 'Q'. When a piece of sodium is added to 'Q' a gas 'R' evolves which burns with a pop sound. Identify P, Q and R and write the chemical equations of the reactions involved.** **[Foreign]**

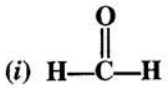
**Ans.** 'P' is ethyl alcohol ($C_2H_5OH$) and 'Q' is ethanoic acid ($CH_3COOH$).

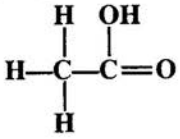
$$\underset{\substack{\text{Ethanol}\\\text{'P'}}}{CH_3CH_2OH} + 2[O] \xrightarrow{K_2Cr_2O_7/\text{Conc. } H_2SO_4} \underset{\substack{\text{Ethanoic acid}\\\text{'Q'}}}{CH_3COOH} + H_2O$$

$$\underset{\text{'Q'}}{2CH_3COOH} + 2Na \longrightarrow 2CH_3COONa + \underset{\substack{\text{Hydrogen}\\\text{'R'}}}{H_2}$$

'R' is hydrogen gas which burns with 'pop' sound.

**69.** **(*a*) Define the term functional group. Identify the functional group present in**

(*i*) 

(*ii*) 

**(*b*) What happens when 5% alkaline $KMnO_4$ solution is added drop by drop to warm ethanol taken in a test tube? State the role of alkaline $KMnO_4$ solution in this reaction.** **[Foreign]**

**Ans.** (*a*) It is atom or group of atoms or reactive part of compound which largely determine the chemical properties of compound.

(*i*) Methanal has aldehyde as functional group.

(*ii*) Ethanoic acid has carboxylic acid as functional group.

(*b*) $CH_3CH_2OH + 2[O] \xrightarrow{KMnO_4/KOH} CH_3COOH + H_2O$

Alkaline $KMnO_4$ acts as oxidising agent.

**70.** **$C_3H_6$, $C_4H_8$ and $C_5H_{10}$ belong to the same homologous series.**

**(*i*) Define homologous series.**

**(*ii*) Why the melting and boiling points of $C_5H_{10}$ is higher than $C_4H_8$?**

**(*iii*) Arrange these hydrocarbons in order of increasing boiling points.**

**Ans.** (*i*) Refer to Ans. 56.

(*ii*) It is because $C_5H_{10}$ has higher molecular weight, more van der Waals' force of attraction and higher boiling points and melting points than $C_4H_8$.

(*iii*) $C_3H_6 < C_4H_8 < C_5H_{10}$ is increasing order of boiling point.

**71.** **Under what conditions an oxidation reaction can be called as combustion reaction? Illustrate your answer with examples.**

**Ans.** When complete oxidation of fuel takes place, it is called combustion reaction. It is highly exothermic and generally accompanied by heat and light.

For example $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(g)$

This reaction is combustion because $CH_4$ burns in excess of oxygen to form carbon dioxide and water.

**72.** **(*a*) Give chemical tests to detect the presence of**

**(*i*) Ethanol (*ii*) Ethanoic acid**

**(*b*) Why ethanoic acid is called glacial acetic acid?**

**Ans.** (*a*) Add sodium hydrogen carbonate. Ethanol will not react. Ethanoic acid will give brisk effervescence due to carbon dioxide.

(*b*) Pure ethanoic acid exist as solid like glaciers at 291 K, therefore, called Glacial acetic acid.

## Long Answer Type Questions [5 Marks]

**73. (*a*) Give a chemical test to distinguish between saturated and unsaturated hydrocarbon.**
**(*b*) Name the products formed when ethane burns in air. Write the balanced chemical equation for the reaction showing the types of energies liberated.**
**(*c*) Why is reaction between methane and chlorine in the presence of sunlight considered a substitution reaction?** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 47 (*a*).

(*b*) $\underset{\text{Ethane}}{2C_2H_6} + 7O_2 \longrightarrow \underset{\text{Carbon dioxide}}{4CO_2(g)} + \underset{\text{Water}}{6H_2O}$

It will liberate heat as well as light energy.

(*c*) $CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$

It is because hydrogen atom of methane gets substituted by chlorine atom to form chloromethane.

**74. A carbon compound 'P' on heating with excess conc. $H_2SO_4$ forms another carbon compound 'Q' which on addition of hydrogen in the presence of nickel catalyst forms a saturated carbon compound 'R'. One molecule of 'R' on combustion forms two molecules of carbon dioxide and three molecules of water. Identify P, Q and R and write chemical equations for the reactions involved.** **[All India]**

**Ans.** 'P' is ethanol ($C_2H_5$—OH) 'Q' is ethene ($CH_2$=$CH_2$) and 'R' is ethane ($C_2H_6$).

$$\underset{\text{Ethanol 'P'}}{CH_3CH_2OH} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethene 'Q'}}{CH_2{=}CH_2} + H_2O$$

$$\underset{\text{Ethene 'Q'}}{CH_2{=}CH_2} + H_2 \xrightarrow{Ni} \underset{\text{Ethane 'R'}}{CH_3{-}CH_3}$$

$$\underset{\text{'R'}}{C_2H_6} + \frac{7}{2}O_2 \longrightarrow \underset{\text{Carbon dioxide}}{2CO_2(g)} + \underset{\text{Water}}{3H_2O(l)}$$

**75. (*a*) You have three unlabelled test tubes containing ethanol, ethanoic acid and soap solution. Explain the method you would use to identify the compounds in different test tubes by chemical tests using litmus paper and sodium metal.**
**(*b*) Give the reason of formation of scum when soaps are used with hard water.**
**[Foreign]**

**Ans.** (*a*) Ethanol will not be affected by blue litmus as well as red litmus paper. Ethanoic acid will turn blue litmus red whereas red litmus will remain as it is. Soap solution will turn red litmus blue but blue litmus will remain as it is. Sodium metal will liberate hydrogen gas with ethanol as well as ethanoic acid. Soap solution will not react with sodium metal.

(*b*) $Ca^{2+}$ and $Mg^{2+}$ present in hard water react with soap to form calcium and magnesium salt of fatty acids which are insoluble in water and form scum.

**76. What are micelles? Why does it form when soap is added to water? Will a micelle be formed in other solvents such as ethanol also? State briefly how the formation of micelles help to clean the clothes having oily spots.** [Foreign]

**Ans. Micelles:** When molecular ions in soaps and detergents aggregate, they form micelles. Soap molecules have two ends, hydrocarbon end which is water repellant where as ionic part which is water loving.

When soap is added to water, the hydrophobic 'tail' of soap will not dissolve in water and soap will align along the surface of water with ionic end in water and hydrocarbon 'tail' out of water by forming cluster of molecules called micelle.

No, micelle will not be formed in ethanol, as soap will dissolve in ethanol.

Micelles trap (attract) dirt, grease, oily spot, etc. which is washed away by water or the oily dirt is collected at the centre of micells which forms an emulsion in water and on rinsing the water washes away dirt attached to them.

## 2015

### Very Short Answer Type Questions [1 Mark]

**77. Write the name and formula of the 2nd member of homologous series having general formula $C_nH_{2n}$.** [Delhi]

**Ans.** $C_2H_4$ or $CH_2=CH_2$ is the first member. Its name is ethene.

$C_3H_6$ or $CH_2=CH—CH_3$ is the second member. Its name is propene.

**78. Write the name and formula of the second member of homologous series having general formula $C_nH_{2n+2}$.** [Delhi]

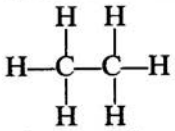
**Ans.** $C_2H_6$ is ethane, second member of homologous series having general formula $C_nH_{2n+2}$.

**79. Write the name and formula of the second member of homologous series having general formula $C_nH_{2n-2}$.** [Delhi]

**Ans.** $HC\equiv C—CH_3$, Propyne ($C_3H_4$) is second member of homologous series.

**80. Write the number of covalent bonds in the molecule of ethane.** [All India]

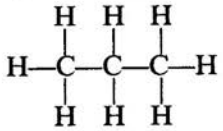
**Ans.**



There are 7 covalent bonds.

**81. Write the number of covalent bonds in the molecule of propane, $C_3H_8$.** [All India]

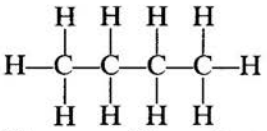
**Ans.**



There are 10 covalent bonds.

**82. Write the number of covalent bonds in the molecule of butane, $C_4H_{10}$. [All India]**

**Ans.**



There are 13 covalent bonds.

**83. Name the process by which unsaturated fats are changed to saturated fats. [Foreign]**

**Ans.** Hydrogenation.

**84. Write the name of each of the following functional groups:**

**(*a*) —OH** **(*b*) —C(=O)— [Foreign]**

**Ans.** (*a*) —OH is alcohol (*b*) —C(=O)— is ketone

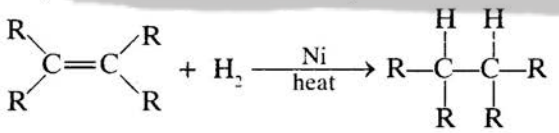
**85. Write the name and molecular formula of the first member of the homologous series of alkynes. [Foreign]**

**Ans.** HC≡CH($C_2H_2$), Ethyne is the first member of alkynes.

## Short Answer Type [II] Questions [3 Marks]

**86. With the help of an example, explain the process of hydrogenation. Mention the essential conditions for the reaction and state the change in physical property with the formation of the product. [Delhi]**

**Ans.** Hydrogenation is the process in which unsaturated hydrocarbon like alkenes react with hydrogen in presence of nickel as catalyst to form saturated compounds.



(Unsaturated liquid) (Saturated solid)

The liquid reactant changes into solid product. Vegetable oils are converted into vegetable ghee by hydrogenation.

**87. What is the difference between the molecules of soaps and detergents, chemically? Explain the cleansing action of soaps. [Delhi]**

**Ans.** Soaps are sodium or potassium salts of long chain fatty acids.

For example: $C_{17}H_{35}COONa$ (Sodium stearate).

Detergents are sodium or potassium salts of sulphonic acids of benzene or alkene. They have $-SO_3Na$ or $-SO_4Na$ group.

Soaps have hydrocarbon part which is hydrophobic and attracts dirt, greese, oil, etc. whereas –COONa part is hydrophillic which attracts water. Hydrophobic part entraps the dirt and greese which is washed away by water attracted by hydrophillic part.

**88. What is meant by isomers? Draw the structures of two isomers of butane, $C_4H_{10}$. Explain why we cannot have isomers of first three members of alkane series.** **[Delhi]**

**Ans.** Isomers are those compounds which have same molecular formula but different structural formula.

$CH_3CH_2CH_2CH_3$ and $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-CH_3$ are two isomers of $C_4H_{10}$.

Isomers are not possible for first three members because branching is not possible.

**89. Write the name and structural formula of the compound obtained when ethanol is heated at 443 K with excess of conc. $H_2SO_4$. Also write chemical equation for the reaction stating the role of conc. $H_2SO_4$ in it.** **[Delhi]**

**Ans.** Refer to Ans. 32.

**90. List two tests for experimentally distinguishing between an alcohol and a carboxylic acid and describe how these tests are performed.** **[All India]**

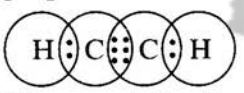
**Ans.** (*i*) **$NaHCO_3$ test:** Add sodium hydrogen carbonate to alcohol and a carboxylic acid separately. Alcohol will not react, whereas carboxylic acid will give brisk effervescence. Pass the gas through lime water. It will turn milky.

(*ii*) **Blue litmus test:** Add a few drops of alcohol and solution of carboxylic acid on blue litmus paper separately. Blue litmus will remain as it is in case of alcohol, whereas it will turn red in carboxylic acid.

**91. Draw the electron-dot structure for ethyne. A mixture of ethyne and oxygen is burnt for welding. In your opinion, why cannot we use a mixture of ethyne and air for this purpose?** **[All India]**

READERS VENUE

**Ans.**



$H-C\equiv C-H$

Ethyne and air will not produce enough heat due to incomplete combustion which can be used for welding purpose. Ethyne and oxygen will produce lot of heat due to complete combustion which can be used for welding purposes.

**92. What is meant by homologous series of carbon compounds? Classify the following carbon compounds into two homologous series and name them.** **[All India]**

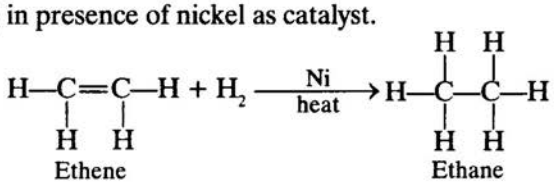
**$C_3H_4$, $C_3H_6$, $C_4H_6$, $C_4H_8$, $C_5H_8$, $C_5H_{10}$**

**Ans.** Homologous series is series of organic compounds which have same functional group, similar chemical properties but gradation in physical properties.

| | | Alkenes | | Alkyne | |
|---|---|---|---|---|---|
| $C_3H_6$ | Propene | $CH_3-CH=CH_2$ | $C_3H_4$ | $HC\equiv C-CH_3$ | Propyne |
| $C_4H_8$ | 1-Butene | $CH_2=CH-CH_2-CH_3$ | $C_4H_6$ | $HC\equiv C-CH_2-CH_3$ | 1-Butyne |
| $C_5H_{10}$ | 1-Pentene | $CH_2=CH-CH_2-CH_2-CH_3$ | $C_5H_8$ | $HC\equiv C-CH_2-CH_2-CH_3$ | 1-Pentyne |

**93. Write the name and general formula of a chain of hydrocarbons in which an addition reaction with hydrogen is possible. State the essential condition for an addition reaction. Stating this condition, write a chemical equation giving the name of the reactant and the product of the reaction.** **[All India]**

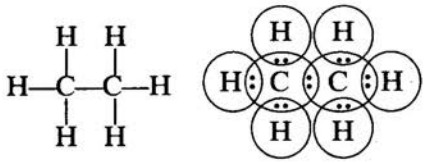
**Ans.** $C_nH_{2n}$ and $C_nH_{2n-2}$ are general formula of alkene and alkynes in which addition reaction with hydrogen is possible. Hydrogen is added to unsaturated hydrocarbon (having double or triple bond) in presence of nickel as catalyst.



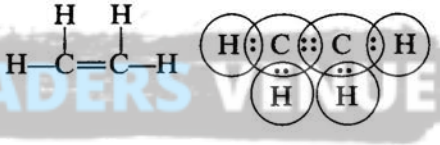

**94. Write the molecular formula of the following compounds and draw their electron-dot structures:**

**(*i*) Ethane (*ii*) Ethene (*iii*) Ethyne** **[Foreign]**

**Ans.** (*i*) Ethane ($C_2H_6$)



(*ii*) Ethene ($C_2H_4$)

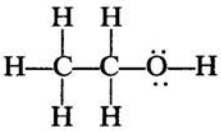
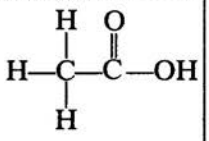
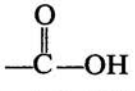


(*iii*) Ethyne ($C_2H_2$)

**95. What is meant by functional group in carbon compounds? Write in tabular form the structural formula and the functional group present in the following compounds:**

**(*i*) Ethanol (*ii*) Ethanoic acid** **[Foreign]**

**Ans.** **Functional Group:** An atom or group of atoms which determines chemical properties of the organic compounds is called functional group.

| **(*i*) Ethanol** | **(*ii*) Ethanoic acid** |
|---|---|
| $C_2H_5OH$  | $CH_3COOH$  |
| Functional group —OH | Functional group  |

**96. Why is homologous series of carbon compounds so called? Write the chemical formula of two consecutive members of any homologous series and state the part of these compounds that determines their (*i*) physical and (*ii*) chemical properties.** **[Foreign]**

**Ans.** Homologous series means members of same family because they have similar chemical properties.

$CH_3OH$ and $CH_3CH_2OH$ are two consecutive members of 'alcohol' homologous series.

Alkyl group determines physical properties.

Functional group-OH determines chemical properites.

**97. Write the name and structural formula of the compound formed when ethanol is heated at 443 K temperature with excess of conc. $H_2SO_4$. What is the role of conc. $H_2SO_4$ in this reaction? Also give the chemical equation for the reaction.** **[Foreign]**

**Ans.** Refer to Ans. 32.

## Long Answer Type Questions [5 Marks]

**98. Explain why carbon forms compounds mainly by covalent bond. Explain in brief two main reasons for carbon forming a large number of compounds. Why does carbon form strong bonds with most other elements?** **[Delhi]**

**Ans.** Carbon has atomic number 6. Its electronic configuration is 2, 4. It cannot lose four electrons because very high energy is required to remove four electrons.

It cannot gain four electrons because 6 protons cannot hold 10 electrons.

$\therefore$ Carbon can share four electrons forming four covalent bonds.

(*i*) **Catenation:** Carbon forms maximum number of compounds due to property of catenation (Self linking).

(*ii*) **Tetra valency:** Carbon can form four covalent bonds, therefore it forms a large number of compounds.

READERS VENUE

Isomerism is also responsible for a large number of carbon compounds. Carbon is small in size, therefore it forms strong bonds with most other elements. It can also form double and triple bonds with some of elements which are very strong.

**99. Both soap and detergent are same type of salts. What is the difference between them? Describe in brief the cleansing action of soap. Why do soaps not form lather in hard water? List two problems that arise due to the use of detergents instead of soaps.** **[All India]**

**Ans.**

| Soaps | Detergents |
|---|---|
| Soaps are sodium or potassium salts of higher fatty acids. | Detergents are sodium or potassium salts of sulphonic acids of benzene or alkene type hydrocarbons. |
| Soaps have –COONa group. | Detergents have $-SO_3Na$ or $-SO_4Na$. |

Soaps react with $Ca^{2+}$ and $Mg^{2+}$ ion present in hard water to form scum (calcium and magnesium salt of fatty acids) and soap goes waste.

(*i*) Detergents are more expensive.

(*ii*) Some detergents are not biodegradable and create water pollution.

**100. Elements forming ionic compounds attain noble gas electronic configuration by either gaining or losing electrons from their valence shells. Explain giving reason why carbon cannot attain such a configuration in this manner to form its compounds. Name the type of bonds formed in ionic compounds and in the compounds formed by carbon. Also explain with reason why carbon compounds are generally poor conductors of electricity.** **[Foreign]**

**Ans.** Carbon cannot lose four electrons because very high amount of energy is required to remove four electrons. Carbon cannot gain four electrons easily because 6 protons cannot hold 10 electrons.

Ionic compound form electrovalent bonds, whereas carbon can share four electrons to form covalent bonds.

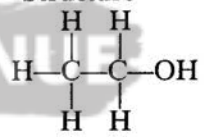
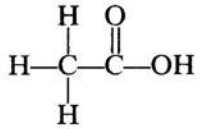
Carbon compounds are poor conductor of electricity because they do not have ions in aqueous solution to carry the current.

## 2014

### Short Answer Type [II] Questions [3 Marks]

**101. State the meaning of the functional group in a carbon compound. Write the functional group present in (*i*) ethanol and (*ii*) ethanoic acid and also draw their structures.** **[Delhi]**

**Ans.** Functional group is an atom or group of atoms that is bonded to a carbon chain. It defines the chemical property of the organic compound.

| | Group | Structure |
|---|---|---|
| (*i*) Ethanol | = Hydroxy (–OH) |  |
| (*ii*) Ethanoic acid | = Carboxylic acid (–COOH) |  |

READERS VENUE

**102. Write the name and general formula of a chain of hydrocarbons in which an addition reaction with hydrogen can take place. Stating the essential conditions required for an addition reaction to occur write the chemical equation giving the name of the reactant and the product of such a reaction.** **[Delhi]**

**Ans.** Name and general formula of the chains of hydrocarbons undergoing addition reaction with hydrogen:

Alkene — $C_nH_{2n}$

Alkyne — $C_nH_{2n-2}$

Essential conditions required for an addition reaction to occur:

(*a*) Multiple bonds must be present between carbon atoms in the chain of hydrocarbon.

(*b*) Addition of hydrogen should be carried out in the presence of catalyst such as nickel or platinum.

Chemical Equations:

$$\underset{\text{Ethene}}{CH_2{=}CH_2} + H_2 \xrightarrow{\text{Ni or Pt}} \underset{\text{Ethane}}{CH_3{-}CH_3}$$

$$\underset{\text{Ethyne}}{CH{\equiv}CH} + 2H_2 \xrightarrow{\text{Ni or Pt}} \underset{\text{Ethane}}{CH_3{-}CH_3}$$

**103. What are esters? How are they prepared? List two uses of esters.** **[Delhi]**

**Ans.** Esters are organic compounds (R—COO—R′) formed by a reaction between an alcohol (R′—OH) and an organic acid (R—COOH), i.e. carboxylic acid and in the presence of a catalyst like conc. $H_2SO_4$ with water as a by-product. Esters are used to make perfumes and soap. They are also used to produce pharmaceutical products, cosmetics, plasticizers and detergents.

**104. State the meaning of the functional group in an organic compound. Write the formula of the functional group present in alcohols, aldehydes, ketones and carboxylic acids.** **[Delhi]**

**Ans.** Functional group is an atom or group of atoms or reactions part of the compound which determines chemical properties of compound.

Alcohol —OH

Aldehyde $-\overset{\overset{O}{\|}}{C}-H$

Carboxylic acid $-\overset{\overset{O}{\|}}{C}-OH$

Ketones $-\overset{\overset{O}{\|}}{C}-$

READERS VENUE

**105. What are homologous series of carbon compounds? Write the molecular formula of two consecutive members of homologous series of aldehydes. State which part of these compounds determines their (*i*) physical and (*ii*) chemical properties.** **[All India]**

**Ans.** A series of compounds in which the same functional group substitutes for hydrogen in a carbon chain is called a homologous series of carbon compounds. They differ from each other by the number of —$CH_2$— units in the main carbon chain.

Molecular formula of two consecutive members of homologous series of aldehydes:

$$CH_3{-}CHO \text{ and } CH_3{-}CH_2{-}CHO$$

Alkyl group —$CH_3$ and —$CH_2CH_3$ part determines physical properties while the functional group —CHO determines chemical properties.

**106. A carboxylic acid (molecular formula $C_2H_4O_2$) reacts with an alcohol in the presence of an acid catalyst to form a compound 'X'. The alcohol on oxidation with alkaline $KMnO_4$ followed by acidification gives the same carboxylic acid $C_2H_4O_2$. Write the name and structure of (*i*) carboxylic acid, (*ii*) alcohol and (*iii*) the compound 'X'.** **[All India]**

**Ans.** Given:

$$C_2H_4O_2 + RCH_2OH \xrightarrow{H^+} X$$

$$RCH_2OH \xrightarrow[H^+]{KMnO_4} C_2H_4O_2$$

Chemical reactions involved:

$$\underset{(C_2H_4O_2)}{\underset{\text{Ethanoic acid}}{CH_3COOH}} + \underset{\text{(Alcohol)}}{\underset{\text{Ethanol}}{C_2H_5OH}} \xrightarrow{H^+} \underset{\text{(X)}}{\underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5}} + H_2O$$

$$\underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow[H^+]{KMnO_4} \underset{\text{Ethanoic acid}}{CH_3COOH}$$

(*i*) The carboxylic acid involved in the reaction is ethanoic acid ($CH_3COOH$).

(*ii*) The alcohol involved in the reaction is ethanol ($CH_3CH_2OH$).

(*iii*) X is the ester formed by the condensation of acetic acid and ethanol and is ethyl ethanoate ($CH_3COOC_2H_5$).

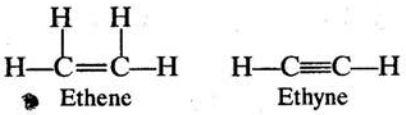
**107. What is meant by homologous series of carbon compounds? Write the general formula of (*i*) alkenes, and (*ii*) alkynes. Draw the structures of the first member of each series to show the bonding between the two carbon atoms.** **[All India]**

**Ans.** The series of chemical compounds having same functional group and similar chemical properties is called homologous series. Each member differs from successive member by $—CH_2—$ group.

The general formula of

(*i*) alkenes is $C_nH_{2n}$ and (*ii*) alkynes is $C_nH_{2n-2}$.

First member of alkenes is $C_2H_4$ (ethene) and alkyne is $C_2H_2$ (ethyne). Their structures are shown below:

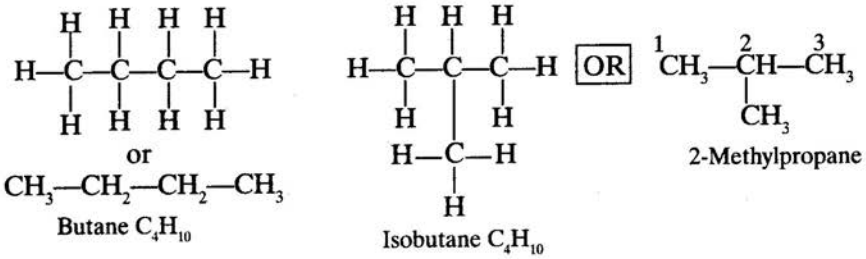


Ethene Ethyne

**108. Define the term 'structural isomerism'. Explain why propane cannot exhibit this property. Draw the structures of possible isomers of butane, $C_4H_{10}$.** **[All India]**

**Ans.** The phenomenon in which compounds have same molecular formula but different structures are called structural isomerism.

Lower alkanes till propane do not show isomerism. They cannot have a branched chain structure to exhibit isomerism. The structures of possible isomers of butane, $C_4H_{10}$ are:




**109. What are isomers? Why can't we have isomers of first three members of alkane series? Draw the possible structures of isomers of butane, $C_4H_{10}$.** [Foreign]

**Ans.** Refer to Ans. 108.

**110. Write the chemical equations to show what happens when**

**(*i*) an ester reacts with a base?**

**(*ii*) methane is treated with chlorine in the presence of sunlight?**

**(*iii*) ethanol reacts with ethanoic acid in the presence of sulphuric acid?** [Foreign]

**Ans.** (*i*) $R—\overset{\overset{O}{\|}}{C}—OR' + NaOH \longrightarrow R—\overset{\overset{O}{\|}}{C}—ONa + R'—HO$

Ester; Sodium hydroxide; Sodium carboxylate; (alcohol)

Or

$$CH_3COOC_2H_5 \xrightarrow{NaOH} CH_3COONa + C_2H_5OH$$

(*ii*) $CH_4 + Cl_2 \xrightarrow{Sunlight} CH_3Cl + HCl$

Reaction does not stop here and all the hydrogen in the methane can in turn be replaced by chlorine atoms.

$$CH_3Cl + Cl_2 \xrightarrow{Sunlight} CH_2Cl_2 + HCl$$

$$CH_2Cl_2 + Cl_2 \xrightarrow{Sunlight} CHCl_3 + HCl$$

$$CHCl_3 + Cl_2 \xrightarrow{Sunlight} CCl_4 + HCl$$

(*iii*) $\underset{\text{Ethanol}}{C_2H_5OH} + \underset{\text{Ethanoic acid}}{CH_3COOH} \xrightarrow{H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + H_2O$

**111. Write the respective chemical equations to show what happens when**

**(*i*) methane is burned in presence of oxygen?**

**(*ii*) ethanol is heated with concentrated sulphuric acid at 443 K?**

**(*iii*) ethanol reacts with ethanoic acid in the presence of an acid acting as a catalyst?** [Foreign]

**Ans.** (*i*) $CH_4 + 2O_2 \longrightarrow 2H_2O + CO_2$

$CO_2$ and water is formed.

(*ii*) $CH_3CH_2OH \xrightarrow{\text{Hot conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$

The concentrated sulphuric acid can be regarded as a dehydrating agent which removes water from ethanol.

(*iii*) $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow{\text{Acid}} \underset{\text{Ethyl ethanoate}}{CH_3{-}\overset{\overset{O}{\|}}{C}{-}OCH_2CH_3} + \underset{\text{Water}}{H_2O}$

Esters are sweet smelling substances.

**112. Write the chemical equation to explain what happens when ethanol is heated with alkaline solution of potassium permanganate. Mention two physical properties and two uses of ethanol.** **[Foreign]**

**Ans.** $C_2H_5OH + 2[O] \xrightarrow{\text{alkaline } KMnO_4} \underset{\text{Ethanoic acid}}{CH_3COOH} + H_2O$

Alkaline $KMnO_4$ is dark pink in colour. So when it is added to ethanol and heated, the pink colour of the solution disappears. When excess of $KMnO_4$ is added, the pink colour does not disappear, indicating that all the ethanol has been converted to ethanoic acid.

Ethanol will evaporate quickly. It is also soluble in water in all proportions. As it is a good solvent, it is used in medicines. It is used to make paints, coatings, adhesives, etc.

**113. Write chemical equations to describe two examples of different oxidations of ethanol. List two uses of ethanol.** **[Foreign]**

READERS VENUE

**Ans.** $CH_3CH_2OH + [O] \longrightarrow CH_3CHO + H_2O$

$CH_3CHO + [O] \longrightarrow CH_3COOH$

**Uses of ethanol:**

(*i*) Used as a solvent in the manufacture of varnishes and perfumes.

(*ii*) Used as a preservative for biological specimens.

**114. Write the chemical equations to show what happens when**

**(*i*) sodium hydroxide is added to ethanoic acid?**

**(*ii*) solid sodium hydrogen carbonate is added to ethanoic acid?**

**(*iii*) ethanol reacts with sodium?** **[Foreign]**

**Ans.** (*i*) $\underset{\substack{\text{Sodium}\\\text{hydroxide}}}{NaOH} + \underset{\text{Acetic acid}}{CH_3COOH} \longrightarrow \underset{\substack{\text{Sodium}\\\text{acetate}}}{CH_3COONa} + \underset{\text{Water}}{H_2O}$

(*ii*) $\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\substack{\text{Sodium hydrogen}\\\text{carbonate}}}{NaHCO_3} \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Water}}{H_2O} + \underset{\text{Carbon dioxide}}{CO_2}$

(*iii*) $\underset{\text{Sodium}}{2Na} + \underset{\text{Ethanol}}{2CH_3CH_2OH} \longrightarrow \underset{\text{Sodium ethoxide}}{2CH_3CH_2O^-Na^+} + \underset{\text{Hydrogen}}{H_2}$

## Long Answer Type Questions [5 Marks]

**115. State the reason why carbon can neither form $C^{4+}$ cations nor $C^{4-}$ anions, but forms covalent compounds. Also state reasons to explain why covalent compounds:**
**(*i*) are bad conductors of electricity?**
**(*ii*) have low melting and boiling points?** **[Delhi]**

**Ans.** Atomic number of carbon is six. This means that it has four electrons in its outermost shell and it needs four more electrons to attain noble gas electronic configuration. It does not form $C^{4+}$ cation, as the removal of four valence electrons will require a huge amount of energy. The cation formed will have six protons and two electrons. This makes it highly unstable. Carbon is unable to form $C^{4-}$ anion as its nucleus with six protons will not be able to hold ten electrons. Thus, carbon achieves noble gas electronic configuration by sharing its four electrons with other elements, i.e. it forms covalent compounds.

(*i*) Covalent compounds are bad conductors of electricity due to lack of ions.

(*ii*) Covalent compounds are formed by covalent bonds and the intermolecular forces of attraction in these compounds are weak. Thus, their melting and boiling points are quite low.

**116. Elements forming ionic compounds attain noble gas configuration by either gaining or losing electrons from their outermost shells. Give reason to explain why carbon cannot attain noble gas configuration in this manner to form its compounds. Name the type of bonds formed in ionic compounds and in the compounds formed by carbon. Also give reason why carbon compounds are generally poor conductors of electricity.** **[All India]**

Ans. The atomic number of carbon is 6. This means that it has 4 electrons in its outermost shell and it needs 4 more electrons to attain noble gas electronic configuration. It cannot form $C^{4+}$ cation, as the removal of 4 valence electrons requires a huge amount of energy. The cation formed has 6 protons and 2 electrons. This makes it highly unstable. Carbon cannot form $C^{4-}$ anion, as its nucleus with 6 protons cannot hold 10 electrons. Thus, carbon achieves noble gas electronic configuration by sharing its 4 electrons with other elements, i.e. it forms covalent compounds. In ionic compounds, ionic bonds are formed; while in carbon compounds, covalent bonds are formed. Carbon compounds are covalent in nature, they are bad conductors of electricity because they lack free electrons and ions

**117. List two reasons for carbon forming a large number of compounds. Name the type of bonding found in most of its compounds. Why does carbon form compounds mainly by this kind of bonding:**
**Give reason why the carbon compounds—**
**(*i*) generally have low melting and boiling points,**
**(*ii*) do not conduct electricity in molten state?** **[All India]**

**Ans.** Two reasons for carbon forming a large number of compounds are:
(*a*) Tetravalency
(*b*) Property of catenation.

Carbon attains nobel gas configuration by sharing its four electrons with other elements, i.e. it forms covalent compounds.

(*i*) Carbon compounds have low melting and boiling points due to weak van der Waals' forces of attraction.

(*ii*) Carbon compounds do not conduct electricity as they are non-polar and do not form ions in molten state.

**118. What are hydrocarbons? Distinguish alkanes from alkenes and each of them from alkynes, giving one example of each. Draw the structure of each compound cited as example to justify your answer.** **[Foreign]**

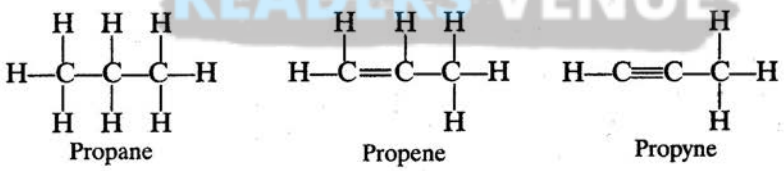
**Ans.** A hydrocarbon is an organic compound made of carbon and hydrogen atoms only. Saturated hydrocarbons have as many hydrogen atoms as possibly attached to every carbon. They have only single bonds between adjacent carbon atoms. Unsaturated hydrocarbons have double and/or triple bonds between some of the carbon atoms.

Alkanes are hydrocarbons that have single covalent bonds joining the carbon atoms. Molecular formula, $C_nH_{2n+2}$, where $n$ is the number of carbon atoms. For example, propane ($C_3H_8$).

Alkenes are hydrocarbons that have one or more C=C bonds. General formula, $C_nH_{2n}$, which is two hydrogen atoms less than the corresponding alkane. For example, propene ($C_3H_6$).

Alkynes are hydrocarbons that have one or more —C≡C— bonds. Molecular formula– $C_nH_{2n-2}$, which is four hydrogen atoms less than the corresponding alkane. For example, propyne ($C_3H_4$).

READERS VENUE




## 2013

### Short Answer Type [II] Questions [3 Marks]

**119. Write the name and the structural formula of the compound formed when ethanol is heated at 443 K with excess of conc. $H_2SO_4$. State the role of conc. $H_2SO_4$ in this reaction. Write chemical equation for the reaction.** **[Delhi]**

**Ans.** Refer to Ans. 32.

**120. Why homologous series of carbon compounds are so called? Write chemical formula of two consecutive members of a homologous series and state the part of these compounds that determines their (*i*) physical properties, and (*ii*) chemical properties.** **[Delhi]**

**Ans.** The series consists of members of same family with similar physical and chemical properties, therefore, called homologous series.

(*i*) $CH_3OH$

(*ii*) $CH_3CH_2OH$ are two consecutive members of homologous series.

Alkyl group $CH_3$— and $CH_3CH_2$— part determines physical properties.

Functional group —OH determines chemical properties of the compounds.

**121. Name the oxidising agent used for the conversion of ethanol to ethanoic acid. Distinguish between ethanol and ethanoic acid on the basis of (*i*) litmus test, (*ii*) reaction with sodium carbonate.** **[Delhi]**

**Ans.** Alkaline potassium permanganate or acidified potassium dichromate may be used as oxidising agents for the conversion of ethanol to ethanoic acid.

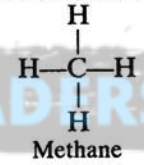
(*i*) Ethanol will not affect litmus paper.
Ethanoic acid will turn blue litmus paper red.

(*ii*) Ethanol will not react with sodium carbonate.
Ethanoic acid will give brisk effervescence due to colourless, odourless carbon dioxide gas.

**122. (*a*) Differentiate between alkanes and alkenes. Name and draw the structure of one member of each.** [Delhi, All India]

**(*b*) Alkanes generally burn with clean flame Why?**

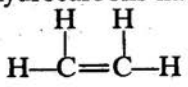
**Ans.** (*a*) Alkanes are saturated hydrocarbons and contain single bonds only, e.g.



Methane

READERS VENUE

Alkenes are unsaturated hydrocarbons having double or triple bonds, e.g.



Ethene

(*b*) Alkanes have higher percentage of hydrogen and less percentage of carbon, therefore, they burn with clear flame.

**123. What happens when:**

**(*a*) ethanol is burnt in air,**

**(*b*) ethanol is heated with excess conc. $H_2SO_4$ at 443 K,**

**(*c*) a piece of sodium is dropped into ethanol?** **[Delhi]**

**Ans.** (*a*) $CO_2$ and $H_2O$ are formed. Heat and light is produced.

$$C_2H_5OH + 3O_2 \longrightarrow 2CO_2 + 3H_2O$$

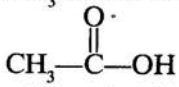
(*b*) Refer to Ans. 32.

(*c*) Hydrogen gas and sodium ethoxide is formed.

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2$$

**124. A carboxylic acid $C_2H_4O_2$ reacts with an alcohol in the presence of $H_2SO_4$ to form a compound 'X'. The alcohol on oxidation with alkaline $KMnO_4$ followed by acidification gives the same carboxylic acid, $C_2H_4O_2$. Write the name and structure of (*i*) carboxylic acid, (*ii*) alcohol and (*iii*) the compound 'X'.** **[All India]**

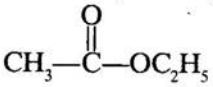
**Ans.** (*i*) $CH_3COOH$ is ethanoic acid.



Ethanoic acid

(*ii*) $CH_3CH_2OH$ is ethanol.

(*iii*) 'X' is $CH_3COOC_2H_5$ (ethyl ethanoate).



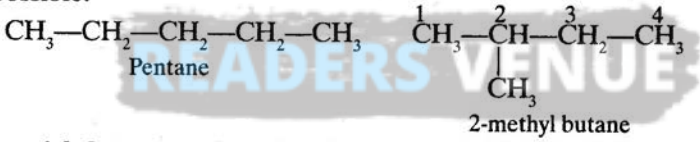
Ethyl ethanoate

**125. What is meant by isomers? "We cannot have isomers of first three members of alkane series." Give reason to justify this statement. Draw the structures of two isomers of pentane, $C_5H_{12}$.** **[All India]**

**Ans.** Isomers are those compounds which have same molecular formula and different structural formula.

Two isomers of pentane are:

In first three members of alkane series, branching is not possible, therefore, isomers are not possible.



Pentane



2-methyl butane

READERS VENUE

**126. (*a*) Distinguish between ethanol and ethanoic acid on the basis of (*i*) litmus test, (*ii*) reaction with sodium hydrogen carbonate.**

**(*b*) Name the oxidising agents used in the conversion of ethanol to ethanoic acid.**

**[All India]**

**Ans.** (*a*) (*i*) Ethanol is neutral to blue litmus whereas ethanoic acid turns blue litmus red.

(*ii*) Ethanol does not react with sodium hydrogen carbonate whereas when ethanoic acid reacts with sodium hydrogen carbonate, brisk effervescence is seen due to the production of carbon dioxide gas.

(*b*) The oxidising agents used in the conversion of ethanol to ethanoic acid are alkaline $KMnO_4$ or acidified $K_2Cr_2O_7$.

**127. What is meant by functional group in an organic compound? State in tabular form the structural formula and the functional groups present in (*i*) ethanol and (*ii*) ethanoic acid.** **[Foreign]**

**Ans.** Refer to Ans. 95.

**128. Two carbon compounds P and Q have the molecular formula $C_3H_6$ and $C_3H_8$ respectively. Which one of the two is most likely to show addition reaction? Justify your answer. Also give the chemical equation to explain the process of addition reaction in this case.** **[Foreign]**

**Ans.** $C_3H_6$ is likely to show addition reaction because it has double bond.
Addition Reaction:

$$\underset{\text{Propene}}{CH_2{=}CH{-}CH_3} + H_2 \xrightarrow[\text{Heat}]{\text{Ni}} \underset{\text{Propane}}{CH_3{-}CH_2{-}CH_3}$$

**129. What are functional groups? Write the formula of the functional group present in alcohols, aldehydes, ketones and carboxylic acids.** **[Foreign]**

**Ans.** Refer to Ans. 104.

**130. Write the structural formula of ethanol and list its two physical properties. What happens when it is heated with excess of conc. $H_2SO_4$ at 433 K? State the role of conc. $H_2SO_4$ in the reaction.** **[Foreign]**

**Ans.** $CH_3{-}CH_2{-}OH$ is structural formula of ethanol.
**Physical properties:**
(*i*) It is a liquid with specific smell. (*ii*) It is soluble in water.
Refer to Ans. 32.
(*i*) It is a liquid with specific smell. (*ii*) It is soluble in water.

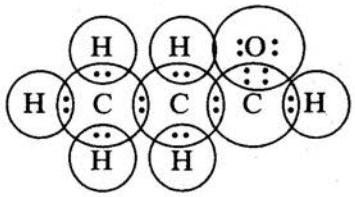
## Long Answer Type Questions [5 Marks]

**131. (*a*) Define the term 'isomers'.**
**(*b*) Draw two possible isomers of the compound with molecular formula $C_3H_6O$ and write their names.**
**(*c*) Give the electron-dot structures of the above two compounds.** **[Delhi]**

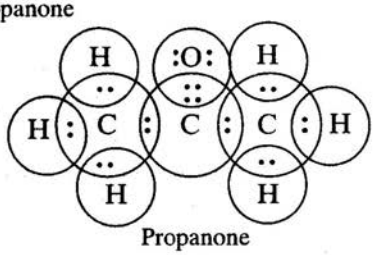
**Ans.** (*a*) Isomers are those compounds which have same molecular formula and different structural formula.

(*b*) $CH_3{-}CH_2{-}\overset{\overset{O}{\|}}{C}{-}H$ and $CH_3{-}\overset{\overset{O}{\|}}{C}{-}CH_3$
Propanal Propanone

(*c*)



Propanal



Propanone

**132. An organic compound 'X' on heating with conc. $H_2SO_4$ forms a compound 'Y' which on addition of one molecule of hydrogen in the presence of nickel forms a compound 'Z'. One molecule of compound 'Z' on combustion forms two molecules of $CO_2$ and three molecules of $H_2O$. Identify giving reasons the compounds 'X', 'Y' and 'Z'. Write the chemical equations for all the chemical reactions involved.** **[All India]**

**Ans.** 'X' is ethanol ($C_2H_5$—OH), 'Y' is ethene($CH_2$=$CH_2$) and 'Z' is ethane.
Refer to Ans. 74.

**133. A carbon compound X turns blue litmus to red and has a molecular formula $C_2H_4O_2$. Identify X and draw its structure. Write chemical equation for the reaction and name of the product formed in each case when X reacts with**
**(*a*) ethanol in the presence of conc. $H_2SO_4$.**
**(*b*) sodium carbonate.** **[Foreign]**

**Ans.** 'X' is ethanoic acid.

Its structure is $CH_3—\overset{\overset{O}{\|}}{C}—OH$.

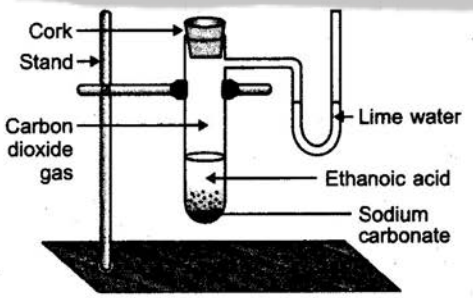
(*a*) $CH_3COOH + C_2H_5OH \xrightarrow{\text{conc. } H_2SO_4} CH_3COOC_2H_5 + H_2O$
Ethanoic acid, Ethanol, Ethyl ethanoate, water

(*b*) $2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$
Ethanoic acid, Sodium carbonate, Sodium ethanoate, Water, Carbon dioxide

**134. When ethanoic acid reacts with sodium hydrogen carbonate a salt X is formed along with a gas Y. Name X and Y. Describe an activity and draw the diagram of the apparatus used to prove that the gas Y is one which you have named. Also write the chemical equation for the reactions involved.** **[Foreign]**

**Ans.** 'X' is sodium ethanoate. 'Y' is carbon dioxide gas.
**Aim:** To demonstrate the reaction of carboxylic acid with sodium carbonate and sodium hydrogen carbonate.
**Materials Required:** Ethanoic acid, sodium hydrogen carbonate, sodium carbonate, lime water

READERS AVENUE




**Evolution of carbon dioxide gas by reaction of ethanoic acid with sodium hydrogen carbonate**

**Procedure:**
1. Set the apparatus as shown in diagram.
2. Take 1 g of $NaHCO_3$ and add 2 ml of ethanoic acid into it.
3. Pass the gas formed through lime water and note down the observations.
4. Repeat the same procedure for sodium carbonate and record your observations.

**Observation:** Brisk effervescence due to carbon dioxide formed which turns lime water milky.

**Chemical Reaction:**

$$CH_3COOH\ (l) + NaHCO_3 \longrightarrow CH_3COONa + H_2O + CO_2$$

$$CH_3COOH\ (l) + Na_2CO_3\ (s) \longrightarrow 2CH_3COONa + H_2O + CO_2$$

$$\underset{\text{Lime water}}{Ca(OH)_2\ (aq)} + \underset{\text{Carbon dioxide}}{CO_2\ (g)} \longrightarrow \underset{\text{(White ppt.)}}{CaCO_3\ (s)} + \underset{\text{Water}}{H_2O}$$

**Conclusion:** Carboxylic acid reacts with sodium hydrogen carbonate to liberate $CO_2$ gas which turns lime water milky.

**135. Give reason why carbon neither forms $C^{4+}$ cations nor $C^{4-}$ anions, but forms covalent compounds which are bad conductors of electricity and have low melting and low boiling points.** **[Foreign]**

**Ans.** Refer to Ans. 115.

## 2012

### Very Short Answer Type Questions [1 Mark]

**136. Name the functional group present in each of the following organic compounds:**
**(*i*) $C_2H_5Cl$ (*ii*) $C_2H_5OH$** **[Delhi]**

**Ans.** (*i*) (—Cl) Halogen (Chloro)
(*ii*) (—OH) Alcohol

READERS VENUE

**137. Name the functional group present in each of the following compounds:**
**(*i*) HCOOH (*ii*) $C_2H_5CHO$** **[Delhi]**

**Ans.** (*i*) —COOH (Carboxylic acid)
(*ii*) —CHO (Aldehyde)

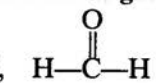
**138. Name the functional group present in each of the following organic compounds:**
**(*i*) $CH_3COCH_3$**
**(*ii*) $C_2H_5COOH$** **[Delhi]**

**Ans.** (*i*) Ketone ($-\overset{\overset{O}{\|}}{C}-$)
(*ii*) Carboxylic acid (—COOH)

**139. Write the name and formula of the second member of the carbon compounds having functional group —OH.** **[All India]**

**Ans.** $\underset{\text{Ethanol}}{CH_3-CH_2-OH}$, $H-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}}-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C}}-OH$

**140. Write the name and formula of the first member of the series of carbon compounds having functional group —CHO.** **[All India]**

**Ans.** HCHO, 
Methanal

**141. Write the name and formula of the first member of the carbon compounds having functional group —COOH.** **[All India, Foreign]**

**Ans.** HCOOH,
Methanoic acid

**142. Write the name and formula of the 2nd member of the series of carbon compounds whose general formula is $C_nH_{2n+1}OH$.** **[Foreign]**

**Ans.** Ethanol, $C_2H_5OH$ or $CH_3CH_2OH$

**143. Write the name and formula of the 2nd member of the series of carbon compounds whose general formula is $C_nH_{2n}$.** **[Foreign]**

**Ans.** $C_3H_6$, $H_2C{=}CH{-}CH_3$
Propane is second member of series whose general formula is $C_nH_{2n}$.

## Short Answer Type [II] Questions [3 Marks]

**144. What are isomers? Draw the structures of two isomers of butane, $C_4H_{10}$. Why can't we have isomers of first three members of alkane series?** **[Delhi]**

**Ans.** Refer to Ans. 88.

**145. Define homologous series of organic compounds. List its two characteristics. Write the name and formula of the first member of the series of alkenes.** **[Delhi]**

**Ans.** Refer to Ans. 4.
$C_2H_4$, $CH_2{=}CH_2$, Ethene is first member of alkene series.
Each member differs from successive member by $—CH_2—$ group. The difference in molecular weight between two successive members is 14 u.

**146. Complete the following equations:**

**(*i*) $CH_4 + O_2 \longrightarrow$**

**(*ii*) $C_2H_5OH \xrightarrow{\text{Hot Conc. } H_2SO_4}$**

**(*iii*) $CH_3COOH + NaOH \longrightarrow$** **[Delhi]**

**Ans.** (*i*) $CH_4(g) + 2O_2(g) \longrightarrow CO_2(g) + 2H_2O(l)$

(*ii*) $C_2H_5OH \xrightarrow{\text{Hot Conc. } H_2SO_4} CH_2{=}CH_2 + H_2O$

(*iii*) $CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O$

**147. What is meant by homologous series of organic compounds? Write the chemical formula of two consecutive members of a homologous series and state the part of these compounds that determines their (*i*) physical properties, and (*ii*) chemical properties.** **[All India]**

**Ans.** Refer to Ans. 120.

**148. Name the oxidising agent used for the conversion of ethanol to ethanoic acid. Distinguish between ethanol and ethanoic acid on the basis of (*i*) litmus test, (*ii*) reaction with sodium hydrogencarbonate.** **[All India]**

**Ans.** Refer to Ans. 121.

**149. Distinguish between esterification and saponification reactions of organic compounds with the help of the chemical equation for each. What is the use of (*i*) esters and (*ii*) saponification process?** **[Foreign]**

**Ans.** Refer to Ans. 9 (*a*) and 33.

**150. How are esters most commonly prepared? Write the equation for the chemical reaction involved. What are the two uses of esters?** **[Foreign]**

**Ans.** Esters are prepared by reaction of carboxylic acid and alcohol in the presence of conc. $H_2SO_4$.

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + \underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow{\text{Conc. } H_2SO_4} \underset{\text{Ethyl ethanoate}}{CH_3COOC_2H_5} + \underset{\text{Water}}{H_2O}$$

Esters are used in cold drinks, ice creams and perfumes.

## Long Answer Type Questions [5 Marks]

**151. What is the difference between the chemical composition of soaps and detergents? State in brief the action of soaps in removing an oily spot from a shirt. Why are soaps not considered suitable for washing where water is hard?** **[Delhi]**

**Ans.** Refer to Ans. 10.

**152. List in tabular form three physical and two chemical properties on the basis of which ethanol and ethanoic acid can be differentiated.** **[Delhi]**

**Ans.** **Physical properties:**

| Ethanol | Ethanoic acid |
|---|---|
| 1. It has specific smell. | 1. It has vinegar like smell. |
| 2. It has burning taste. | 2. It is sour in taste. |
| 3. It does not freeze in winters. | 3. It freezes in winters. |

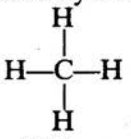
**Chemical properties:**

| Ethanol | Ethanoic acid |
|---|---|
| 1. It does not react with $NaHCO_3$. | 1. It gives $CO_2$ with $NaHCO_3$. |
| 2. It burns with blue flame. | 2. It does not burn with blue flame. |
| 3. It does not affect blue litmus. | 3. It turns blue litmus red. |

**153. What are hydrocarbons? Write the name and general formula of (*i*) saturated hydrocarbons, (*ii*) unsaturated hydrocarbons, and draw the structure of one hydrocarbon of each type. How can an unsaturated hydrocarbon be made saturated?** **[All India]**

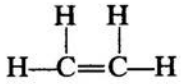
**Ans.** Compounds of carbon and hydrogen atoms only are called hydrocarbons.

(*i*) Alkanes, $C_nH_{2n+2}$ are saturated hydrocarbons.

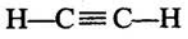


Methane
(Saturated hydrocarbon)

(*ii*) Alkenes, $C_nH_{2n}$ and Alkynes, $C_nH_{2n-2}$ are unsaturated hydrocarbons.

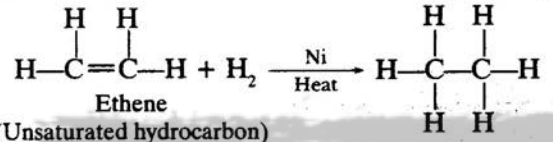


Ethene
(Unsaturated hydrocarbon)



Ethyne
(Unsaturated hydrocarbon)

Unsaturated hydrocarbons can be made saturated by hydrogenation.



Ethene
(Unsaturated hydrocarbon)

Ethane
(Saturated hydrocarbon)

READERS VALUE

**154. What are detergents chemically? List two merits and two demerits of using detergents for cleansing. State the reason for the suitability of detergents for washing, even in the case of water having calcium and magnesium ions.** **[All India]**

**Ans.** Detergents chemically are sodium or potassium salts of sulphonic acid of benzene or alkene.

**Merits:**

(*i*) They work well with hard water.

(*ii*) They are more effective than soaps.

**Demerits:**

(*i*) They are expensive.

(*ii*) Some of them having branching are non-biodegradable, therefore create water pollution.

Detergents are suitable for hard water having $Ca^{2+}$ and $Mg^{2+}$ ions because they do not form insoluble salts with $Mg^{2+}$ and $Ca^{2+}$ ions.

**155. (*a*) With the help of a suitable example, explain the process of hydrogenation mentioning the conditions of the reaction and any one change in physical property with the formation of the product.**

(*b*) **How does a saturated hydrocarbon react with chlorine? Write chemical equation for it. What type of reaction is it called and why?** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 86.

(*b*) Saturated hydrocarbon reacts with chlorine in presence of sunlight to form haloalkanes.

$$\underset{\text{Methane}}{CH_4} + \underset{\text{Chlorine}}{Cl_2} \xrightarrow{\text{Sunlight}} \underset{\text{Chloromethane}}{CH_3Cl} + \underset{\substack{\text{Hydrogen}\\\text{chloride}}}{HCl}$$

It is called substitution reaction because one atom is replaced by another atom.

**156. What are soaps and detergents chemically? Explain the action of cleaning by soaps. State the reason why we can wash our clothes even in hard water using detergents.** **[Foreign]**

**Ans.** Refer to Ans. 10.

## 2011

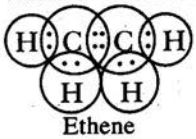
### Very Short Answer Type Questions [1 Mark]

**157. How many covalent bonds are there in a molecule of ethane ($C_2H_6$)?** **[Delhi]**

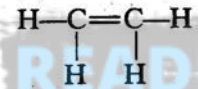
**Ans.** There are 7 covalent bonds in a molecule of ethane.

**158. Write the electron dot structure of ethene molecule ($C_2H_4$).** **[Delhi]**

**Ans.**



Ethene

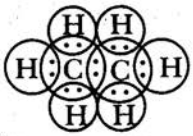


$CH_2 = CH_2$

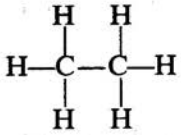
READERS VENUE

**159. Write the electron dot structure of ethane molecule ($C_2H_6$).** **[Delhi]**

**Ans.**



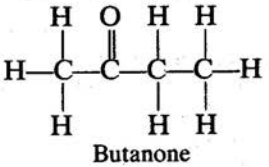
Ethane



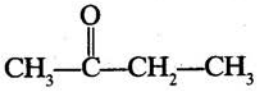
$CH_3—CH_3$

**160. Draw the structure of butanone molecule, $CH_3COC_2H_5$.** **[All India]**

**Ans.**



Butanone

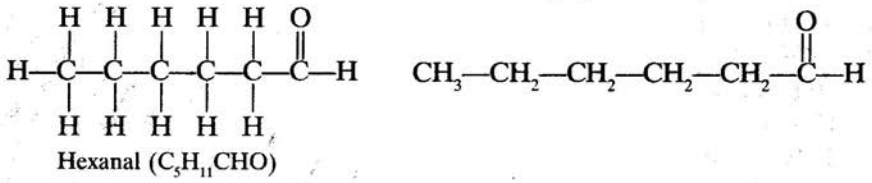


**161. Draw the structure for ethanoic acid molecule, $CH_3COOH$.** **[All India]**

**Ans.** $CH_3—\overset{\overset{O}{\|}}{C}—OH$ is structural formula of ethanoic acid.

**162. Draw the structure of the hexanal molecule, $C_5H_{11}CHO$.** [All India, Foreign]

**Ans.**

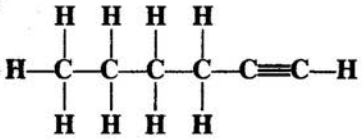


Hexanal ($C_5H_{11}CHO$)

**163. Butanone is a four carbon per molecule compound. Name the functional group present in it.** **[Foreign]**

**Ans.** Ketone

**164. Name the following compound:** **[Foreign]**



**Ans.** 1-Hexyne is IUPAC name of the compound.

## Short Answer Type [II] Questions [3 Marks]

**165. What is an 'esterification' reaction? Describe an activity to show esterification.** **[Delhi]**

**Ans.** Refer to Ans. 9 (*b*).

**166. Out of HCl and $CH_3COOH$, which one is a weak acid and why? Describe an activity to support your answer.** **[Delhi]**

**Ans.** Acetic acid ($CH_3COOH$) is a weaker acid because it does not dissociate completely into its ions in aqueous solution.

**Activity:** Add zinc metal in HCl and $CH_3COOH$ respectively. The hydrogen gas will be evolved faster in HCl and slowly in $CH_3COOH$. It shows acetic acid is a weak acid.

**Alternative Method:**

If we use pH paper, the colour of pH paper will be dark red in HCl and light red in $CH_3COOH$ which shows HCl is a strong acid and $CH_3COOH$ is a weak acid.

**167. Write one chemical equation to represent each of the following types of reactions of organic substances:**

**(*i*) Esterification (*ii*) Saponification (*iii*) Substitution** **[Delhi]**

**Ans.** (*i*) Esterification:

$$CH_3COOH + CH_3OH \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOCH_3 + H_2O$$

(*ii*) Saponification: $CH_3COOC_2H_5 + NaOH \longrightarrow CH_3COONa + C_2H_5OH$

(*iii*) Substitution: $CH_4 + Cl_2 \xrightarrow{\text{Sunlight}} CH_3Cl + HCl$

**168. Write chemical equations for what happens when**

**(*i*) sodium metal is added to ethanoic acid.**

**(*ii*) solid sodium carbonate is added to ethanoic acid.**

**(*iii*) ethanoic acid reacts with a dilute solution of sodium hydroxide.** **[All India]**

**Ans.** (*i*) $H_2$ gas is evolved.

$$2CH_3COOH + 2Na \longrightarrow 2CH_3COONa + H_2$$

Ethanoic acid — Sodium ethanoate — Hydrogen

(*ii*) Brisk effervescence due to carbon dioxide gas is formed.

$$2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + CO_2\uparrow + H_2O$$

Ethanoic acid — Sodium carbonate — Sodium ethanoate — Carbon dioxide — Water

(*iii*) Sodium ethanoate and water are formed.

$$CH_3COOH + NaOH(dil.) \longrightarrow CH_3COONa + H_2O$$

Ethanoic acid — Sodium hydroxide — Sodium ethanoate — Water

**169. Describe two examples of different oxidations of ethanol. Name the products obtained in each case.** **[All India]**

**Ans.** (*i*) When ethanol is heated with copper at 573 K, ethanal is formed.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[573K]{Cu} \underset{\text{Ethanal (Acetaldehyde)}}{CH_3-\overset{\overset{O}{\|}}{C}-H} + H_2$$

(*ii*) When ethanol is oxidised with alkaline potassium permanganate solution, ethanoic acid is formed.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} + 2[O] \xrightarrow[KMnO_4]{\text{Alkaline}} \underset{\text{Ethanoic acid}}{CH_3-\overset{\overset{O}{\|}}{C}-OH} + H_2O$$

**170. Write a chemical equation in each case to represent the following types of chemical reactions of organic compounds:**

**(*i*) Oxidation reactions**

**(*ii*) Addition reactions**

**(*iii*) Substitution reactions** **[Foreign]**

**Ans.** Refer to Ans. 46 (*a*).

**171. (*a*) What is a homologous series of compounds? List any two of its characteristics.**

**(*b*) What is the next higher homologue of $C_3H_7OH$? What is its formula and what is it called?** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 4.

(*b*) $C_4H_9OH$ is next homologue of $C_3H_7OH$.

$CH_3CH_2CH_2CH_2OH$ is structural formula.

Its IUPAC name is 1-Butanol.

## Long Answer Type Questions [5 Marks]

**172.** **(*a*) In tabular form, differentiate between ethanol and ethanoic acid under the following heads:**

**(*i*) Physical state** **(*ii*) Taste**

**(*iii*) $NaHCO_3$ test** **(*iv*) Ester test**

**(*b*) Write a chemical reaction to show the dehydration of ethanol.** **[Delhi]**

**Ans.** (*a*)

| Properties | Ethanol | Ethanoic acid |
|---|---|---|
| (*i*) Physical state | It is liquid with specific smell. | It is also liquid with vinegar like smell. |
| (*ii*) Taste | It has burning taste. | It has sour taste. |
| (*iii*) $NaHCO_3$ test | It does not react with sodium hydrogen carbonate. | It gives brisk effervescence due to $CO_2$. |
| (*iv*) Ester test | Add acetic acid and conc. $H_2SO_4$, pleasant fruity smelling compound, ester is formed. | Add ethyl alcohol and conc. $H_2SO_4$, pleasant fruity smelling compound, ester is formed. |

(*b*) $\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\ K]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2=CH_2} + H_2O$

**173.** **(*a*) What is a soap? Why are soaps not suitable for washing clothes when the water is hard?**

**(*b*) Explain the action of soap in removing an oily spot from a piece of cloth.**

**[Delhi]**

READERS VENUE

**Ans.** (*a*) Soap is sodium or potassium salt of fatty acids.

Soap reacts with $Ca^{2+}$ and $Mg^{2+}$ present in hard water to form scum.

(*b*) Soap has hydrophobic part which attracts dirt, oil and greese whereas hydrophillic part attracts water and dirt, greese, oil is washed away.

**174.** **(*a*) State two properties of carbon which lead to a very large number of carbon compounds.**

**(*b*) Why does micelle formation take place when soap is added to water? Why are micelles not formed when soap is added to ethanol?** **[All India]**

**Ans.** (*a*) (*i*) Catenation (*ii*) Tetravalency

(*b*) It is because a large number of molecular ions of soaps get aggregated and form colloidal solution. Soap has hydrophobic tail (hydrocarbon) which dissolves in hydrocarbon part and hydrophilic part dissolves in water. Ethanol is non-polar solvent therefore micelles are not formed because hydrocarbon part gets attracted towards ethanol and ionic end will not dissolve in alcohol.

**175. Explain isomerism. State any four characteristics of isomers. Draw the structures of possible isomers of butane, $C_4H_{10}$** **[All India]**

**Ans.** Isomerism is a phenomenon due to which some compounds have same molecular formula but different structural formulae.

**Characteristics:**

(*i*) They differ in structural formula.
(*ii*) They differ in melting point.
(*iii*) They differ in boiling point.
(*iv*) They differ in solubility in same solvent.

There are two isomers of butane, $C_4H_{10}$.

(*i*) $CH_3—CH_2—CH_2—CH_3$
*n*-Butane

(*ii*) $CH_3—\underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}}—CH_3$
2-Methylpropane

**176. Give reasons for the following:**

**(*i*) Element carbon forms compounds mainly by covalent bonding.**
**(*ii*) Diamond has a high melting point.**
**(*iii*) Graphite is a good conductor of electricity.**
**(*iv*) Acetylene burns with a sooty flame.**
**(*v*) Kerosene does not decolourise bromine water while cooking oils do.** **[Foreign]**

**Ans.** (*i*) It is because carbon has four valence electrons, it cannot gain or lose four electrons because high energy is needed. It can only share four electrons.
(*ii*) It is due to strong covalent bonds and compact structure of diamond.
(*iii*) It is due to presence of free electrons in graphite because each carbon is linked to three more carbon atoms.
(*iv*) It is due to high percentage of carbon, it burns with sooty or smoky flame.
(*v*) Kerosene oil is mixture of saturated hydrocarbons therefore does not decolourise bromine water.

**177. (*a*) What is a detergent? Name one detergent.**
**(*b*) Write two advantages and two disadvantages of using detergents over soaps.**
**(*c*) Why, by using a detergent, can we wash clothes even in hard water?** **[Foreign]**

**Ans.** (*a*) Detergents are sodium or potassium salts of sulphonic acids of benzene or hydrocarbons of alkene type. Sodium lauryl sulphate.

(*b*) **Advantage:** (*i*) They are more effective than soaps.
(*ii*) They can work well even with hard water.

**Disadvantages:** (*i*) They are expensive.
(*ii*) Some of them are non-biodegradable and create water pollution.

(*c*) Detergents do not form insoluble compound with $Ca^{2+}$ and $Mg^{2+}$ present in hard water.

## 2010

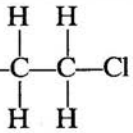
### Very Short Answer Type Questions [1 Mark]

**178. State two characteristic features of carbon which when put together give rise to large number of carbon compounds.** **[Delhi]**

**Ans.** (*i*) Catenation (*ii*) Tetravalency of carbon

**179. Write the structural formula of chloroethane.** **[Foreign]**

**Ans.** $CH_3CH_2Cl$ or



### Short Answer Type [I] Questions [2 Marks]

**180. Write the name and molecular formula of an organic compound having its name suffixed with '–ol' and having two carbon atoms in the molecule. With the help of a balanced chemical equation indicate what happens when it is heated with excess of conc. $H_2SO_4$.** **[All India]**

**Ans.** It is ethanol, its molecular formula is $C_2H_6O$ structural formula is $CH_3CH_2OH$

Ethanol forms ethene, when heated with conc. $H_2SO_4$.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[\text{heat}]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$$

**181. Write the names and molecular formula of two organic compounds having functional group suffixed as '–oic acid'. With the help of a balanced chemical equation and explain what happens when any one of them reacts with sodium hydroxide.** **[All India]**

**Ans.** Methanoic acid, its molecular formula is $CH_2O_2$. Structural formula is HCOOH.
Ethanoic acid, its molecular formula is $C_2H_4O_2$. Structural formula is $CH_3COOH$.
When acid reacts with sodium hydroxide, its sodium salt and water is formed.

$$\underset{\text{Ethanoic acid}}{CH_3COOH} + NaOH \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Water}}{H_2O}$$

**182. What is a homologous series? Which two of the following organic compounds belong to the same homologous series?** **[All India]**

**$C_2H_6$, $C_2H_6O$, $C_2H_6O_2$, $CH_4O$.**

**Ans.** Homologous series is a series of organic compounds which have same functional group and similar chemical properties. Each member of this series differs by —$CH_2$— in its molecular formula and 14 u in its molecular mass.

$C_2H_6O$ ($C_2H_5OH$) and $CH_4O$ ($CH_3OH$) belong to same homologous series.

**183. With the help of a suitable example explain in brief the process of hydrogenation mentioning the conditions for the reaction and also state any one physical property of substances which changes due to hydrogenation.** **[Foreign]**

**Ans.** Refer to Ans. 86.

## Short Answer Type [II] Questions [3 Marks]

**184. Name the functional group of organic compounds that can be hydrogenated. With the help of suitable example explain the process of hydrogenation mentioning the conditions of the reaction and any one change in physical property with the formation of the product. Name any one natural source of organic compounds that are hydrogenated.**

**[Delhi]**

**Ans.** Double bond $=$, triple bond $\equiv$ are functional groups (reactive part of compounds) which can be hydrogenated.

Refer to Ans. 86.

**185. An ester has the molecular formula $C_4H_8O_2$. Write its structural formula. What happens when this ester is heated in the presence of sodium hydroxide solution? Write the balanced chemical equation for the reaction and name the products. What is a saponification reaction?** **[All India]**

**Ans.** There are three possible structural formulae of ester with molecular formula $C_4H_8O_2$.

$CH_3CH_2COOCH_3$, $HCOOCH_2CH_2CH_3$, $CH_3COOC_2H_5$

$$\underset{\substack{\text{Methyl propanoate}\\(C_4H_8O_2)}}{CH_3CH_2COOCH_3} + NaOH \longrightarrow \underset{\text{Sodium propanoate}}{CH_3CH_2COONa} + \underset{\text{Methanol}}{CH_3OH}$$

***Or***

$$\underset{\substack{\text{Propyl methanoate}\\(C_4H_8O_2)}}{HCOOCH_2CH_2CH_3} + NaOH \longrightarrow \underset{\text{Sodium methanoate}}{HCOONa} + \underset{\text{1-Propanol}}{CH_3CH_2CH_2OH}$$

READERS VENUE

***Or***

$$\underset{\substack{\text{Ethyl ethanoate}\\(C_4H_8O_2)}}{CH_3COOC_2H_5} + NaOH \longrightarrow \underset{\text{Sodium ethanoate}}{CH_3COONa} + \underset{\text{Ethanol}}{C_2H_5OH}$$

Saponification is the process in which an ester is treated with sodium hydroxide to form sodium salt of acid and alcohol is formed.

**186. An organic compound 'A' is an essential constituent of wine and beer. Oxidation of 'A' yields an organic acid 'B' which is present in vinegar. Name the compounds 'A' and 'B' and write their structural formula. What happens when 'A' and 'B' react in the presence of an acid catalyst? Write the chemical equation for the reaction.**

**[All India]**

**Ans.** 'A' is ethanol ($C_2H_5OH$) which is essential constituent of wine and beer and 'B' is acetic acid ($CH_3COOH$) which is present in vinegar.

$$\underset{\substack{\text{(Present in wine and beer)}\\\text{'A'}}}{CH_3CH_2OH} + 2[O] \xrightarrow[\text{Oxidation}]{\text{Alkaline } KMnO_4} \underset{\substack{\text{Acetic acid}\\\text{(Present in vinegar)}\\\text{'B'}}}{CH_3COOH} + H_2O$$

When 'A' and 'B' react in the presence of an acid catalyst, ethyl ethanoate is formed.

$$\underset{\text{'B'}}{CH_3COOH(l)} + \underset{\text{'A'}}{C_2H_5OH(l)} \xrightarrow{\text{Conc. } H_2SO_4} CH_3COOC_2H_5(l) + H_2O(l)$$

**187. What is ethanol? State its two properties. What happens when it is heated with excess of conc. $H_2SO_4$ at 443 K? What role does conc. $H_2SO_4$ play in this reaction? Write chemical equation of the reaction involved and the structural formula of the main product formed.** **[All India]**

**Ans.** Ethanol is $C_2H_5OH$.

(*i*) It has specific smell. (*ii*) It is soluble in water.

When ethanol is heated with excess of conc. $H_2SO_4$, ethene is formed along with water.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\text{ K}]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + \underset{\text{Water}}{H_2O}$$

Conc. $H_2SO_4$ acts as dehydrating agent.

Structural formula of ethene is $H-\overset{H}{\overset{|}{C}}=\overset{H}{\overset{|}{C}}-H$.

**188. With the help of balanced chemical equations explain what happens when ethanol is heated with (*i*) alkaline solution of potassium permanganate, (*ii*) excess concentrated sulphuric acid at 443 K. Mention any two uses of ethanol.** **[Foreign]**

**Ans.** (*i*) Ethanol gets oxidised to ethanoic acid.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} + 2[O] \xrightarrow{\text{Alkaline } KMnO_4} \underset{\text{Ethanoic acid}}{CH_3COOH} + H_2O$$

READERS VENUE

(*ii*) Ethene will be formed.

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow[443\text{ K}]{\text{Conc. } H_2SO_4} \underset{\text{Ethene}}{CH_2{=}CH_2} + H_2O$$

**Uses:**

(*i*) It is used in tonics and cough syrups. (*ii*) It is used as fuel.

(*iii*) It is used as solvent. (*iv*) It is used in wine, beer and whisky. (*any two*)

**189. What is a homologous series? Write the molecular formula of the fourth and fifth member of the homologous series of carbon compounds represented by the general formula $C_nH_{2n+1}OH$. Mention any two characteristics of the compounds of a homologous series.** **[Foreign]**

**Ans.** Homologous series is series of organic compound having same functional group and similar chemical properties.

General formula: $C_nH_{2n+1}—OH$

$C_4H_9OH$ is molecular formula of fourth member.

$C_5H_{11}OH$ is molecular formula of fifth member.

**Characteristics:** 1. They are soluble in water.

2. They have specific smell and burning taste.

# 5 PERIODIC CLASSIFICATION OF ELEMENTS

## PREVIOUS YEARS' QUESTIONS

**2019**

### Short Answer Type [I] Questions [2 Marks]

**1. How it can be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements?** **[Delhi]**

**Ans.** • Each group has same number of valence electrons e.g. Li, Na, K have one valence electron.

• In a period, valence electrons goes on increasing from left to right e.g.

| Li | Be | B | C | N | O | F | Ne |
|---|---|---|---|---|---|---|---|
| 2,1 | 2,2 | 2,3 | 2,4 | 2,5 | 2,6 | 2,7 | 2,8 |

Na
2,8,1

K
2,8,8,1

READERS VENUE

It shows that basic structure of the Modern Periodic Table is based on electronic configuration.

**2. The electronic configuration of an element is 2, 8, 4. State its:**
**(*a*) group and period in the Modern Periodic Table.**
**(*b*) name and write its one physical property.**

**Ans.** (*a*) It belongs to Group 14 and third period of periodic table.

(*b*) The element is silicon. It is metalloid. It has high melting point and semiconductor.

**3. Write the name, symbol and electronic configuration of an element 'X' whose atomic number 11.** **[Delhi]**

**Ans.** 'X' is sodium. Its symbol is Na. Its electronic configuration is 2, 8, 1.

**4. Can the following groups of elements be classified as Dobereiner's triad:**
**(*a*) Na, Si, Cl** **(*b*) Be, Mg, Ca**
**Atomic mass of Be–9, Na–23, Mg–24, Si–28, Cl–35, Ca–40. Justify your answer in each case.** **[Delhi]**

**Ans.** (*a*) Na Si Cl
23 28 35

Atomic mass of Si $= \frac{23+35}{2} = \frac{58}{2} = 29$

Although, the atomic mass of Si is nearly average of Na and Cl but it cannot be classified as Dobereiner's triad because these elements do not resemble with each other.

(*b*) Be Mg Ca
9 24 40

Atomic mass of Mg $= \frac{40+9}{2} = 24.5$

It can be classified Dobereiner's triads because these elements resemble with each other.

## Short Answer Type [II] Questions [3 Marks]

**5. Based on the group valency of elements write the molecular formula of the following compounds giving justification for each:**

**(*i*) Oxide of first group elements.**

**(*ii*) Halide of the elements of group thirteen, and**

**(*iii*) Compound formed when an element, A of group 2 combines with an element, B of group seventeen.** **[Delhi]**

**Ans.** (*i*) $Na_2O$ (sodium oxide), $Li_2O$ (lithium oxide), $K_2O$ (potassium oxide)

(*ii*) Boron trichloride ($BCl_3$), Aluminium chloride ($AlCl_3$), Gallium chloride ($GaCl_3$).

(*iii*) $AB_2$ is formula of the compound: $A^2$ $B^1$ → $AB_2$

**6. How is possible valency of element determined from electronic configuration of its atom? Determine the valency of element 'X' whose atomic number is 15.** **[AI Panchkula]**

**Ans.** Valency is equal to number of valence electrons (electrons present in outermost shell) or (8-number of valence electrons).

X(15) has electronic configuration 2, 8, 5.

Its valency is equal to 3 because it can gain 3 electrons to become stable.

## Long Answer Type Questions [5 Marks]

**7. (*a*) List any three observations which posed a challenge to Mendeleev's Periodic Law.**

**(*b*) How does the metallic character of elements vary on moving from**

**(*i*) left to right in a period,**

**(*ii*) from top to bottom in a group of the Modern Periodic Table?**

**Give reason for your answer.** **[AI Allahabad]**

**Ans.** (*a*) • Increasing order of atomic mass could not be maintained.
- Position of isotopes cannot be different as they have same chemical properties although they differ in atomic mass.
- Position of Hydrogen was not justified.
- Similar elements were placed in different groups and dissimilar elements were placed in same group. *(Any three)*

(*b*) (*i*) Metallic character decreases from left to right because atomic size decreases, tendency to lose electrons decreases due to increase in effective nuclear charge.

(*ii*) Metallic character increases from top to bottom because atomic size increases, tendency to lose electron increases due to decrease in effective nuclear charge.

**8. The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons respectively in their outermost shells. Write the group numbers in which these elements are placed in the Modern Periodic Table. Write the electronic configuration of the atoms of B and D and the molecular formula of the compound formed when B and D combine.** **[AI Allahabad]**

**Ans.** 'A' belongs to Group 1, B to Group 13, 'C' to Group 15 and 'D' to Group 17:

B(13): 2, 8, 3

D(17): 2, 8, 7

$B^3$ $D^1$

$BD_3$ is formula formed by the compound.

READERS VENUE

**9. (*a*) How does metallic character of elements in modern periodic table vary on moving (*i*) left to right in a period, (*ii*) top to bottom in a group?**

**(*b*) If an element 'X' is placed in group 14, what will be nature of bond in its chloride? Write the chemical formula of the compound formed.**

**(*c*) An element 'X' has mass number 35, number of neutrons = 18, what is atomic number of 'X'. Write its electronic configuration and determine its valency.**

**[AI Chandigarh]**

**Ans.** (*a*) (*i*) In a period metallic character goes on decreasing, e.g. in 3rd period Na is more metallic than Cl.

(*ii*) In a group, metallic character goes on increasing, e.g. K is more metallic than Na in group 1.

(*b*) $XCl_4$ is formula of compound. It has covalent bonds.

(*c*) Atomic number = Mass number – Number of neutrons

Atomic number = 35 – 18 = 17

Electronic configuration = 2, 8, 7

Valency = 1

**10.** **(*a*) List two criteria Mendeleev's used in his periodic table to classify the elements. State Mendeleev's Periodic law and explain why no fixed position was assigned to hydrogen in Mendeleev's Periodic table.**

**(*b*) How and why does atomic size of elements vary as we move**

**(*i*) from left to right in a period and**

**(*ii*) down a group in the Modern periodic table.** **[AI Uttarakhand]**

**Ans.** (*a*) (*i*) Increasing order of atomic mass

(*ii*) Formula of oxides and hydrides

'Properties of elements are periodic function of their atomic mass' is Mendeleev's Periodic law.

Hydrogen resembles with group 1 as well as Group 17 elements, therefore, no fixed position was assigned.

(*b*) (*i*) Atomic size goes on decreasing from left to right in a periodic table because one proton and one electron is added successively, therefore, effective nuclear charge increases.

(*ii*) Atomic size goes on increasing down the group because number of shells goes on increasing, therefore, effective nuclear charge decreases.

**11.** **(*a*) How is valency of element determined if its electronic configuration is known? Determine the valency of an element with atomic number 9.**

**(*b*) Given below some elements of the modern periodic table. Atomic number of element are given in parenthesis:**

**A(4), B(9), C(14), D(19), E(20)**

**(*i*) With the 'help of electronic configuration, find out which one of the above element will have one electron in outermost shell.**

**(*ii*) Which two elements belong to same group?**

**(*iii*) Which one of the elements belonging to 4th period has bigger atomic size and why?** **[AI Uttarakhand]**

**Ans.** (*a*) Valency is equal to number of valence electrons or 8-number of valence electrons.

F(9) has electronic configuration = 2, 7

Valence electrons = 7, valency = 1

(*b*) (*i*) D(19): 2, 8, 8, 1. It has one valence electron.

(*ii*) A(4): 2, 2 and E(20): 2, 8, 8, 2 belong to same group.

(*iii*) D(19): 2, 8, 8, 1 is bigger than E(20) 2, 8, 8, 2 because 'D' has 19 protons and 19 electrons ∴ less effective nuclear charge than E(20) with 20 protons and 20 electrons.

**12.** **Answer the following questions based on elements with atomic number 3 to 9.**

**(*a*) Name the element which has smallest atomic radius.**

**(*b*) Name the element which shows maximum valency.**

(*c*) **Name the element which is metalloid.**

(*d*) **Name the element which is most electropositive.**

(*e*) **Write the chemical formula of the compound formed when the elements of atomic number 6 and 8 react together.** **[AI Chandigarh]**

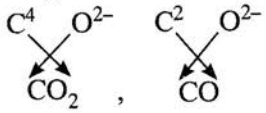
**Ans.** (*a*) 'F' (Fluorine) is smallest.

(*b*) Carbon has maximum valency equal to 4.

(*c*) Boron is metalloid.

(*d*) Lithium is most electropositive element.

(*e*) $CO_2$ and CO are compounds formed by C(6) and O(8).




## 2018

### Long Answer Type Questions [5 Marks]

13. (*a*) **The modern periodic table has been evolved through the early attempts of Dobereiner, Newland and Mendeleev. List one advantage and one limitation of all the three attempts.**

(*b*) **Name the scientist who first of all showed that atomic number of an element is a more fundamental property than its atomic mass.**

(*c*) **State Modern periodic law.** **[CBSE]**

READERS VENUE

**Ans.** (*a*) **Doberenier Law:**

**Advantage:** To predict the atomic mass of middle element in each triad.

| Elements | Atomic mass |
|---|---|
| Li | 6.9 |
| Na | 23.0 |
| K | 39.0 |

**Limitation:** He could identify only three triads, could not classify all the elements discovered of that time. Elements like N, P, As does not follow Dobereiner's 'triads' law.

**Newlands Law:**

**Advantage:** Every eighth element had properties similar to that of first when elements were arranged in increasing order of atomic mass. He correlated properties of elements with atomic mass.

**Limitation:** It was applicable up to calcium. For example, iron was grouped with oxygen and sulphur whereas it has properties similar to cobalt and nickel.

**Mendeleev's Periodic Table:**

**Advantage:** Elements with similar properties could be grouped. He predicted the properties of new elements which helped in their discovery.

**Disadvantage:** No fixed position of hydrogen. Position of isotopes could not be justified. Increasing order of atomic mass could not be maintained.

(*b*) Henry Moseley

(*c*) **Modern Periodic law:** Properties of elements are periodic function of their atomic number.

## 2018 (Compartment)

### Long Answer Type Questions [5 Marks]

**14. Explain giving justification the trends in the following properties of elements, on moving from left to right in a period, in the Modern Periodic Table.** [CBSE]

**(*a*) Variation of valency.**

**(*b*) Change of atomic radius.**

**(*c*) Metallic to non-metallic character.**

**(*d*) Electronegative character.**

**(*e*) Nature of oxides.**

**Ans.** (*a*) The valency increases from left to right till middle and then decreases because valence electrons goes on increasing. Valency is equal to valence electrons till middle. After $15^{th}$ group, valency is equal to 8-valence electrons.

$\therefore$ After group 15 it decreases and becomes zero in group 18.

(*b*) Atomic radius decreases from left to right in a period due to increase in effective nuclear charge as one proton and one electron is being added successively.

(*c*) Metallic character decreases due to increase in ionisation energy and decrease in tendency to lose electrons where as non-metallic character increases due to increase in tendency to gain electrons.

(*d*) Electronegative character increases due to decrease in atomic radius and increase in tendency to attract electron.

(*e*) Basic character of oxides decreases, acidic character of oxides increases due to decrease in metallic character and increase in non-metallic character.

**15. (*a*) What was the basis of Mandeleev's classification of elements?**

**(*b*) List two achievements of Mandeleev periodic tables.**

**(*c*) List any two observations which posed a challenge to Mandeleev's periodic law.** [CBSE]

**Ans.** (*a*) Increasing order of atomic mass and formula of oxides and hydrides was basis of classification in Mendeleev's Periodic Table.

(*b*) (*i*) It could classify all the elements discovered at that time.

(*ii*) It could help in discovery of new elements by predicting their properties.

(*c*) (*i*) Isotopes could not be given different places inspite of different atomic mass but same chemical properties.

(*ii*) Increasing order of atomic mass could not be maintained.

## 2017

### Short Answer Type [II] Questions [3 Marks]

**16. Write the names given to the vertical columns and horizontal rows in the Modern Periodic Table. How does the metallic character of elements vary on moving down a vertical column? How does the size of atomic radius vary on moving left to right in a horizontal row? Given reason in support of your answer in the above two cases.** **[Delhi]**

**Ans.** The vertical columns of periodic table are called *groups*.

The horizontal rows are called *periods*.

**Metallic character:** It increases down the group in a vertical column.

**Reason:** Effective nuclear charge decreases, as tendency to lose electrons increases on moving down the group because the attraction between the nucleus and the valence electron decreases.

**Atomic radius:** It decreases along left to right in a period.

**Reason:** It is because number of shells remain the same. Effective nuclear charge increases due to addition of one proton and one electron successively.

**17. An element P (atomic number 20) reacts with an element Q (atomic number 17) to form a compound. Answer the following questions giving reason:**

**Write the position of P and Q in the Modern Periodic Table and the molecular formula of the compound formed when P reacts with Q.** **[Delhi]**

**Ans.**

| | | |
|---|---|---|
| P(20) | 2, 8, 8, 2 | Valency 2 |
| Q(17) | 2, 8, 7 | Valency 1 |

Element P has 2 valence electrons and 4 shells, therefore, it belongs to group 2 and 4th period of periodic table

Element Q has 7 valence electrons and 3 shells, therefore, it belongs to group 17 and 3rd period of periodic table.

The compound formed between P and Q will have formula $PQ_2$

**18. Write the number of periods and groups in the Modern Periodic Table. How does the metallic character of elements vary on moving (*i*) from left to right in a period, and (*ii*) down a group? Give reason to justify your answer.** **[All India]**

**Ans.** There are 7 periods and 18 groups in Modern Periodic Table.

(*i*) Refer to Ans. 7 (*b*) (*i*).

(*ii*) Refer to Ans. 7 (*b*) (*ii*).

**19. Na, Mg and Al are the elements of the 3$^{rd}$ period of the Modern Periodic Table having group number 1, 2 and 13 respectively. Which one of these elements has the (*a*) highest valency, (*b*) largest atomic radius, and (*c*) maximum chemical reactivity? Justify your answer stating the reason for each.** **[All India]**

**Ans.** (*a*) Al has highest valency equal to 3 because its electronic configuration is 2, 8, 3. It can lose 3 electrons to become stable.

(*b*) Na has largest atomic size because it has least effective nuclear charge as the atomic radius decreases when we move left to right in a period.

(*c*) Na is most reactive due to largest atomic size, it can lose one electron easily to attain stable noble gas configuration.

**20. What is periodicity in properties of elements with reference to the Modern Periodic Table? Why do all the elements of the same group have similar properties? How does the tendency of elements to gain electrons change as we move from left to right in a period? State the reason of this change.** **[All India]**

READERS VENUE

**Ans.** (*a*) The repetition of similar properties after definite interval is called periodicity of properties.

(*b*) It is due to same number of valence electrons and valency, elements of same group resemble with each other.

(*c*) Tendency to gain electron increases from left to right in a period due to decrease in atomic size and increase in effective nuclear charge.

**21. Write the electronic configuration of two elements X and Y whose atomic numbers are 20 and 17 respectively. Write the molecular formula of the compound formed when element X reacts with element Y. Draw electron-dot structure of the product and also state the nature of the bond formed between both the elements.** **[All India]**

**Ans.** X(20): 2, 8, 8, 2 and Y(17): 2, 8, 7

$XY_2$ is the molecular formula of the compound.

$(X^{2+})(:\ddot{Y}:^{-})_2$ is electron dot structure. The bond is ionic bond.

$$X + 2Y \longrightarrow XY_2$$

**22. The atomic number of an element is 19.**

**(*a*) Write the electronic configuration of this element and determine (*i*) the valency of this element, and (*ii*) whether this element is a metal or a non-metal.**

**(*b*) Write the formula of the oxide of this element.**

**(*c*) Is this element more reactive or less reactive than Na (atomic number 11)? Justify your answer giving example.** **[Foreign]**

**Ans.** (*a*) X(19): 2, 8, 8, 1

(*i*) Its valency is 1.

(*ii*) It is a metal.

(*b*) $X_2O$ is formula of its oxide.

(*c*) It is more reactive than Na due to bigger atomic size, it can lose electron easily due to less effective nuclear charge.

**23. The atomic number of an element is 12.**

**(*a*) Write its electronic configuration and determine its valency.**

**(*b*) Is it more reactive or less reactive than Ca (atomic number 20)? Justify your answer giving reason.**

**(*c*) Is it a metal or a non-metal?**

**(*d*) Write the formula of its oxide.** **[Foreign]**

READERS VENUE

**Ans.** (*a*) 2, 8, 2 is the electronic configuration and valency 2.

(*b*) It is less reactive than Ca due to smaller size and has less tendency to lose electron due to greater effective nuclear charge.

(*c*) It is a Metal.

(*d*) XO is formula of its oxide.

**24. Why is atomic number considered to be a more appropriate parameter than atomic mass for the classification of elements in a periodic table? How does the metallic character of elements vary as we move (*a*) from left to right in a period, and (*b*) top to bottom in a group in the modern periodic table? Give reasons to justify your answers.** **[Foreign]**

**Ans.** Properties of elements depend upon valence electrons and valency which is determined by atomic number and not atomic mass.

There are 7 periods and 18 groups in Modern Periodic Table.

(*a*) Refer to Ans. 7 (*b*) (*i*).

(*b*) Refer to Ans. 7 (*b*) (*ii*).

**25. The atomic number of an element is 20.**

**(*a*) Write its electronic configuration and determine its valency.**

**(*b*) Is it a metal or a non-metal?**

**(*c*) Write the formula of its chloride.**

**(*d*) Is it more reactive or less reactive than Mg (atomic number 12)? Give reason for your answer.** **[Foreign]**

**Ans.** (*a*) Electronic configuration: 2, 8, 8, 2; valency: 2.

(*b*) It is a metal.

(*c*) $XCl_2$ or $CaCl_2$

(*d*) It is more reactive than Mg because it is larger in size, therefore, has more tendency to lose electrons due to less effective nuclear charge.

## 2017 (Compartment)

### Very Short Answer Type Question [1 Mark]

**26. State Modern Periodic Law of classification of elements.** **[All India]**

**Ans. Modern Periodic Law:** It states 'Properties of elements are periodic function of their atomic number.

### Short Answer Type Question [2 Marks]

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**27. State Modern Periodic Law. What is number of groups and periods in the Modern Periodic Table?** **[Delhi]**

**Ans. Modern Periodic Law:** Refer to Ans. 26.

There are 18 groups and 7 periods in the Modern Periodic Table.

### Short Answer Type [II] Questions [3 Marks]

**28. An element 'M' has atomic number 12.**

**(*i*) Write its electronic configuration and valency.**

**(*ii*) Is 'M' a metal or a non-metal? Give reason in support of your answer.**

**(*iii*) Write the formula and nature (acidic/basic) of the oxide of M.** **[Delhi]**

**Ans.** (*i*) Its electronic configuration 2, 8, 2 and valency is 2.

(*ii*) 'M' is a metal as it can lose its 2 valence electrons to achieve the noble gas configuration.

(*iii*) The formula and nature of the oxide of M is MO and it forms basic oxide.

**29. How does the atomic radius of the elements change on going**

**(*i*) from left to right in a period, and**

**(*ii*) down a group**

**in the Modern Periodic Table? Give reason in support of your answer.** **[Delhi]**

**Ans.** Refer to Ans. 10 (*b*) (*i*) and (*ii*).

**30. Write the electronic configuration of two elements P (atomic number 17) and Q (atomic number 19) and determine their group numbers and period numbers in the Modern Periodic Table.** **[All India]**

**Ans.** P(17) — 2, 8, 7 is electronic configuration. Group No. 17, period 3rd because it has 7 valence electrons and three shells.

Q(19) — 2, 8, 8, 1 is electronic configuration, Group No. 1, period 4th because it has one valence electron and four shells.

**31. An element 'X' with electronic configuration (2, 8, 2) combines separately with two radicals, $(NO_3)^-$ and $(SO_4)^{2-}$.**

**(*i*) Is 'X' a metal or a non-metal? Write the nature of its oxide.**

**(*ii*) Write the formula of the compounds of 'X' formed by the combination of these radicals. Are these compounds covalent or electrovalent?** **[All India]**

**Ans.** X (2, 8, 2), valency = 2

(*i*) 'X' is a metal because it can lose 2 electrons easily to gain noble gas configuration. Its oxide is basic in nature.

(*ii*) $X^{2+}$ $NO_3^-$ → $X(NO_3)_2$ $\quad$ $X^{2+}$ $SO_4^{2-}$ → $XSO_4$

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These compounds are electrovalent because they are made up of ions

## 2016

### Very Short Answer Type Question [1 Mark]

**32. Out of Li and K which has strong metallic character and why?** **[Delhi]**

**Ans.** 'K' because it is larger in size and can lose electron easily.

### Short Answer Type [II] Questions [3 Marks]

**33. Calcium is an element with atomic number 20. Stating reason answer each of the following questions:**

**(*i*) Is calcium a metal or non-metal?**

**(*ii*) Will its atomic radius be larger or smaller than that of potassium with atomic number 19?**

**(*iii*) Write the formula of its oxide.** **[Delhi]**

**Ans.** (*i*) Ca(20): 2, 8, 8, 2
It is metal because it can lose 2 electrons to become stable.
(*ii*) It will be smaller due to greater effective nuclear charge.
(*iii*) CaO

**34. As we move down a group in the periodic table how does the following change:**
**(*a*) Atomic size (*b*) Valency (*c*) Electronegativity.**

**Ans.** (*a*) Atomic size goes on increasing down the group.
(*b*) Valency remains the same.
(*c*) Electronegativity goes on decreasing down the group.

**35. What are isotopes? Give an example. Why do isotopes of an element have similar properties?**

**Ans.** Isotopes are atoms of same element having different atomic mass but same atomic number, e.g. $^{35}_{17}Cl$ and $^{37}_{17}Cl$. Isotopes resemble in properties due to same number of valence electrons.

**36. An element 'M' with electronic configuration (2, 8, 2) combines separately with $(NO_3)^-$, $(SO_4)^{2-}$ and $(PO_4)^{3-}$ radicals. Write the formula of the three compounds so formed. To which group and period of the Modern Periodic Table does the element 'M' belong? Will 'M' form covalent or ionic compounds? Give reason to justify your answer.** **[Delhi]**

**Ans.** $M(NO_3)_2$, $MSO_4$, $M_3(PO_4)_2$
'M' has 2 valence electrons, therefore, its valency is equal to 2.
or
$Mg(NO_3)_2$, $MgSO_4$, $Mg_3(PO_4)_2$
It belongs to group 2nd and 3rd period of Modern Periodic Table.
'M' will form ionic compounds because it can lose 2 electrons easily to become stable.

**37. (*a*) Name the element with atomic number 19.**
**(*b*) To which group does it belong?**
**(*c*) To which period does it belong?**
**(*d*) Write its electronic configuration.** **[Delhi]**

**Ans.** (*a*) Potassium (19)
(*b*) It belongs to Group 1
(*c*) It belongs to fourth period.
(*d*) 2, 8, 8, 1 is its electronic configuration.

**38. Out of the following elements**
**H(1); Be(4); Na(11); Mg(12)**
**(*a*) Write the pair elements having similar chemical properties.**
**(*b*) State the group number of each pair.**
**(*c*) Name one other element belonging to each of these groups.**

**Ans.** (*a*) Be(4) and Mg(12)
H(1) and Na (11)
(*b*) 1st pair belongs to group 2. 2nd pair belongs to group 1.
(*c*) Calcium belongs to group 2, lithium belongs to group 1.

**39. Two elements 'A' and 'B' belong to the 3rd period of Modern Periodic Table and are in group 2 and 13 respectively. Compare their following characteristics in tabular form:**
**(*a*) Number of electrons in their atoms**
**(*b*) Size of their atoms**
**(*c*) Their tendencies to lose electrons**
**(*d*) The formula of their oxides**
**(*e*) The formula of their chlorides** **[Delhi]**

**Ans.** (*a*) 2 and 3
(*b*) Group 2 element 'A' is bigger than 'B' of group 13.
(*c*) 'A' can lose electrons easily.
(*d*) AO, $B_2O_3$
(*e*) $ACl_2$, $BCl_3$

**40. Atomic number of an element 16. Write its electronic configuration. Find the number of valence electrons and its valency.** **[Delhi]**

**Ans.** Its electronic configuration is 2, 8, 6.
Its valence electrons are 6.
Its valency is equal to 2 because it can gain 2 electrons to become stable.

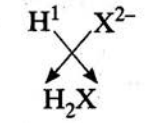
**41. (*a*) Name the metals among the first five elements of the Modern Periodic Table.**
**(*b*) Write their chemical symbols.**
**(*c*) Write the formula of their oxides.** **[Delhi]**

**Ans.** (*a*) Lithium and Beryllium
(*b*) Li and Be
(*c*) $Li_2O$ and BeO are formula of their oxide.

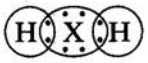
READERS VENUE

**42. An element 'X' belongs to 3rd period and group 16 of the Modern Periodic Table.**
**(*a*) Determine the number of valence electrons and the valency of 'X'.**
**(*b*) Molecular formula of the compound when 'X' reacts with hydrogen and write its electron dot structure.**
**(*c*) Name the element 'X' and state whether it is metallic or non-metallic.**
**[All India]**

**Ans.** (*a*) 'X' has electronic configuration 2, 8, 6, therefore it has 6 valence electrons, therefore, its valency is equal to 2.
(*b*) $H^1$ $X^{2-}$



$H_2X$



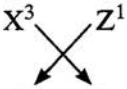

(*c*) 'X' is sulphur. It is non-metallic.

**43. An element 'X' has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of 'X'. Also write group number, period number and valency of 'X'.** **[All India]**

**Ans.** 'X' has mass number = 35
Number of neutrons = 18
Number of protons = Atomic number = 35 – 18 = 17
Electronic configuration 2, 8, 7
It belongs to group 17 and 3rd period.
Its valency is equal to 1.

**44. Three elements 'X', 'Y' and 'Z' have atomic numbers 7, 8 and 9 respectively.**
**(*a*) State their positions (Group number and period number both) in the Modern Periodic Table.**
**(*b*) Arrange these elements in the decreasing order of their atomic radii.**
**(*c*) Write the formula of the compound formed when 'X' combines with 'Z'.**
**[All India]**

**Ans.** (*a*) X, Y, Z belong to Group 15, 16 and 17 respectively. They belong to same period.
(*b*) X > Y > Z is decreasing order of their atomic radii.
(*c*) $X^3$ $Z^1$



X $Z_3$

$\Rightarrow XZ_3$ is formula of compound formed.

**45. The position of eight elements in the Modern Periodic Table is given below where atomic numbers of elements are given in the parenthesis.**

| Period No. | | |
|---|---|---|
| 2 | Li (3) | Be (4) |
| 3 | Na (11) | Mg (12) |
| 4 | K (19) | Ca (20) |
| 5 | Rb (37) | Sr (38) |

**(*i*) Write the electronic configuration of Ca.**
**(*ii*) Predict the number of valence electrons in Rb.**
**(*iii*) What is the number of shells in Sr?**
**(*iv*) Predict whether K is a metal or a non-metal.**
**(*v*) Which one of these elements has the largest atom in size?**
**(*vi*) Arrange Be, Ca, Mg and Rb in the increasing order of the size of their respective atoms.**
**[All India]**

**Ans.** (*i*) 2, 8, 8, 2.
(*ii*) It has one valence electron.
(*iii*) 2, 8, 18, 8, 2. It has five shells.
(*iv*) 'K' is a metal.
(*v*) Rubidium is the largest atom in size.
(*vi*) Be < Mg < Ca < Rb is increasing order of atomic size.

**46. An element 'X' belongs to 3rd period and group 13 of the Modern Periodic Table.**
**(*a*) Determine the valence electrons and the valency of 'X'.**
**(*b*) Molecular formula of the compound formed when 'X' reacts with an element 'Y' (atomic number = 8).**
**(*c*) Write the name and formula of the compound formed when 'X' combines with chlorine.** **[All India]**

**Ans.** (*a*) As 'X' has 3 valence electrons. 'X' has valency equal to 3. It is aluminium.
(*b*) $X^3$ $Y^2$ → $X_2Y_3$ is formula of compound formed or $Al_2O_3$
(*c*) $XCl_3$, Aluminium chloride ($AlCl_3$).

**47. State the main aim of classifying elements. Which is the more fundamental property of elements that is used in the development of Modern Periodic Table. Name and state the law based on this fundamental property. On which side of the periodic table one can find metals, non-metals and metalloids?** **[Foreign]**

**Ans.** The main aim of classification of elements is to study properties of elements conveniently.
Atomic number is more fundamental property to classify elements.
**Modern Periodic Law:** It states properties of elements are periodic function of their atomic number.
Metals are on left hand side, non-metals are on right hand side, metalloids are between metals and non-metals in zig-zag manner.

**48. An element 'X' (Atomic number = 20) burns in the presence of oxygen to form a basic oxide.**
**(*a*) Identify the element and write its electronic configuration.**
**(*b*) State its group number and period number in the Modern Periodic Table.**
**(*c*) Write a balanced chemical equation for the reaction when this oxide is dissolved in water.** **[Foreign]**

**Ans.** (*a*) Calcium; its electronic configuration is 2, 8, 8, 2
(*b*) It belongs to Group 2 and period 4.
(*c*) $CaO + H_2O \longrightarrow Ca(OH)_2$.

**49. An element 'X' belongs to third period and second group of the Modern Periodic Table.** **[Foreign]**
**(*a*) Write its electronic configuration.**
**(*b*) Is it a metal or non-metal? Why?**
**(*c*) Write the formula of the compound formed when 'X' reacts with an element (*i*) Y of electronic configuration 2, 6 and (*ii*) Z with electronic configuration 2, 8, 7.** **[Foreign]**

**Ans.** (*a*) 2, 8, 2
(*b*) It is metal because it can lose 2 electrons easily.
(*c*) (*i*) $X^2$ $Y^2$ → $XY$ (*ii*) $X^2$ $Y^1$ → $XY_2$

**50. The atomic number of an element 'X' is 19.**

**(*a*) Write its electronic configuration.**

**(*b*) To which period of the Modern Periodic Table does it belong and what is its valency?**

**(*c*) If 'X' burns in oxygen to form its oxide, what will be its nature – acidic, basic or neutral?**

**(*d*) Write balanced chemical equation for the reaction when this oxide is dissolved in water.** **[Foreign]**

**Ans.** (*a*) 2, 8, 8, 1.

(*b*) It belongs to group 1 and its valency is equal to 1.

(*c*) Its oxide will be basic.

(*d*) $X_2O + H_2O \longrightarrow 2XOH$

or $K_2O + H_2O \longrightarrow 2KOH$

**51. How does the tendency of the elements to lose electrons change in the Modern Periodic Table in (*i*) a group, (*ii*) a period and why?** **[Foreign]**

**Ans.** (*i*) Tendency to lose electrons increases down the group due to increase in atomic size, therefore, decrease in effective nuclear charge can lose electron easily.

(*ii*) Tendency to lose electrons decreases along a period form left to right due to decrease in atomic size, increase in effective nuclear charge, therefore, it cannot lose electron easily.

## 2015

READERS VENUE

### Short Answer Type [II] Questions [3 Marks]

**52. How many groups and periods are there in the Modern Periodic Table? How do the atomic size and metallic character of elements vary as we move:**

**(*i*) down a group and**

**(*ii*) from left to right in a period** **[Delhi]**

**Ans.** There are 18 groups and 7 periods in Modern Periodic Table.

(*i*) Atomic size goes on increasing down the group.
Metallic character goes on increasing down the group.

(*ii*) Atomic size goes on decreasing along a period from left to right.
Metallic character also goes on decreasing along a period from left to right.

**53. From the following elements:**

$$_4Be;\ _9F;\ _{19}K;\ _{20}Ca$$

**(*i*) Select the element having one electron in the outermost shell.**

**(*ii*) two elements of the same group.**

**Write the formula of and mention the nature of the compound formed by the union of $_{19}K$ and element X(2, 8, 7).** **[Delhi]**

**Ans.** (*i*) $_{19}K$ has electronic configuration 2, 8, 8, 1. It has one valence electron.

(*ii*) $_4Be$ and $_{20}Ca$ belong to same group.

$_{19}K = 2, 8, 8, 1$

$$\underset{(2,8,8,1)}{K} \longrightarrow \underset{(2,8,8)}{K^+} + e^-$$

$$\underset{(2,8,7)}{X} + e^- \longrightarrow \underset{(2,8,8)}{X^-}$$

$(K^+)(\ddot{X}^-)$, KX is formula of compound.

OR

$$\underset{(2,8,8,1)}{K} \longrightarrow \underset{(2,8,8)}{K^+} + e^-$$

$$\underset{(2,8,7)}{Cl} + e^- \longrightarrow \underset{(2,8,8)}{Cl^-}$$

$(K^+)(\ddot{Cl}^-)$, KCl is the formula of compound. It is an ionic compound.

**54. Na, Mg and Al are the elements of the same period of Modern Periodic Table having one, two and three valence electrons respectively. Which of these elements (*i*) has the largest atomic radius, (*ii*) is least reactive? Justify your answer stating reason for each case.** **[Delhi]**

**Ans.** (*i*) Na has largest atomic radius because it has 11 protons and 11 electrons and least effective nuclear charge among these elements.

(*ii*) Al is least reactive because it is smallest in size, therefore, has most effective nuclear charge, least tendency to lose electrons.

**55. Write the number of periods the Modern Periodic Table has. State the changes in valency and metallic character of elements as we move from left to right in a period. Also state the changes, if any, in the valency and atomic size of elements as we move down a group.** **[Delhi]**

**Ans.** Modern Periodic Table has 7 periods.

Valency first increases till middle and then decreases along a period from left to right.

Metallic character decreases from left to right in a period.

There is no change in valency as we move down the group.

Atomic size goes on increasing down the group due to increase in number of shells.

**56. Two elements 'P' and 'Q' belong to the same period of the modern periodic table and are in Group-1 and Group-2 respectively. Compare their following characteristics in tabular form:**

**(*a*) The number of electrons in their atoms**

**(*b*) The sizes of their atoms**

**(*c*) Their metallic characters**

**(*d*) Their tendencies to lose electrons**

**(*e*) The formula of their oxides**

**(*f*) The formula of their chlorides** **[All India]**

**Ans.**

| Group-1 | Group-2 |
|---|---|
| (*a*) They have one valence electron. | (*a*) They have 2 valence electrons. |
| (*b*) They are larger in size. | (*b*) They are smaller in size. |
| (*c*) They are more metallic. | (*c*) They are less metallic. |
| (*d*) They can lose electrons easily. | (*d*) They have less tendency to lose electron than Group-1 elements. |
| (*e*) $P_2O$ is formula of oxide. | (*e*) QO is formula of their oxides. |
| (*f*) PCl is formula of chloride. | (*f*) $QCl_2$ is formula of their chloride. |

**57. Taking the example of an element of atomic number 16, explain how the electronic configuration of the atom of an element relates to its position in the Modern Periodic Table and how valency of an element is calculated on the basis of its atomic number.** **[All India]**

**Ans.** S(16) has electronic configuration 2, 8, 6. It has 6 valence electrons. It belongs to Group 16. It has three shells, therefore, it belongs to 3rd period. It has 6 valence electrons. It can gain 2 electrons to complete its octet, therefore, its valency is equal to 2.

**58. The elements $_4$Be, $_{12}$Mg and $_{20}$Ca, each having two valence electrons in their valence shells, are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions associated with these elements, giving reason in each case:**

**(*a*) In which group should they be?**

**(*b*) Which one of them is least reactive?**

**(*c*) Which one of them has the largest atomic size?** **[All India]**

READERS VENUE

**Ans.** (*a*) They belong to group 2, since they have 2 valence electrons.

(*b*) 'Be' is least reactive because of more effective nuclear charge due to smaller size and least tendency to lose electrons.

(*c*) 'Ca' has the largest atomic size due to presence of 4 shells.

**59. Given below are some elements of the Modern Periodic Table. Atomic number of the element is given in the parentheses:**

**A(4), B(9), C(14), D(19), E(20)**

**(*a*) Select the element that has one electron in the outermost shell. Also write the electronic configuration of this element.**

**(*b*) Which two elements amongst these belong to the same group? Give reason for your answer.**

**(*c*) Which two elements amongst these belong to the same period? Which one of the two has bigger atomic radius?** **[All India]**

**Ans.** (*a*) D(19) = 2, 8, 8, 1

It has one valence electron.

(*b*) 'A' and 'E' belong to same group because they have same number of valence electrons. A(4) = 2, (2); E(20) = 2, 8, 8, (2)

(*c*) 'A' and 'B' belong to same period as they have same number of shells. A(4) = 2, 2; B(9) = 2, 7.

'A' has bigger atomic size due to less effective nuclear charge.

**60. Write the main aim of classifying elements. Name the basic property of elements used in the development of Modern Periodic Table. State the Modern Periodic Law. On which side (part) of the Modern Periodic Table do you find metals, metalloids and non-metals?** **[Foreign]**

**Ans.** Refer to Ans. 47.

**61. The atomic number of an element 'X' is 20.**

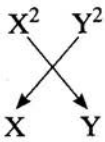
**(*i*) Determine the position of the element 'X' in the periodic table.**

**(*ii*) Write the formula of the compound formed when 'X' reacts/combines with another element 'Y' (atomic number 8).**

**(*iii*) What would be the nature (acidic or basic) of the compound formed? Justify your answer.** **[Foreign]**

**Ans.** (*i*) The element belongs to Group 2 and 4th period because it has 2 valence electrons and four shells.

(*ii*) $X^2$ $Y^2$



X Y

X has electronic configuration 2, 8, 8, 2 Valency = 2

Y has electronic configuration 2, 6 Valency = 2.

XY is the formula of the compound.

READERS VENUE

(*iii*) Basic oxide because 'X' is metal. It can lose 2 electrons to become stable. Metallic oxides are basic in nature.

**62. An element 'X' is placed in the 3rd group and 3rd period of the Modern Periodic Table. Answer the following questions stating reason for your answer in each case:**

**(*a*) Write the electronic configuration of the element 'X'.**

**(*b*) Write the formula of the compound formed when the element 'X' reacts with another element 'Y' of atomic number 17.**

**(*c*) Will the oxide of this element be acidic or basic?** **[Foreign]**

**Ans.** (*a*) 'X' has electronic configuration 2, 8, 3.

(*b*) 'X' has valency equal to 3. 'Y' has electronic configuration 2, 8, 7, so valency = 1.

$X^3$ $Y^1$

$XY_3$ is formula of compound formed.

(*c*) Oxide of this element will be basic.

**63. In the following table, the positions of six elements A, B, C, D, E and F are given as they are in the Modern Periodic Table:**

| Group → / Period ↓ | 1 | 2 | 3–12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | A | | | | | C | | | D |
| 3 | | | | B | E | | | | F |

**On the basis of the above table, answer the following questions:**

**(*i*) Name the element which forms only covalent compounds.**

**(*ii*) Name the element which is a metal with valency three.**

**(*iii*) Name the element which is a non-metal with valency three.**

**(*iv*) Out of B and C, whose atomic radius is bigger and why?**

**(*v*) Write the common name for the family to which the elements D and F belong.**

**[Foreign]**

**Ans.** (*i*) 'E' forms only covalent bonds.

(*ii*) 'B' is metal with valency three.

(*iii*) 'C' is non-metal with valency 3.

(*iv*) 'B' is bigger due to less effective nuclear charge.

(*v*) D and F belong to noble gases.

READERS VENUE

**64. Four elements P, Q, R and S belong to the third period of the Modern Periodic Table and have respectively 1, 3, 5 and 7 electrons in their outermost shells. Write the electronic configurations of Q and R and determine their valencies. Write the molecular formula of the compound formed when P and S combine.** **[Foreign]**

**Ans.** P(1) Q(3) R(5) S(7)

Q 2, 8, 3 ∴ Valency equal to 3 because it can lose 3 electrons to become stable.

R 2, 8, 5 ∴ Valency equal to 3 because it can gain 3 electrons to become stable.

$P^1$ $S^1$

P S

PS is formula of compound formed.

'P' has valency equal to 1 because it can lose one electron to become stable.

'S' has valency equal to 1 because it can gain ore electron to become stable.

## 2014

### Very Short Answer Type Questions [1 Mark]

**65. Write the number of vertical columns in the Modern Periodic Table. What are these columns called?** **[Delhi]**

**Ans.** There are 18 vertical columns in the Modern Periodic Table. These vertical columns are called groups.

**66. Write the number of horizontal rows in the Modern Periodic Table. What are these rows called?** **[Delhi]**

**Ans.** There are seven horizontal rows in the Modern Periodic Table. These rows are called periods.

**67. Write any one difference in the electronic configurations of group-1 and group-2 elements?** **[Delhi]**

**Ans.** Group 1 elements have one valence electron configuration and are good reducing agents.
Group 2 elements have two valence electron configuration. They tend to lose electrons easily.

**68. List any two properties of the elements belonging to the first group of the Modern Periodic Table.** **[All India]**

**Ans.** First group elements are also known as alkali metals.
(*a*) These elements exhibit +1 valency.
(*b*) These are very reactive and not found freely in nature.

READERS VENUE

**69. Write the atomic numbers of two elements 'X' and 'Y' having electronic configurations 2, 8, 2 and 2, 8, 6 respectively.** **[All India]**

**Ans.** Atomic number of X = 2 + 8 + 2 = 12
Atomic number of Y = 2 + 8 + 6 = 16

**70. The atomic numbers of three elements A, B and C are 12, 18 and 20 respectively. State, giving reason, which two elements will show similar properties.** **[All India]**

**Ans.** A(12) = 2, 8, 2
B(18) = 2, 8, 8
C(20) = 2, 8, 8, 2
Elements A and C will show similar properties as they belong to the same group and have two electrons in their valence shells.

**71. State the modern periodic law of classification of elements.** **[Foreign]**

**Ans.** Refer to Ans. 26.

**72. Out of the three elements P, Q and R having atomic numbers 11, 17 and 19 respectively, which two elements will show similar properties and why?** **[Foreign]**

**Ans.** Elements P, R will show similar properties as they belong to the same group with valency 1. P(11) = 2, 8, (1) and R(19) = 2, 8, 8, (1)

**73. Write the formula used to determine the maximum number of electrons which a shell in an atom can accommodate.** **[Foreign]**

**Ans.** Each shell has a maximum number of $2n^2$ electrons where $n$ is the shell number.

## Short Answer Type [II] Questions [3 Marks]

**74. Based on the group valency of elements state the formula for the following giving justification for each:**

**(*i*) Oxides of 1st group elements,**

**(*ii*) Halides of the elements of group 13, and**

**(*iii*) Compounds formed when an element of group 2 combines with an element of group 16.** **[Delhi]**

**Ans.** (*i*) Valency of group 1 elements: 1

Valency of oxygen: 2

Oxides of group 1 elements:

Element M O

Valency 1 2 $= M_2O$

So, formula of the oxides of group 1 is $M_2O$, where M is the group 1 element and O is oxygen.

(*ii*) Valency of group 13 elements: 3

Valency of Halogens: 1

Halides of group 13 elements:

Element M X

Valency 3 1 $= MX_3$

So, formula of the halides of group 13 is $MX_3$, where M is the group 13 element and X is halogen.

(*iii*) Valency of group 2 elements: 2

Valency of group 16 elements: 2

Compounds of group 2 and group 16 elements:

Element M N

Valency 2 2 $= MN$ Because 2 and 2 will get cancelled

1 : 1

So, formula of the compounds of group 2 and 16 is MN, where M is the group 2 element and N is the group 16 element.

**75. (*a*) Define the following terms:**

**(*i*) Valency; (*ii*) Atomic size**

**(*b*) How do the valency and the atomic size of the elements vary while going from left to right along a period in the Modern Periodic Table?** **[Delhi]**

**Ans.** (*a*) (*i*) **Valency:** Valency of an element is the measure of its combining power or the combining capacity of an atom with other atoms when it forms chemical compounds or molecules. Valency of an atom is equal to the number of electrons gained, lost or shared by an atom to achieve the nearest noble gas configuration.

(*ii*) **Atomic size:** Atomic size or atomic radius is the distance between the centre of the nucleus and the outermost shell of an isolated atom.

(*b*) **Variation in valency:** On moving from left to right in the periodic table, valency increases up to 4 and then decreases. The electrons present in the last shell determine the valency of a particular element. If the number of valence electrons is less than or equal to 4, valency = number of valence electrons. If the number of valence electrons is more than 4, valency = 8 – number of valence electrons.
**Variation in atomic size:** Atomic size decreases along a period. This is because on moving across a period, the number of valence shells remains the same and the electrons increase by one unit. As a result, the effective nuclear charge increases and thus, the atomic radius decreases.

**76. Consider two elements 'A' (Atomic number 17) and 'B' (Atomic number 19):**

**(*i*) Write the positions of these elements in the Modern Periodic Table giving justification.**

**(*ii*) Write the formula of the compound formed when 'A' combines with 'B'.**

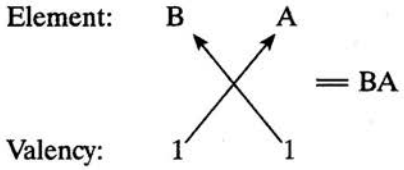
**(*iii*) Draw the electron-dot structure of the compound and state the nature of the bond formed between the two elements.** **[Delhi]**

**Ans.** (*i*) Position of the elements in the periodic table:

| | Period | Group | Electronic configuration |
|---|---|---|---|
| A(17) – | 3 | 17 | 2, 8, 7 |
| B(19) – | 4 | 1 | 2, 8, 8, 1 |

The elements are arranged by increasing atomic number (number of protons) and number of valence electrons. Element A with atomic number 17 has electronic configuration (2, 8, 7). So, there are 3 shells of electrons and hence it is in the third period. There are 7 valence electrons and therefore, it is in group 17. Similarly, the position is element B with electronic configuration (2, 8, 8, 1) is justified. It has one valence electrons, so its group is 1 and it has four shells, therefore, it belongs to fourth period.

(*ii*) Atomic number of A = 17
Electronic configuration = 2, 8, 7
Number of valence electrons = 7
Valency of A = 8 – 7 = 1
Atomic number of B = 19
Electronic configuration = 2, 8, 8, 1
Number of valence electrons = 1
Valency = 1




So, the formula of the compound formed when elements A and B combine is BA.

(*iii*) $B^{\times} + \dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{A}}}: \longrightarrow [B^+][:\underset{\cdot\cdot}{\overset{\cdot\cdot}{A}}:^-]$

They form an ionic bond by losing and gaining an electron.

**77. Consider two elements 'X' (Atomic number 17) and 'Y' (Atomic number 20).**

**(*i*) Write the positions of these elements in the Modern Periodic Table giving justification.**

**(*ii*) Write the formula of the compound formed by the combination of 'X' and 'Y.'**

**(*iii*) Draw the electron-dot structure of the compound formed and state the nature of the bond formed between the two elements.** **[Delhi]**

**Ans.** (*i*)

| | Period | Group |
|---|---|---|
| X | 3 | 17 |
| Y | 4 | 2 |

(*ii*) Atomic number of X = 17

Electronic configuration = 2, 8, 7

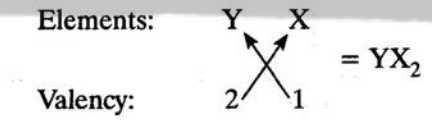
Valency = 8 – 7 = 1

Atomic number of Y = 20

Electronic configuration = 2, 8, 8, 2

Valency = 2

READERS VENUE




The formula of the compound formed when elements X and Y combine is $YX_2$.

(*iii*) $\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{X}}}: + {}^{\times}Y^{\times} + \dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{X}}}: = (Y^{2+})(:\underset{\cdot\cdot}{\overset{\cdot\cdot}{X}}:^-)_2$

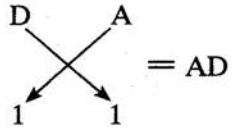
They form ionic bond.

**78. The electrons in the atoms of four elements A, B, C and D are distributed in three shells having 1, 3, 5 and 7 electrons in the outermost shell respectively. State the period in which these elements can be placed in the Modern Periodic Table. Write the electronic configuration of the atoms of A and D and the molecular formula of the compound formed when A and D combine.** **[All India]**

**Ans.**

| Element | Valence electrons | Period |
|---|---|---|
| A | 1 | 3 |
| B | 3 | 3 |
| C | 5 | 3 |
| D | 7 | 3 |

Electronic configuration of A: 2, 8, 1
Electronic configuration of D: 2, 8, 7
Molecular formula of the compound formed with A and D.
Number of valence electrons of element A = 1
Valency of A = 1
Number of valence electrons of element D = 7
Valency of D = 8 – 7 = 1




So, the formula of the compound formed when elements A and D combine is AD.

**79. Study the following table in which positions of six elements A, B, C, D, E and F are shown as they are in the Modern Periodic Table:**

| Group → / Period ↓ | 1 | 2 | 3-12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | A | | | | | B | | | C |
| 3 | | | | D | E | | | | F |

**On the basis of the above table, answer the following questions:**

**(*i*) Name the element which forms only covalent compounds.**
**(*ii*) Name the element which is a metal with valency three.**
**(*iii*) Name the element which is a non-metal with valency three.**
**(*iv*) Out of D and E, which is bigger in size and why?**
**(*v*) Write the common name for the family to which the elements C and F belong.**
**[All India]**

**Ans.** (*i*) Element E will form covalent compounds only by sharing its four valence electrons.
(*ii*) Element D is a metal with valency three.
(*iii*) Element B is a non-metal with valency three.
(*iv*) We know that the size of elements decreases on moving left to right in a period. Therefore, element D is larger than element E.
(*v*) Elements C and F belong to the noble gas family (group 18).

**80. What is meant by 'group' in the Modern Periodic Table? How do the following change on moving from top to bottom in a group?**

**(*i*) Number of valence electrons**
**(*ii*) Number of occupied shells**
**(*iii*) Size of atoms**
**(*iv*) Metallic character of elements**
**(*v*) Effective nuclear charge experienced by valence electrons** **[All India]**

**Ans.** Vertical columns of the periodic table are known as groups.

(*i*) The number of valence electrons remains constant when we move down the group.

(*ii*) The number of occupied shells increases down the group.

(*iii*) The size of atoms increases down the group.

(*iv*) The metallic character of elements increases down the group.

(*v*) The effective nuclear charge decreases down the group.

**81. The elements Be, Mg and Ca each having two electrons in their outermost shells are in periods 2, 3 and 4 respectively of the modern periodic table. Answer the following questions, giving justification in each case:**

**(*i*) Write the group to which these elements belong.**

**(*ii*) Name the least reactive element.**

**(*iii*) Name the element having largest atomic radius.** **[All India]**

**Ans.** (*i*) These elements belong to group 2 as they all contain two electrons in their outermost shells.

(*ii*) 'Be' is the least reactive element as reactivity increases down the group due to increase in atomic size.

(*iii*) 'Ca' is the element having largest atomic radius as atomic size goes on increasing down the group.

**82. Study the following table in which positions of six elements A, B, C, D, E and F are shown as they are in the Modern Periodic Table:**

READERS VENUE

| Group → / Period ↓ | 1 | 2 | 3-12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | | A | | | | | B | | C |
| 3 | D | | | | E | | | | F |

**On the basis of the above table, answer the following questions:**

**(*i*) Name the element which will form only covalent compounds.**

**(*ii*) Which element is a metal with valency one?**

**(*iii*) Which element is a non-metal with valency two?**

**(*iv*) Out of D and E, which has a bigger atomic radius and why?**

**(*v*) Write the formula of the compound formed when B combines with D.**

**[Foreign]**

**Ans.** (*i*) Element E will form covalent compounds only by sharing its four valence electrons.

(*ii*) Element D is a metal with valency one.

(*iii*) Element B is a non-metal with valency two.

(*iv*) Moving left to right across a period, atomic radius decreases due to increase in effective nuclear charge, so element D will have bigger atomic radius than E.

(*v*) Electronic configuration of B = 2, 6; valency of B = 2
Electronic configuration of D = 2, 8, 1; valency of D = 1
Molecular formula of the compound formed with B and D

$$B^2 \quad D^1 \rightarrow BD_2$$

So, the formula of the compound formed when elements B and D combine is $BD_2$.

**83. What are groups and periods in the periodic table? Two elements X and Y belong to group 1 and 2 respectively and are in the same period of the periodic table. How do the following properties of X and Y vary?**

**(*i*) Size of their atom**
**(*ii*) Their metallic character**
**(*iii*) Their valencies in forming oxides**
**(*iv*) Molecular formula of their chlorides** **[Foreign]**

**Ans.** The 18 vertical columns in the periodic table are known as groups and the 7 horizontal rows are known as periods.

(*i*) Atomic size decreases in moving from left to right. So, atomic size of element X is greater than element Y.
(*ii*) Metallic character decreases across a period. So, element X exhibits more metallic character than element Y.
(*iii*) Element X has one valence electron and its oxide is basic in nature while element Y has two valence electrons with less basic oxide.
(*iv*) Molecular formula of chlorides:
XCl and $YCl_2$.

**84. Write the number of groups and periods in the Modern Periodic Table. Mention the criteria of placing elements in the (*i*) same group and (*ii*) the same period. Illustrate your answer with an example for each case.** **[Foreign]**

**Ans.** There are 18 groups and 7 periods in the Modern Periodic Table.

(*i*) The elements present in any one group have the same number of valence electrons, e.g. fluorine (F) and chlorine (Cl) belong to group 17 with the electronic configuration as:
F = 2, 7
Cl = 2, 8, 7
(*ii*) Atoms of different elements with the same number of occupied shells are placed in the same period. Na, Mg, Al, Si, P, S, Cl and Ar belong to the third period, since the electrons in the atoms of these elements are filled in K, L and M shells. Each period marks a new electronic shell getting filled. Period number is equal to number of shells.

**85. The electronic configuration of an element is 2, 8, 8, 1.**
**(*i*) State its group number and period number in the Modern Periodic Table.**
**(*ii*) State whether this element is a metal or a non-metal.**
**Give reason for the justification of your answer in each case.** **[Foreign]**

**Ans.** (*i*) This element belongs to group 1 and period 4 because it has one valence electron and four shells.
(*ii*) It is a metal as it can easily lose its valence shell electron.

## 2013

### Very Short Answer Type Questions [1 Mark]

**86. How many vertical columns are there in the Modern Periodic Table and what are they called?** **[Delhi]**

**Ans.** There are 18 vertical columns in the Modern Periodic Table and these are called groups.

**87. How many horizontal rows are there in the Modern Periodic Table and what are they called?** **[Delhi]**

**Ans.** There are 7 horizontal rows in the periodic table and these are called periods.

**88. Write two reasons responsible for late discovery of noble gases.** **[Delhi]**

**Ans.** (*i*) It is because these are inert, i.e. do not react.
(*ii*) They are less available in nature.

**89. State modern periodic law of classification of elements.** **[All India]**

**Ans.** Refer to Ans. 26.

READERS VENUE

**90. The atomic numbers of three elements A, B and C are 11, 17 and 19 respectively. State giving reason which two elements will show similar chemical properties.** **[All India]**

**Ans.** A and C will show similar properties because these elements have same number of valence electrons. 'A': 2, 8, 1; 'C': 2, 8, 8, 1

**91. The atomic numbers of three elements X, Y and Z are 3, 11 and 17 respectively. State giving reason which two elements will show similar chemical properties.** **[All India]**

**Ans.** X and Y will show similar chemical properties as these have same number of valence electrons. X: 2, 1; Y: 2, 8, 1

**92. Give reason why noble gases are placed in separate group in modern periodic table.** **[Foreign]**

**Ans.** It is because they resemble with each other but do not resemble with other group elements.

**93. Write the formula that determines the maximum number of electrons that a shell of an atom can accommodate.** **[Foreign]**

**Ans.** $2n^2$ where '$n$' is number of shell.

**94. The electronic configurations of two elements X and Y are 2, 8, 7 and 2, 8, 8, 3 respectively. Write atomic numbers of X and Y.** **[Foreign]**

**Ans.** X : 2, 8, 7
Y : 2, 8, 8, 3
X has atomic number 17 and 'Y' has atomic number 21.

## Short Answer Type [II] Questions [3 Marks]

**95. Given below are some elements of the Modern Periodic Table:**

$$_4Be,\ _9F,\ _{14}Si,\ _{19}K,\ _{20}Ca$$

**(*i*) Select the element that has one electron in the outermost shell and write its electronic configuration.**

**(*ii*) Select two elements that belong to the same group. Give reason for your answer.**

**(*iii*) Select two elements that belong to the same period. Which one of the two has bigger atomic size?** **[Delhi]**

**Ans.** (*i*) $_{19}K$ has one electron in its outermost shell. Its electronic configuration is 2, 8, 8, 1.

(*ii*) $_4Be$ and $_{20}Ca$ belong to the same group as they have two electrons in their outermost shells.

(*iii*) $_4Be$ and $_9F$ belong to the same period out of which $_4Be$ is bigger in size.

or

$_{19}K$ and $_{20}Ca$ belong to the same period out of which $_{19}K$ is bigger in size.

**96. Write the number of periods the Modern Periodic Table has. How do the valency and metallic character of elements vary on moving from left to right in a period? How do the valency and atomic size of elements vary down a group?** **[Delhi]**

**Ans.** The periodic table has 7 periods in it.
Valency first increases from left to right till the middle then decreases in a period, whereas metallic character decreases along a period from left to right.
Atomic size goes on increasing down the group, whereas valency remains the same in a group.

**97. An element X (atomic number 17) reacts with an element Y (atomic number 20) to form a compound.**

**(*a*) Write the position of these elements in the Modern Periodic Table.**

**(*b*) Write the formula of the compound formed.**

**Justify your answer in each case.** **[Delhi]**

**Ans.** Refer to Q. 77.

**98. The elements Li, Na and K, each having one valence electron, are in period 2, 3 and 4 respectively of Modern Periodic Table.**

**(*a*) In which group of the periodic table should they be?**

**(*b*) Which one of them is least reactive?**

**(*c*) Which one of them has the largest atomic radius? Give reason to justify your answer in each case.** **[Delhi]**

**Ans.** (*a*) Group 1 as these have one valence electron.
(*b*) Li is least reactive due to smallest size, highest effective nuclear charge and less tendency to lose electron.
(*c*) K is largest in size as it has four shells.

**99. The electronic configuration of an element 'X' is 2, 8, 8, 2. To which (*a*) period and (*b*) group of the Modern Periodic Table does 'X' belong? State its valency. Justify your answer in each case.** **[All India]**

**Ans.** (*a*) It belongs to fourth period as it has four shells.
(*b*) It belongs to second group as it has two valence electrons.
(*c*) Its valency is equal to 2 because it can lose 2 electrons to become stable.

**100. Four elements P, Q, R and S have atomic numbers 12, 13, 14 and 15 respectively.**
**Answer the following questions giving reasons:**
**(*i*) What is the valency of Q?**
**(*ii*) Classify these elements as metals and non-metals.**
**(*iii*) Which of these elements will form the most basic oxide?** **[All India]**

**Ans.** (*i*) The valency of Q is 3.
(*ii*) P and Q are metals as these can lose electrons. R and S are non-metals as these can gain electrons.
(*iii*) P will form most basic oxide as it is most metallic.

**101. The atomic number of an element is 17. Predict (*a*) its valency, (*b*) whether it is a metal or non-metal, (*c*) its relative size with respect to other members of its group. Justify your answer in each case.** **[All India]**

**Ans.** Element with atomic number 17 has electronic configuration 2, 8, 7.
(*a*) Its valency is 1 as it can gain 1 electron to become stable like noble gas.
(*b*) It is a non-metal as it can gain electron.
(*c*) It is bigger than F(9) as it has three shells whereas 'F' has two shells but it is smaller than rest of elements Br, I, At as number of shells go on increasing down the group.

**102. The atomic number of an element 'X' is 20. Write**
**(*a*) its valency,**
**(*b*) whether it is a metal or non-metal,**
**(*c*) the formula of compound formed when the element 'X' reacts with an element 'Y' of atomic number 8.**
**Justify your answer in each case.** **[All India]**

**Ans.** X(20) = 2, 8, 8, 2  Y(8) = 2, 6
(*a*) Valency of X is 2 as it can lose 2 electrons to become stable.
(*b*) It is a metal as it can lose electrons to form +ve ions.
(*c*) $X^2$ $Y^2$

XY

XY is formula because the valency of X is 2 and Y is also 2.

**103. Write the electronic configuration of element A (At. No. 17) and element B (At No. 19). State the formula of the compound formed when element A combines with element B. Draw the electron-dot structure of the product and state the nature of the bond formed.** **[Foreign]**

**Ans.** Refer to Ans. 76.

**104. The following table shows the position of six elements A, B, C, D, E, and F in the Modern Periodic Table:**

| Group / Period | 1 | 2 | 3 to 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|
| 2 | A | | | | | B | | | C |
| 3 | | | | D | E | | | | F |

**Using the above table, answer the following questions:**

**(*a*) Name the element which forms only covalent compounds.**

**(*b*) Name the element which is a metal with valency 3.**

**(*c*) Name the element which is a non-metal with valency 3.**

**(*d*) Out of D and E, which one is bigger in size and why?**

**(*e*) Write the common name for the family of elements C and F.** **[Foreign]**

**Ans.** Refer to Ans. 79.

**105. Write the electronic configuration of element A(At. No. 20) and element B(At. No. 17). State the formula of the compound formed when element A combines with element B. Draw the electron-dot structure of the product and state the nature of the bond formed.** **[Foreign]**

READERS VENUE

**Ans.** A(20): 2, 8, 8, 2

B(17): 2, 8, 7

Valency of A is 2, 'B' is 1.

$A^2$ $B^1$

$AB_2$ is the formula of compound. Electron-dot structure is $(A)^{2+}\left(:\ddot{\underset{\cdot\cdot}{B}}:^{-}\right)_2$.

It is an ionic bond.

## 2012

### Short Answer Type [I] Question [2 Marks]

**106. How can the valency of an element be determined if its electronic configuration is known? What will be the valency of an element of atomic number 9?** **[Delhi]**

**Ans.** Valency of an element is determined with the help of valence electrons, which are determined with the help of electronic configuration. Valency is equal to valence electrons or 8-number of valence electrons. Element with atomic number 9 has electronic configuration 2, 7. Its valency is equal to 1 because it can gain 1 electron to become stable.

**107. An element 'X' has atomic number 13:**
**(*a*) Write its electronic configuration.**
**(*b*) State the group to which 'X' belongs.**
**(*c*) Is 'X' a metal or a non-metal?**
**(*d*) Write the formula of its bromide.** **[Delhi]**

**Ans.** (*a*) 2, 8, 3
(*b*) Group 13
(*c*) 'X' is a metal.
(*d*) $X^{3+}$ $Br^-$

$XBr_3$ $XBr_3$ is formula of its bromide.

**108. State the Modern Periodic Law for classification of elements. How many (*a*) groups and (*b*) periods are there in the Modern Periodic Table?** **[Delhi]**

**Ans.** 'Properties of elements are the periodic function of their atomic number.'
(*a*) There are 18 groups.
(*b*) There are 7 periods in the Modern Periodic Table.

**109. An element 'M' has atomic number 11.**
**(*a*) Write its electronic configuration.**
**(*b*) State the group to which 'M' belongs.**
**(*c*) Is 'M' a metal or a non-metal?**
**(*d*) Write the formula of its chloride.** **[Delhi]**

READERS VENUE

**Ans.** (*a*) 2, 8, 1
(*b*) Group 1
(*c*) 'M' is a metal.
(*d*) $M^+$ $Cl^-$

MCl
MCl is formula of its chloride.

**110. An element 'M' has atomic number 12.**
**(*a*) Write its electronic configuration.**
**(*b*) State the group to which 'M' belongs.**
**(*c*) Is 'M' a metal or a non-metal?**
**(*d*) Write the formula of its oxide.** **[Delhi]**

**Ans.** (*a*) 2, 8, 2
(*b*) Group 2
(*c*) 'M' is a metal.
(*d*) $M^{2+}$ $O^{2-}$, MO is formula of its oxide.

MO

**111. Choose from the following:**

$_6C$, $_8O$, $_{10}Ne$, $_{11}Na$, $_{14}Si$

**(*a*) Elements that should be in the same period.**

**(*b*) Elements that should be in the same group.**

**State reason for your selection in each case.** **[All India]**

**Ans.** (*a*) $_6C$, $_8O$ and $_{10}Ne$ are in same period $_6C(2, 4)$, $_8O(2, 6)$ and $_{10}Ne(2, 8)$, i.e. 2nd period as they have two shells. $_{11}Na$ and $_{14}Si$ are in same period, i.e. 3rd period as they have three shells $_1Na(2, 8, 1)$ $_{14}Si(2, 8, 4)$.

(*b*) $_6C(2, 4)$, $_{14}Si(2, 8, 4)$ are in same group because they have same number of valence electrons, i.e. four.

**112. An element 'X' belongs to 3rd period and group 17 of the periodic table. State its (*a*) electronic configuration, (*b*) valency. Justify your answer with reasoning.** **[All India]**

**Ans.** (*a*) X(17): 2, 8, 7

(*b*) Valency: 1

It has atomic number 17 and, therefore electronic configuration will be 2, 8, 7. It can gain one electron to become stable, therefore its valency is equal to 1. It belongs to third period, as it has three shells. It belongs to group 17 because it has 7 valence electrons.

**113. The formula of magnesium oxide is MgO. State the formula of barium nitrate and barium sulphate, if barium belongs to the same group as magnesium.** **[All India]**

**Ans.** $Ba(NO_3)_2$ $Ba^{2+}$ $NO_3^-$

$Ba(NO_3)_2$

$BaSO_4$ $Ba^{2+}SO_4^{2-}$

$BaSO_4$

READERS VENUE

**114. Choose from the following:**

$_{20}Ca$, $_3Li$, $_{11}Na$, $_{10}Ne$

**(*a*) An element having two shells completely filled with electrons.**

**(*b*) Two elements belonging to the same group of the periodic table.** **[All India]**

**Ans.** (*a*) $_{10}Ne$ has electronic configuration 2, 8. Its both shells are completely filled.

(*b*) $_3Li(2, 1)$ and $_{11}Na(2, 8, 1)$ belong to same group of periodic table, i.e. 1st group.

**115. Why do all the elements of the (*a*) same group have similar properties, (*b*) same period have different properties?** **[All India]**

**Ans.** (*a*) Elements of same group have similar properties due to same number of valence electrons, therefore they have same valency.

(*b*) Elements of the same period have different properties as they differ in number of valence electrons.

**116. An element 'E' has the following electronic configuration:**

| K | L | M |
|---|---|---|
| 2 | 8 | 6 |

**(*a*) To which group of the periodic table does element 'E' belong?**
**(*b*) To which period of the periodic table does element 'E' belong?**
**(*c*) State the number of valence electrons present in element 'E'.**
**(*d*) State the valency of the element 'E'.** **[All India]**

**Ans.** (*a*) 'E' belongs to group 16. (*b*) It belongs to 3rd period.
(*c*) It has 6 valence electrons. (*d*) Its valency is equal to 2.

**117. Choose from the following:**

$_4Be$, $_9F$, $_{19}K$, $_{20}Ca$

**(*a*) The element having one electron in the outermost shell.**
**(*b*) Two elements of the same group.** **[Foreign]**

**Ans.** (*a*) $_{19}K$ (2, 8, 8, 1) has one valence electron.
(*b*) $_4Be$ (2, 2) and $_{20}Ca$ (2, 8, 8, 2) belong to the same group.

**118. An element has atomic number 13.**
**(*a*) What is the group and period number to which this element belongs?**
**(*b*) Is this element a metal or a non-metal? Justify your answer.** **[Foreign]**

**Ans.** (*a*) It belongs to group 13 and 3rd period.
(*b*) It is a metal because it can lose 3 electrons to become stable.

**119. The electronic configuration of two elements 'A' and 'B' are 2, 8, 3 and 2, 8, 7 respectively. Find the atomic number of these elements. State the nature and formula of the compound formed by the union of these two elements.** **[Foreign]**

**Ans.** 'A' has atomic number 13. 'B' has atomic number 17.

$A^{3+}B^{1-}$

$\searrow\swarrow$

$AB_3$

It is an ionic compound.

**120. The atomic number of three elements are given below:**

| Element (symbol) | A | B | C |
|---|---|---|---|
| Atomic number | 5 | 7 | 10 |

**Write the symbol of the element which belongs to (*a*) group 13, (*b*) group 15, of the periodic table. State the period of the periodic table to which these elements belong. Give reason for your answer.** **[Foreign]**

**Ans.** (*a*) 'A' belongs to group 13 because its electronic configuration is 2, 3, i.e. it has 3 valence electrons.
(*b*) 'B' belongs to group 15 because its electronic configuration is 2, 5, i.e. it has 5 valence electrons.
They belong to 2nd period as they both have two shells.

**121. The electronic configuration of two elements 'A' and 'B' are 2, 8, 7 and 2, 8, 8, 2 respectively. Write the atomic number of these elements. What will be formula of the compound formed and the nature of bond between them when these two elements chemically combine together?** **[Foreign]**

**Ans.** 'A' has atomic number 17. Its electronic configuration is 2, 8, 7. Its valency is equal to 1.

'B' has atomic number 20. Its electronic configuration is 2, 8, 8, 2. Its valency is 2.

$$B^{2+}A^{1-} \rightarrow BA_2$$

Ionic bond will be formed.

**122. The atomic numbers of three elements are given below:**

| Element (symbol) | A | B | C |
|---|---|---|---|
| Atomic number | 3 | 6 | 9 |

**Write the symbol of the element which belongs to (*a*) group 1, (*b*) group 14, of the periodic table. State the period of the periodic table to which these elements belong. State reason to support your answer.** **[Foreign]**

**Ans.** (*a*) A belongs to group 1.

(*b*) B belongs to group 14.

These elements belong to second period because these elements have two shells. 'A' has electronic configuration 2, 1 and has one valence electron so, belongs to group 1. 'B' has electronic configuration 2, 4 and has four valence electrons so, belongs to group 14 and period 2. 'C' has electronic configuration 2, 7 and has one valence electron. All of them contain two shells and so belong to second period.

## Short Answer Type [II] Questions [3 Marks]

**123. F, Cl and Br are the elements each having seven valence electrons. Which of these (*a*) has the largest atomic radius, (*b*) is most reactive? Justify your answer stating reason for each.** **[Delhi]**

**Ans.** (*a*) Bromine has largest atomic radius because it has four shells: 2, 8, 18, 7.

(*b*) Fluorine is most reactive because it is smallest in size and can gain electron easily.

**124. Na, Mg and Al are the elements having one, two and three valence electrons respectively. Which of these elements (*a*) has the largest atomic radius, (*b*) is least reactive? Justify your answer stating reason for each.** **[All India]**

**Ans.** (*a*) Na has the largest atomic radius because it has 11 protons and 11 electrons, therefore least effective nuclear charge.

(*b*) Al is least reactive because it has smallest atomic size due to 13 protons and 13 electrons, it has greater effective nuclear charge, therefore cannot lose electrons easily, hence it is least reactive.

**125.** **(*a*) How are the following related?**

**(*i*) Number of valence electrons of different elements in the same group.**

**(*ii*) Number of shells of elements in the same period.**

**(*b*) How do the following change?**

**(*i*) Number of shells of elements as we go down a group.**

**(*ii*) Number of valence electrons of elements on moving from left to right in a period.**

**(*iii*) Atomic radius in moving from left to right along a period.**

**(*iv*) Atomic size down a group.** **[All India]**

**Ans.** (*a*) (*i*) Different elements in same group have same number of valence electrons.

(*ii*) Number of shells of elements in same period are equal.

(*b*) (*i*) Number of shells of elements goes on increasing down the group.

(*ii*) Number of valence electrons of elements goes on increasing on moving from left to right in a period, e.g. lithium has 1, beryllium has 2, boron has 3, carbon has 4, nitrogen has 5, oxygen has 6, fluorine has 7 and neon has 8 valence electrons.

(*iii*) Atomic radius goes on decreasing in moving from left to right along a period.

(*iv*) Atomic size goes on increasing down a group.

**126.** **(*a*) How many periods are there in the Modern Periodic Table of elements?**

**(*b*) How do atomic radius, valency and metallic character vary down a group?**

**(*c*) How do the atomic size and metallic character of elements vary as we move from left to right in a period?** **[Foreign]**

READERS VENUE

**Ans.** (*a*) There are 7 periods.

(*b*) Atomic radius goes on increasing down the group, valency remains same. Metallic character increases down the group.

(*c*) Atomic size decreases along a period from left to right. Metallic character decreases along a period from left to right.

## 2011

### Short Answer Type [I] Question [2 Marks]

**127.** **(*i*) How do you calculate the possible valency of an element from the electronic configuration of its atom?**

**(*ii*) Calculate the valency of an element X whose atomic number is 9.** **[Delhi]**

**Ans.** If the element has 1, 2, 3, 4 valence electrons, its valency will be 1, 2, 3, 4 respectively. If the element has 5, 6, 7, 8 valence electrons, its valency will be 3, 2, 1, 0. Element with atomic number 9 has electronic configuration 2, 7. So, its valency will be 1.

**128.** **How does the electronic configuration of an atom of an element relate to its position in the modern periodic table? Explain with one example.** **[Delhi]**

**Ans.** The position of element depends upon number of valence electrons which depend upon electronic configuration. Those elements which have same valence electrons, occupy same group.
Those elements which have one valence electron belong to group 1.
Elements with two valence electrons belong to group 2.
Period number is equal to number of shells.
If valence electrons are equal to 1, it belongs to group 1. If it has 2 shells, it belongs to second period, e.g. if element 'X' has atomic number 11, its electronic configuration is 2, 8, 1. It has one valence electron, it belongs to group 1 and it has three shells therefore, it is in third period.

**129. The atomic numbers of three elements, X, Y and Z are 9, 11 and 17 respectively. Which two of these elements will show similar chemical properties? Why? [Delhi]**

**Ans.** Electronic configuration of X, Y and Z will be:
X(9): 2, 7
Y(11): 2, 8, 1
Z(17): 2, 8, 7
X and Z will show similar chemical properties due to same number of valence electrons.

**130. On the basis of electronic configuration, how will you identify the first and the last element of a period? [Delhi]**

**Ans.** First element has 1 valence electron and last element has 8 valence electrons. Number of shells remain the same in the same period.

**131. In the modern periodic table, the element Calcium (atomic number = 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these elements has physical and chemical properties resembling those of Calcium and why? [All India]**

**Ans.** Elements with atomic number 12, 38 resemble calcium in physical and chemical properties because they have same number of valence electrons and belong to same group 2.
Mg(12): 2, 8, 2
Ca(20): 2, 8, 8, 2
Sr(38): 2, 8, 18, 8, 2

**132. How does the metallic character of elements change along a period of the periodic table from the left to the right and why? [All India]**

**Ans.** The metallic character goes on decreasing along a period from left to right because atomic size goes on decreasing therefore, tendency to lose electrons decreases.

**133. How does the valency of elements vary**
**(*a*) in going down a group, and**
**(*b*) in going from left to right in a period of the periodic table? [All India]**

**Ans.** (*a*) Valency remains the same in a group.
(*b*) Valency first goes on increasing from left to right in a period till middle of period, then decreases.

**134. What is meant by periodicity of properties of elements? Why are the properties of elements placed in the same group of the periodic table similar? [Foreign]**

**Ans.** The repetition of similar properties after a definite interval is called periodicity of properties.
The elements of same group have similar chemical properties due to same number of valence electrons and same valency.

**135. In the periodic table, how does the tendency of atoms to lose electrons change on going from**
**(*i*) left to right across a period?**
**(*ii*) top to bottom in a group?** **[Foreign]**

**Ans.** (*i*) Tendency to lose electrons decreases from left to right across a period.
(*ii*) Tendency to lose electrons increases from top to bottom in a group.

**136. Give reasons:**
**(*i*) Elements in a group have similar chemical properties.**
**(*ii*) Elements of Group I form ions with a charge of +1.** **[Foreign]**

**Ans.** (*i*) Elements in a group have same number of valence electrons and same valency, therefore have similar chemical properties.
(*ii*) It is because elements of group 1 lose one electron to acquire +1 charge and become stable.

## Short Answer Type [II] Questions [3 Marks]

**137. Two elements X and Y belong to group 1 and 2 respectively in the same period of periodic table. Compare them with respect to:**
**(*i*) the number of valence electrons in their atoms**
**(*ii*) their valencies**
**(*iii*) metallic character**
**(*iv*) the sizes of their atoms**
**(*v*) the formulae of their oxides**
**(*vi*) the formulae of their chlorides** **[Delhi]**

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**Ans.** (*i*) 'X' has 1 valence electron, 'Y' has 2 valence electrons.
(*ii*) 'X' has valency equal to 1, 'Y' has valency equal to 2.
(*iii*) 'X' is more metallic than 'Y'.
(*iv*) 'X' is bigger than 'Y'.
(*v*) $X_2O$ and YO are formulae of their oxides.
(*vi*) XCl and $YCl_2$ are formulae of their chlorides.

**138. The atomic number of an element is 16. Predict**
**(*i*) the number of valence electrons in its atom**
**(*ii*) its valency**
**(*iii*) its group number**
**(*iv*) whether it is a metal or a non-metal**
**(*v*) the nature of oxide formed by it**
**(*vi*) the formula of its chloride** **[All India]**

**Ans.** The electronic configuration of S(16) is 2, 8, 6.
(*i*) 6
(*ii*) 2
(*iii*) 16
(*iv*) Non-metal
(*v*) Acidic oxide
(*vi*) $SCl_2$ is a formula of its chloride.

**139. The positions of three elements A, B and C in the periodic table are indicated below:**

| Group 16 | Group 17 | |
|---|---|---|
| — | — | (First Period) |
| — | A | (Second Period) |
| — | — | (Third Period) |
| B | C | (Fourth Period) |

**(*a*) State whether element C would be a metal or a non-metal. Why?**

**(*b*) Which is the more active element, A or C? Why?**

**(*c*) Which type of ion (cation or anion) will be formed by the element C? Why?** **[Foreign]**

**Ans.** (*a*) 'C' will be non-metal because it has 7 valence electrons, it can gain one electron easily.

(*b*) 'A' is more active element than 'C' because 'A' can gain electron easily due to smaller size.

(*c*) 'C' will gain one electron to become negative ion, i.e. anion because it will have electrons more than protons.

## 2010

### Very Short Answer Type Questions [1 Mark]

**140. What is the valency of silicon with atomic number 14?** **[Foreign]**

**Ans.** Silicon has valency equal to 4.

**141. What is the valency of phosphorus with atomic number 15?** **[Foreign]**

**Ans.** Phosphorus has valency equal to 3.

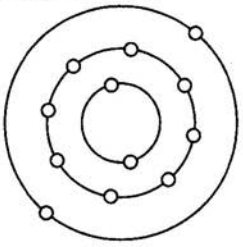
**142. What is the valency of an element with atomic number 35?** **[Foreign]**

**Ans.** The valency of an element with atomic number 35 is equal to 1.

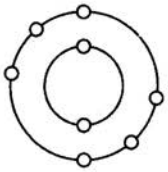
### Short Answer Type [I] Question [2 Marks]

**143. Elements magnesium and oxygen respectively belong to group 2 and group 16 of the Modern Periodic Table. If the atomic number of magnesium and oxygen are 12 and 8 respectively, draw their electronic configuration and show the process of formation of their compound by transfer of electrons.** **[Foreign]**

**Ans.** Mg(12): 2, 8, 2 O(8): 2, 6



K = 2, L = 8, M = 2



K = 2, L = 6

$$\underset{2,8,2}{Mg} \longrightarrow \underset{2,8}{Mg^{2+}} + 2e^-$$

$$\underset{2,6}{O} + 2e^- \longrightarrow \underset{2,8}{O^{2-}}$$

$$Mg \overset{\times}{\underset{\times}{\rightleftharpoons}} \ddot{O}: \Rightarrow (Mg)^{2+} (:\ddot{O}:^{2-})$$

MgO is the compound formed.

## Short Answer Type [II] Questions [3 Marks]

**144. Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but different number of electrons in their outermost shell. It was found that elements A and G combine to form an ionic compound. This compound is added in a small amount to almost all vegetable dishes during cooking. Oxides of elements A and B are basic in nature while those of E and F are acidic. The oxide of D is almost neutral. Based on the above information answer the following questions:**

**(*i*) To which group or period of the Periodic Table do the listed elements belong?**

**(*ii*) What would be the nature of compound formed by a combination of elements B and F?**

**(*iii*) Which two of these elements could definitely be metals?**

**(*iv*) Which one of the eight elements is most likely to be found in gaseous state at room temperature?**

**(*v*) If the number of electrons in the outermost shell of elements C and G be 3 and 7 respectively, write the formula of the compound formed by the combination of C and G. [HOTS; Delhi]**

**Ans.** (*i*) A and B belong to group 1 and 2 because they form basic oxides. C belongs to group 13 as it has 3 valence electrons. D belongs to group 14 as it forms almost neutral oxide. E and F belong to group 15 and 16 as they form acidic oxides, G belongs to group 17 as it has 7 valence electrons and H belongs to group 18. They belong to 3rd period of the Periodic Table because AG is NaCl, added in a small amount to almost all vegetable dishes during cooking and Na and Cl belong to 3rd period.

(*ii*) Ionic compounds will be formed because 'B' is metal and 'F' is non-metal. 'B' can lose two electrons and 'F' can gain two electrons.

(*iii*) A and B are definitely metals as they form basic oxides.

(*iv*) G and H are gaseous at room temperature.

(*v*) $CG_3$ is the formula of the compound formed by combination of C and G.

**145. Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but different number of electrons in their outermost shells. It was found that elements A and G combine to form an ionic compound which can also be extracted from sea water. Oxides of the elements A and B are basic in nature while those of E and F are acidic. The oxide of element D is almost neutral. Answer the following questions based on the information given herein:**

**(*i*) To which group or period of the periodic table do the listed elements belong?**

**(*ii*) Which one of the eight elements is likely to be a noble gas?**

(*iii*) **Which one of the eight elements would have the largest atomic radius?**
(*iv*) **Which two elements amongst these are likely to be non-metals?**
(*v*) **Which one of these eight elements is likely to be a semi-metal or metalloid?**

**[HOTS; Delhi]**

**Ans.** (*i*) A and B belong to group 1 and 2 because they form basic oxides. C belongs to group 13 as it has 3 valence electrons. D belongs to group 14 as it forms almost neutral oxide. E and F belong to group 15 and 16 as they form acidic oxides, G belongs to group 17 as it has 7 valence electrons and H belongs to group 18. They belong to 3rd period of Periodic Table because sodium belongs to 3rd period and AG is NaCl, ionic compound of sodium which can be obtained from sea water and A(Na) and G(Cl) belong to 3rd period.
(*ii*) H belongs to noble gas.
(*iii*) A has the largest atomic radius.
(*iv*) E and F are likely to be non-metals.
(*v*) D is likely to be metalloid or semi-metal.

**146. Atoms of seven elements A, B, C, D, E, F and G have a different number of electronic shells but have the same number of electrons in their outermost shells. The elements A and C combine with chlorine to form an acid and common salt respectively. The oxide of element A is liquid at room temperature and is a neutral substance, while the oxides of the remaining six elements are basic in nature. Based on the above information, answer the following questions:**

(*i*) **What could the element A be?**
(*ii*) **Will elements A to G belong to the same period or same group of the periodic table?**
(*iii*) **Write the formula of the compound formed by the reaction of the element A with oxygen.**
(*iv*) **Show the formation of the compound by a combination of element C with chlorine with the help of electronic structure.**
(*v*) **What would be the ratio of number of combining atoms in a compound formed by the combination of element A with carbon?**
(*vi*) **Which one of the given elements is likely to have the smallest atomic radius?**

**[HOTS; All India]**

**Ans.** (*i*) 'A' is hydrogen because its oxide $H_2O$ is liquid at room temperature.
(*ii*) A to G belong to same group of the periodic table as these have same number of valence electrons.
(*iii*) $A_2O$
(*iv*) $(C^{\times})$ $(\cdot\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}}:)$ or $(Na^+)$ $(:\dot{\underset{\cdot\cdot}{\overset{\cdot\cdot}{Cl}}}:^-)$, common salt
$(C)^+(Cl)^-$
(*v*) $A^1$ $C^4$ $A_4C$, i.e. 4: 1
$A_4C$
(*vi*) 'A' has smallest atomic size.

**147. In the following table, six elements A, B, C, D, E and F (here letters are not the usual symbols of the elements) of the Modern Periodic Table with atomic numbers 3 to 18 are given:** **[HOTS; Foreign]**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3<br>A | 4 | 5 | 6 | 7 | 8<br>E | 9 | 10<br>G |
| 11<br>B | 12<br>C | 13 | 14<br>D | 15 | 16 | 17<br>F | 18 |

**(*a*) Which of these is (*i*) a noble gas, (*ii*) a halogen?**

**(*b*) If B combines with F, what would be the formula of the compound formed?**

**(*c*) Write the electronic configurations of C and E.** **[Foreign]**

**Ans.** (*a*) (*i*) G is a noble gas.

(*ii*) F is a halogen.

(*b*) BF will be the formula of the compound formed.

$B^1$ $F^1$

B F

(*c*) C has atomic number 12 and electronic configuration is K = 2, L = 8, M = 2.
E has atomic number 8 and electronic configuration is K = 2, L = 6.

**148. In the following table, are given eight elements A, B, C, D, E, F, G and H (here letters are not the usual symbols of the elements) of the Modern Periodic Table with the atomic numbers of the elements in parenthesis.**

| Period | Group 1 | Group 2 |
|---|---|---|
| 2 | A (3) | E (4) |
| 3 | B (11) | F (12) |
| 4 | C (19) | G (20) |
| 5 | D (37) | H (38) |

**(*i*) What is the electronic configuration of F?**

**(*ii*) What is the number of valence electrons in the atom of F?**

**(*iii*) What is the number of shells in the atom of F?**

**(*iv*) Write the size of the atoms of E, F, G and H in decreasing order.**

**(*v*) State whether F is a metal or a non-metal.**

**(*vi*) Out of the three elements B, E and F, which one has the biggest atomic size?**

**[HOTS; Foreign]**

**Ans.** (*i*) F has electronic configuration 2, 8, 2.

(*ii*) F has 2 valence electrons.

(*iii*) There are three shells in 'F'.

(*iv*) H > G > F > E is decreasing order of size of atoms.

(*v*) 'F' is a metal.

(*vi*) 'B' is having biggest atomic size among B, E and F.

# 6 LIFE PROCESSES

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [I] Questions [2 Marks]**

1. **Write two different ways in which glucose is oxidised to provide energy in human body. Write products formed in each case.** **[Delhi]**

**Ans.** Two different ways in which glucose is oxidised to provide energy in Human body and their products are

(*i*) **Lack of oxygen:** Lactic acid and energy

(*ii*) **Presence of oxygen:** Carbon dioxide, water and energy.

2. **How is $O_2$ and $CO_2$ transported in human beings?** **[Delhi]**

**Ans.** Oxygen and carbon dioxide are transported in human beings with a gas transportation system. This system is mainly composed of following parts:

**Lungs:** Lungs help in breathing in oxygen-rich air and breathing out carbon dioxide-rich air.

**Heart:** Heart pumps deoxygenated blood to lungs for oxygenation and pumps oxygenated blood to different organs of the body.

**Veins:** Veins usually carry deoxygenated blood from different parts of the body to the heart. One exception is the pulmonary vein which carries oxygenated blood from lungs to heart.

**Arteries:** Arteries usually carry oxygenated blood from heart to different parts of the body. One exception is the pulmonary artery which carries deoxygenated blood from heart to lungs.

3. **List two different functions performed by pancreas in our body.** **[Delhi]**

**Ans.** The different functions performed by pancreas in our body are:

(*i*) Pancreas secretes pancreatic juice which contains protein digesting enzyme trypsin.

(*ii*) It secretes lipase for breaking down emulsified fats.

## Short Answer Type [II] Questions [3 Marks]

**4. Write three types of blood vessels. Give one important feature of each.** **[Delhi]**

**Ans.** Three different types of vessels with one important feature are as follows:

(*i*) Arteries – carry oxygenated blood

(*ii*) Veins – carry deoxygenated blood

(*iii*) Capillaries – Exchange of $O_2$, $CO_2$, dissolved nutrients and excretory products takes place.

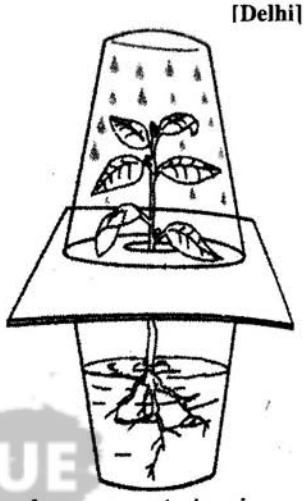
**5. Define the term transpiration. Design an experiment to demonstrate this process.** **[Delhi]**

**Ans.** Transpiration is defined as the loss of water in the form of vapour from the aerial parts of a plant.

Experiment to demonstrate transpiration

(*a*) **Materials required:** 2 transparent plastic glass, square cardboard, one small plant, vaseline, water and scissor.

(*b*) **Method:** A small hole need to be made at the centre of the cardboard. The plant stem to be passed through the hole and the gap to be sealed with vaseline. The bottom glass to be filled with water and the roots of the plant to be dipped in the water. The plant to be covered with the other glass from top. When the arrangement is kept in sunlight for 3-4 hours, droplets of water will be observed on the sides of the inverted glass which is due to transpiration.



**Arrangement showing transpiration experiment**

**6. What is photosynthesis? Explain its mechanism.** **[Delhi]**

**Ans.** Photosynthesis is a process in which green plants convert carbon di oxide and water into carbohydrates in presence of sunlight and chlorophyll. Carbohydrates are utilized to provide energy to the plant.

Mechanism

$$6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

The following events occur during the process:

(*i*) Light energy is absorbed by chlorophyll.

(*ii*) Light energy is converted to chemical energy and water molecules are split into hydrogen and oxygen.

(*iii*) Carbon dioxide is then reduced to carbohydrate.

**7. List in tabular form three distinguishing features between autotrophic nutrition and heterotrophic nutrition.** **[AI Allahabad]**

**Ans.** Differences between Autothropic nutrition and heterotrophic nutrition

| Autotrophic Nutrition | Heterotrophic Nutrition |
|---|---|
| 1. Organisms make their food from $CO_2$ and water in presence of sunlight and chlorophyll. | 1. Organisms derive their food from other living organisms. |
| 2. All green plants are autrophic and use sunlight as a source of energy. | 2. The energy is derived from intake and digestion of organic substances |
| 3. Energy received from autotrophic nutrition is more. | 3. Energy received from heterotrphic nutrition is less. |

**8. What is transpiration? List its two functions.** **[AI Allahabad]**

**Ans.** Transpiration is defined as the process by which plants lose water in the vapour form from the aerial parts of the plants.

**Functions of transpiration:**

(*i*) Transpiration helps to remove excess water

(*ii*) Transpiration helps to regulate the temperature of the plant.

**9. (*a*) What is translocation? Why is it essential for plants?**

**(*b*) Where do the substances in plants reach as a result of translocation?** **[AI Allahabad]**

**Ans.** (*a*) **Translocation** is the transport of food from the leaves to other parts of the plant and occurs in the part of the vascular tissue known as phloem.

Translocation is essential because every part of the plant needs food for obtaining energy, for building its parts and maintaining its life.

(*b*) Substances reach all parts of the plant by the network of phloem as a result of translocation.

## 2018

### Long Answer Type Questions [5 Marks]

**10. (*a*) Mention any two components of blood.**

**(*b*) Trace the movement of oxygenated blood in the body.**

**(*c*) Write the function of valves present in between atria and ventricles.**

**(*d*) Write one structural difference between the composition of artery and veins.**

**[CBSE]**

**Ans.** (*a*) Blood is composed of plasma and three types of cells–Red blood cells, white blood cells and platelets.

(*b*) – Oxygenated blood from the lungs is brought to the left atrium by pulmonary veins.

– When the atrium contracts, blood is transferred to left ventricle.
– When the ventricle contracts, blood is pushed into the aorta and through arteries to all parts of the body.

(*c*) The valves prevent the backflow of blood from ventricles into atria.

(*d*)

| Arteries | Veins |
|---|---|
| (*i*) They have thick elastic walls. | (*i*) They are thin walled. |
| (*ii*) They have no internal valves. | (*ii*) They have valves internally. |

(*any one*)

**11. (*a*) Define excretion.**

**(*b*) Name the basic filtration unit present in the kidney.**

**(*c*) Draw excretory system in human beings and label the following organs of the excretory system which perform following functions:**

**(*i*) form urine.**

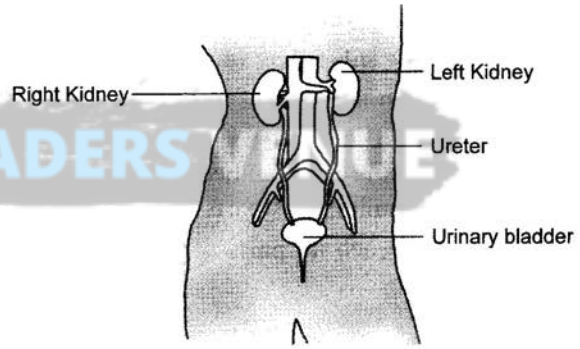
**(*ii*) is a long tube which collects urine from kidney.**

**(*iii*) store urine until it is passed out.** **[CBSE]**

**Ans.** (*a*) Excretion is the biological process of removal of harmful metabolic wastes from the body.

(*b*) Nephrons.

(*c*) (*i*) Kidney
(*ii*) Ureter
(*iii*) Urinary bladder




**Excretory system in human beings**

## 2018 (Compartment)

### Long Answer Type Questions [5 Marks]

**12. (*a*) Write the reaction that occurs when glucose breaks down anaerobically in yeast.**

**(*b*) Write the mechanism by which fishes breath in water.**

**(*c*) Name the balloon likes structures present in lungs. List its two functions.**

**(*d*) Name the respiratory pigment and write its role in human beings.** **[CBSE]**

**Ans.** (*a*) Glucose $\xrightarrow[\text{cytoplasm}]{\text{In the}}$ Pyruvate $\xrightarrow[\text{cytoplasm}]{\text{In the}}$ Ethanol + Carbon dioxide + Energy

(*b*) Fishes breathe with the gills by diffusion.

(*c*) Alveoli are the balloon-like structures.

- They provide a surface for exchange of gases.
- They contain a residual volume of air so that there is sufficient time for exchange of gases.

(*d*) Haemoglobin is the respiratory pigment in humans.

- It transports a major part of oxygen and some amount of carbon dioxide through blood.

**13. (*a*) Name the process and explain the type of nutrition found in green plants. List the raw materials required for this process. Give chemical equation for the mentioned process.**

**(*b*) Write three events that occur during this process.** **[CBSE]**

**Ans.** (*a*) - Photosynthesis is the process.

- Green plants show autotrophic nutrition.
- The raw materials required for photosynthesis are carbon dioxide and water and energy in the form of sunlight.
- The equation is as follows:

$$6CO_2 + 6H_2O \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} \underset{\text{Glucose}}{C_6H_{12}O_6} + 6CO_2$$

(*b*) The three events in photosynthesis are

(*i*) Absorption of light energy by chlorophyll.

(*ii*) Conversion of light energy to chemical energy and splitting of water molecules into hydrogen and oxygen.

(*iii*) Reduction of carbon dioxide to carbohydrates.

## 2016

### Short Answer Type [I] Questions [2 Marks]

**14. Sate two functions performed by bile juice.** **[CBSE]**

**Ans.** Bile juice in secreted by the liver. (*i*) It contains bile pigments, bile salts that emulsifies fat to fatty acids. (*ii*) Bile juice also neutrilizes the acidic food in the stomach and makes it alkaline so that it can react with the enzymes of pancreatic juice.

**15. Mention the site of complete digestion in our body? Name the end products formed on complete digestion of carbohydrates, proteins and fats.** **[CBSE]**

**Ans.** The site of complete digestion in our body is the small intestine. The final products produced after digestion of carbohydrates is glucose and fat into fatty acid and glycerol.

## Short Answer Type [I] Questions [3 Marks]

**16. Mention the three kinds of cells present in blood. Write one function of each.** **[CBSE]**

**Ans.** Blood is made up of plasma and corpuscles. Three kind of corpuscles are:

WBC, RBC and Blood platelets

Red Blood corpuscles (RBC) are small, biconvex cells that contain haemoglobin which helps to transport $O_2$ from the lungs to the all cells of the body and $CO_2$ from body cells to the lungs. White blood cells (WBC) main function is defence of the body against diseases and other infection.

Blood platelets are responsible for the clotting of blood which prevents loss of blood from the body.

**17. Write one function of each of the following components of the transport system in human beings:**

**(*a*) Blood vessels**

**(*b*) Lymph**

**(*c*) Heart** **[CBSE]**

**Ans.** (*a*) **Blood vessels—**Blood vessels are elastic muscular tubes that act as a channel to carry blood in the body.

(*b*) **Lymph—**Lymph is a yellow fluid connective tissue. The excess fluid that comes from the intercellular spaces are drained backed into the blood by the lymph.

(*c*) **Heart—**Heart is a hollow muscular organ that pumps oxygenated blood from the lungs into the body and deoxygenated blood from the body to the lungs for purification.

READERS VENUE

## 2015

## Short Answer Type [I] Questions [2 Marks]

**18. What are enzymes? Name any one enzyme of our digestive system and write its function.** **[CBSE]**

**Ans.** Enzymes are proteins which acts as biological catalysts. Catalysts are those proteins which take part in a chemical reaction, increase the rate of chemical reaction without being used up or breaking down into other substances.

For example: Amylase catalyses the breakdown of starch into sugars in the mouth and small intestine.

**19. (*i*) Write the balanced chemical equation for the process of photosynthesis.**

**(*ii*) When do the desert plants take up carbon dioxide and perform photosynthesis?** **[CBSE]**

**Ans.** (*i*) Photosynthesis can be represented using a chemical equation.

The overall balanced equation is

$$6CO_2 + 12H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6H_2O + 6O_2$$

(*ii*) Desert plants open up their stomata during night and take in CO Stomata remains close during the day time to prevent the loss of water by transpiration. They store the $CO_2$ in their cells until the sun comes out and they can carry on with photosynthesis during the day time.

## Short Answer Type [II] Questions [3 Marks]

**20. In single celled organisms diffusion is sufficient to meet all their requirements of food, exchange of gases or removal of wastes but it is not in case of multicellular organisms. Explain the reason for this difference.** [CBSE]

**Ans.** Unicellular organisms can absorb sufficient oxygen because of its complete contact with the atmosphere, but in multicellular organisms the rate of absorption and diffusion through the body surface is very less because all cells are not in direct contact with the atmosphere. Multicellular organisms require greater amount of oxygen to sustain life processes which cannot be fulfilled by the process of diffusion.

**21. Draw a diagram of human excretory system and label kidneys, ureters on it.** [CBSE]

**Ans.** Refer to Ans. 11(*c*).

**22. Name the acid presents in the following:**
**(*i*) Tomato (*ii*) Vinegar (*iii*) Tamarind** [CBSE]

**Ans.** (*i*) Citric acid (*ii*) Acetic acid (*iii*) Tartaric acid.

**23. State the role of the following in human digestive system:**
**(*i*) Digestive enzymes (*ii*) Hydrochloric acid (*iii*) Villi** [CBSE]

**Ans.** (*i*) **Digestive enzymes** – Foods need to be broken into their small or simpler molecules so that they can be absorbed into the bloodstream. However, the physical breakdown of food is not enough. Enzymes are proteins needed for the chemical breakdown of food and to speed up the process of digestion. Digestive enzymes are located in the glands of alimentary canal.

(*ii*) **Hydrochloric acid** - Hydrochloric acid helps to kill the germs which might have entered into the system through food. It also creates an acidic medium for the pepsin to act on food and to breakdown proteins.

(*iii*) **Villi** – Villi are finger-like projections in the small intestine. They help to increase the surface area for absorption of the digested food. Villi are richly supplied with blood vessel which help to absorb digested food into the blood stream.

## Long Answer Type Question [5 Marks]

**24. (*a*) Explain how does the exchange of gases occur in plants across the surface of stems, roots and leaves.**
**(*b*) How are water and minerals transported in plants?** [CBSE]

**Ans.** (*a*) In plants, there are tiny pores called stomata in leaves and lenticels in old stem which facilitate the exchange of gases. Carbon dioxide is taken in and oxygen is given out during photosynthesis. The reverse process takes place during respiration specially at night.

(*b*) Water and minerals are transported from the root hairs and carried by the xylem vessels (mainly in an upward direction); Xylem and phloem vessels are part of the plant's vascular bundle.
Phloem transports the products of photosynthesis from the leaves, to store food in the parts like the stem, roots, fruits etc.

## 2014

### Very Short Answer Type Question [1 Mark]

**25. Mention the raw materials required for photosynthesis.** **[CBSE]**

**Ans.** The following raw materials are required for photosynthesis:

(*i*) **Carbon Dioxide:** Plants get $CO_2$ from atmosphere through stomata of the leaves.

(*ii*) **Water:** Plants absorb water from soil through roots and transport to the leaves.

(*iii*) **Sunlight:** Sunlight is absorbed by the chlorophyll and other green parts of the plant.

### Short Answer Type [I] Questions [2 Marks]

**26. Why do herbivores have longer, small intestine than carnivores?** **[CBSE]**

**Ans.** Digestion of cellulose takes a longer time. Hence, herbivores eating grass need a longer small intestine to allow complete digestion of cellulose. Carnivorous animals cannot digest cellulose due to the absence of enzyme cellulase, hence they have a shorter intestine.

**27. Write correct sequence of four steps of method for the preparation of temporary mount of a stained leaf peel.** **[CBSE]**

**Ans.** (*i*) Take a healthy leaf from the potted plant.

(*ii*) Remove a part of the peel from the lower surface of the leaf. You can do this by folding the leaf over and gently pulling the peel apart using forceps. Keeps the peel in a watch glass containing water.

(*iii*) Put a few drops of safranin stain in a watch glass.

(*iv*) After 2-3 minutes take out the peel and place it on a clean glass slide.

(*v*) Put a drop of glycerin over the peel and place a clean coverslip gently over it with the help of a needle.

(*vi*) Remove the excess stain and glycerin with the help of blotting paper.

(*vii*) Observe the slide under magnifications of the compound microscope.

### Short Answer Type [II] Questions [3 Marks]

**28. In mammals and birds why is it necessary to separate oxygenated and de-oxygenated blood?** **[CBSE]**

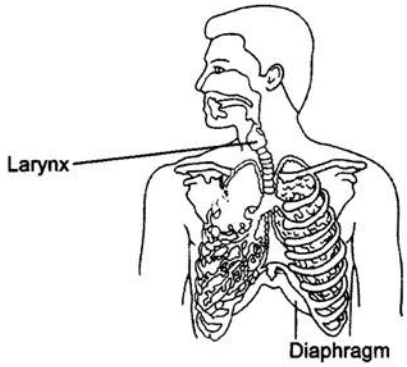
**Ans.** Mammals and birds are warm blooded animals. This means they can control their body temperature and do not have to depend on environment for their body temperature regulation. Because of this birds and mammals require optimum oxidization of glucose which would be possible with good supply of oxygen. So it is required to have separate oxygenated and deoxygenated blood to supply the required amount of oxygen.

**29. Draw a neat diagram of excretory system of human beings and label on it:**
**(*i*) Left kidney (*ii*) Urinary bladder** **[CBSE]**

**Ans.** Refer to Ans. 11(*c*).

**30. Draw a diagram of human respiratory system and label on it:**
**(*i*) Diaphragm (*ii*) Larynx** **[CBSE]**

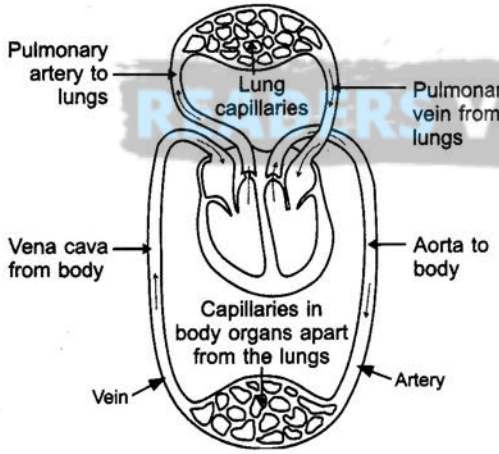
**Ans.**




**31. (*a*) Name the site of exchange of material between the blood and surrounding cells.**
**(*b*) Draw a schematic representation of transport and exchange of oxygen and carbon dioxide in human body.** **[CBSE]**

**Ans.** (*a*) Capillaries

(*b*)




READERS VENUE

## 2013

### Very Short Answer Type Question [1 Mark]

**32. What would be the consequences of deficiency of haemoglobin in your body?** **[CBSE]**

**Ans.** The deficiency of haemoglobin in our body is called anaemia. In anaemia, the blood is unable to carry the sufficient amount of oxygen required by the body. So, respiration would be less and less energy will be available to the body. The haemoglobin deficient person will feel weak, pale, lethargic and will be unable to perform heavy physical work.

## Short Answer Type [II] Questions [3 Marks]

**33. List three characteristics of lungs which make it an efficient respiratory surface.** [CBSE]

**Ans.** These features which particularly make our lungs efficient for gas exchange.

1. **Thin:** the air sac walls are very thin so that gases can quickly diffuse through them. Oxygen is absorbed in to the blood and carbon dioxide is given out in to the lungs to be exhaled out.
2. **Moist:** the air sacs are moist with mucus so that gases can dissolve before diffusing.
3. **Large surface area:** the surface area for gases to diffuse through in human lungs is roughly the same as a tennis court. The alveoli help to increase the surface area for absorption of oxygen.
4. **Good blood supply:** the air sacs or the alveoli have a large capillary network so that large volumes of gases can be exchanged. More the flow of blood more exchange.

**34. (*a*) What is the role of HCl in our stomach?**
**(*b*) What is emulsification of fats?**
**(*c*) Which protein digesting enzyme is present in pancreatic juice?**

**Ans.** (*a*) (*i*) It sterilises food by killing pathogens and other microbes.
(*ii*) It has a pH of 2, which is perfect for entyaus such as pepsin to break down proteins as effectively as possible.
(*iii*) Helps emulsify food (digestion of protein and stimulates the pancreas to produce digestive enzymes and bile) and protects against harmful bacteria
(*b*) Breakdown of large gloubule fats into smaller fats droplets is known as emulsification.
(*c*) Trypsin is the enzyme secreted by the pancreas which aids in digestion of proteins.

**35. List in tabular form three differences between arteries and veins.**

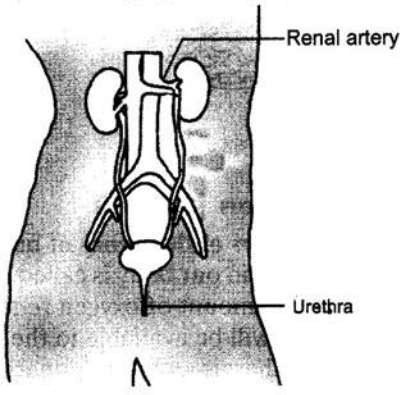
**Ans.**

| Arteries | Veins |
|---|---|
| (*i*) Arteries carry oxygenated blood, away from the heart to other parts of the body. | (*i*) Veins carry deoxygenated blood, towards the heart from different part of body. |
| (*ii*) These are thick-walled, highly muscular. | (*ii*) These are thin-walled. |
| (*iii*) They do not have valves. | (*iii*) They have valves. |

## Long Answer Type Questions [5 Marks]

**36. Draw a diagram of human excretory system and label renal artery and urethra. State in brief the function of: (*a*) renal artery (*b*) kidney (*c*) ureter (*d*) urinary bladder** [CBSE]

**Ans.**



(*a*) **Renal artery:** The renal artery carries blood to the kidneys. This blood comes directly from the heart and is sent to the kidneys to be filtered before it passes through the rest of the body.

(*b*) **Kidney:** The kidneys perform the essential function of removing waste products from the blood and excrete them in the form of urine.

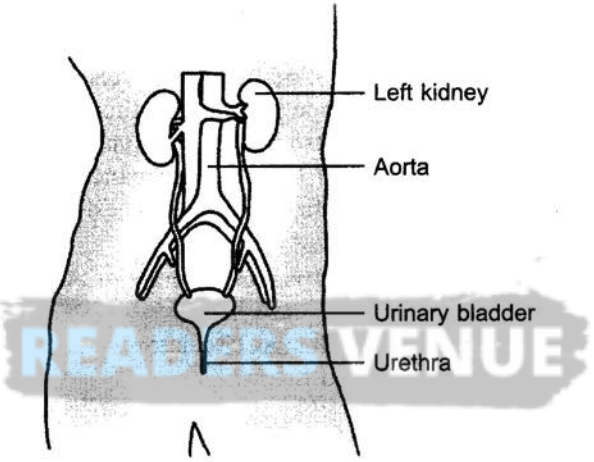
(*c*) **Ureter:** The ureter is a tube that carries urine from the kidneys to the urinary bladder.

(*d*) **Urinary bladder:** The urinary bladder is an expandable muscular sac that stores urine before it is excreted out of the body through the urethra.

**37. (*a*) Draw a diagram of excretory system in human beings and label the following parts. Aorta, kidney, urinary bladder and urethra.**

**(*b*) How is urine produced and eliminated?** **[CBSE]**

**Ans.** (*a*)




**Excretory system in human beings**

(*b*) Kidneys filter out the waste materials and excess water from the blood and form urine. This is how urine is produced.

The urine formed in the kidney passes through ureters to the urinary bladder. Urine is stored in the urinary bladder until the pressure of the bladder leads to the urge to pass it out. This is how urine is eliminated.

## 2012

### Short Answer Question [I] [2 Marks] [CBSE]

**38. Why do the walls of the trachea not collapse when there is less air in it?**

**Ans.** Rings of cartilages are present in trachea. These rings support the trachea and do not allow the trachea to collapse when there is less air in it.

## Short Answer Type [II] Questions [3 Marks]

**39. In human alimentary canal, name the site of complete digestion of various components of food. Explain the process of digestion.** [CBSE]

**Ans.** In small intestine, complete digestion of various components of food take place.
The process of digestion of food in mouth, stomach and small intestine in human body are as follows:
**Mouth:** Digestion of food begins in the mouth. Saliva present in mouth contains a digestive enzyme, called salivary amylase, maltose and dextrins, which breaks down starch into sugar.
**Stomach:** Stomach stores and mixes the food received from the oesophagus with gastric juices. The main components of gastric juice are hydrochloric acid, mucus and pepsinogen. Hydrochloric acid dissolves bits of food and creates an acidic medium. In this medium, pepsinogen is converted to pepsin which is a protein-digesting enzyme. Mucus protects the inner lining of the stomach from the action of HCl.
**Small Intestine:** Small intestine is the site of complete digestion of carbohydrates, proteins and fats. Small intestine produces intestinal juice from the glands present in its wall. The intestinal juice helps in further digestion of food. Small intestine also obtains digestive juices from liver and pancreas. The liver produces bile juice that causes emulsification of fats and the pancreas produces pancreatic juice for digesting proteins and emulsified fats. This digested food is finally absorbed through the intestinal walls.

**40. List the three kinds of blood vessels of human circulatory system and write their functions in tabular form.** [CBSE]

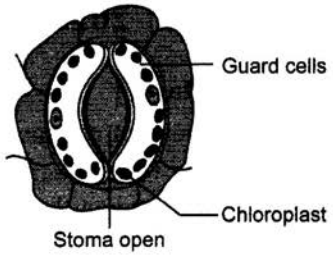
**Ans.** Three types of blood vessels in human circulatory system are arteries, veins and capillaries. Their functions are tabulated below:

| Arteries | Veins | Capillaries |
|---|---|---|
| Arteries carry oxygenated blood from heart to various organs of the body. | Veins carry deoxygenated blood from various organs to heart. | Exchanges of materials between blood and surrounding cells take place in the capillaries. |

## Long Answer Type Questions [5 Marks]

**41. (*a*) Draw a diagram to show open stomatal pore and label on it:**
**(*i*) guard cells (*ii*) chloroplast**
**(*b*) State two functions of stomata.**
**(*c*) How do guard cells regulate the opening and closing of stomatal pore?** [CBSE]

**Ans.** (*a*)



(*b*) Two functions of stomata are:

(*i*) Exchange of gases between the plant and the atmosphere takes place through stomata.

(*ii*) Transpiration in plants takes place through stomata.

(*c*) The opening and closing of the pore is a function of the guard cells. The guard cells swell when water flows into them causing the stomatal pore to open. Similarly, the pore closes if the guard cells shrink. As large amount of water is lost through these stomata, the plant closes these pores when it does not require carbon dioxide for photosynthesis.

**42.** (*a*) **Draw a diagram of human respiratory system and label the following:**

**(*i*) part where air is filtered by fine hair and mucus**

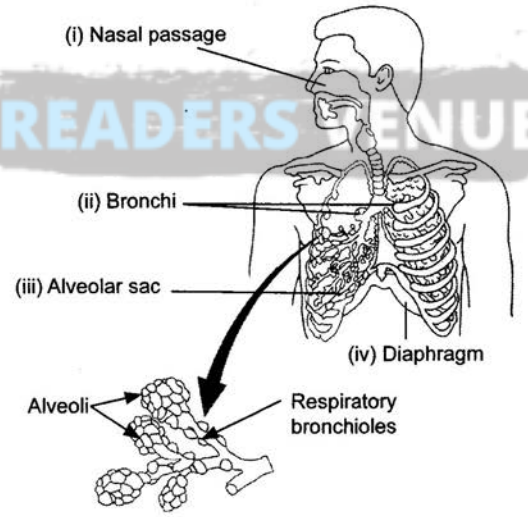
**(*ii*) part which terminates in balloon – like structures**

**(*iii*) balloon – like structures where exchange of gases takes place.**

**(*iv*) part which separates chest cavity from abdominal cavity.**

**(*b*) Why is the rate of breathing in aquatic organisms much faster than in terrestrial organisms?** **[CBSE]**

**Ans.** (*a*)

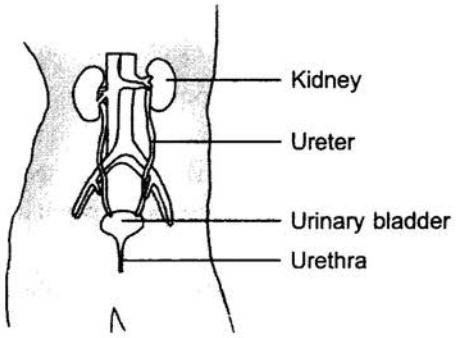



**Human Respiratory System**

(*b*) Quantity of dissolved oxygen is fairly low in water as compared to the amount of oxygen in air. Aquatic organisms therefore have to breathe faster than terrestrial organisms to absorb the required amount of oxygen from the water.

**43. Draw a neat diagram of excretory system of human beings and label the following:**
**(*i*) Kidney (*ii*) Ureter (*iii*) Urinary Bladder (*iv*) Urethra** **[CBSE]**

**Ans.**




**Excretory system in human beings**

## 2011

### Short Answer Type [I] Questions [2 Marks]

**44. What are the final products after digestion of carbohydrates and proteins?** **[CBSE]**

**Ans.** The final product produced after digestion of carbohydrates is glucose and of proteins is amino acids.

**45. What is saliva? State its role in the digestion of food.** **[CBSE]**

**Ans.** Saliva is a watery fluid secreted by the salivary glands in the mouth.

The digestive functions of saliva include moistening food, and easy movement of food in the food pipe, so it can be swallowed easily. Saliva contains the enzyme salivary amylase that breaks down starch into simple sugars.

**46. Explain the process of nutrition in *Amoeba*.** **[CBSE]**

**Ans.** The various steps of nutrition are ingestion, digestion, assimilation and egestion. When *Amoeba* comes in contact with food particles, it sends out pseudopodia, which engulfs the prey by forming a food cup, which is known as ingestion. When the tips of the encircling pseudopodia touch each other, the food is encaptured into a bag called food vacuole. The food vacuole serves as a temporary stomach secreting digestive juice, this step is known as digestion. The digested food gets absorbed and diffuses into the cytoplasm and then assimilated. Egestion of undigested food takes place at any point on the surface of the body.

**47. State two differences between arteries and veins.** **[CBSE]**

**Ans.** Refer to Ans. 35.

**48. How are the alveoli designed to maximise the exchange of gases?** [CBSE]

**Ans.** Alveoli are small pouches or sacs like structure. They are surrounded by blood capillaries. Thus, a large amount of air is brought in contact with the air in the lungs. More than millions of alveoli are present in the lungs. The presence of millions of alveoli in the lungs provides a very large surface area for the exchange of gases. The availability of large surface area maximises the exchange of gases.

**49. Name two excretory products other than $O_2$ and $CO_2$ in plants.**

**Ans.** The two excretory products other than $O_2$ and $CO_2$ in plants are resins and gums.

## Short Answer Type [II] Questions [3 Marks]

**50. (*a*) "The breathing cycle is rhythmic whereas exchange of gases is a continuous process." Justify this statement.**

**(*b*) What happens if conducting tubes of circulatory system develops a leak? State in brief, how could this be avoided?**

**(*c*) How opening and closing of stomata takes place?** [CBSE]

**Ans.** (*a*) The breathing cycle involves inhalation and exhalation of air due to alternate expansion and contraction of thoracic cavity. Thus it is a rhythmic process. But exchange of gases is a continuous process as it takes place between the blood and each and every cell, by diffusion.

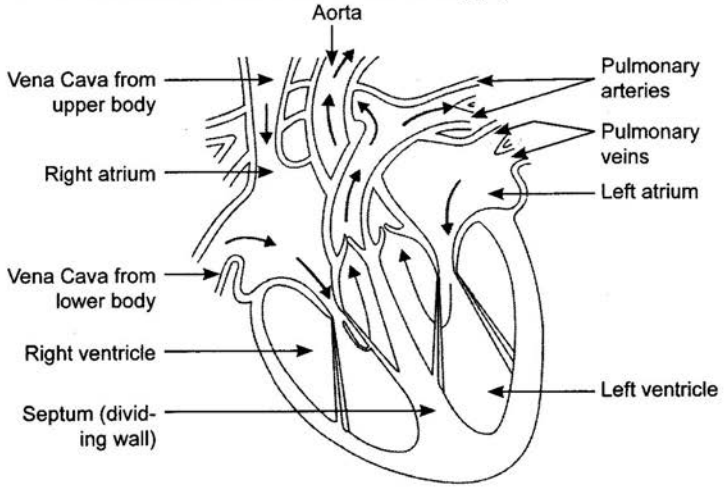
(*b*) The circulatory system will become inefficient if it develops a leak. This could be avoided by maintaining a normal blood pressure.

(*c*) When water flows into the guard cells, the guard cells swell and the stomatal pore opens up. When water moves out the guard cells shrinks and the stomatal pore closes.

READERS VENUE

**51. Draw a diagram of the front view of human heart and label any six parts including at least two, that are concerned with arterial blood supply to the heart muscles.** [CBSE]

**Ans.**




**Internal Structure of Human Heart**

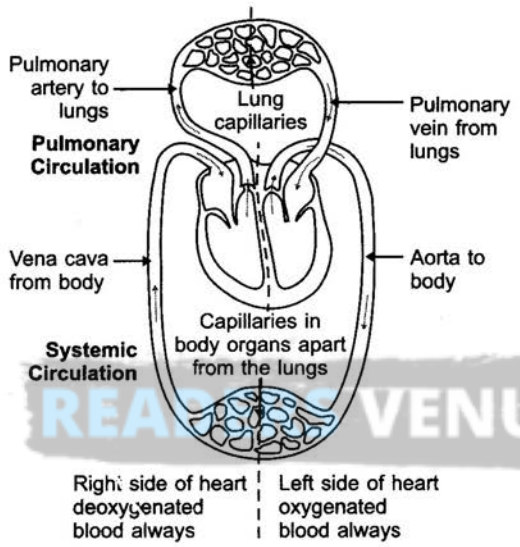
## Long Answer Type Questions [5 Marks]

**52.** **(*a*) Draw a schematic representation of transport and exchange of oxygen and carbon dioxide during transportation of blood in human beings and label on it:**

**Lung capillaries, Pulmonary artery to lungs, Aorta to body, Pulmonary veins from lungs.**

**(*b*) What is the advantage of separate channels in mammals and birds for oxygenated and deoxygenated blood?** **[CBSE]**

**Ans.** (*a*) A schematic representation of transportation and exchange of oxygen and carbon dioxide during transportation of blood in human beings




(*b*) It is necessary to separate oxygenated and deoxygenated blood in mammals and birds because they need high energy and large amount of oxygen. The separation of oxygenated and deoxygenated blood provides high oxygen supply to the organs.

**53.** **(*a*) Draw a diagram depicting Human Alimentary Canal and label on it: Gall bladder, Liver and Pancreas.**

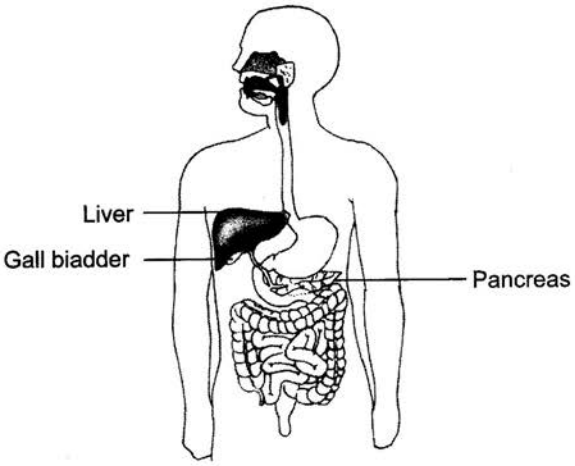
**(*b*) State the roles of Liver and Pancreas.**

**(*c*) Name the organ which performs the following functions in humans:**

**(*i*) Absorption of digested food**

**(*ii*) Absorption of water.** **[CBSE]**

**Ans.** (*a*)




**Alimentary canal of man**

(*b*) Liver: It synthesizes and stores bile juice secreted by gall bladder which breaks down fats into fat globules.

(*c*) The organ which performs the following functions in humans are as follows:

Pancreas: It secretes pancreatic juice which contains enzymes like trypsin for digesting proteins and lipase for breaking down emulsified fats.

(*i*) Absorption of digested food – Small intestine.

(*ii*) Absorption of water – Large intestine.

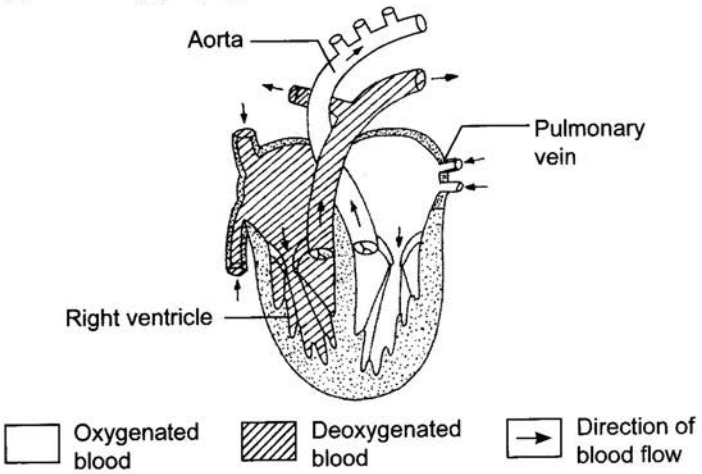
LEADERS VENUE

**54.** (*a*) **Draw a sectional view of the human heart and label on it – Aorta, Right ventricle and Pulmonary veins.**

(*b*) **State the functions of the following components of transport system:**

**(*i*) Blood (*ii*) Lymph** **[CBSE]**

**Ans.** (*a*)




**Sectional View of Human Heart**

(*b*) The functions of blood and lymph are as follows:

(*i*) **Blood**

- Oxygen is transported by the blood to the tissues of the body for the breakdown of digested food.
- Carbon dioxide is transported to the lungs by the blood plasma.
- The digested and absorbed nutrients are transported by blood to the tissues. Nitrogenous wastes are transported to the kidneys.
- It regulates the body temperature and maintains the pH of the body tissues.
- It transports various hormones from one region to another and bring about the coordination.
- It maintains water balance to constant level.
- The lymphocytes produce antibodies against the invading antigens and protect from diseases.
- It helps in rapid healing of wounds by forming a clot at the site of injury.

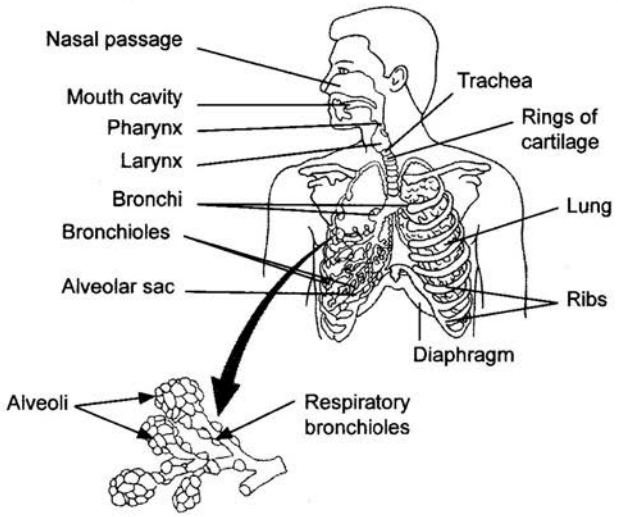
(*ii*) **Lymph**

- It cleans the cellular environment.
- It returns proteins and tissue fluids to the blood (drainage)
- It provides a pathway for the absorption of fats and fat-soluble vitamins into the bloodstream.
- It defends the body against disease.

**55. (*a*) Draw a labelled diagram of the respiratory system of human beings with diaphragm at the end of expiration.**

**(*b*) List four conditions required for efficient gas exchange in an organism.** **[CBSE]**

**Ans.** (*a*)




**Human Respiratory System**

(*b*) (*i*) A large surface area over which exchange can take place.

(*ii*) A concentration gradient without which nothing will diffuse.

(*iii*) A thin surface across which gases diffuse.

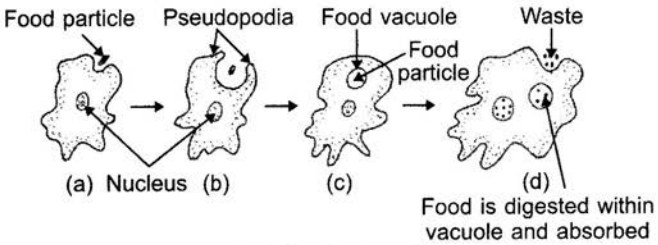
(*iv*) Warm conditions.

**56. (*a*) Draw a diagram to show the nutrition in Amoeba and label the parts used for this purpose. Mention any other purpose served by this part other than nutrition.**

**(*b*) Name the glands associated with digestion of starch in human digestive tract and mention their role.**

**(*c*) How is required pH maintained in the stomach and small intestine?** [CBSE]

**Ans.** (*a*)




**Nutrition in Amoeba**

Pseudopodia serves the purpose of locomotion apart from nutrition.

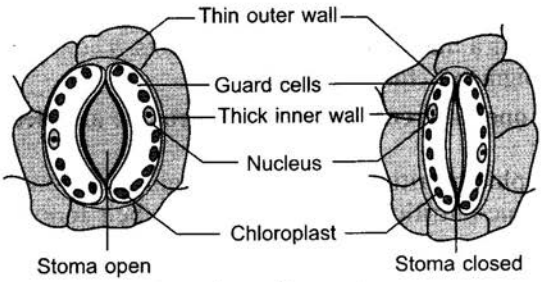
(*b*) The salivary gland is associated with digestion of starch in human digestive tract. It secretes saliva which contains enzyme salivary amylase. This enzyme converts starch into maltose (sugar).

(*c*) Gastric glands present on the walls of the stomach release HCl. HCl creates an acidic medium, which facilitates the action of enzyme pepsin. Bile juice from liver makes the food alkaline in small intestine for the pancreatic enzymes to act.

**57. (*a*) Draw a labelled diagram of stomata. List two functions of stomata.**

**(*b*) What are the raw materials used during photosynthesis? Write chemical equation for photosynthesis.** [CBSE]

**Ans.** (*a*)




**Functions of stomata**

(*i*) Gaseous exchanges between plant and the atmosphere.

(*ii*) Plant loses water through stomata which helps in movement of minerals from soil to leaves.

(*b*) Raw materials for photosynthesis: Carbon dioxide, water, chlorophyll and sunlight are the essential raw materials for photosynthesis.

(*i*) Carbon dioxide is a gas, which is released into the atmosphere during respiration. This gas is utilised by the autotrophic plants which enters the leaf through the stomata present on its surface during the process of photosynthesis.

(*ii*) Water is another requirement for photosynthesis, which is transported upward through xylem tissues to the leaves, from where it reaches the photosynthetic cells.

(*iii*) Chlorophyll is a green pigment in plants, which acts as a catalyst. It is responsible for absorption of the sun's energy by the plant.

(*iv*) Light affects photosynthesis by its intensity, quality and duration.

The chemical equation for photosynthesis is as follows:

$$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$$

**58. (*a*) Leaves of a healthy potted plant were coated with vaseline to block the stomata. Will this plant remain healthy for long? State three reasons for your answer.**

**(*b*) State any two differences between autotrophic nutrition and heterotrophic nutrition.** **[CBSE]**

**Ans.** (*a*) No, this plant will not remain healthy for long. The plant will begin to die because

(*i*) Gaseous exchange will not take place.

(*ii*) No absorption of $CO_2$, hence no photosynthesis.

(*iii*) Transpiration will not occur; hence no transportation of water.

(*b*) Refer to Ans. 7.

READERS VENUE

## 2010

### Very Short Answer Type Questions [1 Mark]

**59. Name the green dot-like structures in some cells observed by a student when a leaf peel was viewed under a microscope. What is this green colour due to?** **[Delhi]**

**Ans.** The green dot-like structures in some cells observed by a student when a leaf peel is viewed under a microscope are chloroplasts. The green colour is due to the presence of green pigment, chlorophyll.

**60. State any one difference between autotrophic and heterotrophic modes of nutrition.** **[All India]**

**Ans.** In autotrophic nutrition, organisms obtain their food from inorganic substances. In heterotrophic nutrition, organisms derive their food from organic substances.

**61. Give one reason why multicellular organisms require special organs for exchange of gases between their body and their environment.** **[All India]**

**Ans.** In unicellular organisms, the entire body of the organism is in contact with the environment hence exchange of materials can take place but, in multicellular organisms the entire body of the organism is not in contact with the environment and hence simple diffusion is not helpful.

**62. Name the process in plants where water is lost as water vapour.** **[All India]**

**Ans.** Transpiration is the process when plants loose water as vapour.

**63. What is 'translocation' in plants?** **[All India]**

**Ans.** Translocation is the movement of soluble materials, products of photosynthesis from leaves to other tissues throughout the plant.

**64. State the basic difference between the process of respiration and photosynthesis.** **[Foreign]**

**Ans.**

| Respiration | Photosynthesis |
|---|---|
| (*i*) It takes place in all living cells. | (*i*) Takes place only in green plant cells. |
| (*ii*) Respiration uses $O_2$ and releases $CO_2$. | (*ii*) In photosynthesis, $CO_2$ is used and $O_2$ is released. |

**65. Name the intermediate and the end products of glucose breakdown in aerobic respiration.** **[Foreign]**

**Ans.**

| Cellular respiration |
|---|
| Glucose<br>↓<br>Pyruvic acid<br>↓<br>Carbon dioxide + Water + 38 molecules of ATP |

**66. In the experiment "Light is essential for photosynthesis", why does the uncovered part of the leaf turn blue-black after putting iodine solution?** **[Foreign]**

**Ans.** Starch is produced in the uncovered part of the leaf because it is exposed to sunlight allowing it to photosynthesize, which turns blue-black in presence of iodine solution.

**67. Name the component of blood that helps in the formation of blood clot in the event of a cut.** **[Foreign]**

**Ans.** Platelets help in clotting of blood in the event of a cut.

**68. Mention how organisms like bread moulds and mushrooms obtain their food.** **[Foreign]**

**Ans.** Organisms like bread moulds and mushrooms breakdown the food materials outside the body and then absorb the nutrients of the bread.

## Short Answer Type [II] Questions [3 Marks]

**69. Describe in brief the function of kidneys, ureters, urinary bladder and urethra.** **[Foreign]**

**Ans.** The kidneys filter the blood and concentrate the filtrate to make urine. They also help regulate blood pressure.

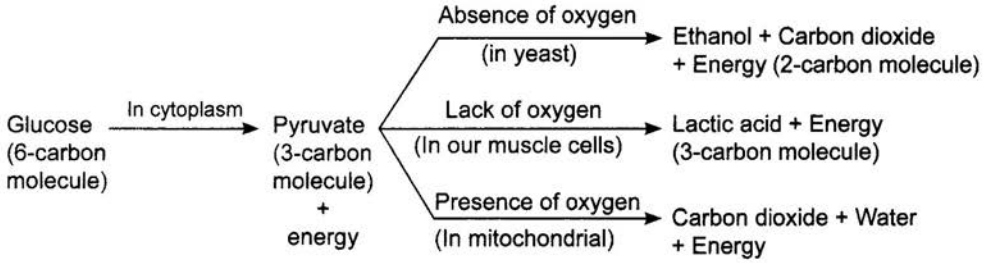
Ureters transport the urine to the urinary bladder.

Urinary bladder is like a holding tank for the urine until it's ready to be excreted.

Urethra is the tube that connects the urinary bladder to the outside of the body for excretion.

**70. Explain the process of breakdown of glucose in a cell (ii) in the absence of oxygen.** **[Foreign]**

**Ans.** The process of breakdown of glucose in a cell are as follows:




The first step in the breakdown of glucose both in presence of $O_2$ and in absence of $O_2$ is same. In this step, glucose is broken down into pyruvate.

Second step which involves further breakdown of pyruvate into simple compounds can take place in two different ways:

(*i*) **In presence of $O_2$:** In the presence of $O_2$, pyruvate is converted into $CO_2$ and water. Energy released during aerobic respiration is much greater than that released during an anaerobic respiration.

(*ii*) **In absence of $O_2$:** In the absence of $O_2$ in yeast, pyruvate is converted into ethanol and $CO_2$ and the process is called fermentation. In absence of $O_2$, in our muscle cells, pyruvate is converted into lactic acid. The build-up of lactic acid in muscle cells causes cramps.

TOPPERS VENUE

## Long Answer Type Question [5 Marks]

**71. (*a*) List the three events that occur during the process of photosynthesis. Explain the role of stomata in this process.**

**(*b*) Describe an experiment to show that "sunlight is essential for photosynthesis."** **[Delhi]**

**Ans.** (*a*) The three events that occur during the process of photosynthesis are:

(*i*) Absorption of light energy by the green pigment chlorophyll.

(*ii*) Conversion of light energy into chemical energy and the splitting of water molecule into hydrogen and oxygen.

(*iii*) Reduction of carbon dioxide into carbohydrate.

**Role of Stomata**

Stomata are tiny pores present on the surface of leaves. They are also present on the surface of young stems. Stomata are mainly engaged in the exchange of gases (entry of $CO_2$ and release of $O_2$) associated with photosynthesis. Plant closes the stomata when it does not need $CO_2$ for photosynthesis.

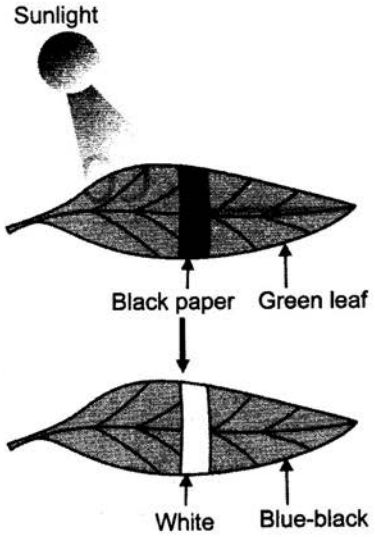
(*b*) Sunlight is essential for photosynthesis

**Procedure:**

(*i*) Place a healthy green potted plant in a dark room for 1-2 days. This is done to ensure that the plant consumes all its reserve food and the leaves do not contain any starch.

(*ii*) Then, cover a portion of a leaf of this plant on both sides with two uniform pieces of black paper, fixed in position with two paper clips.

(*iii*) Now, expose this plant to bright light. After a few hours, remove the leaf and decolourize it with alcohol and test the presence of food (starch) with iodine solution.




**Observation:** It can be observed that the portion of the leaf covered with black paper does not show any presence of starch (food).

**Conclusion:** This is because the food prepared by plants through the process of photosynthesis is stored as starch. Starch reacts with the iodine solution to give blue-black colour. Only those portions of the leaf that were exposed to sunlight could photosynthesise. Hence, gives blue- black colour when tested with iodine. The portion of the leaf covered with black paper did not receive sunlight. Hence, starch was not produced. Thus, it can be concluded that the sunlight is essential for photosynthesis.

# 7 CONTROL AND COORDINATION

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [II] Questions [3 Marks]**

**1. What are plant hormones? Name the plant hormones responsible for the following:**
**(*i*) Growth of stem**
**(*ii*) Promotion of cell division**
**(*iii*) Inhibition of growth**
**(*iv*) Elongation of cells** **[Delhi]**

**Ans.** Plant hormones are chemical substances produced naturally in plants and regulate one or more physiological processes when present in low concentration. Plant hormones have to coordinate growth, development and responses to the environment.

The plant hormones responsible for:

(*i*) Growth of stem — Auxins and Gibberellin

(*ii*) Promotion of cell division — Cytokinins

(*iii*) Inhibition of growth — Abscisic acid

(*iv*) Elongation of cells — Auxins

**2. What is feedback mechanism of harmonic regulation. Take the example of insulin to explain this phenomenon.** **[Delhi]**

**Ans.** Hormones need to be secreted in precise quantities. The timing and amount are regulated by feedback mechanism. Feedback mechanism is a loop in which a product feeds back to control its own production.

For example, if sugar level in blood rises, they are detected by the cells of the pancreas which respond by producing more insulin. As the blood sugar level falls, insulin feedback to lower its own production and the production stops. This process of increasing and decreasing production of insulin continues through feedback mechanism.

**3. Nervous and hormonal systems together perform the function of control and coordination in human beings. Justify this statement with the help of an example.** **[Delhi]**

**Ans.** The nervous system controls and coordinates all the functions in human body. The nervous system carries out its functions in close coordination with the hormonal system.

Nerves of the body do not reach each and every corner of the body and hence needs assistance from the hormones to control all the parts of the body. The control from nervous system is much faster than the hormonal control. Hormonal control is mainly based on feedback mechanism and tells the body to either speed up a particular secretion or to reduce the secretion of a particular hormone as per the situation. Nervous control, on the other hand, is more of a direct control. Both nervous system and hormonal system complement each other. Thus, it can be said that nervous and hormonal systems together perform the function of control and coordination in human beings.

### Long Answer Type Questions [5 Marks]

**4. (*a*) Why is the use of iodised salt advisable? Name the disease caused due to deficiency of iodine in our diet and state its one symptom.** **[AI Allahabad]**

**(*b*) How do nerve impulses travel in the body? Explain.**

**Ans.** (*a*) Iodine is necessary for the thyroid gland to make thyroxine hormone. Thyroxine regulates metabolism of carbohydrates, fats and proteins in the body to provide the best balance for growth. Deficiency of iodine in our diet causes goiter. One symptom of goiter is swelling of neck.

(*b*) The information acquired at the end of the dendrite tip of a neuron sets off a chemical reaction which creates an electrical impulse. The impulse travels from the dendrite to the cyton along the axon to its end. At the end of the axon, the electrical impulse sets off the release of some chemicals, which cross the synapse and start a similar electrical impulse in a dendrite of the next neuron. In this way, nerve impulse travels in the body.

TOPPERS VENUE

## 2018

### Short Answer Type [I] Questions [2 Marks]

**5. (*a*) Name one gustatory receptor and one olfactory receptor present in human beings.**

**(*b*) Write a and b in the given flow chart of neuron through which information travels as an electrical impulse.** **[CBSE]**

**Dendrite** ⟶ **a** ⟶ **b** ⟶ **End point of Neuron**

**Ans.** (*a*) Gustatory receptor—Tongue
Olfactory receptor—Nose

(*b*) (*i*) Cell body/Cyton (*ii*) Axon

So, electric impulse flow chart will be as follows:

Dendrite ⟶ Cell body/Cyton ⟶ Axon ⟶ End point of neuron

### Short Answer Type [II] Questions [3 Marks]

**6. Name the hormones secreted by the following endocrine glands and specify one function of each:** [CBSE]

**(*a*) Thyroid (*b*) Pituitary (*c*) Pancreas**

**Ans.** (*a*) Thyroxine
- It regulates the metabolism of carbohydrates, fats and proteins.

(*b*) Growth hormone
- It regulates growth and development of the body.

(*c*) Insulin
- It regulates the level of blood sugar.

## 2018 (Compartment)

### Short Answer Type [I] Questions [2 Marks]

**7. Different parts of brain are associated with specific functions. Name the part of human brain which perform the following function:** [CBSE]

**(*a*) Sensation of feeling full**

**(*b*) Vomiting**

**(*c*) Picking up a pencil**

**(*d*) Riding a bicycle**

**Ans.** (*a*) Forebrain (a centre for hunger)

(*b*) Hindbrain (medulla)

(*c*) Hindbrain (cerebellum)

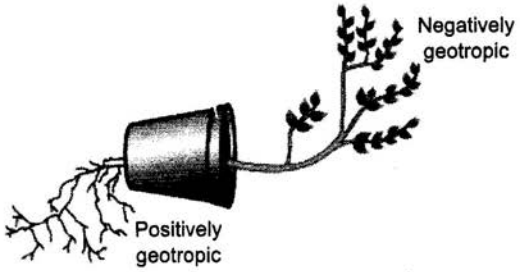
(*d*) Hindbrain (cerebellum)

READERS VENUE

### Short Answer Type [II] Questions [3 Marks]

**8. What is geotropism? Draw a labelled diagram of a potted plant showing positive geotropism and negative geotropism.** [CBSE]

**Ans.** Geotropism refers to the growth movements of plants in response to the gravity or pull of earth.




**Potted plant showing positive and negative geotropism.**

## 2016

### Very Short Answer Type Question [1 Mark]

**9. Name two components of central nervous system in Humans.** [CBSE]

**Ans.** The two components of central nervous system are brain and spinal cord.

### Short Answer Type [II] Questions [3 Marks]

**10. Name the hormone which regulates carbohydrate, protein and fat metabolism in our body. Which gland secretes this hormone? Why is it important for us to have iodised salt in our diet?** [CBSE]

**Ans.** Thyroxine regulates carbohydrates, protein and fat metaboslism in our body.

Thyroxine is secreted from thyroid gland. Iodine is required for the proper functioning of thyroid gland which secretes thyroxine hormone. Deficiency of iodine in our food causes goitre in which the thyroid gland to enlarges as it needs to absorbs more amount of iodine. Therefore, iodine is added to salt to supplement iodine requirement.

**11. Name the hormone required for the following. Also mention the name of endocrine gland from which that hormone is secreted:**

**(*i*) Lowering of blood glucose.**

**(*ii*) Development of moustache and beard in human males.**

**(*iii*) Metabolism of carbohydrates, fats and proteins.** [CBSE]

**Ans.**

| | **Hormone** | **Endocrine Glands** |
|---|---|---|
| (*i*) Lowering of blood glucose — | Insuline | Pancreas |
| (*ii*) Development of mustache and beard in human males— | Testosterone | Testis |
| (*iii*) Metabolism of carbohydrate fats and protein— | Thyroxine | Thyroid |

READERS VENUE

## 2015

### Very Short Answer Type Question [1 Mark]

**12. Why is it advised to use iodised salt in our diet?** [CBSE]

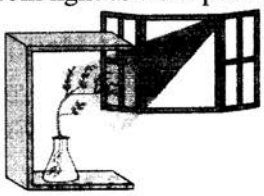
**Ans.** Iodine stimulates the thyroid gland to produce thyroxin hormone. Deficiency of this hormone results in the enlargement of the thyroid gland. This can lead to goitre.

### Short Answer Type [II] Questions [3 Marks]

**13. State how concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light?** [CBSE]

**Ans.** When a growing plant detects light, auxin synthesises at the shoot tip to help the cells to grow longer. When light comes from one side, auxin diffuses towards the shady side

of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light and the plant appears to bend towards light.



**Response of plant to direction of light**

**14. What is synapse? In a neuron cell how is an electrical impulse created and what is the role of synapse in this context?** **[CBSE]**

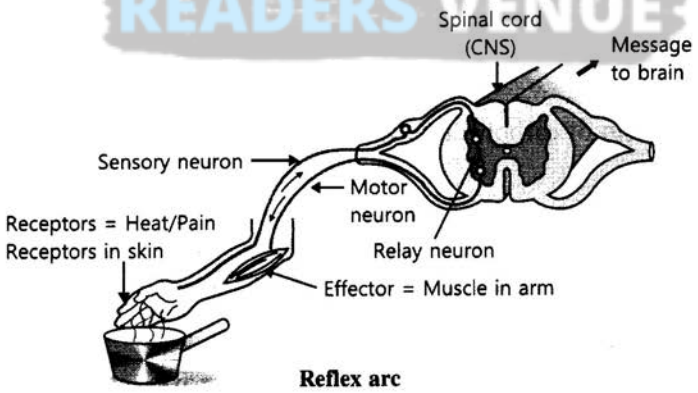
**Ans.** A synapse is the gap between the two neurons. Here the axon terminal of one neuron is in close proximity to the dendrite of the second neuron. When a nerve impulse reaches the knob like nerve ending of an axon, a tiny amount of a chemical substance is released in the synapse. This chemical substance is called as the neurotransmitter. At synapse the electrical signals converted into chemicals, that can easily cross over the gap and pass on to the next neurons where it again converted into electrical signals.

## Long Answer Type Question [5 Marks]

**15. What is meant by reflex-action? With the help of a labelled diagram trace the sequence of events which occur when we touch a hot object.** **[CBSE]**

**Ans.** Reflex action is defined as an unconscious, automatic and involuntary response of effector, i.e. muscle and gland to a stimulus which is monitored through the spinal cord.

READERS VENUE




**Reflex arc**

**Sequence of events when we touch a hot object are:**

(*a*) Receptor organ skin receives the stimulus and activates a sensory nerve impulse.

(*b*) Sensory neuron carries the message in the form of sensory impulse to the spinal cord.

(*c*) The spinal cord acts as a modulator. The neurons of spinal cord transmit the sensory nurve impulses to motor neuron.

(*d*) Motor nerve conducts these impulses to the effector organ hand which responds by pulling back the hand away from the hot object.

## 2014

### Very Short Answer Type Question [1 Mark]

**16. Give an example of a plant hormone that promotes its growth. Where it is synthesized?** [CBSE]

**Ans.** Plant hormone that promotes growth is auxin. It is synthesized at the tip of the plant stem.

### Short Answer Type [I] Question [2 Marks]

**17. (*i*) Name the hormones that are released in human males and females when they reach puberty.**

**(*ii*) Name a gland associated with brain. Which problem is caused due to the deficiency of the hormone released by this gland?** [CBSE]

**Ans.** (*i*) Testes in males produces hormone testosterone.
Ovaries in females produces hormone oestrogen.

(*ii*) Pituitary gland is associated with brain. It releases growth hormone which stimulates growth in all organs. A person having deficiency of growth hormone suffers from dwarfism whereas a person having too much growth hormone becomes very tall.

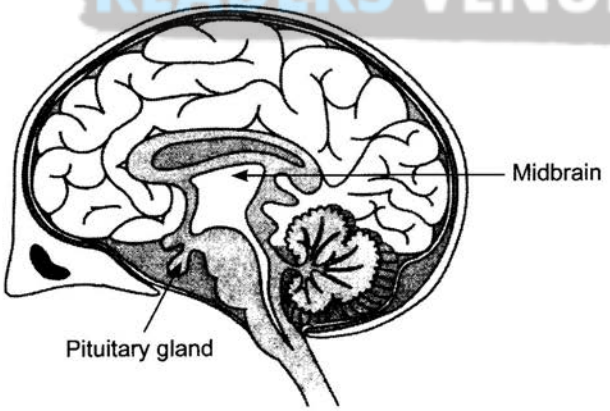
### Short Answer Type [II] Questions [3 Marks]

**18. Draw neat diagram of human brain and label on it the following parts:**

**(*i*) Midbrain (*ii*) Pituitary gland** [CBSE]

READERS VENUE

**Ans.**




**Human brain**

**19. Write one example each of the following tropic movements:**

**(*i*) Positive phototropism** **(*ii*) Negative phototropism**

**(*iii*) Positive geotropism** **(*iv*) Negative geotropism** [CBSE]

**(*v*) Hydrotropism** **(*vi*) Chemotropism**

**Ans.** (*i*) Positive phototropism: shoots growing towards light.
(*ii*) Negative phototropism: roots growing away from light towards ground.
(*iii*) Positive geotropism: growth of roots towards earth due to the pull of the earth.
(*iv*) Negative geotropism: shoots growing away from the earth during the process of fertilisation in a flower.
(*v*) Hydrotropism: roots growing towards the source of water.
(*vi*) Chemotropism: growth of pollen tubes towards the ovules during the process of fertilization in a flower.

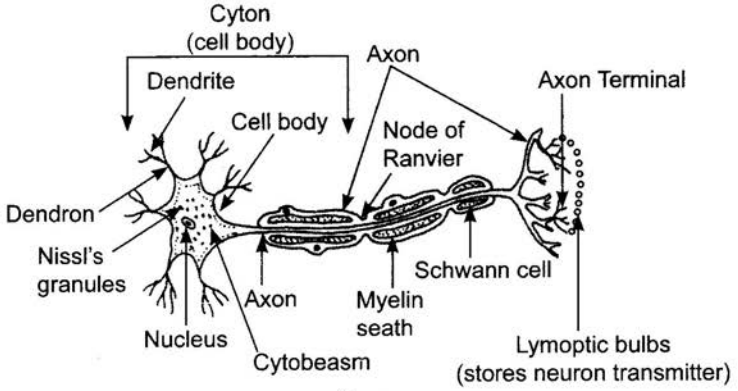
## Long Answer Type Questions [5 Marks]

**20.** **(*a*) Name the hormone which is released into the blood when its sugar level rises. Name the organ which produces this hormone and its effect on blood sugar level. Also mention the digestive enzymes secreted by this organ with one function of each.**
**(*b*) Explain the need of Chemical communication in multicellular organisms. [CBSE]**

**Ans.** (*a*) Insulin is the hormone which is released into the blood when its sugar level rises. Pancreas secretes the hormones called insulin. Insulin lowers the blood sugar level. Pancreas secretes pancreatic juice into small intestine which contains enzymes like trypsin for digesting proteins and lipase for breaking down emulsified fat.
(*b*) Multicellular organisms need chemical communication because the electrical impulses generated in the nerve cell will reach only to those cells which are connected to nervous tissues. Moreover, once the electrical impulse is generated in a cell and transmitted, it takes time to reset the mechanism before it can create generate and transmit a new impulse.

**21.** **State the structural and the functional unit of the nervous system. Draw its neat labelled diagram and write two functions. [CBSE]**

**Ans.** The structural and functional unit of the nervous system is the neuron.



**Neuron**

Functions of a neuron are:
(*a*) Neurons carry messages in the form of electrical signals called electrical impulses.
(*b*) Neurons helps in regulating control and coordination in animals.

## 2013

### Very Short Answer Type Question [1 Mark]

**22. State the function of:**
**(*i*) gustatory receptors, and**
**(*ii*) olfactory receptors.** **[CBSE]**

**Ans.** (*i*) Gustatory receptors – they detect taste.
(*ii*) Olfactory receptors – they detect smell.

### Short Answer Type [II] Questions [3 Marks]

**23. (*a*) Explain any three directional movements in plants.**
**(*b*) How brain and spinal cord are protected in human?**
**(*c*) Name the master gland present in the brain.** **[CBSE]**

**Ans.** (*a*) The three directional movements in plants are:
Phototropism: movement of plant towards or away from the light.
Geotropism: movement of plant parts towards the earth or away from it.
Hydrotropism: movement of plant parts towards or away from any source of water.
(*b*) Brain is protected by a bony box in the skull called **cranium.** Spinal cord is protected by a bony cage called vertebral column.
(*c*) Pituitary gland present in the brain is known as the master gland.

**24. List in tabular form five differences between nervous control and chemical control.** **[CBSE]**

**Ans.**

| Nervous System | Endocrine System |
|---|---|
| (*i*) Formed of a collection of neuron cells. | (*i*) Formed of a set of glands. |
| (*ii*) Electrochemical pulses are the means of signal transmission. | (*ii*) Chemicals called hormones are the means of signal transmission. |
| (*iii*) Signal transmission is fast, but the functions are not prolonged. | (*iii*) Signal transmission is slow, but the functions are long lasting. |
| (*iv*) The cells are interconnected and the whole system is continuous. | (*iv*) The organs of the whole system are not physically connected yet those are discrete. |
| (*v*) Use the neurons to transmit the signal. | (*v*) Use the circulatory system to transmit the signal. |

## 2012

### Very Short Answer Type Questions [1 Mark]

**25. Name the part of the brain which controls posture and balance of the body.** **[CBSE]**

**Ans.** Cerebellum in hind-brain controls the posture and balance of the body.

**26. Mention the part of the body where gustatory and olfactory receptors are located.** **[CBSE]**

**Ans.** Gustatory receptors are located in Cerebrum of fore-brain.
Olfactory receptors are located in Olfactory lobe of fore-brain.

## Short Answer Type [II] Questions [3 Marks]

**27. Smita's father has been advised by a doctor to reduce his sugar intake.**

**(*i*) Name the disease he is suffering from and name the hormone whose deficiency is?**

**(*ii*) Identify the gland that secretes it and mention the function of this hormone.**

**(*iii*) Explain how the time and amount of secretion of this hormone is regulated in human system.** **[CBSE]**

**Ans.** (*i*) He is suffering from diabetes. Deficiency of insulin causes diabetes.

(*ii*) Pancreas secretes insulin. Insulin helps in regulating blood sugar.

(*iii*) When the sugar level in blood increases, it is detected by cells of the pancreas which responds by producing more insulin in blood. As the blood sugar level falls, insulin secretion is reduced.

**28. (*a*) How is brain protected from injury and shock?**

**(*b*) Name two main parts of hind brain and state the functions of each.** **[CBSE]**

**Ans.** (*a*) Brain is protected by a bony box in the skull called cranium. Inside the box, the brain is contained in a fluid-filled balloon which provides further shock absorption.

(*b*) Two main parts of hind-brain are — Medulla and Cerebellum. Their functions are:

**Medulla:** It controls the involuntary actions such as blood pressure, salivation and vomiting.

**Cerebellum:** It is responsible for precision of voluntary actions and maintaining the posture and balance of the body.

TOPPERS VENUE

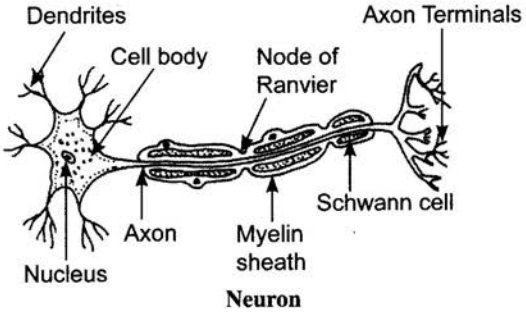
**29. (*a*) Draw the structure of neuron and label cell body and axon.**

**(*b*) Name the part of neuron:**

**(*i*) where information is acquired**

**(*ii*) through which information travels as an electrical impulse.** **[CBSE]**

**Ans.** (*a*) A nerve cell (Neuron)




**Neuron**

(*b*) (*i*) Dendrite (*ii*) Axon

**30. (*a*) Which plant hormone is present in greater concentration in the areas of rapid cell division?**

**(*b*) Give one example of a plant growth promoter and a plant growth inhibitor.** [CBSE]

**Ans.** (*a*) Cytokinin is present in greater concentration in the areas of rapid cell division.

(*b*) An example of a plant growth promoter is gibberellins and example of a plant growth inhibitor is abscisic acid.

## 2011

### Short Answer Type [II] Questions [3 Marks]

**31. Which organ secretes a hormone when blood sugar rises in our body? Name the hormone and name one enzyme released by this organ.** [CBSE]

**Ans.** Pancreas secretes a hormone when blood sugar rises in our body.

Insulin is the hormone released by this organ and the name of the enzyme is trypsin and lipase (*any one*).

**32. (*a*) Explain how auxins help in bending of plant stem towards light.**

**(*b*) State the objective of the experiment for which experimental set-up is shown in the given diagram.** [CBSE]

**Ans.** (*a*) In plant shoots, the role of auxin is to cause a positive phototropism, i.e. to grow the plant towards the light. When light is incident on a plant from one direction, it causes the auxins to redistribute towards the shaded side of the plant. One function of auxin is to cause cell elongation. The redistribution causes the cells on the shaded side to elongate more than those on the side with the light shining on them. This causes the shoot to bend towards the light.

(*b*) The objective of the experiment is to show phototropic movement of plant.

**33. What causes a tendril to encircle or coil around the object in contact with it is? Explain the process involved.** [CBSE]

**Ans.** Thigmotropism is responsible for a tendril to coil around a object. Thigmotropism is directional response of plants to the touch of an object.

When a tendril comes in contact with any support, the part of the tendril in contact with the object does not grow as rapidly as the part away of the tendril away from the object. This cause the tendril to circle around the object and thus, cling to it.

**34. Name any three endocrine glands in human body and briefly write the function of each of them.** [CBSE]

**Ans.** Three endocrine glands with their function in human body are as follows:

(*i*) **Thyroid gland:** It secretes a hormone called thyroxine which regulates the metabolism of carbohydrates, fats and proteins in the body and so provide the best balance for nutrients and mental ability.

(*ii*) **Adrenal gland:** It secretes two hormones—adrenalin and corticoid hormones regulate blood pressure, heartbeat, breathing rate and carbohydrate metabolism.

(*iii*) **Pancreas:** It secretes two hormones—insulin and glucagon. Insulin hormone lowers the blood glucose level. Glucagon hormone increases the blood glucose level.

**35. Which part of the brain controls involuntary actions? Write the function of any two regions of it.** **[CBSE]**

**Ans.** Hind-brain controls the involuntary actions.

Cerebellum controls the coordination of body movement and helps in mantaining the posture.

Medulla oblongata regulates the involuntary actions such as swallowing, coughing, sneezing and vomiting.

**36. What is chemotropism? Give one example. Name any two plant hormones and mention their functions.** **[CBSE]**

**Ans.** Chemotropism is the movement of a part of the plant in response to a chemical stimulus. It can be positive chemotropism or negative chemotropism.

Example: The growth of pollen tube towards the ovule during the process of fertilisation in a flower.

Two plant hormones with their functions are as follows:

Auxins promote cell elongation, root formation, cell division, respiration and other physiological processes like protein synthesis, etc.

Gibberellins stimulate stem elongation, seed germination and flowering.

**37. State the functions of any three of the structural and functional unit of nervous system.** **[CBSE]**

**Ans.** The structural and functional unit of nervous system, i.e. neuron with their functions are as

(*i*) **Cell body:** Stimulus received from dendrite is changed into impulse in the cyton.

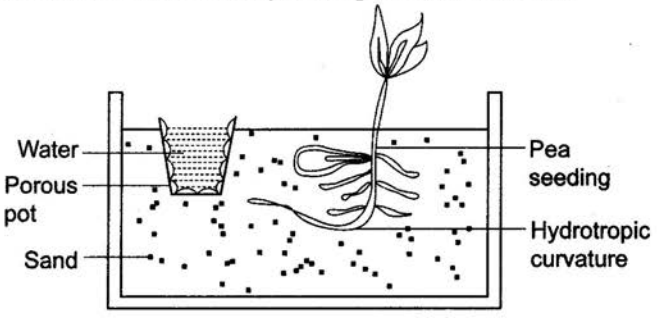
(*ii*) **Dendrites:** They receive sensation or stimulus, which may be physical or chemical.

(*iii*) **Axon:** It conducts impulse away from the cell body.

**38. What is 'hydrotropism'? Describe an experiment to demonstrate 'hydrotropism'.** **[CBSE]**

**Ans.** 'Hydrotropism' is the directional growth of a plant part in response to water. For example, roots show hydrotropism as they grow towards water in the soil and are positively hydrotropic.

An experiment to demonstrate hydrotropism is as follows:



(*i*) A porous pot filled with water is taken and inserted in a tub filled with dry sand.
(*ii*) A freshly germinated pea seedling is sowed in the sand.
(*iii*) As water is not available in sand, the root growing will bend towards the porous pot filled with water.
(*iv*) A hydrotropic curvature of the root is observed as it grows towards water.
(*v*) This bending of root shows the movement in response towards water.

**39. What are 'hormones'? State one function of each of the following hormones:**
**(*i*) Thyroxine (*ii*) Insulin** [CBSE]

**Ans.** Hormones are the chemical substances which coordinate and control the activities of living organisms and also their growth.
(*i*) **Function of Thyroxine:** This hormone regulates the metabolism of carbohydrates and fats.
(*ii*) **Function of insulin:** This hormone helps in regulating sugar level in the blood.

## 2010

### Very Short Answer Type Questions [1 Mark]

**40. How is the spinal cord protected in the human body?** [CBSE]

**Ans.** Spinal cord is enclosed in a bony cage called vertebral column.

**41. A potted plant is made to lie horizontally on the ground. Which part of the plant will show**
**(*i*) positive geotropism? (*ii*) negative geotropism?** [CBSE]

**Ans.** (*i*) Root (*ii*) Shoot.

READERS VENUE

**42. Mention the function of the hind-brain in humans.** [CBSE]

**Ans.** Hind brain controls respiration, cardio-vascular reflexes and gastric secretions. It also modulates the motor commands initiated by the cerebrum.

**43. Mention the function of adrenaline hormone.** [CBSE]

**Ans.** Adrenaline hormone is released into the blood from the adrenal gland during stimulation of the nervous system on seeing any adverse situation of fight or fright, it:
(*i*) increases the blood pressure.
(*ii*) increases heart beat rate.
(*iii*) increases breathing rate.
(*iv*) diverts blood to essential organs including the heart, brain and skeletal muscles by dilating their blood vessels and constricting those of less essential organs, such as the skin and digestive system.

### Short Answer Type [I] Questions [2 Marks]

**44. Name the two main organs of our central nervous system. Which one of them plays a major role in sending command to muscles to act without involving thinking process? Name the phenomenon involved.** [CBSE]

**Ans.** The two main organs of CNS are brain and spinal cord.
Spinal cord plays a major role in sending command to muscles to act without involving thinking process. This phenomenon is called reflex action.

**45. Name the hormone secreted by human testes. State its functions.** **[CBSE]**

**Ans.** Testes secrete male sex hormone called testosterone.
The function of testosterone is to regulate male accessory sex organs and secondary sexual characters like moustache, beard and voice.

**46. Name and explain the function of the hormone secreted by the pituitary gland in humans.** **[All India]**

**Ans.** Hormones secreted by pituitary gland alongwith their functions are:
(*i*) **Growth hormone:** It regulates growth and development of bones and muscles.
(*ii*) **Trophic hormone:** It regulates secretion of hormones from other endocrine glands.
(*iii*) **Prolactin hormone:** It regulates the function of mammary glands in females.
(*iv*) **Vasopressin hormone:** It regulates water and electrolyte balance in the body.
(*v*) **Oxytocin hormone:** It regulates ejection of milk during lactation.

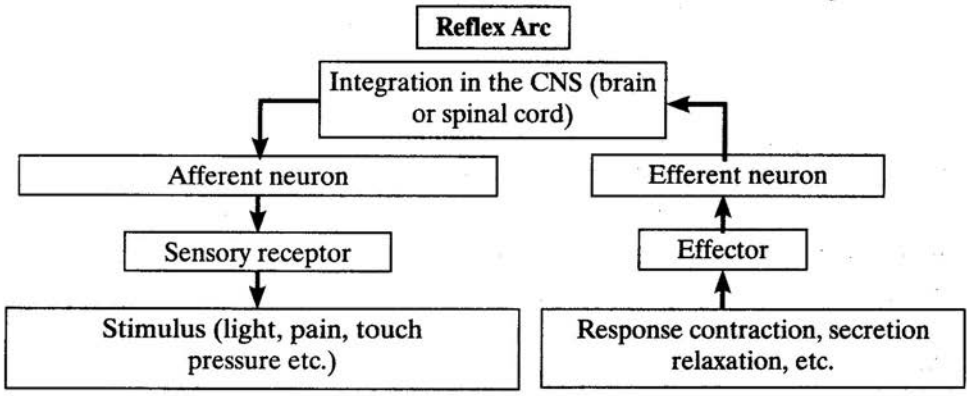
## Short Answer Type [II] Questions [3 Marks]

**47. What is a reflex action? Describe the steps involved in a reflex action.**
**[Delhi; Foreign 2009]**

**Ans.** **Reflex action:** It is defined as an unconscious, automatic and involuntary response of effectors, i.e. muscles and glands, to a stimulus, which is monitored through the spinal cord.
**Mechanism of reflex action:** It involves the following steps:
(*i*) Receptor organ like skin perceives the stimulus and activates a sensory nerve impulse.
(*ii*) Sensory organ carries message in the form of sensory impulse to the spinal cord.
(*iii*) The spinal cord acts as modulator. The neurons of spinal cord transmit the sensory nerve impulse to motor neuron.
(*iv*) Motor nerve conducts these impulses to the effectors like leg muscles which responds by pulling back the organ away from the harmful stimulus.

**48. List the components of reflex arc in correct sequence. State in brief the role of brain in reflex action.** **[Foreign]**

**Ans.** The reflex arc pathway is shown in the flow chart as follows:
The Reflex arc does not involve brain. It minimises the overloading of brain.



# 8 HOW DO ORGANISMS REPRODUCE?

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [II] Questions [3 Marks]**

**1. What is carpel? Write the function of its various parts.** **[AI Allahabad]**

**Ans.** Carpel is located at the centre of a flower and is the female reproductive organ of the plant. It is made up of three parts- stigma, style and ovary.

Functions of its various parts are:

**Stigma:** Stigma is the terminal part of the carpel, which is sticky and helps in receiving the pollen grains from the anther of stamen during pollination.

**Style:** Style is the middle elongated part of the carpel which connects stigma to the ovary.

**Ovary:** It is the swollen bottom part of the carpel, which contains ovules and each ovule has an egg cell-the female gamete.

READERS VENUE

**Long Answer Type Questions [5 Marks]**

**2. Define pollination. Explain the different types of pollination. List two agents of pollination? How does suitable pollination lead to fertilization?** **[Delhi]**

**Ans.** Pollination is the transfer of pollen grains from the anther of a stamen to the stigma of a carpel.

**Different types of pollination:**

(*i*) Self-pollination: It is the transfer of pollen grains from the anther to the stigma within a flower or between two flowers of the same plant.

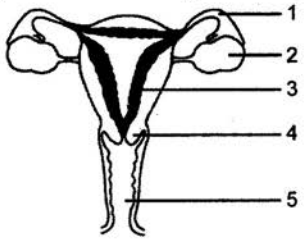
(*ii*) Cross-pollination: It is the transfer of pollen grains from anther to the stigma of two flowers on different plants of the same species.

The two agents of pollination are wind and insect.

When the pollen falls on a suitable stigma, pollen tube grows out of the pollen grain through the style to reach the ovary. Double fertilization occurs inside each embryo sac in which two fusions, syngamy and triple fusion takes place. When one male gamete fuses with the egg contained in the embryo sac of the ovule, zygote is formed. The other

male gamete fuses with the two polar nuclei and the process is called triple fusion. After fertilization the zygote divides several times to form an embryo within an ovule. The ovule then gets converted into a seed. The ovary develops and ripens to form a fruit.

**3. (*a*) Identify the given diagram. Name the parts 1 to 5.**




**(*b*) What is contraception? List three advantages of adopting contraceptive measures.** **[Delhi]**

**Ans.** (*a*) The diagram is of Human Female Reproductive System.

1. Fallopian tube
2. Ovary
3. Uterus
4. Cervix
5. Vagina

(*b*) Contraception is a method used to avoid pregnancy.

Three advantages of adopting contraceptive measures are as follows:

1. It helps in avoiding unwanted pregnancy.
2. Condom helps in preventing STDs (Sexually Transmitted Diseases)
3. It helps in maintaining reproductive health in women.

## 2018

### Short Answer Type [II] Questions [3 Marks]

**4. Write one difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of survival – the one reproducing asexually or the one reproducing sexually? Give reason to justify your answer.** **[CBSE]**

**Ans.** Differences between asexual and sexual mode of reproduction.

| Asexual reproduction | Sexual reproduction |
|---|---|
| (*a*) A single parent is involved.<br>(*b*) There is no formation or fusion of gametes.<br>(*c*) No genetic variation is created in the progeny. | (*a*) Two parents (a male and a female) are involved.<br>(*b*) There is formation and fusion of gametes.<br>(*c*) There is genetic variation in the progeny. (*any one*) |

– The species reproducing sexually will have better chances of survival because genetic variation is created during sexual reproduction; in case of an adverse environmental change, atleast some variants will survive and continue the race.

## 2017

### Very Short Answer Type Questions [1 Mark]

**5. Name the method by which *spirogyra* reproduces under favourable conditions. Is this method sexual or asexual?** **[Delhi]**

**Ans.** *Spirogyra* reproduces by fragmentation.
It is an asexual method of reproduction.

**6. How does *Planaria* reproduce. Is this method sexual or asexual?** **[Delhi]**

**Ans.** *Planaria* reproduces by regeneration, i.e., it get cuts into pieces and each piece grows into a new organism.
— It is an asexual method of reproduction.

**7. How does *Plasmodium* reproduce. Is this method sexual or asexual?** **[Delhi]**

**Ans.** *Plasmodium* reproduces by multiple fission, where the cell divides into many daughter cells simultaneously; it is an asexual method of reproduction.

**8. Name the organs producing sperms and ova respectively in humans.** **[Foreign]**

**Ans.** Testes produce sperms and ovary produces ova.

**9. Name the organ in humans which produces (*i*) male germ cell, and (*ii*) female germ cell.** **[Foreign]**

READERS VENUE

**Ans.** (*a*) Testis
(*b*) Ovary

**10. What is fertilisation? Where does it occur in a human female?** **[Foreign]**

**Ans.** Fertilisation refers to the fusion of male and female gametes.
It occurs in the fallopian tube.

### Short Answer Type [II] Questions [3 Marks]

**11. What happens when:** **[Delhi]**

**(*a*) Accidently, *Planaria* gets cut into many pieces?**
**(*b*) *Bryophyllum* leaf falls on the wet soil?**
**(*c*) On maturation *sporangia* of *Rhizopus* bursts?**

**Ans.** (*a*) When *Planaria* gets cut into many pieces, each piece grows into a complete new organism, i.e. regeneration occurs.

(*b*) The buds produced in the notches along the margin of the leaf of Bryophyllum develop into new plants.

(*c*) The spores are liberated from the *sporangia* and each of them develops into a new *Rhizopus* individual.

**12. State the basic requirement for sexual reproduction? Write the importance of such reproductions in nature.** **[Delhi]**

**Ans.** Sexual reproduction requires male and female individuals of the species.

New genetic variations are created, where each variation would be novel, as sexual reproduction combines DNA (genetic material with accumulated variations) from two different individuals. Such genetic variations are useful in ensuring survival of species.

**13. State the changes that take place in the uterus when:** **[Delhi]**

**(*a*) Implantation of embryo has occurred.**

**(*b*) Female gamete/egg is not fertilised.**

**Ans.** (*a*) After implantation, the cell divisions continue to occur.

A placenta develops and the embryo gets nutrition from the mother's blood through placenta.

The complete development of the foetus occurs in about nine months.

(*b*) When the female gamete is not fertilised, the thickened and spongy lining of the uterus is not required any more. Hence, the lining along with its blood vessels, breaks and comes out through the vagina as blood and mucus, in the process, called menstruation.

**14. List any four steps involved in sexual reproduction and write its two advantages.** **[Delhi]**

**Ans.** Steps in sexual reproduction.

(*i*) Formation of germ cells/gametes that involves DNA copying.

— The number of chromosomes or the amount of DNA is halved in the gametes.

(*ii*) Transfer or bringing the gametes physically together to effect their fusion or fertilisation.

(*iii*) Fertilisation or fusion of gametes to form the zygote; the chromosome number or the amount of DNA is made the same as that of the parents.

(*iv*) Development of zygote into an adult organism.

Advantages

— It results in creation of new genetic combinations or variations.

— Variations are necessary for evolution and also for survival of the species in case of an adverse change in the environment.

**15. Reproduction is one of the most important characteristics of living beings. Give three reasons in support of the statement.** **[All India]**

**Ans.** (*i*) Reproduction is necessary to maintain the continuity of species.

(*ii*) Reproduction is linked to the stability of populations of species, which occupy well-defined places called niches in the ecosystems.

(*iii*) The variations created during reproduction are responsible for survival of a species in case of an adverse change in the environment and evolution.

**16. What is vegetative propagation? State two advantages and two disadvantages of this method.** **[All India]**

**Ans.** Vegetative propagation refers to the development of new plants from vegetative parts (roots, stem or leaves) of an existing plant.

**Advantages:**

(*i*) Plants produced by vegetative propagation can bear flowers and fruits earlier than those produced from seeds.

(*ii*) It makes possible the propagation of plants, which have lost the capacity to produce seeds.

(*iii*) Desirable characters can be maintained through generations as the plants produced are genetically similar to the parent plant. (*any two*)

**Disadvantages:**

(*i*) No genetic variation is created.

(*ii*) Continued vegetative propagation can lead to loss of vigour.

**17. List three techniques that have been developed to prevent pregnancy. Which one of these techniques is not meant for males? How does the use of these techniques have a direct impact on the health and prosperity of a family?** **[All India]**

**Ans.** • The techniques to prevent pregnancy include:

(*i*) Creation of mechanical barriers.

(*ii*) Changing the hormonal balance of the body.

(*iii*) Use of intra-uterine contraceptive devices.

(*iv*) Surgical methods. (*Any three*)

READERS VENUE

• Use of intra-uterine devices is not meant for males.

**Impact of use of contraceptives:**

(*i*) Use of mechanical barriers like condoms can prevent the spread of sexually-transmitted diseases.

(*ii*) Pregnancy will make major demands on the body and mind of the woman and if she is not ready for it, her health will be adversely affected; such a condition can be avoided.

(*iii*) By having a small family, the standard of living can be improved.

**18. Describe reproduction by spores in *Rhizopus*.** **[All India]**

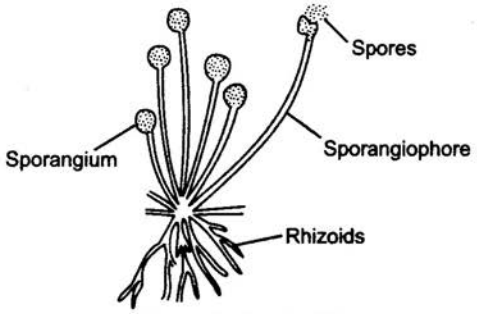
**Ans.** Reproduction in *Rhizopus*:

• *Rhizopus* reproduces asexually by formation of spores.

• At maturity, the hyphae produce tiny blob-on-stick structures, called sporangia.

• The sporangia contain cells, called spores.

• The spores are thick-walled and on reaching a suitable moist surface grow into new individuals.




**Asexual Reproduction in Rhizopus**

**19. List the two types of reproduction. Which one of the two is responsible for bringing in more variations in its progeny and how?** **[All India]**

**Ans.** The two types of reproduction are:

(*a*) Sexual reproduction and

(*b*) Asexual reproduction.

Sexual reproduction brings in more variation in the progeny. It is because:

(*a*) Variations appear during DNA copying, that occurs during gamete or germ cell formation.

(*b*) DNA from two different individuals are combined in the progeny.

**20. What is regeneration? Give one example of an organism that shows this process and one organism that does not. Why does regeneration not occur in the latter?** **[Foreign]**

**Ans.** Regeneration is defined as the ability of any small part of the body to give rise to a new individual e.g.

(*a*) *Hydra* and *Planaria* shows regeneration.

(*b*) Amphibians and human beings do not show regeneration.

- Regeneration is carried out by certain specialised cells, which can proliferate to make a large number of cells and different cells undergo development to become various cell types and tissues.
- Such regenerative cells are not found in amphibians and humans.

**21. What is contraception? Name any two methods. How does the use of these methods have a direct effect on the health and prosperity of a family? State any three points.** **[Foreign]**

**Ans.** Contraception refers to the prevention of pregnancy by different mechanisms.

The contraceptive methods include

(*a*) Mechanical barrier methods

(*b*) Hormonal imbalance method

(*c*) Intra-uterine contraceptive devices

(*d*) Surgical methods. (*any two*)

**Impact of use of contraceptives:**

(*a*) Use of mechanical barriers like condoms can prevent the spread of sexually-transmitted diseases.

(*b*) Pregnancy will make major demands on the body and mind of the woman and if she is not ready for it, her health will be adversely affected; such a condition can be avoided.

(*c*) By having a small family, the standard of living can be improved.

**22. What is placenta? Describe its two major functions.** **[Foreign]**

**Ans. Structure of placenta:**

- Placenta is a disc-like structure embedded in the uterine wall.
- It contains villi on the embryo's side and on the mother's side there are blood spaces, which surround the villi; this arrangement provides a large surface area for exchange of materials.

**Functions of placenta:**

- It transfers glucose and oxygen from the mother's blood to the foetus.
- It also removes the wastes ($CO_2$ and nitrogenous wastes) generated by the foetus to the mother's blood.

## Long Answer Type Questions [5 Marks]

**23. (*a*) Name the organ that produces sperms as well as secretes a hormone in human males. Name the hormone it secretes and write its functions.**

**(*b*) Name the parts of the human female reproductive system where fertilisation occurs.**

**(*c*) Explain how the developing embryo gets nourishment inside the mother's body.** **[Delhi]**

READERS VENUE

**Ans.** (*a*) The male organ is testis. It secretes the hormone testosterone and regulates the formation of sperms.

— It brings about changes in the appearance of boys at the time of puberty.

(*b*) Fertilisation occurs in the oviduct.

(*c*) The developing embryo gets nourishment from the mother's blood with the help of a special tissue, called placenta.

The placenta provides a large surface area for the passage of glucose and oxygen from the mother's blood to the embryo.

**24. (*a*) Write the functions of each of the following parts in a human female reproductive system:**

**(*i*) Ovary (*ii*) Uterus (*iii*) Fallopian tube**

**(*b*) Write the structure and functions of placenta in a human female.** **[All India]**

**Ans.** (*a*) (*i*) **Ovary**

- It produces the female gametes or ova for reproduction.
- It also produces the female sex hormones.

(*ii*) **Uterus**

- Implantation of the embryo occurs in the lining of uterus and the complete development of foetus occurs here.
- The contractions of the muscles of uterus help in child birth.

(*iii*) **Oviduct**
- It transports the ova from the ovary to uterus/womb.
- Fertilisation occurs in the oviduct.

(*b*) Refer to Ans. 22.

**25. Give one example each of unisexual and bisexual flowers. Differentiate between the two types of pollination that occur in flowers. What happens when a pollen lands on the suitable stigma? Write about the events that occur till the seed formation in the ovary.** **[Foreign]**

**Ans.** Unisexual flowers—Papaya or watermelon.

Bisexual flowers—Mustard, *Hibiscus* the two types of pollination are:

(*a*) Self-pollination and (*b*) Cross-pollination

**Differences**

| Self-pollination | Cross-pollination |
|---|---|
| – It is the process of transfer of pollen from the anther to the stigma of the same flower. | – It is the process of transfer of pollen from the anthers of a flower to the stigma of another flower. |
| – Genetic variations do not occur. | – Genetic variations occur. |

When a pollen lands on a suitable stigma. A pollen tube grows out of the pollen grain and grows through the style to reach the ovary, where the female gamete is present.
- The pollen tube carries the male gametes.
- Fertilisation occurs in the ovule and a zygote is formed.
- The zygote undergoes repeated cell divisions and forms the embryo inside the ovule.
- The ovule develops a tough coat and is converted into a seed.
- The ovary grows into a fruit.
- The sepals, petals and stamens fall off.

## 2017 (Compartment)

### Short Answer Type [I] Questions [2 Marks]

**26. List any four modes of asexual reproduction.** **[All India]**

**Ans.** Modes of asexual reproduction

(*i*) Fission (*ii*) Fragmentation
(*iii*) Regeneration (*iv*) Budding

### Short Answer Type [II] Questions [3 Marks]

**27. (*a*) Write the functions of the following parts of human male reproductive system:**
**(*i*) Testis; (*ii*) Vas deferens; (*iii*) Urethra; (*iv*) Prostate**
**(*b*) List any two common pubertal changes that appear in human males.** **[Delhi]**

**Ans.** (*a*) (*i*) **Testis**
- It produces the male gametes, sperms, for reproduction.
- It also secretes male sex hormones.

(*ii*) **Vas deferens**
- It transports the sperms formed in the testis to urethra.

(*iii*) **Urethra**
- It forms the common passage for sperms and urine to the outside.

(*iv*) **Prostate**
- It is a gland which secretes a fluid, which provide nutrition and a medium for the sperms to move in the female reproductive tract towards the egg cell.

(*b*) The pubertal changes in boys
- Their voice begins to crack.
- Growth of hair on the face.
- The penis occasionally begins to become enlarged and erect. (*any two*)

**28. What is asexual reproduction? Write the process of budding in Hydra.** **[Delhi]**

**Ans.** - The reproduction which involves a single parent and no formation or fusion of germ cells (gametes), is called asexual reproduction.
- Budding in *Hydra*.
- *Hydra* uses the regenerative cells for reproduction.
- A bud develops as an outgrowth due to repeated cell divisions at a specific site.
- The bud develops into a tiny individual.
- When fully mature, it detaches from the parent body and becomes a new independent individual.

READERS VENUE

**29. List and explain briefly any three methods of contraception.** **[Delhi]**

**Ans. Methods of contraception**

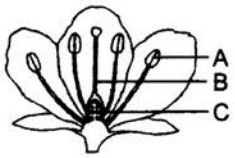
(*i*) Creation of a mechanical barrier
- The sperms do not reach the egg e.g. condoms or similar coverings worn in the vagina do not allow the sperms to come in contact with the ovum.

(*ii*) Changing the hormonal balance
- The eggs are not released and hence, fertilisation cannot occur, e.g. oral pills.

(*iii*) Use of contraceptive devices
- The devices placed in the uterus prevents pregnancy, e.g. copper T.

(*iv*) Surgical methods
- In males, the vas deferens is blocked.
- In females, the fallopian tube is blocked.
- In these methods, the transport of gametes is prevented and hence, they cannot meet for fertilisation. (*Any three*)

**30. Name the three parts A, B and C of the flower shown in the figure and state one function of each.** **[All India]**




**Ans. Parts of a Flower:**

**A: Anther:** It produces the pollen grains, which later form the male gametes for reproduction.

**B: Style:** It exposes the stigma for pollination.

**C: Ovary:** It contains ovule(*s*) and each ovule contains an egg cell, the female germ cell.

## Long Answer Type Questions [5 Marks]

**31. (*a*) What is pollination? Give its two types.**

**(*b*) Draw a longitudinal section of female reproductive part of a flower showing germination of pollen grain. Label on it the following:**

**(*i*) Stigma; (*ii*) Pollen tube with a male germ cell;**

**(*iii*) Female germ cell.** **[Delhi]**

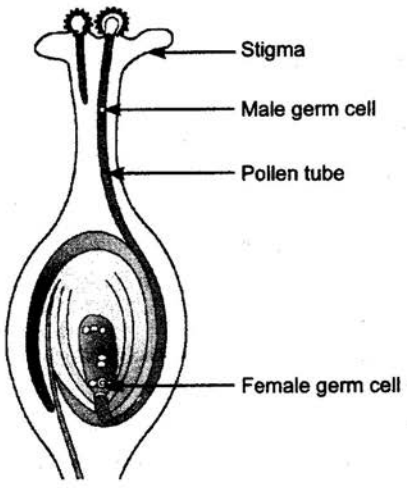
**Ans.** (*a*) Pollination refers to the transfer of pollen grains from the anther to the stigma of a flower.

– It is of two types

(*i*) Self-pollination (*ii*) Cross-pollination

READERS VENUE

(*b*)




**L.S of female reproductive part of a flower showing germination of pollen grain.**

**32. (*a*) Write the functions of the following parts in human female reproductive system:**
**(*i*) Ovary**
**(*ii*) Fallopian tube**
**(*iii*) Uterus**
**(*b*) Describe the structure and functions of placenta.** **[All India]**

**Ans.** (*a*) (*i*) **Ovary**
- It produces the female gametes, ova for reproduction.
- It also secretes the female sex hormones.

(*ii*) **Fallopian tube**
- It carries the egg from the ovary towards uterus.
- Fertilisation occurs in the fallopian tube.

(*iii*) **Uterus**
- The embryo is implanted in the uterus and the complete development of the foetus till birth takes place here.
- It is responsible for the delivery of the infant after complete development.

(*b*) **Placenta**
Refer to Ans. 22.

## 2016

### Very Short Answer Type Questions [1 Mark]

**33. Name the part of *Bryophyllum* where the buds are produced for vegetative propagation.** **[Delhi]**

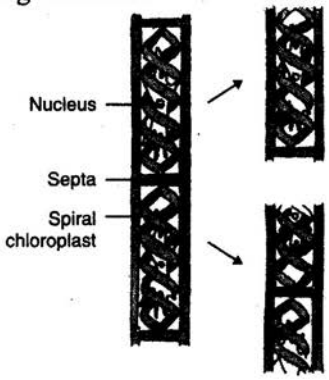
**Ans.** Adventitious buds that arise from the notches in the leaf margins of *Bryophyllum*.

**34. What happens when a *Planaria* gets cut into two pieces?** **[Delhi]**

**Ans.** When *Planaria* gets cut into two pieces, each piece regenerates into a new *Planaria*.

**35. What happens when a mature *Spirogyra* filament attains considerable length?** **[All India]**

**Ans.** When a filament of *Spirogyra* attains considerable length on maturation, it breaks into smaller fragments and each fragment then grows into a new plant. This mode of reproduction is called fragmentation.



**36. What are those organisms called which bear both the sex organs in the same individual? Give one example of such organism.** **[All India]**

**Ans.** These organisms are called hermaphrodites, e.g. earthworms and leech.

**37. List two functions of ovary of human female reproductive system.** **[All India]**

**Ans.** The ovaries have two main reproductive functions in the body. They produce oocytes (eggs) for fertilisation and also produce the reproductive hormones, oestrogen and progesterone.

**38. Name the method by which *Hydra* reproduces. Is this method sexual or asexual?** **[Foreign]**

**Ans.** *Hydra* reproduces by the method of budding. This is an asexual method of reproduction.

**39. Why is fertilization not possible without pollination?** **[Foreign]**

**Ans.** Fertilization is the process in which the pollen and the egg fuse to form the zygote. Pollination is the process through which pollen grains are transferred from anthers of the stamen to the stigma of the carpel. Fertilization is not possible if matured pollen grains do not reach the receptive stigma.

**40. List two unisexual flowers.** **[Foreign]**

**Ans.** Cucumber and watermelon.

## Short Answer Type [II] Questions [3 Marks]

**41. Name the parts A, B and C shown in the following diagram and state one function of each.** **[Delhi]**

READERS VENUE

**Ans.** Refer to Ans. 30.

**42. Suggest three contraceptive methods to control the size of human population which is essential for the health and prosperity of a country. State the basic principle involved in each.** **[Delhi]**

**Ans.** Refer to Ans. 29.

Use of these contraceptive devices helps in preventing unwanted pregnancies. They can prevent the chances of frequent pregnancies which otherwise affect the health of a woman. They help in family planning by controlling the number of children in a family. So, proper care is provided to the children and it also reduces the chances of poverty.

Use of contraceptive devices also reduces the chances of getting sexually transmitted diseases such as AIDS. In this way, the birth control methods play an important role in the health and prosperity of the family.

**43. What are the functions of testis in the human male reproductive system? Why are these located outside the abdominal cavity? Who is responsible for bringing about changes in appearance seen in boys at the time of puberty?** **[Delhi]**

**Ans.** The functions of testis in human male reproductive system are:

(*i*) To produce sperms

(*ii*) To produce the male hormone called testosterone

The testis are located outside the abdominal cavity as the sperms need a lower temperature to mature than the normal body temperature.

Testosterone is responsible for bringing about the changes in the appearance seen in boys at the time of puberty.

**44. How do organisms whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with suitable example.** **[Delhi]**

**Ans.** In asexual reproduction the mother cell divides and forms a similar daughter cell as a result of cell division, so the same number of chromosomes are present in the daughter cell also.

Gamete formation is the first step in sexual reproduction. Number of chromosomes is halved during gamete formation. As a result, the number of chromosomes in gamete is half the number of chromosomes in somatic cells. When male and female gametes fuse during fertilization, the number of chromosomes becomes equal to that in somatic cells. This explains how, offspring and parents of organisms reproducing sexually have the same number of chromosomes.

READERS VENUE

**45. What is multiple fission? How does it occur in an organism? Explain briefly. Name one organism which exhibits this type of reproduction.** **[Delhi]**

**Ans.** Multiple fission is the process of asexual reproduction where the parent cell divides into several small and equal-sized daughter individuals. The nucleus divides to produce large number of nuclei and then the cytoplasm separates forming a membrane around it. Thus, creating multiple daughter cells. *Plasmodium* exhibits this type of reproduction.

**46. What is meant by pollination? Name and differentiate between the two modes of pollination in flowering plants.** **[Delhi, Foreign]**

**Ans.** Refer to Ans. 2.

**47. What is pollination? List its two types and write a distinguishing feature between the two.** **[Delhi; Foreign]**

**Ans.** Refer to Ans. 2.

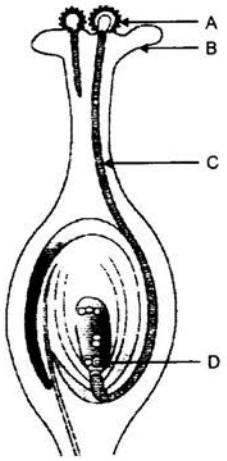
**48. Define reproduction. How does it help in providing stability to the population of species?** **[All India]**

**Ans.** Reproduction is the biological process by which new individual organisms, offspring are produced from their parents. Reproduction is a fundamental feature of all known life; each individual organism exists as the result of reproduction.

Every species has to constantly struggle for its survival. Natural predators and vagaries of nature keep on removing a large section of the population of a particular species. Moreover, the natural cycle of life and death also removes a section of the population. Reproduction is a way to replenish the lost section of population. Thus, it can be said that reproduction is linked to the stability of population of a species.

**49.** (*a*) **List two reasons for the appearance of variations among the progeny formed by sexual reproduction.**

(*b*)




(*i*) **Name the part marked 'A' in the diagram.**

(*ii*) **How does 'A' reach part 'B'?**

(*iii*) **State the importance of the part 'C'.**

(*iv*) **What happens to the part marked 'D' after fertilisation is over?** **[All India]**

**Ans.** (*a*) (*i*) Crossing over between two chromosomes during meiosis in the process of gametes formation is a major reason for variation.

(*ii*) Genetic material coming from two parents in the offspring cause variation.

(*b*) (*i*) pollen grain.

(*ii*) by wind, animals, etc.

(*iii*) Pollen tube carries the pollens to the ovary.

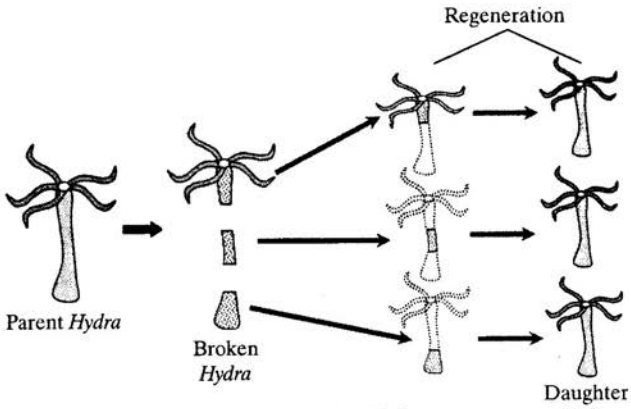
(*iv*) After fertilization, the zygote formed changes into a fruit.

**50.** **Explain the term "Regeneration" as used in relation to reproduction of organisms. Describe briefly how regeneration is carried out in multicellular organisms like *Hydra*.** **[All India]**

**Ans.** Regeneration is the ability of organisms to generate lost or damaged body parts.

Many fully differentiated organisms show the ability of regeneration.

In *Hydra*, if the body is cut into half, the lower part will develop head while the upper part will develop a new foot. If its cells are separated and aggregated back, *Hydra* will reform its structure.




**Regeneration in *Hydra***

**51. In the context of reproduction of species state the main difference between fission and fragmentation. Also give one example of each.** **[All India]**

**Ans.**

| Fission | Fragmentation |
|---|---|
| 1. It occurs in unicellular organisms. | 1. It occurs in multicellular organisms. |
| 2. The cells splits into 2 or more cells, giving rise to daughter cells. | 2. The body of the organism simply breaks into smaller pieces upon maturation. These pieces grow into new individuals. |
| e.g. *Amoeba* | e.g. *Spirogyra* |

**52. What happens when**

**(*a*) *Planaria* gets cut into two pieces?**

**(*b*) A mature *Spirogyra* filament attains considerable length?**

**(*c*) On maturation sporangia burst?** **[Foreign]**

PAPERS VENUE

**Ans.** (*a*) Refer to Ans. 34.

(*b*) Refer to Ans. 35.

(*c*) These are non-motile spores produced inside structures called sporangia in fungi such as *Rhizopus* and *Mucor*. On maturation, sporangial wall rupture and spores are dispersed to grow into a new individual. These spores are dispersed by wind.

**53. What is sexual reproduction? List its four significances.** **[Foreign]**

**Ans.** The production of new living organisms by combining genetic information from two individuals of different types (sexes). In most higher organisms, one sex (male) produces a small motile gamete which travels to fuse with a larger stationary gamete produced by the other (female).

(*i*) Two different sexes, i.e. male and female take part in the process.

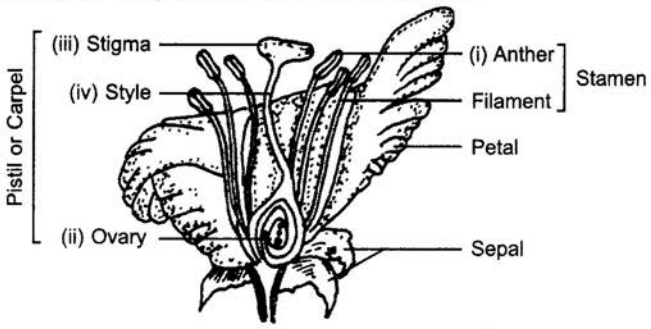
(*ii*) Testis in male produces the male gametes or sperms and the ovary in female produces female gametes or ova.

(*iii*) Variations appear due to new combinations of genes during crossing over.

(*iv*) Daughter organisms or offsprings are genetically different from the parents.

**54. Name the reproductive parts of an angiosperm. Where are these parts located? Explain in brief the structure of its female reproductive parts.** **[Foreign]**

**Ans.** The male reproductive part of an angiosperm is the stamen and female reproductive part is the pistil/carpel. They are located in the flower.




Female reproductive part (carpel/pistil) consists of the following:
**Stigma:** sticky landing site for pollen grains.
**Style:** a tube that contains male germ cells, and leads to ovary.
**Ovary:** contains ovules that develops into seeds.

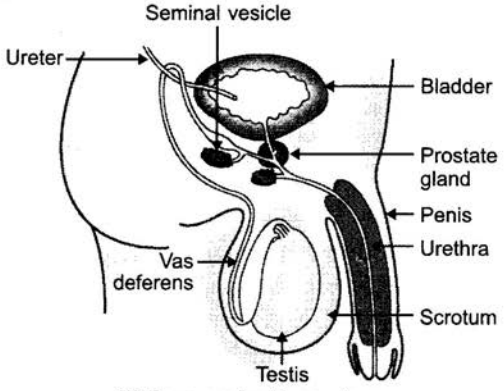
**55. (*a*) Mention the role of the following organs of human male reproductive system:**
**(*i*) Testis (*ii*) Scrotum (*iii*) Vas deferens (*iv*) Prostate glands**
**(*b*) What are the two roles of testosterone?** **[Foreign]**

**Ans.** (*a*) (*i*) **Testis:** These are the male reproductive organs responsible for producing male hormone testosterone and sperms.

(*ii*) **Scrotum:** It regulates the temperature of the testes.

(*iii*) **Vas deferens:** It transports mature sperm to the urethra, the tube that carries urine or sperm to outside of the body, in preparation for ejaculation.

(*iv*) **Prostate glands:** The job of the prostate gland is to secrete prostate fluid, one of the components of semen. The mixture of sperm and fluid is called semen. The muscles of the prostate gland also help to propel the seminal fluid through the urethra and into the female reproductive organ during ejaculation.




**Male reproductive system**

(*b*) **Two roles of testosterone are as follows:**

(*i*) It regulates the formation of sperms.

(*ii*) At the time of puberty, certain changes are seen in the appearance in boys. These are due to this hormone.

## Long Answer Type Questions [5 Marks]

**56.** (*a*) **Write the functions of the following parts in human female reproductive system:**

(*i*) **Ovary** (*ii*) **Oviduct** (*iii*) **Uterus**

(*b*) **Describe the structure and function of placenta.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 24 (*a*).

(*b*) Refer to Ans. 22.

**57.** **What is placenta? Describe its structure. State its functions in case of a pregnant human female.** **[All India]**

**Ans.** Placenta is a special tissue that develops between the uterine wall and the embryo (foetus). This eventually grows into a flat disc–shaped structure covering part of the uterine wall.

**Functions:** The role of placenta in human female is as follows:

(*i*) During pregnancy, placenta attaches the foetus to uterine wall.

(*ii*) It possesses villi that increases the surface area for fixation and absorption.

(*iii*) It facilitates the passage of nutrition and oxygen to embryo from mother through blood.

(*iv*) Waste substances produced by embryo (foetus) are removed through placenta into mother's blood.

READERS VENUE

**58.** **What is vegetative propagation? List with brief explanation three advantages of practising this process for growing some types of plants. Select two plants from the following which are grown by this process:**

**Banana, Wheat, Mustard, Jasmine, Gram.** **[Foreign]**

**Ans.** **Vegetative propagation:** It is a process by which new organisms arise without production of seeds or spores. It can occur naturally or be induced by using chemicals horticulturists.

The advantages of vegetative propagation are as follows:

- It helps in the easy propagation of non-flowering plants.
- It helps in producing hybrid varieties of various plants with improved qualities.
- It helps in propagation of plants in a fast way.
- It helps in the propagation of plants which do not produce seeds, e.g. banana and jasmine.

**59.** (*a*) **State in brief the functions of the following organs in the human female reproductive system:**

**Ovary, Fallopian tube, Uterus.**

(*b*) **What is menstruation? Why does it occur?** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 56 (*a*).

(*b*) Every month or so, the uterus lining gets thicker to prepare for a fertilized egg, if the woman becomes pregnant. If the egg doesn't get fertilized, that lining is released from the body as blood through the vagina. This monthly process is called menstruation.

## 2015

### Very Short Answer Type Questions [1 Mark]

**60. List two functions performed by the testis in human beings.** **[Delhi]**

**Ans.** Functions of testis are:

1. Production of sperms
2. Production of the hormone testosterone.

**61. Name the life process of an organism that helps in the growth of its population.** **[All India]**

**Ans.** Reproduction.

**62. Name two simple organisms having the ability of regeneration.** **[All India]**

**Ans.** *Hydra* and *Planaria* have the ability of regeneration.

**63. Name the causative agent of the disease "Kala-azar" and its mode of asexual reproduction.** **[Foreign]**

**Ans.** The causative organism of the disease "Kala-azar" is *Leishmania*. It reproduces by binary fission.

READERS VENUE

**64. Name the parts of a bisexual flower that are not directly involved in reproduction.** **[Foreign]**

**Ans.** Sepals and petals of bisexual flowers are not directly involved in reproduction.

### Short Answer Type [I] Questions [2 Marks]

**65. Write two differences between binary fission and multiple fission in tabular form.** **[Delhi]**

**Ans.**

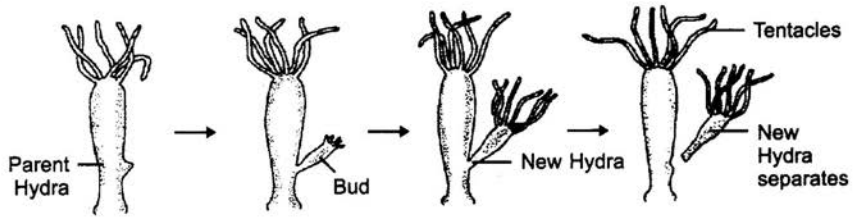
| Binary fission | Multiple fission |
|---|---|
| (*i*) It is the division of the parent into two nearly equal sized daughter individuals. | (*i*) It is the division of the parent into many small daughter individuals. |
| (*ii*) Nucleus divides into two parts with equal distribution of all the material to form two new individuals. | (*ii*) Nucleus of the parent cell divides to form a number of small nuclei and develop into many new individuals. |

### Short Answer Type [II] Questions [3 Marks]

**66. Explain budding in *Hydra* with the help of labelled diagrams only.** **[Delhi]**

**Ans.** A bud develops as an outgrowth on parent body due to repeated cell division at a specific site. These buds develop into individuals, which detach from parent body when they mature.

In *Hydra*, the cells divide rapidly at a specific site and develop as an outgrowth called a bud. These buds, while attached to parent plant, develop into small individuals. When it becomes larger enough, it detaches itself from parents body to exist as an independent individual.




**67. List any four methods of contraception used by humans. How does their use have a direct effect on the health and prosperity of a family.** **[Delhi]**

**Ans.** Refer to Ans. 29.

**Impact of use of contraceptives:** Refer to Ans. 21.

**68. What are sexually transmitted diseases? List two example of each disease caused due to (*i*) bacterial infection and (*ii*) viral infection. Which device or devices may be used to prevent the spread of such diseases?** **[Delhi]**

**Ans.** Diseases that are transmitted from one person to another through contact sexual contact are known as sexual transmitted diseases.

(*i*) **Diseases caused due to bacterial infection:** Gonorrhoea and Syphilis.

(*ii*) **Diseases caused due to viral infection:** AIDS, Herpes.

Use of condoms can prevent the spread of these diseases to a great extent.

**69. (*a*) Name the following:**

**(*i*) Thread like non-reproductive structures present in *Rhizopus*.**

**(*ii*) 'Blobs' that develop at the tips of the non-reproductive threads in *Rhizopus*.**

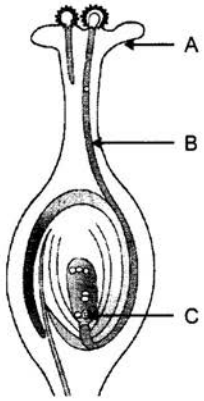
**(*b*) Explain how these structures protect themselves and what is the function of the structures released from the 'blobs' in *Rhizopus*.** **[Delhi]**

**Ans.** (*a*) (*i*) Thread like non-reproductive structures present in *Rhizopus* are known as the hyphae.

(*ii*) Spores develop at the tips of the non-reproductive threads in *Rhizopus* at the tips of the hyphae.

(*b*) In fungi *Rhizopus*, some specialized hyphae give rise to globular structures known as sporangia, containing spores. The sporangia burst to release spores. Since these spores are light and disperse by air, they land on various substances. When the spores find suitable substrata for germination, each of these spores germinate to produce a new individual. During unfavorable conditions these spores are protected by thick walls until they come in contact with favorable substrata.

**70. Name the parts A, B and C shown in the diagram and write their functions.**




[Delhi; All India]

**Ans.** **A** - Stigma

**Function:** Pollen lands on it and germination starts.

**B** - Pollen tube

**Function:** It carries the pollen to the egg cell for fertilization.

**C** - Egg cell

**Function:** It fuses with the male gamete to form a zygote.

**71. List six specific characteristics of sexual reproduction.** **[All India]**

**Ans.** Following are the characteristics of sexual reproduction:

- Two different sexes, i.e. male and female take part in the process.
- Testis in male produces the male gametes or sperms and the ovary in female produces female gametes or ova.
- Gametes are formed by meiosis or reduction division and so are haploid in nature.
- Sperms are motile and move towards ovum for fertilisation.
- Sperms and ova come into contact with each other and fuse to form a zygote or egg by a process called fertilisation.
- It involves slow multiplication.
- Variations appear due to new combinations of genes during crossing over.
- Daughter organisms or offsprings are genetically different from the parents.

The diploid zygote then divides by mitosis and passes through different developmental phases to transform into a multicellular individual.

**72. List four points of significance of reproductive health in a society. Name any two areas related to reproductive health which have improved over the past 50 years in our country.** **[All India]**

**Ans.** Significance of reproductive health in a society:

(*a*) It prevents the spread of various sexually transmitted diseases such as AIDS, syphilis, etc.

(*b*) Individuals with sound reproductive health produce better offspring which have better chances of survival.

(*c*) Better sex education and awareness helps to maintain the population and prevent population explosion.

(*d*) Unwanted and teen pregnancies can be avoided.

The reproductive health in India has improved tremendously over the past 50 years.

(*a*) Family planning: Better family planning has led to reduction in family size.

(*b*) Mortality rate: Mother and infant mortality rates have drastically reduced because of better health care facilities.

**73. List three distinguishing features between sexual and asexual types of reproduction, in tabular form.** **[All India]**

**Ans.** Refer to Ans. 4.

**74. List four categories of contraceptive methods. State in brief two advantages of adopting such preventive methods.** **[All India]**

**Ans.** Refer to Ans. 29.

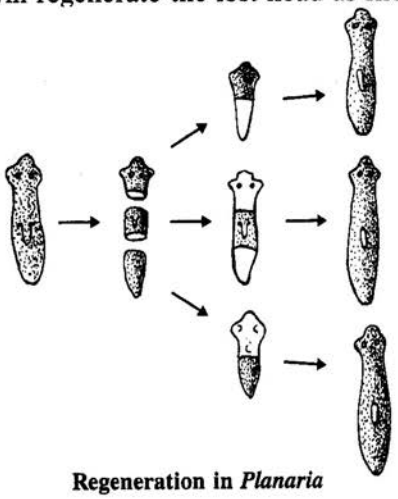
**Two advantages of adopting such preventive methods:** Refer to Ans. 3 (*b*).

**75. Write one main difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of survival—the one reproducing asexually or the one reproducing sexually? Justify your answer.** **[Foreign]**

**Ans.** The difference between asexual and sexual reproduction is that only one parent is needed in asexual reproduction whereas two parents are needed in sexual reproduction. The organisms reproducing sexually have better chances of survival because it promotes diversity of characters in an offspring due to combinations of genes which can lead to variation, whereas in asexual reproduction evolutionary change is not possible as only one parent is involved therefore no variation takes place.

**76. Explain the process of regeneration in *Planaria*. How is this process different from reproduction?** **[Foreign]**

**Ans.** *Planaria* is a type of flatworm. It has the amazing capacity to regenerate its lost body parts. If it is cut horizontally, separating the head from the tail, the head will regenerate the lost tail and the tail will regenerate the lost head as shown below:



**Regeneration in *Planaria***

Regeneration is carried out by specialized cells, in which the organism needs to be cut into pieces to get more organisms. In reproduction, the organism need not to be cut to multiply or to form new offspring.

**77. What is placenta? Explain its function in humans.** **[Foreign]**

**Ans.** Refer to Ans. 22.

**78. Draw longitudinal section of a bisexual flower and label the following parts on it:**

**(*i*) Anther** **(*ii*) Ovary**

**(*iii*) Stigma** **(*iv*) Style** **[Foreign]**

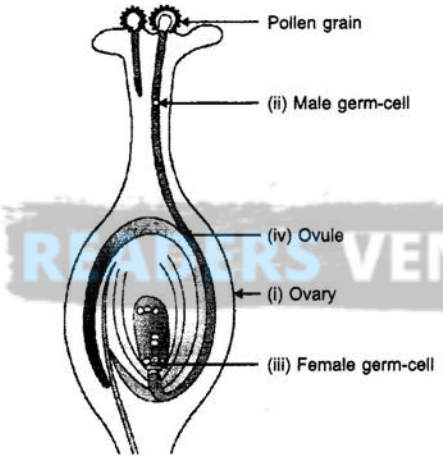
**Ans.** Refer to Ans. 54.

**79. Explain any three advantages of vegetative propagation.** **[Foreign]**

**Ans.** Refer to Ans. 16.

**80. Draw a diagram of the longitudinal section of a flower exhibiting germination of pollen on stigma and label (*i*) ovary, (*ii*) male germ-cell, (*iii*) female germ-cell and (*iv*) ovule on it.** **[Foreign]**

**Ans.**

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## Long Answer Type Questions [5 Marks]

**81. Write the functions of the following in human female reproductive system:**

**Ovary, oviduct, uterus**

**How does the embryo get nourishment inside the mother's body? Explain in brief.** **[Delhi]**

**Ans.** Refer to Ans. 24 (*a*).

After implantation, a disc-like special tissue called placenta develops between the uterus wall and the embryo. The placenta helps in the exchange of nutrients, oxygen and waste products between the embryo and the mother. Thus, it provides nourishment to the growing embryo.

**82.** **(*a*) Name the human male reproductive organ that produces sperms and also secretes a hormone. Write the functions of the secreted hormone.**

**(*b*) Name the parts of the human female reproductive system where**

**(*i*) fertilisation takes place,**

**(*ii*) implantation of the fertilised egg occurs.**

**Explain how the embryo gets nourishment inside the mother's body.** **[All India]**

**Ans.** (*a*) Testes produce sperms and secrete a hormone called testosterone.

The function of testosterone is to control the development of male sex organs and male secondary sexual characteristic such as a deeper voice, moustache, beard and more body hair as compared to females.

(*b*) (*i*) Fertilisation takes place in the oviduct or fallopian tubes.

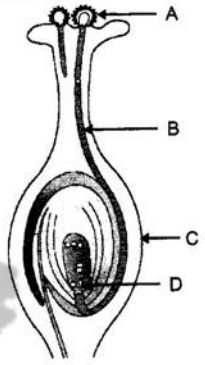
(*ii*) Implantation of the fertilised egg occurs in the uterus.

**83.** **(*a*) Identify A, B, C and D in the given diagram and write their names.**

**(*b*) What is pollination? Explain its significance.**

**(*c*) Explain the process of fertilisation in flowers. Name the parts of the flower that develop after fertilisation into**

**(*i*) seed,** **(*ii*) fruit.** **[Foreign]**




**Ans.** (*a*) A – Stigma B –Pollen tube

C – Ovary D – Female germ cell / Egg cell

(*b*) **Pollination:** Transfer of pollen grains from anther to the stigma of a flower.

**Significance of pollination:** Process of pollination leads to fertilization as it brings the male and female gametes together for fusion.

(*c*) After a pollen falls on a suitable stigma, the pollen tube grows out of the pollen grain and travels through the style to reach the ovule in the ovary. Here the male germ cell (carried by the pollen tube) fuses with the female germ cell to form a zygote.

(*i*) Ovule (*ii*) Ovary

## 2014

### Short Answer Type [I] Questions [2 Marks]

**84.** **List four advantages of vegetative propagation.** **[Delhi]**

**Ans.** Refer to Ans. 16.

**85.** **List four modes of asexual reproduction.** **[Delhi]**

**Ans.** Four modes of asexual reproduction are:

(*i*) **Fragmentation:** It is the unintentional cutting up of the body of an organism in which each part grows into a different organism, e.g. in fungi, annelids.

(*ii*) **Budding:** Formation of new individual from an outgrowth called a bud, e.g. in Yeast and *Hydra*.

(*iii*) **Multiple fission:** A single cell divides into many daughter cells simultaneously, e.g. in *Plasmodium*.

(*iv*) **Binary fission:** A single cell divides into two halves, e.g. in bacteria and *Amoeba*.

**86. List four modes of asexual reproduction other than fission in the living organisms.** **[Delhi]**

**Ans.** Four modes of reproduction other than fission are:

(*a*) Fragmentation (*b*) Regeneration

(*c*) Budding (*d*) Spore formation

**87. Draw labelled diagrams to illustrate budding in *Hydra*.** **[All India]**

**Ans.** Refer to Ans. 66.

**88. What is the main difference between sperms and eggs of humans? Write the importance of this difference.** **[All India]**

**Ans.** Sperm has Y or X chromosome as its sex chromosomes, while egg has X-chromosome as its sex chromosome. There is a marked difference in size, shape, metabolic activity, cytoplasm content, motility, etc. in the sperms and eggs.

The difference in the sperm and egg cells helps to determine sex of a child.

It is determined by the type of sperm that fertilise the egg. If a sperm containing Y chromosome fertilises the egg, a male child develops, whereas a sperm with X chromosome, results in a female child after fertilization.

**89. (*a*) How do *Leishmania* and *Plasmodium* reproduce?**

**(*b*) State one difference in their mode of reproduction.** **[Foreign]**

**Ans.** (*a*) *Leishmania* and *Plasmodium* both reproduce through fission.

(*b*) One main difference in their mode of reproduction is that *Leishmania* reproduce through binary fission while *Plasmodium* reproduce through multiple fission.

**90. Define multiple fission. Give one example.** **[Foreign]**

**Ans.** Refer to Ans. 45.

**91. List two preparations shown every month by the uterus in anticipation of pregnancy in humans.** **[Foreign]**

**Ans.** Uterus prepares itself in the following ways:

(*i*) The uterine wall becomes thick with rich blood supply to receive the egg.

(*ii*) The placenta (a disc-like structure) is formed to help the zygote to get attached to the uterine wall for nutrition and exchange of gases.

## Short Answer Type [II] Questions [3 Marks]

**92.** **(*a*) Write the names of those parts of flower which serve the same function as the following do in the animals:**
**(*i*) testis (*ii*) sperm (*iii*) ovary (*iv*) egg**
**(*b*) State the function of flowers in the flowering plants.** **[Delhi]**

**Ans.** (*a*) (*i*) Testis – Anther
In animals, testis produces sperm.
In plants, anther produces pollen grains.
(*ii*) Sperm – Pollen grain
Sperm is the male gamete in animals.
Pollen grain is the male gamete in plants.
(*iii*) Ovary – Ovary
In animals, ovary produces eggs.
In plants also, ovary contains ovules.
(*iv*) Egg – Ova/Ovum
Egg after fertilisation with sperm produces embryo. Ova turns to zygote after the fusion of male gamete.

(*b*) Flowers assist in sexual reproduction. Flower is the most important part in angiosperms because the reproductive parts are located inside it.

**93.** **List four methods of contraception used by humans. Justify the following statement: "The use of contraceptive methods has a direct effect on the health and prosperity of a family."** **[Delhi, All India]**

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**Ans.** Refer to Ans. 29 and 21.

**94.** **Draw diagrams to explain the regeneration that takes place in each of the body parts of *Planaria* when its body is cut into three pieces. Name any other organism in which a similar process can be observed.** **[Delhi]**

**Ans.** Refer to Ans. 76.
*Hydra* is also another organism in which a similar process can be observed.

**95.** **On cutting the body of an organism into many pieces it was observed that many of these pieces developed as new individuals. Name the process and list two organisms in which this process may be observed. Draw a schematic diagram to illustrate the changes that are likely to be observed during the development of new individuals in any one of the organisms named.** **[Delhi]**

**Ans.** The process of developing new individuals from the pieces of an organism is called regeneration. It is observed in *Planaria* and *Hydra*.
**Diagram:** Refer to Ans. 76.

**96.** **Explain the process of regeneration in *Planaria*. How is this process different from reproduction?** **[All India]**

**Ans.** Refer to Ans. 76.

**97. What is placenta? State its function in human female.** **[All India]**

**Ans.** Refer to Ans. 57.

**98. List any two modes of asexual reproduction in animals. Under which mode of reproduction is vegetative propagation placed and why? List two advantages of vegetative propagation.** **[All India]**

**Ans.** Two modes of asexual reproduction in animals are:

(*i*) **Binary fission:** Many bacteria and protozoa simply split into two equal halves during cell division.

(*ii*) **Fragmentation:** *Spirogyra* simply breaks up into smaller pieces upon maturation. These pieces or fragments grow into new individuals.

**Two advantages of vegetative propagation:** Refer to Ans. 58.

**99. Write one difference between asexual and sexual mode of reproduction. Which species is likely to have better chances of survival – the one reproducing asexually or the one reproducing sexually? Justify your answer.** **[All India]**

**Ans.** Refer to Ans. 75.

**100. Describe in brief the function of the various parts of the female reproductive part of a bisexual flower.** **[Foreign]**

**Ans.** **Two advantages of vegetative propargation:** Refer to Ans. 1.

**101. On the notice board of ultrasound clinics it is generally stated, "Here prenatal sex determination and disclosure of sex (boy or girl before birth) of foetus is not done. It is prohibited and punishable under law."**

**(*a*) List two advantages of imposing ban on prenatal sex determination.**

**(*b*) What can students do to educate the society about the following?**

**(*i*) The ill-effects of indiscriminate female foeticide.**

**(*ii*) Adopting small family norms.** **[Foreign]**

**Ans.** (*a*) Banning of prenatal sex determination will:

(*i*) avoid female foeticide.

(*ii*) improve sex ratio in the country.

(*b*) (*i*) Ignorance is one of the major causes for the increase in the indiscriminate female foeticide. Therefore, spreading awareness can go a long way in saving our future sisters, mothers, daughters and wives.

(*ii*) The size of the family is a matter of great importance not only for the country as a whole but also for the welfare and health of the individual, the family and the community. So, skits can be shown highlighting the advantages of small family.

**102. Name the two reproductive parts of a bisexual flower which contain the germ cells. State the location and function of its female reproductive part.** **[Foreign]**

**Ans.** The two reproductive parts of a bisexual flower are stamen and carpel.

Refer to Ans. 1.

**103. What is vegetative propagation? List its two advantages. Select two plants raised by this method from the list given below:**

**Wheat, tomato, rose, pea, gram, corn, banana.** **[Foreign]**

**Ans.** Refer to Ans. 58.

From the list given, banana and rose can be raised by vegetative propagation.

## Long Answer Type Questions [5 Marks]

**104. (*a*) Give one example each of a unisexual and a bisexual flower.**

**(*b*) Mention the changes a flower undergoes after fertilisation.**

**(*c*) How does the amount of DNA remain constant though each new generation is a combination of DNA copies of two individuals?** **[Delhi]**

**Ans.** (*a*) Unisexual flowers—Watermelon, cucumber, papaya, etc. (*any one*)

Bisexual flowers—*Hibiscus*, rose, lily, etc. (*any one*)

(*b*) **Changes in a flower after fertilisation:**

After fertilisation, the zygote divides several times to form an embryo within the ovule. The ovule develops a tough coating and is gradually converted into a seed. The ovary grows rapidly and ripens to form a fruit. Meanwhile, the petals, sepals, stamens, style and stigma may shrivel and fall off. However, in some cases, they remain persistent in the fruit.

(*c*) The reproducing cells produce a copy of their DNA through some chemical reactions and result in two copies of DNA. The copying of DNA always takes place along with the creation of additional cellular structure. This process is then followed by the division of a cell into two cells. In this way, the amount of DNA remains constant through each new generation.

**105. (*a*) Name the respective part of human female reproductive system:**

**(*i*) that produces eggs,**

**(*ii*) where fusion of egg and sperm takes place, and**

**(*iii*) where zygote gets implanted.**

**(*b*) Describe in brief what happens to the zygote after it gets implanted.** **[Delhi]**

**Ans.** (*a*) (*i*) Ovary (*ii*) Fallopian tube (*iii*) Uterus

(*b*) Refer to Ans. 13 (*b*).

**106. (*a*) Write the name of the human male reproductive organ that produces sperms and secretes a hormone. Name the hormone secreted and state its function.**

**(*b*) Write the site of fertilisation and the part where the zygote gets implanted in the human female.**

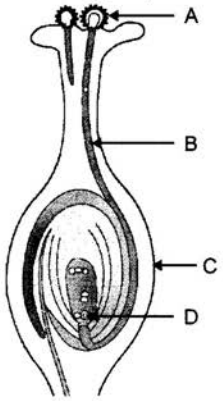
**(*c*) State, in brief, how an embryo gets its nourishment inside the mother's body.** **[Delhi; Foreign]**

**Ans.** (*a*) The formation of sperms takes place in the testes. It secretes the hormone, called testosterone. In addition to regulating the formation of sperms, testosterone brings about changes in appearance seen in boys at the time of puberty.

(*b*) Sperms travelling upwards reach the oviduct where they may encounter the egg. The fertilised egg, the zygote, gets implanted in the lining of the uterus, and starts dividing.

(*c*) Refer to Ans. 81.

**107.** (*a*) **Name the parts labelled as A, B, C and D in the diagram given below:**




(*b*) **What is pollination? State its significance.**

(*c*) **How does fertilisation occur in flowers? Name the parts of the flower that develop into (*i*) seed, and (*ii*) fruit after fertilisation.** **[All India]**

**Ans.** (*a*) A — Pollen grain B — Pollen tube
C — Ovary D — Female germ-cell

(*b*) Refer to Ans. 83 (*b*).

(*c*) After the pollen lands on a suitable stigma, it has to reach the female germ cells which are in the ovary. For this, a tube grows out of the pollen grain and travels through the style to reach the ovary and fertilisation occurs.

The ovule of the flower develops into a seed and its ovary develops into a fruit.

**108.** (*a*) **Draw a sectional view of human female reproductive system and label the part where**

(*i*) **eggs develop.**

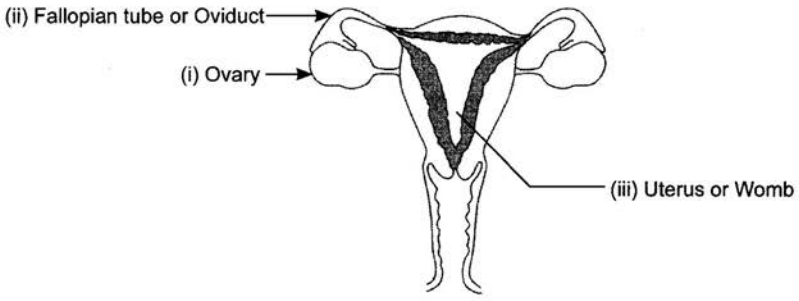
(*ii*) **fertilisation takes place.**

(*iii*) **fertilised egg gets implanted.**

(*b*) **Describe, in brief, the changes the uterus undergoes**

(*i*) **to receive the zygote, (*ii*) if zygote is not formed.** **[All India]**

**Ans.** (*a*)



(*i*) The development of egg occurs in the ovary.

(*ii*) Fertilisation takes place in the fallopian tube.

(*iii*) The fertilised egg gets implanted in the uterus.

(*b*) (*i*) The uterus prepares itself every month to receive a fertilised egg/zygote. The inner uterus lining becomes thick and is supplied with blood to nourish the embryo.

(*ii*) If the egg is not fertilised, then the uterus lining is not required. Hence, it breaks down and gets released in the form of blood and mucous through the vagina. This process lasts for 2 – 8 days.

**109. List in tabular form the two differences between asexual and sexual mode of reproduction. Name and explain with the help of labelled diagram the process by which *Hydra* reproduces asexually.** **[Foreign]**

**Ans. Difference between asexual and sexual reproduction:**

Refer to Ans. 4.

**Asexual reproduction in *Hydra*:**

Refer to Ans. 66.

## 2013

### Very Short Answer Type Questions [1 Mark]

**110. "Cell division is a type of reproduction in unicellular organism." Justify.** **[Delhi]**

**Ans.** The formation of two daughter cells from one parent cell in unicellular organism leads to the production of more individuals.

**111. Name the body part where fertilisation occurs in human female.** **[All India]**

**Ans.** Fallopian tube or oviduct.

**112. Write the number of immature eggs present in the ovaries of a newly born baby girl. Mention what happen to these immature eggs when the girl attains puberty.** **[Foreign]**

**Ans.** The ovaries of a newly born baby girl contain thousands of immature eggs. When the girl attains puberty, some of these start maturing. One egg is produced every month by one of the ovaries.

### Short Answer Type [I] Questions [2 Marks]

**113. Mention the two functions of human testis.** **[Delhi]**

**Ans.** Two functions performed by testis in human beings are as follows:

(*i*) Formation of sperms takes place in testis.

(*ii*) Testis secretes the hormone testosterone which regulates the formation of sperms and brings changes in appearance of boys at the time of puberty.

**114.** **(*a*) Trace the path of sperms from where they are produced in human body to the exterior.**

**(*b*) Write the functions of secretions of prostate gland and seminal vesicle in human.** **[Delhi]**

**Ans.** (*a*) Testes → vasa efferentia → epididymis → vas deferens → ejaculatory duct → urethra runs through penis and opens to the outside.

(*b*) Both prostate gland and seminal vesicles produce fluids, which are released in the urethra for nourishment and transportation of sperms.

**115.** **List two advantages of growing grapes or banana plants through vegetative propagation.** **[All India]**

**Ans.** (*i*) Traits of the parent plants are preserved.

(*ii*) Since they do not possess viable seeds, vegetative propagation is advantageous.

**116.** **(*a*) How do *Leishmania* and *Plasmodium* reproduce?**

**(*b*) State one difference in their mode of reproduction.** **[All India]**

**Ans.** Refer to Ans. 89.

**117.** **List four advantages of vegetative propagation.** **[Foreign]**

**Ans.** Refer to Ans. 16.

## Short Answer Type [II] Questions [3 Marks]

**118.** **Explain the process of regeneration in *Planaria*.** **[Delhi]**

**Ans.** Refer to Ans. 76.

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**119.** **What is placenta? Explain its function in human female.** **[Delhi]**

**Ans.** Refer to Ans. 29.

**120.** **(*a*) Explain the process of regeneration in *Planaria*.**

**(*b*) How is regeneration different from reproduction?** **[Delhi]**

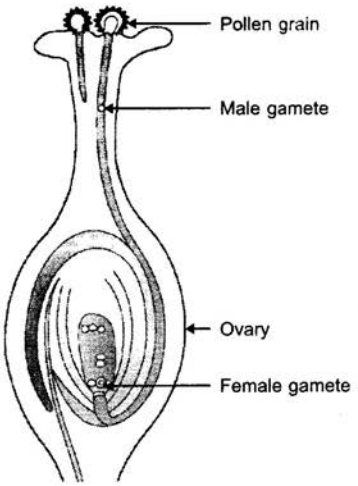
**Ans.** Refer to Ans. 76.

**121.** **Define the term pollination and fertilization. Draw a diagram of a pistil showing pollen tube growth into the ovule and label the following:**

**Pollen grain, male gamete, female gamete, ovary.** **[Delhi]**

**Ans.** **Pollination:** Pollination is the transfer of pollen grains from the anther of a stamen to the stigma of a carpel. The pollen grains are transferred by many agents, such as insects, birds, animals, wind and water.

**Fertilization:** It is the process of fusion of a male gamete with a female gamete to form a zygote. It occurs during sexual reproduction.




**Fertilization in flowering plants**

**122. Write two examples each of sexually transmitted diseases caused by (*i*) bacteria, (*ii*) virus. Explain how the transmission of such diseases be prevented.** **[Delhi]**

**Ans.** Refer to Ans. 68.

**123.** **(*a*) Name the following:**

**(*i*) thread like non-reproductive structures present in *Rhizopus*.**

**(*ii*) 'blobs' that develop at the tips of the non-reproductive threads in *Rhizopus*.**

**(*b*) Explain the structure and the function of the structures released from the 'blobs' in *Rhizopus*.** **[Delhi]**

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**Ans.** Refer to Ans. 69.

**124. Explain the meaning of sexually transmitted diseases (STD). Give two examples of STDs each, caused due to (*i*) bacterial infection and (*ii*) viral infection. State in brief how the spread of such diseases may be prevented.** **[Delhi]**

**Ans.** Refer to Ans. 68.

**125. Describe in brief the role of (*i*) testis (*ii*) seminal vesicle (*iii*) vas deferens (*iv*) ureter (*v*) prostate gland in human male reproductive system.** **[Delhi]**

**Ans.** (*i*) **Testis:** Refer to Ans. 55 [(*a*) (*i*)]

(*ii*) **Seminal vesicle:** It secretes fluid for nourishment of sperms.

(*iii*) **Vas deferens:** Refer to Ans. 55 [(*a*) (*iii*)]

(*iv*) **Ureter:** It is a tube that connects urinary bladder and the genital organs of a male.

(*v*) **Prostate gland:** Refer to Ans. 55 [(*a*) (*iv*)]

**126. Explain budding in *Hydra* with the help of diagrams only.** **[All India]**

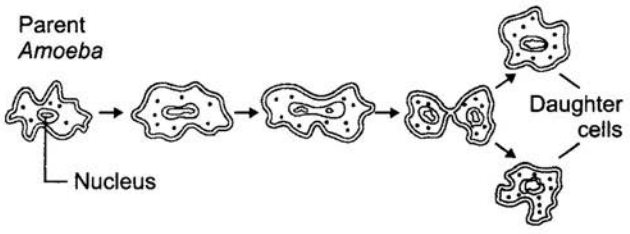
**Ans.** Refer to Ans. 66.

**127. List any four methods of contraception used by humans. How does their use have a direct effect on the health and prosperity of the family?** **[All India]**

**Ans.** Refer to Ans. 29 and 21.

**128. Only with the help of labelled diagrams show binary fission in *Amoeba*.** **[Foreign]**

**Ans.**




**Binary Fission in *Amoeba***

**129. List two functions of each one of the following parts of the human female reproductive system:**

**(*i*) ovaries (*ii*) Fallopian tubes (*iii*) Uterus** **[Foreign]**

**Ans.** Refer to Ans. 24 (*a*).

**130. List four methods to avoid pregnancy. Why should these methods be adopted?** **[Foreign]**

**Ans.** Refer to Ans. 29.

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## Long Answer Type Questions [5 Marks]

**131. (*a*) List three distinguishing features between sexual and asexual types of reproduction.**

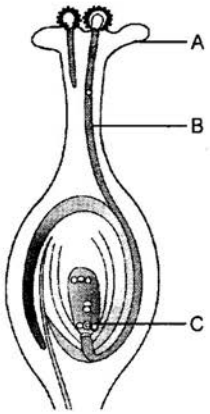
**(*b*) Explain why variations are observed in the offsprings of sexually reproducing organisms.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 4.

(*b*) Variations are the differences in the characters or traits among the individuals of a species. Sexual reproduction gives rise to more viable variations than asexual reproduction because it involves two parents, and when the genes are transmitted from one generation to the next generations the dominant characters are expressed.

**132. (*a*) Identify A, B and C in the given diagram and write their functions.**

**(*b*) Mention the role of gamete and zygote in sexually reproducing organisms.**




**[Delhi]**

**Ans.** (*a*) Refer to Ans. 70.

(*b*) Gametes (or germ cells) are of two types: the male gamete and the female gamete. Male germ cells are produced by pollen grains and female germ cells are produced by ovule. During pollination, the pollen grains reach the stigma and pollen tube starts to grow from the pollen grain inside the style. During fertilisation, the male germ cells travels through the pollen tube and reaches the female germ cell in the ovule.

Fusion of male germ cell with the female germ cell gives rise to zygote. The zygote when grows become a new organism.

**133.** (*a*) **Draw a sectional view of human female reproductive system and label the following parts:**

(*i*) **Where the development of egg occurs.**

(*ii*) **Where fertilization takes place.**

(*b*) **Describe the changes the uterus undergoes:**

(*i*) **to receive the zygote.**

(*ii*) **if zygote is not formed.** **[Delhi]**

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**Ans.** (*a*) Refer diagram to Ans. 108 (*a*) (*i*) and (*ii*).

(*b*) Refer to Ans. 108 (*b*).

**134. What is pollination? How does it occur in plants? How does pollination lead to fertilisation? Explain.** **[All India]**

**Ans.** Refer to Ans. 2.

**135.** (*a*) **Write the function of placenta in human females.**

(*b*) **List four ways of preventing pregnancy. State two advantages of using such preventive methods.** **[All India]**

**Ans.** (*a*) Refer to Ans. 22.

(*b*) Refer to Ans. 29.

**136. Write two causes of human population explosion. Explain with help of suitable examples how this explosion can be checked.** [All India]

**Ans.** Two causes of population explosion are:

(*i*) **Lack of family planning:** There is huge population of our country who do not believe in family planning for various reasons like cultural values where children are believed to be the blessings of god. Also, the poor people believe that more children means more hands to work, so they prefer to have more children.

(*ii*) **Better medical attention:** Today the medical attention has reduced the number of deaths and increased the survival rate. The increase in population can only be checked by the means of contraceptive methods. Small family is a healthy family has to be propagated and taught to the people. Education is a must.

**137. (*a*) Give one example each of a unisexual and a bisexual flower.**

**(*b*) How is the number of chromosomes of the parent cells maintained in the cells of the offsprings of sexually reproducing organisms?**

**(*c*) Mention the changes the flower undergoes after fertilisation.** [Foreign]

**Ans.** (*a*) Papaya is a unisexual and *Hibiscus* is a bisexual flower.

(*b*) The parents are diploid ($2n$) as each of them has two sets of chromosomes. They form haploid ($1n$) male and female gametes through the process of meiosis. The haploid gametes have one set of chromosomes. These two gametes fuse during fertilization and the offspring become diploid ($2n$) which is same as parent's chromosome number.

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(*c*) After fertilisation, the zygote divides several times to form an embryo within the ovule. The ovule develops a tough coat and gradually gets converted into seed. The ovary grows rapidly to form a fruit. Meanwhile, the petals, sepals, stigma and style falls off.

**138. (*a*) Why can fertilisation occur only once in a month in a human female? Explain.**

**(*b*) Prenatal sex determination has been prohibited by law. State the necessity of enforcement of this law.**

**(*c*) Where are human testes located and why? State their functions.** [Foreign]

**Ans.** (*a*) On attaining puberty, the eggs in the ovaries of a human female starts maturing. Only one egg is produced by one of the ovaries every month. Fertilisation can therefore occur only once in a month in a human female.

(*b*) The most ideal female : male sex ratio for a healthy society is 1000:1000. Because of reckless female foeticide, sex ratio is decreasing at an alarming rate in some sections of our society. It has therefore become necessary to ban detection of sex of foetus.

(*c*) Testes are located outside the abdominal cavity inside the scrotum in a human male. The scrotum provides optimum temperature for the formation of sperms.

## 2012

### Short Answer Type [I] Questions [2 Marks]

**139. List two advantages of vegetative reproduction practised in case of an orange plant.** [Delhi]

**Ans.** Two advantages of practising vegetative reproduction in orange plants are:

(*i*) The best variety of oranges can be chosen and propagated as the produce is similar in shape and size.

(*ii*) Many seeds which are produced, are not able to germinate to produce good variety so vegetative propagation is a good option.

(*iii*) It can produce genetically healthy, pest resistant and insect resistant variety.

**140. State one genetically different feature between sperm and eggs of human.** [Delhi]

**Ans.** The sex chromosome of human male is XY. A sperm of human male carries either an X chromosome or one Y chromosome. The sex chromosome of human female is XX and hence, the egg always carries the X chromosome.

If a sperm carrying X chromosome fertilises an egg which carries X chromosome, then the child born will be a girl. If a sperm carrying Y chromosome fertilises an egg which carries X chromosome, then the child born will be a boy.

**141. How does growing embryo get nutrition from the mother's blood?** [Delhi]

**Ans.** The growing embryo gets itself attached or implanted on the uterine wall. Uterus wall gets thickened due to rich supply of blood vessels. The embryo gets attached to the uterine wall through a thick tissue known as the placenta. Placenta contains villi which provides a large surface area for exchange of gases and helps the embryo obtain nutrition from mother's blood. It also helps to pass waste products from embryo to mother.

**142. Define the term puberty. List two changes observed in girls at the time of puberty.** [Delhi]

**Ans.** Puberty is the stage of life when the general body growth has reached its optimum and then it prepares for maturity so as to be able to reproduce. So, reproductive tissues begin to mature and all the hormonal activity begins causing physical changes.

Two basic changes observed in girls at the time of puberty are:

(*i*) The breast size begins to increase.

(*ii*) Menstruation starts.

**143. What is meant by asexual reproduction? List its any two different forms.** [Delhi]

**Ans.** Asexual reproduction is a type of reproduction by which offsprings are produced from a single parent, and inherit the genes of that parent only; it does not involve the fusion of gametes and parental traits are almost never changed.

Fission in *Amoeba* and fragmentation in *Spirogyra* are two different forms of asexual reproduction.

**144. Name an organism which reproduces by spore formation. List three conditions favourable for spores to germinate and grow.** **[All India]**

**Ans.** *Rhizopus* reproduces by spore formation.

Conditions favourable for spore formation are:

(*i*) Availability of food, (*ii*) moist place, and (*iii*) dark place.

**145. State the role of placenta in the development of embryo.** **[All India]**

**Ans.** Refer to Ans. 22.

**146. "DNA copies generated during reproduction will be similar but may not be identical to the original." Justify this statement.** **[All India]**

**Ans.** During the process of cell division, DNA present in the cell gets replicated with the help of biochemical reactions. During there chemical reactions, there is always a chance that during replication of DNA some changes occur. This produces variations in the copy of DNA, thus, making it similar but not identical.

**147. Why is vegetative propagation practised for growing some plants? List two plants which are grown by this method.** **[All India]**

**Ans.** Refer to Ans. 58.

**148. List two advantages of practising vegetative propagation in plants. Select two plants raised by this method from the list given below:**

**Banana, gram, pea, rose, tomato, wheat.** **[Foreign]**

**Ans.** Advantages of vegetative propagation are:

(*i*) Plants raised by vegetative propagation can bear fruits and flowers earlier.

(*ii*) Plants produced are genetically similar.

Banana and rose can be raised by vegetative method.

READERS VENUE

**149. List the parts of human male reproductive system which contribute fluid to the semen. State two advantages semen offers to the sperms.** **[Foreign]**

**Ans.** Prostate glands and seminal vesicles add fluid in the vas deferens.

Semen makes transportation of sperms easier and also provides nutrition to the sperms.

**150. Name the two types of germ-cells present in human beings. How do they structurally differ from each other? Give two differences.** [Foreign)

**Ans.** The two types of germ-cells present in human beings are sperm and ova.

(*i*) The sperm of human has either X or Y chromosome. The ova always carry X chromosome.

(*ii*) The sperm is structurally long with a tail. The ova is round in structure.

## Short Answer Type [II] Questions [3 Marks]

**151. Explain the meaning of sexually transmitted disease (STD). Give two examples of STD each, caused due to (*i*) bacterial and (*ii*) viral infection. State in brief how the spread of such diseases may be prevented.** **[All India]**

**Ans.** Refer to Ans. 68.

**152. List and explain in brief three methods of contraception.** **[All India]**

**Ans.** Refer to Ans. 29.

**153. What is AIDS? Which microbe is responsible for AIDS infection? State one mode of transmission of this disease. Explain in brief one measure for the prevention of AIDS.** **[Foreign]**

**Ans.** AIDS is Acquired Immune Deficiency Syndrome. It is caused by a virus called HIV (Human Immunodeficiency Virus). AIDS is transmitted by sexual contact with an infected person. AIDS can be prevented by avoiding sexual contact with an infected person or by using condom during sex.

## Long Answer Type Questions [5 Marks]

**154. Define the term pollination and fertilization. Draw a diagram of a pistil showing pollen tube growth into the ovule and label the following: Pollen grain, male gamate, female gamete, ovary.** **[Delhi]**

**Ans.** Refer to Ans. 132.

**155. Describe in brief the role of (*i*) testis (*ii*) seminal vesicle, (*iii*) vas deferens, (*iv*) ureter and (*v*) prostate gland in human male reproductive system.** **[Delhi]**

**Ans.** (*i*) **Testis:** Refer to Ans. 55 [(*a*) (*i*)]

(*ii*) **Seminal vesicle:** It secretes fluid for nourishment of sperms.

(*iii*) **Vas deferens:** Refer to Ans. 55 [(*a*) (*iii*)]

(*iv*) **Ureter:** It is a tube that connects urinary bladder and the genital organs of a male.

(*v*) **Prostate gland:** Refer to Ans. 55 [(*a*) (*iv*)]

READERS VENUE

**156. Draw a diagram of a human female reproductive system and label the part**

**(*i*) that produces egg**

**(*ii*) where fusion of egg and sperm take place**

**(*iii*) where zygote is implanted.**

**What happens to human egg when it is not fertilised?** **[All India]**

**Ans.** Refer to Ans. 105 (*a*) (*i*), (*ii*) and (*iii*).

If the egg is not fertilised, the thick and nourishing lining of the uterus breaks and comes through vagina as blood and mucous. This is known as menstruation.

**157. Distinguish between unisexual and bisexual flowers giving one example of each. Draw a diagram showing process of germination of pollen grains on stigma and label the following parts:**

**(*i*) Female germ cell**

**(*ii*) Male germ cell**

**(*iii*) Ovary** **[All India]**

**Ans.** **Unisexual flowers:** Flowers which possess either stamens (male reproductive parts) or the pistil (female reproductive part). They do not have both the parts in the same flower, e.g. papaya, watermelon, cucumber. (*any one e.g.*)

**Bisexual flowers:** Flowers which possess both female and the male reproductive parts in the same flower, e.g. sunflower, *Hibiscus*, mustard. (*any one e.g.*)

**Diagram:** Refer to Ans. 80 (Fig. Fertilization in a flowering plant)

**158. List and explain in brief methods of contraception.** **[All India]**

**Ans.** Refer to Ans. 29.

**159. State in brief the changes that take place in a fertilised egg (zygote) till birth of the child in the human female reproductive system. What happens to the egg when it is not fertilised?** **[Foreign]**

**Ans.** The egg gets fertilised in the oviduct. The fertilised egg, the zygote gets implanted in the lining of the uterus and starts dividing. The uterus prepares itself every month to receive and nurture the growing embryo. The lining thickens and is richly supplied with blood to nourish the growing embryo. The embryo gets nutrition from the mother's blood with the help of a special tissue called placenta. The development of the foetus inside the mother's womb takes approximately nine months. On completion of 9 months, the child is born as a result of rhythmic contractions of the muscles of the uterus. If the egg is not fertilised, the thick and nourishing lining of the uterus breaks and comes through vagina as blood and mucous. This is known as menstruation.

**160.** **(*i*) Explain with the help of a diagram how pollen after landing on the stigma of a flower helps male germ cell to reach the female germ cell. Label the following: Ovary, female germ cell, male germ cell and pollen grain.**

**(*ii*) State the meaning of pollination and mention a distinguishing feature between self-pollination and cross-pollination.** **[Foreign]**

**Ans.** Refer to Ans. 2.

## 2011

### Short Answer Type [I] Questions [2 Marks]

**161. Write any two differences between binary fission and multiple fission in a tabular form as observed in cells of organisms.** **[Delhi]**

**Ans.** Refer to Ans. 65.

**162. Explain giving one example of each, the unisexual and the bisexual flowers.** [Delhi]

**Ans.** Refer to Ans. 157.

**163. List any four modes of asexual reproduction.** **[Delhi]**

**Ans.** Four modes of asexual reproduction are:

(*i*) Binary fission in *Amoeba*, (*ii*) Fragmentation in *Spirogyra*,

(*iii*) Regeneration in *Planaria* (*iv*) Budding in *Hydra*.

**164. Why is DNA copying an essential part of the process of reproduction?** [Delhi]

**Ans.** The process of reproduction is the method used to produce similar offspring to continue the race. During this process sex cells are formed which need to have the characteristics of the parents which are transferred through the genes. So with the help of chemical processes the DNA which contains all the traits and characteristics of the parent are duplicated, One copy is now transferred to each of the gametes thus ensuring same characteristics of the parent. Therefore, DNA copying is essential part of reproduction.

**165. List any four reasons for vegetative propagation being practised in the growth of some type of plants.** [All India]

**Ans.** Four reasons to use vegetative propagation are:

(*i*) The best variety of the fruit can be chosen and propagated as the produce is similar in shape and size.

(*ii*) Many seeds which are produced are not able to germinate to produce good variety so vegetative propagation is a good option.

(*iii*) It can produce genetically healthy, pest resistant and insect resistant variety.

(*iv*) It is fast and very cheap as we do not have to buy any seeds for germination.

**166. Describe the role of fallopian tubes in the female reproductive system.** [All India]

**Ans.** Fallopian tube is the place where the ova meets the sperm to fuse together and forms the zygote. This zygote starts to multiply to start the formation of the foetus and pregnancy begins.

READERS VENUE

**167. Explain the terms:**

**(*i*) Implantation of zygote (*ii*) Placenta** [Foreign]

**Ans.** (*i*) Implantation of the zygote takes place after fertilization has occured. The zygote gets attached to the uterine wall with the help of the tissue called placenta.

(*ii*) Refer to Ans. 22.

**168. What is vegetative propagation? Write two of its advantages.** [Foreign]

**Ans.** Refer to Ans. 16.

## Short Answer Type [II] Questions [3 Marks]

**169. (*a*) List two sexually transmitted diseases in each of the following cases:**

**(*i*) Bacterial infections**

**(*ii*) Viral infections**

**(*b*) How may the spread of such diseases be prevented?** [Delhi]

**Ans.** (*a*) (*i*) Bacterial infections: gonorrhoea, syphilis

(*ii*) Viral infection: HIV, genital herpes

(*b*) The spread of these diseases can be prevented by abstaining from having sex with infected person, use of preventive barrier, condom during sex.

**170. What does HIV stands for? Is AIDS an infectious disease? List any four modes of spreading AIDS.** **[All India]**

**Ans.** HIV stands for Human Immunodeficiency Virus.

Yes, AIDS is an infectious disease.

Four modes of spreading AIDS are as follows:

(*i*) By having sexual contact with an infected person.

(*ii*) By the transfusion of blood from an infected person.

(*iii*) Through infected needles used for injection.

(*iv*) Through the placenta from the mother to child during pregnancy.

**171. Expand AIDS. List any four methods of prevention (control) of AIDS.** **[Foreign]**

**Ans.** AIDS stands for Acquired Immune Deficiency Syndrome.

AIDS spreads through

- Blood
- Pre-seminal fluids
- Vaginal fluids
- Semen
- Rectal fluids
- Breast milk

Four methods of prevention or control of AIDS are as follows:

(*i*) Always use a fresh injection.

(*ii*) Use a physical barrier like condom during sexual act.

(*iii*) Blood transfusion should not be done without checking for HIV infection.

(*iv*) Pregnant mothers should ensure their HIV status and get treated.

**172. (*a*) List any four reasons for adopting contraceptive methods.**

**(*b*) If a woman is using copper-T, will it help in protecting her from sexually transmitted diseases? Why?** **[Foreign]**

**Ans.** (*a*) Four reasons for adopting contraceptive methods are:

(*i*) To have required number of children.

(*ii*) To control and manage the number of people in a family due to financial restraints.

(*iii*) To prevent the transfer of sexually transmitted diseases.

(*iv*) To prevent population growth.

(*b*) Sexual transmission of diseases occurs by the fluids released, and mixing up of these fluids. Copper-T does not prevent the interchange of the fluids but only prevents the entry of these fluids into the cervix. So, it will not be able to prevent diseases to be transferred.

**173. Explain the following methods of contraception giving one example of each:**

**(*i*) Barrier method**

**(*ii*) Hormonal imbalance method**

**(*iii*) Surgical method.** **[Foreign]**

**Ans.** Refer to Ans. 29.

## Long Answer Type Questions [5 Marks]

**174.** (*a*) **Draw a diagram of the longitudinal section of a flower and label on it sepal, petal, ovary and stigma.**

(*b*) **Write the names of male and female reproductive parts of a flower.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 54.

(*b*) Male reproductive part: Stamen

Female reproductive part: Pistil/carpel.

**175.** (*a*) **What is fragmentation in organisms? Name a multicellular organism which reproduces by this method.**

(*b*) **What is regeneration in organism?**

**Describe regeneration in *Planaria* with the help of a suitable diagram.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 35.

(*b*) Regeneration is the ability of organisms to generate lost or damaged body parts.

**Regeneration in *Planaria*:** Refer to Ans. 76.

**176. With the help of suitable diagrams, explain the various steps of budding in *Hydra*.** **[All India]**

**Ans.** **Budding in *Hydra*:** Budding is a mode of asexual reproduction in which a new individual is formed from an outgrowth called a bud.

Refer to Ans. 66.

**177. What is binary fission in organisms? With the help of suitable diagrams, describe the mode of reproduction in *Amoeba*.** **[All India]**

READERS VENUE

**Ans.** Single-celled eukaryotes follow a simple asexual reproduction where the organism after replicating its genetic material, divides into two nearly equal sized daughter cells. Thus, producing two daughter cells. This form of reproduction takes place in *Amoeba*.

**Diagram:** Refer to Ans. 128.

**178.** (*a*) **What is spore formation?**

(*b*) **Draw a diagram showing spore formation in *Rhizopus*.**

(*c*) **List two advantages for organisms to reproduce themselves through spores.** **[Foreign]**

**Ans.** (*a*) Spore formation is a mode of asexual reproduction in which an organism forms small globular case or sporangia. Small microscopic reproductive units called spores are produced inside the sporangia.

(*b*) **Diagram:** Spore formation in *Rhizopus*: Refer to Ans. 18.

(*c*) Two advantages for organisms to reproduce themselves through spores are as follows:

(*i*) It is a easier and faster mode of reproduction.

(*ii*) Offsprings produced are identical thus form a stable population.

**179.** **(*a*) Draw a diagram illustrating fertilization in the flowering plant and label on it– Male germ cell, ovary, female germ cell and pollen grain.**
**(*b*) Distinguish between self-pollination and cross-pollination.**
**(*c*) List two advantages for organisms to reproduce themselves through spores.** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 80.

(*b*)

| Self-pollination | Cross-pollination |
|---|---|
| (*i*) It is the transfer of pollens from anther to stigma of the same flower. | (*i*) It is the transfer of pollen grains from the anther of a flower to the stigma of a flower of a different plant of the same species. |
| (*ii*) It occurs in smaller flowers. | (*ii*) Flowers have brightly colored petals, nectar and scent, long stamens and pistils. |
| (*iii*) It occurs in flowers that produce less number of pollen grains. | (*iii*) It occurs in flowers that produce large number of pollen grains. |
| (*iv*) It needs no external agencies for transfer of pollens. | (*iv*) It needs wind, insects, etc for transfer of pollens. |
| (*v*) More uniform progeny is formed with no variations. | (*v*) It allows for diversity in the species, as the genetic information of different plants are combined. |

(*c*) Refer to Ans. 178 (*c*).

READERS VENUE

## 2010

### Short Answer Type [I] Questions [2 Marks]

**180.** **With the help of a diagram show the different stages of binary fission in *Amoeba*.** **[Delhi]**

**Ans.** Refer to Ans. 128.

**181.** **List any four reasons for vegetative propagation being practised in the growth of some type of plants.** **[All India]**

**Ans.** Refer to Ans. 165.

**182.** **Name the hormone secreted by human testis. State its function.** **[All India]**

**Ans.** Hormone: Testosterone
Refer to Ans. 43.

### Short Answer Type [II] Questions [3 Marks]

**183.** **Write the full form of DNA. Name the part of the cell where it is located. Explain its role in the process of reproduction of the cell.** **[Delhi]**

**Ans.** DNA—Deoxyribonucleic acid. It is located in the nucleus of the cell.
Refer to Ans. 164.

**184. Explain vegetative propagation with the help of two examples. List two advantages of vegetative propagation.** **[Delhi]**

**Ans.** Refer to Ans. 16.

**185. List any two differences between pollination and fertilisation.** **[Delhi]**

**Ans.**

| Pollination | Fertilisaton |
|---|---|
| (*i*) It is the transfer of pollen grains from anther to the stigma of a flower.<br>(*ii*) Pollination precedes fertilisation.<br>(*iii*) It happens outside the flower.<br>(*iv*) It needs external agencies like wind, insects, etc. | (*i*) It is the fusion of male and female gametes.<br>(*ii*) Fertilisation occurs only after pollination when the pollen grain has germinated and sent the male gametes to ovule.<br>(*iii*) It happens inside the flower.<br>(*iv*) It does not need external agencies.<br>(*any two*) |

## Long Answer Type Questions [5 Marks]

**186. (*a*) Draw a longitudinal section of a flower and label the following parts:**

**(*i*) part that produces pollen grain.**

**(*ii*) part that transfers male gametes to the female gamete.**

**(*iii*) part that is sticky to trap the pollen grain.**

**(*iv*) part that develops into a fruit.**

**(*b*) Differentiate between pollination and fertilisation.** **[All India]**

READERS VENUE

**Ans.** (*a*) Refer to Ans. 54.

(*i*) Part that produces pollen grain: anther

(*ii*) Part that transfers male gamete to the female gamete: style

(*iii*) Sticky part to trap pollen grain: stigma

(*iv*) Part that develops into fruit: Ovary.

(*b*) Refer to Ans. 185.

**187. (*a*) Explain the role of placenta in the development of human embryo.**

**(*b*) Give example of two bacterial and two viral sexually transmitted diseases. Name the most effective contraceptive which prevents spread of such diseases.** **[All India]**

**Ans.** (*a*) Refer to Ans. 22.

(*b*) Refer to Ans. 68.

# 9 HEREDITY AND EVOLUTION

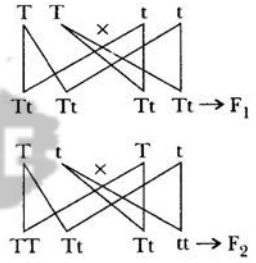
## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [II] Questions [3 Marks]**

**1. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in $F_1$ and $F_2$ generations when he crossed the tall and short plants. Write the ratio he obtained in $F_2$ generation plants.** **[Delhi]**

**Ans.** The plant Mendel used for his experiment is Pea plant.




When Mendel crossed pure tall and short pea plants all the plants in $F_1$ progeny were tall plants, when Mendel crossed the tall plants of $F_1$ progeny the short plants reappeared and he got both tall and short plants.

The ratio of tall and short plants in $F_2$ progeny was 3:1

**2. List two differences between acquired traits and inherited traits by giving an example of each.** **[Delhi]**

| Acquired traits | Inherited traits |
|---|---|
| (*a*) These are the traits which an individual acquires after birth. | (*a*) These are the traits which an individual acquires from his/her parents through the genes/DNA. |
| (*b*) They cannot be passed on to the next generation. | (*b*) They can be passed on to the next generation. |
| (*c*) Their effect is only in the somatic cells, which does not get inherited to another generation. | (*c*) These have effects on the non-somatic cells which pass to the progeny. |
| Example: Less body weight due to starvation | Example: Colour of hair and eye. |

(*any two*)

## Long Answer Type Questions [5 Marks]

**3. (*a*) What are homologous structures? Give an example.**
**(*b*) "The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it." Justify this statement with the help of a flow chart showing sex-determination in human beings. [AI Allahabad]**

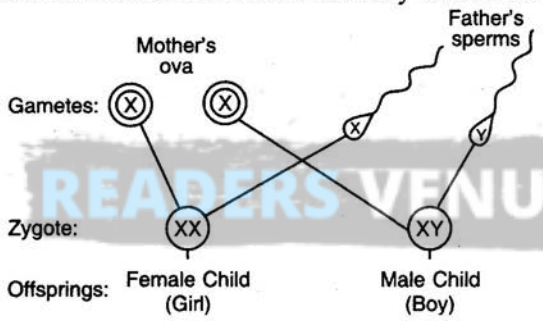
**Ans.** (*a*) Structures which have same basic design and developmental origin but have different functions and appearance are called homologous structures. Example: the forelimb of a frog, a lizard, a bird and a man have same structural design but perform different functions and hence are called homologous structure.

(*b*) There are 23 pairs of chromosomes present in human beings. Out of these 23 pairs, one pair is of sex chromosomes. There are two type of sex chromosomes found in human being, X and Y. A female has X chromosomes and a male has one X and one Y chromosome.

Sex of a child depends on what happens during fertilization:

(*i*) The female gamete, ova always contributes an X chromosome during fertilization.

(*ii*) The male gamete, sperm contributes either X or Y chromosome during fertilization. But whether sperm will contribute the X chromosome or Y chromosome is a matter of chance and the man donot have any control on it.




**Determination of Sex in Humans**

(*iii*) If a sperm carrying X chromosome fertilizes an ova which always carries an X chromosome, then the child born will be a girl. But if a sperm carrying Y chromosome fertilizes an egg which always carries X chromosome, then the child born will be a boy.

(*iv*) Thus, sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it.

## 2018

## Very Short Answer Type Questions [1 Mark]

**4. A Mendelian experiment consisted of breeding pea plants bearing violet flowers with pea plants bearing white flowers. What will be the result in $F_1$ progeny? [CBSE]**

**Ans.** All plants in $F_1$ generation will bear violet flowers.

## 2018 (Compartment)

### Very Short Answer Type Questions [1 Mark]

**5. Mendel took tall pea plants and short pea plants and produced $F_1$ progeny through cross-fertilisation. What did Mendel observe in the $F_1$ progeny? [CBSE]**

**Ans.** Mendel observed that all pea plants in the $F_1$ progeny were tall.

### Short Answer Type [II] Questions [3 Marks]

**6. What are acquired traits? Why are these traits generally not inherited over generations? Explain. [CBSE]**

**Ans.** Acquired traits are those traits which an individual acquires after birth during its life time.

- These are changes in the non-reproductive tissues.
- The DNA influenced/changed by these characters; hence, they cannot be passed on to the next generation.

**Example:** Muscles of a wrestler.

### Long Answer Type Questions [5 Marks]

**7. (*a*) What is variation? How is variation created in a population? How does the creation of variation in a species promote survival?**

**(*b*) Explain how, offspring and parents of organisms reproducing sexually have the same number of chromosomes. [CBSE]**

READERS VENUE

**Ans.** (*a*) Variation refers to the differences in the characteristics among the individuals of a species.

- Variation is created in a population by
  - (*i*) Errors in DNA copying.
  - (*ii*) Recombination during sexual reproduction.
- In case of a drastic change in the environment of the niche of the population, at least some variants would have chances of survival.

(*b*)
- There are special lineages of cells in specialised organs in multicellular organisms.
- Such cells undergo a special type of cell division, called meiosis, and the germ cells (gametes) formed have only half the amount of chromosomes as the parent cell.
- When two such germ cells (with half the number of chromosomes) fuse, a zygote/ new individual is formed with the re-establishment of the number of chromosomes as in parent organism.

## 2017

### Very Short Answer Type Questions [1 Mark]

**8. Newly formed DNA copies may not be identical at times. Give one reason.** [All India]

**Ans.** The newly formed DNA copies may not be identical because the process of DNA copying will have some variation each time.

**9. Why is variation important for a species?** [All India]

**Ans.** Variations are important for the survival of species over time.

### Short Answer Type [II] Questions [3 Marks]

**10. Distinguish between the acquired traits and the inherited traits in tabular form, giving one example for each.** [Delhi]

**Ans.** Refer to Ans. 2.

**11. Explain with the help of an example each, how the following provide evidences in favour of evolution:** [Delhi]

**(*a*) Homologous organs**
**(*b*) Analogous organs**
**(*c*) Fossils**

**Ans.** (*a*) Refer to Ans. 3 (*a*).

(*b*) Analogous organs are those organs/structures in different groups of organisms, that are similar in their function, but are dissimilar in their basic structural plan design and origin. Such organs do not indicate common ancestry of the species. For example, wings of birds and those of bats.

(*c*) Fossils are the preserved traces of organisms that lived in the past. Fossils indicate the time periods when the different groups of organisms lived in the earth. For example, *Archaeopteryx* is a fossil bird which looks like a bird but it has many other features which are found in reptiles.

**12. Mention the total number of chromosomes along with the sex chromosomes that are present in a human female and a human male. Explain how in sexually producing organisms the number of chromosomes in the progeny remains the same as that of the parents.** [Delhi]

**Ans.** — There are 23 pairs (or 46) chromosomes, i.e., 22 pairs of autosomes and one pair of sex chromosomes.

— In males, there are 22 pairs of autosomes and XY sex chromosomes.

— In females, there are 22 pairs of autosomes and XX sex chromosomes.

In sexually reproducing organisms.

— There is a special type of cell division, i.e. meoiosis during the formation of germ cells or gametes; hence the gametes have only half the number of chromosomes (half the amount of DNA) as the parent organisms.

— When two such germ cells (the male and the female gametes) fuse during fertilisation, the number of chromosomes in the zygote becomes the same as that of the parent organisms.

**13. "Natural selection and speciation leads to evolution." Justify this statement. [Delhi]**

**Ans.** — Speciation refers to the appearance of a new species from the existing species.

— If a population of a species splits into two and the individuals of the two populations cannot reproduce with each other, speciation has occurred.

— Genetic drift will accumulate different changes in each of the two sub-populations over generations.

— Natural selection may operate differently in the two sub-populations based on the different geographical and other environmental conditions.

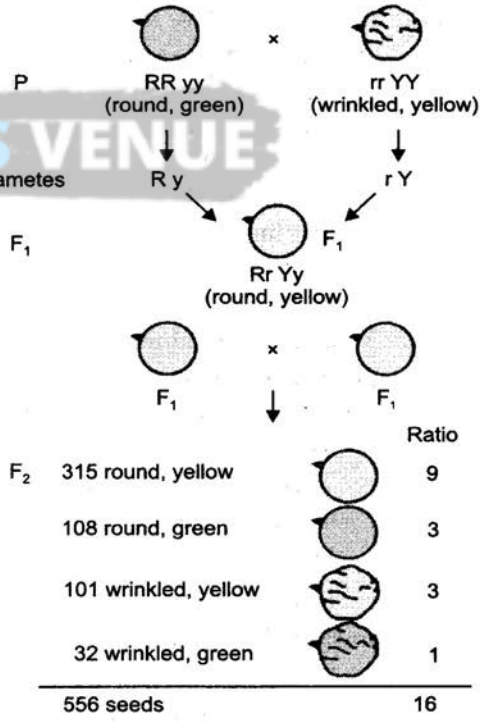
— If the DNA changes are severe enough, such as change in the number of chromosomes; the germ cells or gamates of these two populations cannot fuse together.

— Thus natural selection and speciation lead to evolution of a new species.

**14. How did Mendel's experiments show that different traits are inherited independently? Explain. [CBSE]**

**Ans.** Mendel cross-bred pea plants showing two different characteristics, rather than just one. When he cross-bred pea plants of round green seeds with wrinkled yellow seeds, he got $F_1$ generation with all such seeds which were yellow and round. So, it was concluded that round and yellow character of seeds were dominant traits in the pea plant.

When plants from seeds of $F_1$ generation were cross-bred by self pollination to get the seeds of $F_2$ generation, found different combination characters in these seeds. The seeds were round-yellow, round -green, wrinkled - yellow and wrinkled-green seeds. Round seeds with yellow colour were more dominating. Also there were few wrinkled green seeds. So traits of two different characters were inherited independent of each other and made new combination characteristics independent of their previous combinations.




**Independent inheritance of two separate traits, shape and colour of seeds.**

The ratio of his $F_2$ generation was:

9 : 3 : 3 : 1

9 Round yellow (both dominating traits)

3 Round green

3 Wrinkled yellow

1 Wrinkled green (both recessive traits)

**15. How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism?** **[All India]**

**Ans.**
- Mendel crossed a tall pea plant with a short pea plant.
- All the plants produced in the $F_1$ generation were tall.
- When the $F_1$ tall plants were self-pollinated, the $F_2$ generation consisted of both tall and short plants.
- It explains that the dominant trait expresses itself in the $F_1$ plants, where the recessive trait (shortness) is hidden.
- The appearance of short plants in the $F_2$ indicates that the trait shortness has been inherited by the $F_1$ plants, but not expressed.

**16. "Evolution and classification of organisms are interlinked." Give reasons to justify this statement.** **[All India]**

**Ans.**
- We group organisms into groups based on the similarities in their characteristics.
- Certain basic characteristics are shared by most or all the organisms, like the cell is the basic unit of life in all organisms.
- The characteristics at the next level of classification would be shared by most organisms, but not by all organisms.
- By taking the fundamental design differences, a hierarchy is developed that allows making of classification groups.
- We can work out the evolutionary relationships of the species by identifying the hierarchies of characteristics between them.
- The more characteristics two species will have in common, the more closely related they are.
- The more closely related the two species, they would have had a recent common ancestor.
- Thus, classification of species is a reflection of their evolutionary relationship.

**17. With the help of two suitable examples, explain why certain experiences and traits earned by people during their lifetime are not passed on to their next generations. When can such traits be passed on?** **[All India]**

**Ans.** Certain experiences and traits acquired by people during their lifetime are not passed on to their next generations because these traits do not change the gene/DNA of the germ cells. For example,

(*a*) Losing weight due to starvation.

(*b*) Cutting the tails of mice for a few generation can not produce tailless mice.

Such traits can only be passed on to the next generation when they alter/change the DNA of the germ cells.

**18. What is an evolution? It cannot be equated with progress. Explain with the help of a suitable example.** **[All India]**

**Ans.**
- Evolution is the process of making complex body designs from the existing simple ones, as adaptations to the changing environment accumulate over generations.
- Evolution cannot be equated with progress because:
  - (*a*) When a new species is formed, the old ones also survive and does not disappear.
  - (*b*) It is the genetic drift and natural selection that have led to the formation of a population that cannot reproduce with the old one.

e.g. the single-celled bacteria inhabit the most inhospitable habitats like hot springs, deep sea thermal vents, etc, where human beings cannot live.

**19. How do variations arise in organisms? "Variation is useful for the survival of species." Justify this statement with the help of an example.** **[Foreign]**

**Ans.** Variations arise due to

(*i*) Errors in DNA copying

(*ii*) Sexual reproduction, as it combines DNA from two different individuals variation is useful for the survival of species.

If an adverse change occurs in the habitat of a species, if there were some individuals with suitable variation, in the population of that species, they would survive and continue the species, e.g.

If the temperature of temperate waters increases, due to global warming, the bacteria living in such waters would not be able to live there, but if there were some variants, resistant to heat, they would survive and continue further and their extinction will be prevented.

**20. Give an example of the characteristics being used to determine how close two species are in evolutionary terms.** **[Foreign]**

**Ans.**
- The homologous characteristics help to determine an evolutionary relationship between different species.
- Homologous organs are those organs in different groups/species of organisms that have a similar basic structural design, but perform different functions.
- The hands/forelimbs of humans, wings of a bird and the foreclimbs of other mammals like cow, horses etc, are homologous and have a similar basic structural design and origin.
- The structural designs are similar because they are inherited from a common ancestor.

**21. List any three factors and mention how they could lead to the rise of a new species.** **[Foreign]**

**Ans.** Speciation factors responsible:

(*a*) **Geographical isolation.**

- If a population of a species splits into two due to some geographical barrier, the gene flow between the two sub-populations decreases and each of the sub-populations becomes very different from the other; they lose the ability to reproduce with each other and become different species.

(*b*) **Genetic drift**

- It refers to any accidental change in the frequency of certain genes especially in small populations.
- Genetic drift can accumulate different changes in the two sub-populations.
- The changes may be in the number of chromosomes, where the gametes of the two groups cannot fuse with each other; each becomes a new species.

(*c*) **Natural selection**

- Nature selects those individuals in the population of a species, which are better adopted to survive and reproduce in the given environment.
- The frequency of certain genes changes in the population leading to changes in the characteristics and making them a new species.

**22. Describe any three methods of tracing evolution relationship amongst organisms.** **[Foreign]**

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**Ans.** – The evolutionary relationships of the species can be worked out by identifying the hierarchies of characteristics between species.

– The more characteristics the two species will have in common, the more closely they related are.

– The more closely related species would have had a recent common ancester.

– Homologous characteristics help to identify an evolutionary relationship; they are the organs in different groups of organisms, that are similar in their basic structural design, but are dissimilar is their functions.

– Analogous organs are those organs in different groups of organisms which perform similar in their basic structural design and origin.

**23. What are fossils? How do they act as an evidence for organic evolution?** **[Foreign]**

**Ans.** The remains of dead plants and animals which were buried under the rocks millions of years ago are called **fossils.**

Fossils tell us about the process of evolution. The fossils of different organisms have some features similar to one species while some features are similar to the other species. In this way, they show the link between two species. They tell us that one species evolves from the other.

## Long Answer Type Questions [5 Marks]

**24. How do Mendel's experiments show that**

**(*a*) traits may be dominant or recessive?**

**(*b*) inheritance of two traits is independent of each other?** **[Delhi]**

**Ans.** (*a*) Traits may be dominant or recessive.

— When Mendel crossed a tall pea plant with a dwarf pea plant, all the $F_1$ plants were tall.

— When the $F_1$ plants were self-pollinated and an $F_2$ progeny raised, there were tall plants and dwarf plants.

— The trait (tallness) which has appeared in the $F_1$ plants is called a dominant trait, while dwarfness that remained hidden in $F_1$ plants, but appeared in $F_2$ plants, is called a recessive trait.

(*b*) Inheritance of two traits is independent of each other:

— When Mendel crossed a tall pea plants with round seeds and a dwarf pea plant with wrinkled seeds, the $F_1$ plants were all tall with round seeds; tallness and round seeds are dominant traits.

— When the $F_2$ progeny was raised by self-pollinating $F_1$ plants, it consisted of plants as follows. Tall plants with round seeds tall plants with wrinkled seeds. Dwarf plants with round seeds dwarf plants with wrinkled seeds.

— It indicates that the tall/dwarf trait and round/wrinkled seed trait are independently inherited.

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**25. With the help of an example for each, distinguish between the acquired traits and the inherited traits. Why are the traits/experiences acquired during the entire lifetime of an individual not inherited in the next generation? Explain the reason of this fact with an example.** **[All India]**

**Ans.** Refer to Ans. 2.

– Since the acquired traits/experiences do not alter/affect the DNA of the germ cells, they are not inherited by the next generation.

e.g. If the tails of some mice were removed by surgery in each generation, tailless mice are not produced in the subsequent generations, because removal of the tail cannot change the genes/DNA of the germ cells of these mice.

**26. What are fossils? How are fossils formed and how is their age determined? State the importance of fossils in the study of evolution.** **[Foreign]**

**Ans.** Fossils are the preserved traces of organisms that lived in the past.

Fossils are formed when the body or some part(s) of the dead organism remain(s) in an environment that does not allow its/their complete decomposition. The mud covering the body part(s) becomes hardened and retain the impression or some hard parts thus forming a fossil.

**Age of the fossils is calculated by**

(*a*) detecting the ratio of the different isotopes of the same element in the fossil material.

(*b*) dig into the earth and find the position of the fossil in the earth's crust; the fossils found near the surface are more recent than those found deeper in the earth.

**Use of fossils in study of evolution:**

(*a*) Fossils tell us the time period when the different forms of life lived on the earth.

(*b*) They tell us that the older forms were simpler and the recent forms are complex.

(*c*) They give us an idea about the ancestors of different recent forms of life.

## 2017 (Compartment)

### Short Answer Type [I] Questions [2 Marks]

**27. What is speciation? State any two factors which could lead to speciation.** **[All India]**

**Ans.** – Speciation refers to the phenomenon in which new species are formed from the existing species.

– The factors leading to speciation are (*i*) genetic drift and (*ii*) natural selection.

### Short Answer Type [II] Questions [3 Marks]

**28. Distinguish between inherited traits and acquired traits giving one example of each. Give reason why the traits acquired by an individual during the life time are not inherited.** **[Delhi]**

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**Ans.** Refer to Ans. 2 & 25.

**29. What are Chromosomes? Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained.** **[Delhi]**

**Ans.** Chromosomes are the structures that bear the DNA or genes; they carry the DNA or genes to the progeny cells.

– There are special lineages of cells in the sexually–reproducing organisms.

– These cells undergo a special type of cell division, called meiosis; consequently, the germ cells formed have only half the number of chromosomes as the parent cell.

– When two such germ cells (with half the number of chromosomes) fuse, a zygote/new individual is formed with the same number of chromosomes as the parent organism.

**30. What are homologous organs? Give one example. Can the wings of a butterfly and the wings of a bat be regarded as homologous? Give reason in support of your answer.** **[All India]**

**Ans.** Refer to Ans. 3 (*a*).

- The wings of a butterfly and those of a bat cannot be considered as homologous, because they have a common function (flying), but their origin and basic structure are different.
- They are analogous organs because they have a common function, though the basic structure is different.

**31. If we cross-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant, we will get plants of $F_1$ generation. If we now self-cross the pea plant of $F_1$ generation, we obtain pea plants of $F_2$ generation.** **[All India]**

**(*i*) What do the plants of $F_1$ generation look like?**

**(*ii*) State the ratio of tall plants to dwarf plants in $F_2$ generation.**

**(*iii*) State the type of plants not found in $F_1$ generation but appeared in $F_2$ generation. Write the reason for the same.**

**Ans.** (*i*) The plants of $F_1$ generation will be tall like the dominant parent.

(*ii*) Tall plants 3 : Dwarf plants 1, i.e. 3 : 1.

(*iii*) – Dwarf plants are not found in $F_1$ generation.

- It is because, when two copies of a gene (alleles) exist together in the $F_1$ plants, only the trait; tallness is expressed, i.e. it is dominant.
- The other trait dwarfness remains hidden as it is a recessive trait.

## Long Answer Type Questions [5 Marks]

**32. How do Mendel's experiment show that**

**(*i*) the traits may be dominant or recessive, and**

**(*ii*) different traits are inherited independently?** **[Delhi]**

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**Ans.** Refer to Ans. 24.

**33. Define evolution. How does it occur? Explain how fossils provide evidences in support of evolution.** **[All India]**

**Ans.** – Evolution is defined as the phenomenon of gradual changes occurring over millions of years, resulting in complex body designs and new species from the pre-existing simpler ones.

- **Steps in evolution**
  - Gene flow occurs between two populations of a species that are only partly, but not completely separated.
  - If the two populations are completely isolated, the gene flow between them is much reduced.
  - Over generations, genetic drift will accumulate different changes in these sub-populations.
  - Natural selection may also operate differently in these different geographic locations.

- Together, the processes of genetic drift and natural selection make these two populations different and in capable of reproducing with each other.
- They have become two new species, i.e. evolution has occurred.

– Fossils provide evidences in support of evolution:

(*i*) Fossils indicate the time period in the history of the earth, when different species lived.

(*ii*) Fossils indicate the evolutionary relationships among different species.

(*iii*) The fossils found closer to the surface of earth are more complex than fossils found in deeper layers of the earth.

## 2016

### Very Short Answer Type Questions [1 Mark]

**34. What is DNA?** **[Foreign]**

**Ans.** Deoxyribonucleic acid, a self-replicating material which is present in nearly all living organisms as the main constituent of chromosomes. It is the carrier of genetic information.

### Short Answer Type [II] Questions [3 Marks]

**35. How do organisms, whether reproduced asexually or sexually maintain a constant chromosome number through several generations? Explain with the help of suitable example.** **[Delhi]**

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**Ans.** In asexual reproduction, parent cell divides mitotically to form the offspring. Thus, asexually reproducing organisms maintain a constant chromosome number.

In sexual reproduction, the gametes usually contain half number of chromosomes compared to the numbers present in the body cells. These haploid gametes when fuse produce a new cell with double number of chromosomes than the gametes and same as the body cells. In this way organisms restrict doubling of DNA and maintain the chromosome number.

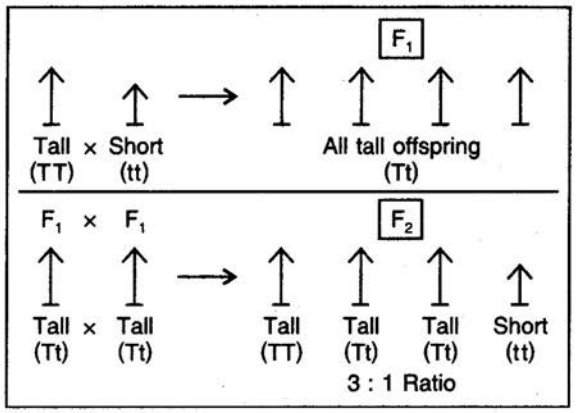
**For example:** Human being somatic cells contain 46 chromosomes. When gametes are formed they contain half the number that is 23 chromosomes in each gamete. When these gametes fuse to form the zygote again they get to maintain the 46 number of chromosomes.

**36. In one of his experiments with pea plants Mendel observed that when a pure tall pea plant is crossed with a pure dwarf pea plant, in the first generation, $F_1$ only tall plants appear.**

**(*a*) What happens to the traits of the dwarf plants in this case?**

**(*b*) When the $F_1$ generation plants were self-fertilised, he observed that in the plants of second generation, $F_2$ both tall plants and dwarf plants were present. Why it happened? Explain briefly.** **[Delhi]**

**Ans.**




(*a*) The dwarfness being recessive trait was not visible in the $F_1$ generation.

(*b*) Law of independent assortment says that alleles of different characters separate independent from each other during gamete formation. In this case, alleles of tall and dwarf characters were assorted independently.

**37. List three distinguishing features, in tabular form, between acquired traits and the inherited traits.** **[Delhi]**

**Ans.** Refer to Ans. 2.

**38. How did Mendel interpret his result to show that traits may be dominant or recessive? Describe briefly.** **[Delhi]**

**Ans.** Refer to Ans. 24 (*a*).

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**39. In a monohybrid cross between tall pea plants (TT) and short pea plants (tt) a scientist obtained only tall pea plants (Tt) in the $F_1$ generation. However, on selfing the $F_1$ generation pea plants, he obtained both tall and short plants in $F_2$ generation. On the basis of above observations with other angiosperms also, can the scientist arrive at a law? If yes, explain the law. If not, give justification for your answer.** **[Delhi]**

**Ans.** Yes, the scientist will arrive at a law on the basis of his observations. It is the law of dominance proposed by Mendel. According to this law, in pure breeding varieties of pea plant, the $F_1$ generation shows only dominant trait while in $F_2$ generation both dominant and recessive traits are expressed.

**40. How do Mendel's experiment show that traits are inherited independently?** **[All India]**

**Ans.** Refer to Ans. 14.

**41. "Two areas of study namely 'evolution' and 'classification' are interlinked." Justify this statement.** **[All India]**

**Ans.** Refer to Ans. 16.

**42. List two differences in tabular form between dominant trait and recessive traits. What percentage/proportion of the plants in the $F_2$ generation/progeny were round, in Mendel's cross between round and wrinkled pea plants?** **[Foreign]**

**Ans.**

| Dominance | Recessive |
|---|---|
| 1. A dominant factor allele expresses itself in the presence or absence of a recessive trait. | 1. A recessive trait is able to express itself only in the absence of a dominant trait. |
| 2. For example, tall plant, round seed, violet flower, etc. are dominant characters in a pea plant. | 2. For example, dwarf plant, wrinkled seed, white flower, etc. are recessive traits in a pea plant. |

In $F_2$ generation, 75% of pea plant showed round and yellow traits.

**43. What is speciation? Explain in brief the role of natural selection and genetic drift in this process.** **[Foreign]**

**Ans.** Speciation is arising of a new species from a sub-population of a species which is geographically or reproductively isolated over a long period of time from the other population of the same species.

**Natural Selection**

Natural selection is one of the basic mechanisms of evolution, along with mutation, migration, and genetic drift. Darwin's grand idea of evolution by natural selection is relatively simple but often misunderstood. To find out how it works, imagine a population of beetles:

**For example**: Some beetles are green and some are brown. Since the environment can't support unlimited population growth, not all individuals get to reproduce to their full potential. In this example, green beetles tend to get eaten by birds and survive to reproduce less often than brown beetles do. The surviving brown beetles have brown baby beetles because this trait has a genetic basis. The more advantageous trait, brown coloration, which allows the beetle to have more offspring, becomes more common in the population. If this process continues, eventually, all individuals in the population will be brown and green beetles will be eliminated.

**Genetic Drift**

Genetic drift occurs when there is a change in the genetic makeup over the generations. This change or evolution of new species is not due to environmental or other kind of stress on individuals.

**For example:** Suppose, a garden has red and white poppies. The red poppies exchange genetic material with white poppies. Over a period of time, only red poppies are seen while the white poppies soon become rare.

**44. Explain Mendel's experiment with peas on inheritance of characters considering only one visible contrasting character.** **[Foreign]**

**Ans.** Mendel assumed that the unit of hereditary characters is the factors of determiners which occur in pairs. One of each comes from the mother while the other comes from the father. The unit character or factor is now called as gene.

When a pair of contrasting characters ( alleles) are present together, only one of them expresses itself and the other remains suppressed or hidden The character which is expressed (or is visible) is called as dominant and the character which remains hidden is termed as recessive.

**45. List three factors that provide evidences in favour of evolution in organisms and state the role of each in brief.** **[Foreign]**

**Ans.** The three factors that provide evidences in favour of evolution in organism are:

(*i*) **Fossils:** Refer to Ans. 11 (*c*).

(*ii*) **Homologous organs:** Refer to Ans. 3 (*a*).

(*iii*) **Analogous organs:** Refer to Ans. 11 (*b*).

## Long Answer Type Questions [5 Marks]

**46. What is meant by speciation? List four factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species? Give reason to justify your answer.** **[Delhi]**

Ans. Speciation is the evolutionary process by which reproductively isolated biological populations evolve to become distinct species.

Factors which could lead to the formation of new species are:

(*i*) **Genetic drift:** Over generations, genetic drift may accumulate which leads to speciation.

(*ii*) **Natural selection:** Natural selection may work differently in different locations which may give rise to speciation.

(*iii*) Severe DNA change.

(*iv*) A variation may occur which does not allow sexual act between two groups.

Geographical isolation would not be a major factor in the speciation of a self pollinating plant species.

Since the plants are self pollinating, which means that the pollens are transferred from the anther of one flower to the stigma of the same flower or of another flower of the same plant. Therefore, there is no change in the genetic makeup of the plant over the generations.

**47. Define evolution. How does it occur? Describe how fossils provide us evidences in support of evolutions.** **[All India]**

**Ans.** Refer to Ans. 33.

**48. (*a*) Why did Mendel choose garden pea for his experiments? Write two reasons.**

**(*b*) List two contrasting visible characters of garden pea Mendel used for his experiment.**

(*c*) **Explain in brief how Mendel interpreted his results to show that the traits may be dominant or recessive.** **[Foreign]**

**Ans.** (*a*) Normally pea plant was self-fertilizing, because petals enclose the reproductive organs till fertilization. The self-fertilization through many generations helps in easily obtaining the pure line with constant trait in pea plants. The pea plant was easy to cultivate.

(*b*) The two characteristics used by Mendel for his experiments were:

(*i*) Tall and Dwarf Variety (*ii*) round and wrinkled seed coats.

(*c*) Mendel took pea plants with different characteristics- a tall plant with a short plant, produced progeny by cross-pollination and calculated the percentage of tall and short progeny. There were no half way characteristics in the first generation, no medium height plants in the $F_1$ generation. All plants were tall. He carried his experiment further by getting both the parental plants of the $F_1$ generation to reproduce by self-pollination. In the second generation $F_2$, all plants were not tall. One quarter of them were short. This indicated that both traits tall and dwarf were inherited in the $F_1$ generation but only tallness which was a dominant trait was expressed in $F_1$ generation,the dwarf trait which was recessive trait was not visible in $F_1$ but was visible in $F_2$ generation.

**49. What are fossils? How are they formed? List two methods of determining the age of fossils. Explain in brief the importance of fossils in deciding the evolutionary relationships.** **[Foreign]**

**Ans.** Refer to Ans. 26.

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## 2015

### Very Short Answer Type Questions [1 Mark]

**50. What is speciation?** **[Delhi]**

**Ans.** The process by which new species develop from the existing species is known as speciation.

**51. Where is DNA found in a cell?** **[All India]**

**Ans.** DNA is found in the nucleus of a cell.

### Short Answer Type [II] Questions [3 Marks]

**52. What is DNA copying? State its importance.** **[Delhi]**

**Ans.** DNA copying is the process of production of new DNA molecules from an already existing DNA molecule through a chemical reaction.

(*i*) It helps in transmission of characteristics from parents to offspring.

(*ii*) DNA contains the information necessary for the inheritance of features.

**53. "We cannot pass on to our progeny the experiences and qualifications earned during our lifetime." Justify the statement giving reason and examples.** **[Delhi]**

**Ans.** Any changes in the somatic cells is not carried to the progeny or into the DNA. So, the traits acquired during the lifetime are not inheritable. These are called acquired traits.

**For example:** If a low does not get sufficient food for a considerable time, its weight will be reduced due to starvation. The low weight of this cow is an acquired traits.

**54.** (*i*) ***Planaria*, insects, octopus and vertebrates all have eyes. Can we group eyes of these animals together to establish a common evolutionary origin? Justify your answer.**

(*ii*) **"Birds have evolved from reptiles." State evidence to prove the statement.** **[Delhi]**

**Ans.** (*i*) The eyes seen in planaria, insects, octopus and vertebrates vary greatly in their structure. Insects have compound eyes and vertebrates have highly specialized eyes. The complex structure of eyes of these organisms have developed over generations. These organisms can be used for studying evolution of eyes.

(*ii*) (*a*) *Archaeopteryx* is considered to be the connecting link between Reptiles and Aves. It acts as an evidence to prove that birds evolved from reptiles. Reptilian characters include the following:

- Limbs bear two claws on unfused digits. It lacks metatarsals of the foot.
- Cranium resembles the reptilian skull.
- Tail is long.
- Pelvis resembles that of the reptiles.

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Avian characters include the Presence of feathers. Hallux or the first toe is flexible as in birds. wings and furcula resembled the birds. Reduced fingers as in birds.

(*b*) Development of eye is not a point utilized in classification rather it is an important feature in the evolution. Evolution of eye was not successfully explained by Darwin. It is the assumption made by the scientists that first eye-like structure could have been a light sensitive spot on the skin. This could have gone through many changes and complexities to form human eye. Vertebrates and octopuses developed the eye resembling a pin-hole camera. Nerve fibres pass in front of the retina. Cephalopods have eyes in which nerves are attached to the retina. They do not have a blind spot. Blind spot is present in the retina of the vertebrate eye whereas blind spot is absent in the octopus eye. Human eye is a complex structure made up of different structures which individually are incapable of vision. Altogether, the lens, the pupil, the iris and the retina make the vision possible.

**55. List in tabular form, two distinguishing features between the acquired traits and the inherited traits with one example of each.** **[Delhi]**

**Ans.** Refer to Ans. 2.

**56. What is speciation? List four factors responsible for speciation.** **[Delhi]**

**Ans.** Refer to Ans 46.

**57. What are chromosomes? Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained.** **[All India]**

**Ans.** Refer to Ans. 29.

**58. Explain with an example for each, how the following provides evidences in favour of evolution in organisms:**

**(*a*) Homologous organs** **(*b*) Analogous organs**

**(*c*) Fossils** **[All India]**

**Ans.** (*a*) Refer to Ans. 3 (*a*).

(*b*) Refer to Ans. 11 (*b*).

(*c*) Refer to Ans. 11 (*c*).

**59. Explain the following:**

**(*a*) Speciation** **(*b*) Natural Selection** **[All India]**

**Ans.** (*a*) Refer to Ans. 46.

(*b*) **Natural Selection:** Natural selection is the process of evolution of a species whereby characteristics which help individual organisms to survive and reproduce are passed on to their offspring, and those characteristics which do not help are not passed on to their offspring.

Charles Darwin proposed the theory of natural selection. According to him, nature selects the fittest to survive in the present environment.

There are always chances of changes in the progeny when an animal reproduces by sexual reproduction.

**Example:** If one of the progeny of deer is tall and the other is short, then the tall one with long legs will survive. Because the progeny with short height cannot reach the leaves of tall trees and cannot get food, they will starve and hence die. Thus, it proves the theory of natural selection.

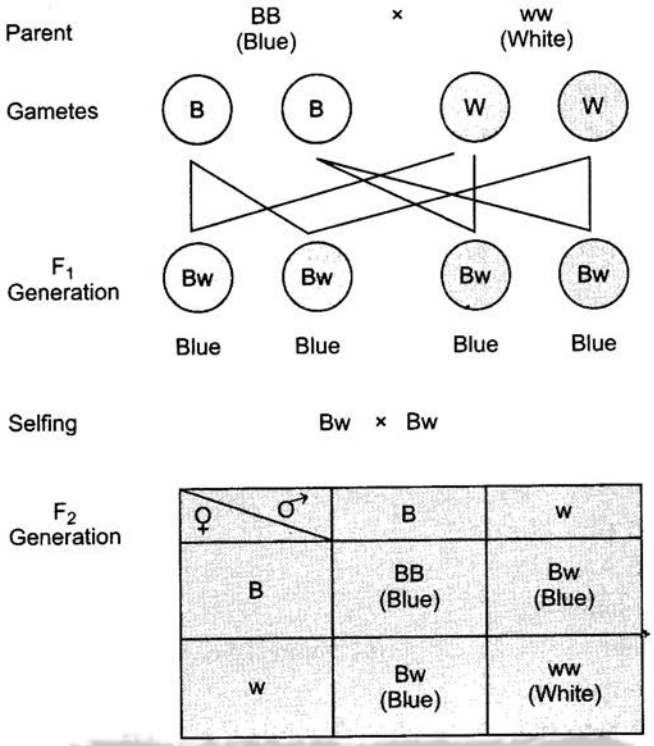
**60. A pea plant with blue colour flower denoted by BB is cross-bred with a pea plant with white flower denoted by ww.**

**(*a*) What is the expected colour of the flowers in their $F_1$ progeny?**

**(*b*) What will be the percentage of plants bearing white flower in $F_2$ generation, when the flowers of $F_1$ plants were selfed?**

**(*c*) State the expected ratio of the genotype BB and Bw in the $F_2$ progeny.** **[All India]**

**Ans.**




(*a*) The $F_1$ progeny is expected to have plants with blue colour flowers.

(*b*) 1/4 of the $F_2$ generation bears white flowers. Therefore, 25% of the $F_2$ progeny bears white flowers in the $F_2$ generation when the flowers of $F_1$ plants were selfed.

(*c*) The ratio of the genotype BB and Bw in the $F_2$ progeny is 1 (BB): 2 (Bw).

**61. "It is a matter of chance whether a couple will have a male or a female child." Justify this statement by drawing a flow chart.** **[Foreign]**

**Ans.** Refer to Ans. 3 (*b*).

**62. "It is possible that a trait is inherited but may not be expressed." Give a suitable example to justify this statement.** **[Foreign]**

**Ans.** Refer to Ans. 15.

**63. Why is DNA copying an essential part of the process of reproduction? What are the advantage of sexual reproduction over asexual reproduction?** **[Foreign]**

**Ans.** DNA copying is important for reproduction. Additional copies of DNA are made during replication; which is necessary for the new cells formed after cell division. Moreover, some minor alterations during DNA replication are responsible for bringing variations in the long run.

The advantage is that sexual reproduction creates more diversity and therefore different types of resistance against different traits. Asexual reproduction makes exactly the same copy, this means that if some sort of virus mutated to kill something that was asexual it would wipe out the whole entire species because that species did not have different characteristics. Since they had all the same genetics they would all die of the same thing. So diversity is the key to survival and sexual reproduction creates diversity.

**64.** **(*a*) Cite the evidence on the basis of which it is concluded that birds have evolved from reptiles.**

**(*b*) Insects, Octopus, Planaria and Vertebrates also possess eyes. Can these animals be grouped together on the basis of the eyes they possess. Why or why not? Give reason to justify your answer.** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 54 (*ii*).

(*b*) Refer to Ans. 54 (*i*).

## Long Answer Type Questions [5 Marks]

**65.** **How many pairs of chromosomes are present in human beings? Out of these how many are sex chromosomes? How many types of sex chromosomes are found in human beings?**

**"The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it." Draw a flow chart showing determination of sex of a newborn to justify this statement.** **[Delhi]**

**Ans.** Refer to Ans. 3 (*b*).

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**66.** **What are fossils? How are they formed? Describe in brief two methods of determining the age of fossils. State any one role of fossils in the study of the process of evolution.** **[All India]**

**Ans.** Refer to Ans. 26.

**Role of fossils in the study of the process of evolution:**

Fossils tell us about the process of evolution. The fossils of different organisms have some features similar to one species while some features are similar to the other species. In this way, they show the link between two species. They tell us that one species evolves from the other.

**67.** **How do Mendel's experiments show that the**

**(*a*) traits may be dominant or recessive,**

**(*b*) traits are inherited independently?** **[All India]**

**Ans.** (*a*) Refer to Ans. 24 (*a*). (*b*) Refer to Ans. 14.

**68.** **What is speciation? List four factors that could lead to speciation. Which of these cannot be a major factor in the speciation of a self-pollinating plant species? Explain.** **[Foreign]**

**Ans.** Refer to Ans. 13.

## 2014

### Very Short Answer Type Questions [1 Mark]

**69. Give the respective scientific terms used for studying:**

**(*i*) the mechanism by which variations are created and inherited and**

**(*ii*) the development of new type of organisms from the existing ones. [Delhi]**

**Ans.** (*i*) Genetics

(*ii*) Evolution

**70. Name the information source for making proteins in the cells. [Delhi]**

**Ans.** Cellular DNA is the source for making proteins in cells.

**71. Write the contribution of Charles Darwin in the field of 'evolution'. [Delhi]**

**Ans.** Charles Darwin's theory of evolution indicates the evolution of life from simple to more complex forms and natural selection has been the backbone for the theory of evolution.

**72. What is a gene? [All India]**

Ans. A unit of heredity present in the chromosomes DNA that instructs the cell to produce a specific protein which is transferred from a parent to offspring and is held to determine some characteristic of the offspring.

**73. What is heredity? [All India]**

**Ans.** Heridity is the process in which the characters or the traits of the parents are passed on to the off spring, and through successive generations.

READERS VENUE

**74. No two individuals are absolutely alike in a population. Why? [All India]**

**Ans.** Sexual reproduction involves combination of genes from gametes of two parents, the genes get cross over and segregate during the combination of gametes which causes changes and so no two individuals are alike in a population.

**75. All the variations in a species do not have equal chances of survival. Why? [Foreign]**

**Ans.** Variations in a species may develop due to combinations of genes, mutations or segregation of genes. All variations will not be able to survive if they are not suitable for adaptions as per the requirement of the organism.

**76. Why do mice whose tails were surgically removed just after birth for generations, continue to produce mice with tails? [Foreign]**

**Ans.** Because cutting of tail is an acquired trait and is not inherited.

**77. Why is the progeny always tall when a tali pea plant is crossed with a short pea plant? [Foreign]**

**Ans.** Tall plants are pure breeds which have the dominant traits and the dwarf plants have the recessive traits which may not be visible in the first generation.

## Short Answer Type [I] Question [2 Marks]

**78. "The chromosomal number of the sexually producing parents and their offspring is the same." Justify this statement.** **[All India]**

**Ans.** Refer to Ans. 35.

## Short Answer Type [II] Questions [3 Marks]

**79. (*a*) Give the evidence that the birds have evolved from reptiles.**

**(*b*) Insects, octopus, *Planaria* and vertebrates possess eyes. Can we group these animals together on the basis of eyes that they possess? Justify your answer giving reason.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 54 (*ii*).

(*b*) Refer to Ans. 54 (*i*).

**80. A cross was made between pure breeding pea plants, one with round and green seeds and the other with wrinkled and yellow seeds.**

**(*a*) Write the phenotype of $F_1$ progeny. Give reason for your answer.**

**(*b*) Write the different types of $F_2$ progeny obtained along with their ratio when $F_1$ progeny was selfed.** **[Delhi]**

**Ans.** (*a*) A cross was made between round, green seeds and wrinkled, yellow seeds. It is a dihybrid cross, i.e. two traits are taken.

Dominant are yellow colour and round shape over green and wrinkled.

Parents RRyy × rrYY

Round, green Wrinkled, yellow

Gametes Ry rY

$F_1$ generation RrYy

Round Yellow

READERS VENUE

It occurs because dominant traits (round and yellow) express themselves, whereas recessive traits (wrinkled and green) get suppressed.

(*b*) When $F_1$ generation is selfed, $F_2$ progeny is as follows: RrYy × RrYy

| | | | |
|---|---|---|---|
| RRYY | RRYy | RrYY | RrYy |
| RRYy | RRyy | RrYy | Rryy |
| RrYY | RrYy | rrYY | rrYy |
| RrYy | Rryy | rrYy | rryy |

RY Ry rY ry RY Ry rY ry

Round yellow : Wrinkled yellow : Round green : Wrinkled green

9 : 3 : 3 : 1

**81.** **(*a*) Mendel crossed tall pea plants with dwarf pea plants in his experiment. Write his observations giving reasons on the $F_1$ and $F_2$ generations.**

**(*b*) List any two contrasting characters other than height that Mendel used in his experiments in pea plants.** **[Delhi]**

**Ans.** (*a*) Mendel crossed tall pea plants with dwarf pea plants.

| | | | | |
|---|---|---|---|---|
| Parents | : | (TT) | × | (tt) |
| | | Pure tall plant | | Pure short plant |
| $F_1$ generation | : | (Tt) (Tt) | | (Tt) (Tt) |
| Selfing of $F_1$ | : | (Tt) | × | (Tt) |
| $F_2$ generation | : | (TT) (Tt) | | (Tt) (tt) |

**Observation:** $F_1$ generation—No 'medium-height' plants were there. All plants were tall. Only one of the parental traits was seen, not some mixture of the two. $F_2$ progeny—Not all plants were tall. One quarter of them were short. This indicates that both the tallness and shortness traits were inherited in the $F_1$ plants, but only the tallness trait was expressed. Mendel proposed that something was being passed unchanged from generation to generation. Factors contain and carry hereditary information.

(*b*) The two contrasting traits other than height used by Mendel are:

(*i*) Pod colour – Yellow pod colour was dominant over green colour.

(*ii*) Seed shape – Round seed shape was dominant over wrinkled seed shape.

**82.** **With the help of suitable examples, explain why certain traits cannot be passed on to the next generation. What are such traits called?** **[All India]**

**Ans.** Refer to Ans. 3 (*b*).

**83.** **"A trait may be inherited, but may not be expressed." Justify this statement with the help of a suitable example.** **[All India]**

**Ans.** Refer to Ans. 15.

**84.** **"It is a matter of chance whether a couple will give birth to a male child or a female child." Justify this statement with the help of a flow chart showing the fusion of sex chromosomes.** **[All India]**

**Ans.** Refer to Ans. 3 (*b*).

**85.** **What is the effect of DNA copying, which is not perfectly accurate, on the reproduction process? How does the amount of DNA remain constant though each new generation is a combination of DNA copies of two individuals?** **[All India]**

**Ans.** DNA copying is necessary:

1. Passing on the information or characters from the parent to off spring.
2. The copying which at times is not perfect produces variation during sexual reproduction leading to evolution.
3. DNA carries all the information and key for the production of every type of cell proteins which control the functioning of organisms.

4. DNA copying help to produce new cells and help in adaptation also.

During reproduction the chromosomes get halved in each gamete. That is each gamete has 23 chromosomes instead of 46 as in a somatic cell. When two gametes fuse to form the zygote the number of gametes become to be 46 again from 23. Thus the number of chromosomes is maintained.

**86. Explain Mendel's experiment with peas on inheritance of characters, considering only one visible contrasting character.** **[Foreign]**

**Ans.** Refer to Ans. 81 (*a*).

**87. Distinguish between inherited and acquired traits by giving one example of each. Give reason why the traits acquired during the lifetime of an individual are not inherited.** **[Foreign]**

**Ans.** Refer to Ans. 2 and 6.

**88. List three main factors responsible for the rise of a new species giving brief description about each.** [All India, Foreign]

**Ans.** Refer to Ans. 46.

**89. Define the term 'evolution'. "Evolution should not be equated with progress." Give reason to justify this statement.** **[Foreign]**

**Ans.** Refer to Ans. 18.

## 2013

READERS VENUE

### Very Short Answer Type Questions [1 Mark]

**90. What is speciation?** **[Delhi]**

**Ans.** Refer to Ans. 27.

**91. List any two factors that could lead to speciation.** **[Delhi]**

**Ans.** Refer to Ans. 27.

**92. No two individuals are absolutely alike in a population. Why?** **[All India]**

**Ans.** Refer to Ans. 74.

**93. Why is DNA copying necessary during reproduction?** **[All India]**

**Ans.** Refer to Ans. 85.

**94. Name the genetic material that is responsible for inheritance of traits.** **[Foreign]**

**Ans.** Gene.

**95. Why do mice, whose tails were removed surgically for generations, continue to produce mice with tails?** **[Foreign]**

**Ans.** Tails of mice are made up of somatic cells. These cells play no role in reproduction. The gametes are containing the genetic material which is responsible for transferring of characters from the parent to the offspring. So the new born mice will have tails.

**96. State the contribution of Charles Darwin in the field of "Evolution."** **[Foreign]**

**Ans.** Refer to Ans. 71.

## Short Answer Type [I] Questions [2 Marks]

**97. "The chromosomes number of the sexually reproducing parents and their offspring is the same." Justify this statement.** **[Delhi]**

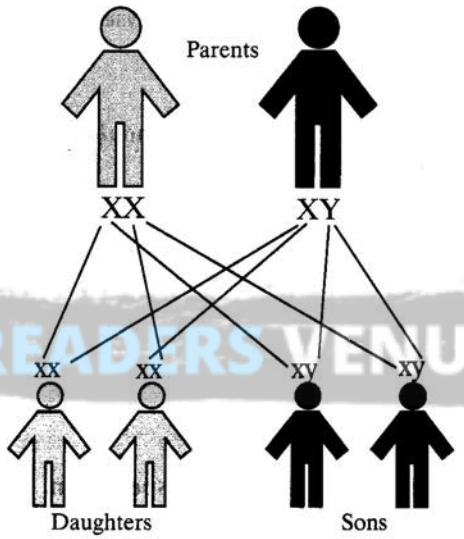
**Ans.** Refer to Ans. 29.

**98. State the importance of chromosomal difference between sperms and eggs of humans.** **[All India]**

**Ans.** Sexual reproduction involves two individuals a male and a female.

Male produces sperms which have X and Y chromosomes.

Female produces ova which has only X chromosomes.




READERS VENUE

If a male gamete with X chromosome fertilizes an ova with X chromosome the zygote will have – XX combination thus forming a female child.

If a male with Y chromosome fertilizes an ova with X chromosome the zygote will have – XY combination thus forming a male child.

**99. Mention two reasons for the appearance of variations among the progeny formed by sexual reproduction.** **[Foreign]**

**Ans.** (*i*) Two individuals as parents are involved to make the gametes which is the main reason for variation development in the progeny.

(*ii*) During meiosis, the chromosomes during cross-over may combine differently leading to variation.

## Short Answer Type [II] Questions [3 Marks]

**100. Tabulate two distinguishing features between acquired traits and inherited traits with one example of each.** **[Delhi]**

**Ans.** Refer to Ans. 2.

**101. "The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it." Justify this statement with the help of flow chart showing determination of sex of a newborn.** **[Delhi]**

**Ans.** Refer to ans 3 (*b*).

**102. What are fossils? State their importance in the study of evolution with the help of a suitable example.** **[Delhi]**

**Ans.** Refer to Ans. 26.

**103. How are fossils formed? State two methods of determining the age of fossils.** **[All India]**

**Ans.** Refer to Ans. 26.

**104. A cross was carried out between a pure bred tall pea plant and a pure bred dwarf pea plant and $F_1$ progeny was obtained. Later, the $F_1$ progeny was selfed to obtain $F_2$ progeny. Answer the following questions:**

**(*a*) What is the phenotype of the $F_1$ progeny and why?**

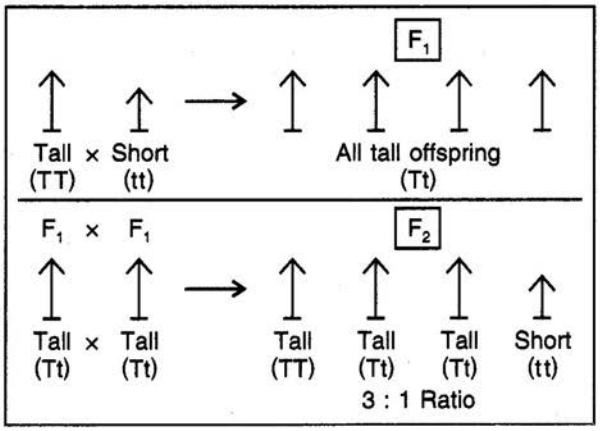
**(*b*) Give the phenotypic ratio of the $F_2$ progeny.**

**(*c*) Why is the $F_2$ progeny different from the $F_1$ progeny?** **[All India]**

**Ans.** (*a*) In $F_1$ progeny, all plants are 'Tt' i.e. they are tall because tallness is dominant over dwarfness.

(*b*) The phenotypic ratio of $F_2$ progeny is 3: 1, i.e. 3 tall plants and 1 dwarf plants.

(*c*) $F_2$ progeny is different from $F_1$ progeny because in the $F_2$ progeny, the recessive allele for dwarfness (tt) is also obtained and we have 25% per cent of dwarf plants.



**105. A blue colour flower plant denoted by BB is crossbred with a white colour flower plant denoted by ww.**

**(*a*) State the colour of flower we would expect in their $F_1$ progeny.**

**(*b*) Write the percentage of plants bearing white flower in $F_2$ generation when the flowers of $F_1$ plants were selfed.**

**(*c*) State the expected ratio of the genotypes BB and Bw in the $F_2$ progeny. [All India]**

**Ans.** Refer to Ans. 60.

**106. Explain with the help of suitable examples why certain traits cannot be passed on to the next generation. What are such traits called? [All India]**

**Ans.** Refer to Ans. 6.

**107. List three main factors responsible for speciation and describe each one of them. [Foreign]**

**Ans.** Refer to Ans. 21.

**108. A cross was made between pure breeding pea plants with round and green seeds and the other with wrinkled and yellow seeds.**

**(*a*) Write the phenotype of the $F_1$ progeny. Give reasons.**

**(*b*) Write the different types of $F_2$ progeny obtained along with their ratio when $F_1$ progeny were selfed. [Foreign]**

**Ans.** Refer to Ans. 80.

**109. (*a*) Planaria, insects, octopus and vertebrates possess eyes. State, giving reason, why we cannot group these animals together on the basis of the eyes that they possess.**

**(*b*) Give an evidence to prove that birds have evolved from reptiles. [Foreign]**

**Ans.** (*a*) Refer to Ans. 54 (*i*).

(*b*) Refer to Ans. 54 (*ii*).

**110. Explain with the help of a suitable example how artificial selection has helped in understanding evolutionary relationship. [Foreign]**

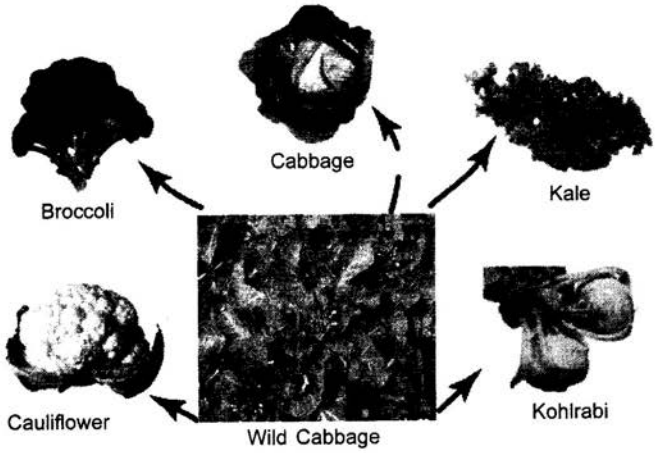
**Ans.** We can trace the evolutionary relationship through artificial selection by studying the changes in DNA during the reproduction.

For example:

Over two thousand years ago, farmers have cultivated wild cabbage, as a source of food plant. They produced different varieties of vegetable from wild cabbage by the method of artificial selection.

- Some farmers selected for swollen stem and formed kohlrabi.
- Some farmers selected for arrested flowers and formed broccoli.
- Some farmers selected for sterile flowers and formed cauliflower.
- Some farmers cultivated for short distance between the leaves cabbage.
- Some farmers grew it for large leafy type called kale.

- Some farmers preffered for coloured red leaves for forming red cabbage.




## 2012

### Short Answer Type [II] Questions [3 Marks]

**111. What is meant by the term speciation? List four factors which could lead to speciation.** **[Delhi]**

**Ans.** Refer to Ans. 46.

**112. A blue colour flower plant denoted by BB is crossbred with that of white colour flower plant denoted by bb.**

**(*a*) State the colour of flower you would expect in their $F_1$ generation plants.**

**(*b*) What must be the percentage of white flower plants in $F_2$ generation if flowers of $F_1$ plants are self-pollinated?**

**(*c*) State the expected ratio of the genotypes BB and Bb in the $F_2$ progeny.** **[Delhi]**

**Ans.** Refer to Ans. 60.

**113. Distinguish between homologous organs and analogous organs. In which category would you place wings of a bird and wings of a bat? Justify your answer giving a suitable reason.** **[Delhi]**

**Ans.**

| Homologous organs | Analogous organs |
|---|---|
| (*i*) Basic structural design is the same. | (*i*) Have different basic structural design. |
| (*ii*) Perform different functions. | (*ii*) Perform similar functions. |
| (*iii*) Different to look at. | (*iii*) Same to look at. |
| (*iv*) Eg: Fore limb of a frog and a bird. | (*iv*) Wings of birds and bat. |

Wings of a bird and wings of a bat are used for flying but they have different basic structural design, so they are analogous organs.

**114. Define the term 'evolution'. "Evolution cannot be equated with progress." Justify this statement.** **[Delhi]**

**Ans.** Refer to Ans. 18.

**115. State and describe in brief any three main factors responsible for the rise of a new species?** **[Delhi]**

**Ans.** Refer to Ans. 107.

**116. If we cross pure-bred tall (dominant) pea plant with pure-bred dwarf (recessive) pea plant we will get pea plants of $F_1$ generation. If we now self-cross the pea plant of $F_1$ generation, then we obtain pea plants of $F_2$ generation.**

**(*a*) What do the plants of $F_1$ generation look like?**

**(*b*) State the ratio of tall plants to dwarf plants in $F_2$ generation.**

**(*c*) State the type of plants not found in $F_1$ generation but appeared in $F_2$ generation, mentioning the reason for the same.** **[All India]**

**Ans.** (*a*) All plants of $F_1$ generation will be tall plants.

(*b*) 3: 1

(*c*) Dwarf trait is recessive trait which was not expressed in the $F_1$ generation, expressed in the $F_2$ generation after self pollination.

**117. State the meaning of acquired traits and inherited traits. which of the two is not passed on to the next generation? explain with the help of an example.** **[All India]**

**Ans.** Acquired traits cannot be passed on to offspring. Organisms develop acquired traits they are not in DNA/genes. Example: A dog's puppies won't be missing a leg just because he is not having one as he lost it in an accident.

**118. How are fossils formed? Describe, in brief, two methods of determining the age of fossils.** **[All India]**

**Ans.** Refer to Ans. 26.

**119. List in tabular form two distinguishing features between acquired traits and inherited traits, with one example of each.** **[All India]**

**Ans.** Refer to Ans. 2.

**120. "The father is responsible for the sex of the child, not the mother." Justify this statement.** **[All India]**

**Ans.** Refer to Ans. 3 (*b*).

**121. List three roles of fossils in tracing evolutionary relationships.** **[Foreign]**

**Ans.** Fossils help us to understand the process of evolutionary relationships in the following ways:

1. They provide us the clues of the past organisms which lived many years ago.
2. They help us to build relationships between present and the past organisms. Like the legendary Archaeopteryx a reptilian bird with wings and the present day birds.
3. The zoological time scale could become relative and helped us to understand the behavior of the animal life in the past accordingly the climate.

**122.** **(*i*) We see eyes in *Planaria*, insects, octopus and the vertebrates. Can eyes be grouped together in case of the above mentioned animals to establish a common evolutionary origin. Why?**

**(*ii*) State one evidence that birds have evolved from reptiles.** **[Foreign]**

**Ans.** (*i*) Refer to Ans. 54 (*i*).

(*ii*) Refer to Ans. 54 (*ii*).

**123.** **With the help of a flow chart explain in brief how the sex of a new born is genetically determined in human beings. Which of the two parents, the mother or the father is responsible for determination of the sex of the child?** **[Foreign]**

**Ans.** Refer to Ans. 3 (*b*).

**124.** **"An individual cannot pass on to its progeny the experiences of its lifetime." Justify the statement with the help of an example and also give reason for the same.** **[Foreign]**

**Ans.** Experiences acquired during the lifetime of an individual are not inherited because there is no change in the genes of the germ cells. Change in the non-reproductive tissues cannot be passed on to the DNA of the germ cells.

**For example:** A wrestler works hard to develop muscles and strength during his life time but his child does not get the muscle structure from the father, as this characteristic is not present in the DNA of the cell. He has to work hard again to gain the muscles to become a wrestler.

## 2011

READERS VENUE

### Short Answer Type [II] Questions [3 Marks]

**125.** **Explain the terms:** **[Delhi]**

**(*i*) Speciation** **(*ii*) natural selection**

**Ans.** (*i*) Refer to Ans. 27.

(*ii*) Refer to Ans. 43.

**126.** **Explain with examples how the following are evidences in favour of evolution in organisms.**

**(*i*) homologous organs**

**(*ii*) Analogous organs**

**(*iii*) Fossils** **[Delhi]**

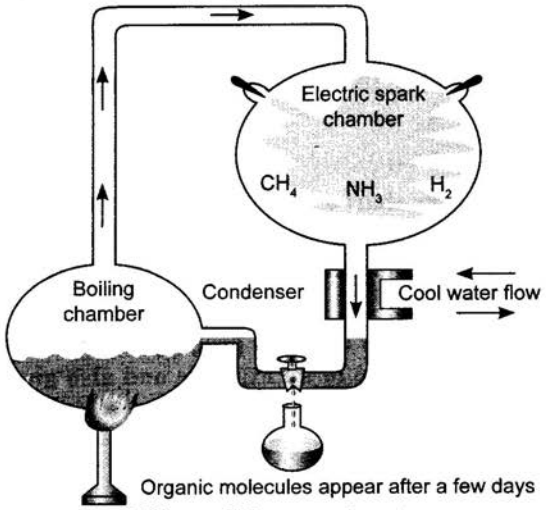
**Ans.** Refer to Ans. 11.

**127.** **Explain how equal genetic contribution of male and female parents is ensured in the progeny.** **[Delhi]**

**Ans.** Refer to Ans. 35.

**128. What evidence do we have for the origin of life from inanimate matter? [All India]**

**Ans.**




**Miller and Urey experiment**

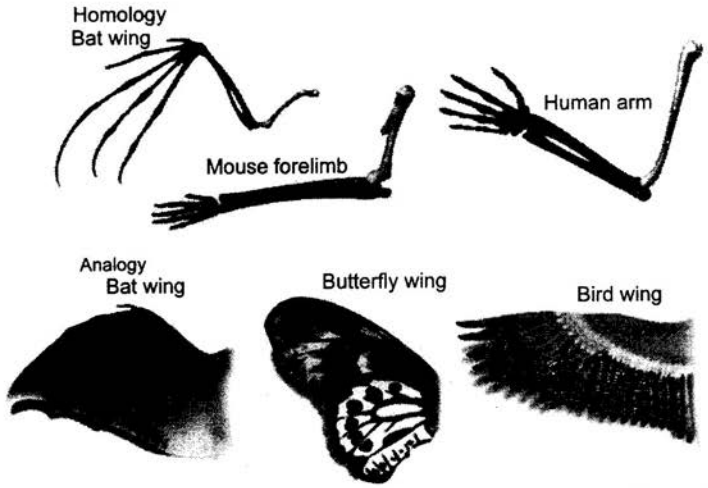
The evidence for the origin of life inanimate matter was provided by the experiments conducted by Stanley Miller and Harolde Curvey. They assembled an apparatus to create an early earth atmosphere which was supposed to consist of gases like methane, ammonia and hydrogen sulphide, etc. (but no oxygen), over water. This was maintained at a temperature just below 100 °C and electric sparks were then passed through the mixture of gases (to stimulate lighting) for about one week. At the end of one week, it was found that about 15% of carbon (from methane) had been converted into simple compounds of carbon including, 'amino acid' which make up protein molecules found in living organisms.

**129. Give an example of body characteristics used to determine how close two species are in terms of evolution and explain it. [All India]**

**Ans.** Homologous, analogous and the vestigial organs help us to determine how close two species can be in accordance with the similarities or dissimilarities of their organs. The organs similar would have a common ancestor. For example, forelimbs of human and wings of birds show closeness between the two species because the organs have similar basic structural design of limbs though it has been modified to perform different functions.

**130. What are homologous organs? Can the wing of a butterfly and the wing of a bat be regarded as homologous? why? [All India]**

**Ans.** Organs which have common design but serve different functions in different animals are called homologous organs. For eg:- although the structures are same but the forelimbs of a frog are used for jumping, birds use for flying and those of humans are used for handling tools. This also shows that frogs, birds and humans have evolved from a common ancestor.




No, the wing of a butterfly and the wing of a bat cannot be considered homologous organs because they have a common function for flying but their origin and structure are not common. So, they are analogous organs.

**131. Describe any three ways in which individuals with a particular trait may increase in a population?** **[All India]**

**Ans.** The organisms of a particular trait may increase if:

(*a*) The organisms have a better adaptability to the environment, and are able to survive better and reproduce.

(*b*) The population is able to resist the diseases and is able to be healthy then certainly the trait is strong and increases the population.

(*c*) Geographical isolation of a population, caused by various types of barriers (such as mountain ranges, rivers and sea). The geographical isolation leads to reproductive isolation due to which therer is no flow of genes between separated group of population

**132. State the evidence we have for the origin of life from inanimate mater?** **[All India]**

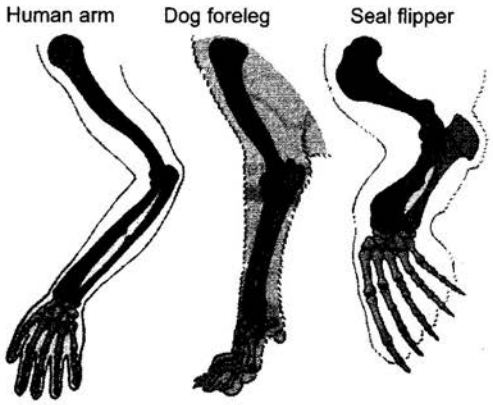
**Ans.** Refer to Ans. 128.

**133. What are fossils? What do they tell us about the process of evolution?** **[All India]**

**Ans.** Refer to Ans. 26.

**134. Explain how evolutionary relationship can be treated by the study of homologous organs.** **[Foreign]**

**Ans.** Forelimb of human and bird are homologous organs. They have same structural design and developmental origin but they have different functions and appearance. Homologous organs help us to understand that the organism has evolved from a common ancestor. The more common characteristics the two species have, the more closely they are related.




**135. "Only variations confer an advantage on an individual organism will survive in a population." Justify this statement.** **[Foreign]**

**Ans.** Variations are the genetic changes that are visible in the off spring.Variations can be good and not so useful for the species.

Only variations which are advantageous to the organism are able to survive and pass on these variations to the next generation. If the variation is not useful then the organism would not be able to survive. These variations carried over to many generations accumulate in a population. Hence, there is no chance for the detrimental (variations causing death) variations to be carried to the next generation. Only advantageous variations can survive.

**136. How is the sex of a child fixed during the fertilization step in human beings? Explain.** **[Foreign]**

READERS VENUE

**Ans.** Refer to Ans. 3 (*b*).

## 2010

### Short Answer Type [I] Question [2 Marks]

**137. Give one example each of characters that are inherited and the ones that are acquired in humans. Mention the difference between the inherited and the acquired characters.** **[Delhi]**

**Ans.** Refer to Ans. 2.

**138. Why is variation beneficial for the species, but not necessarily for the individual?** **[Foreign]**

**Ans.** Variations are found in all organisms which reproduce sexually. But the variation found in an individual can benefit only one organism but if the variation is found in a group or species it would benefit the whole group. If the environmental conditions

drastically change then if one organism as an individual is unable to survive a change where as big group is able to adapt and overcome the change, it is obvious that a group is benefitted. For eg. A polar bear has fat depositions under the skin to over come the cold, if a variant is not able to deposit the fat then they would not be able to survive and perish as a group. So the variants help in the survival of the species.

## Short Answer Type [II] Questions [3 Marks]

**139. Name two homologous structures in vertebrates. Why are they so called? How do such organs help in understanding an evolutionary relationship.** **[All India]**

**Ans.** Refer to Ans. 3 (*a*).

**140. Name the organism Mendel used for his experiments. Explain about $F_1$ and $F_2$ progeny obtained by Mendel when he bred the tall and the short varieties of the organism he experimented with.** **[All India]**

**Ans.** *Pisum sativum*

Refer to Ans. 24 (*a*).

**141. Mendel selected two kinds of pea plants for his experiment, namely those that always gave tall plants and those that always gave short plants. He then obtained progeny $F_1$ from tall and short plants. He selfed the $F_1$ progeny and obtained $F_2$ progeny. Write and explain the results of $F_1$ and $F_2$ progeny obtained by Mendel.** **[Foreign]**

**Ans.** Refer to Ans. 24 (*a*) & 14.

**142. Explain the mechanism of sex determination in humans.** **[All India]**

READERS VENUE

*or*

**With the help of a flow chart explain in brief how the sex of a newborn is genetically determined in human beings. Which of the two parents, the mother or the father, is responsible for determination of sex of a child?** **[Foreign]**

**Ans.** Refer to Ans. 3 (*b*).

**143. With the help of suitable examples explain natural selection.** **[Foreign]**

**Ans.** In natural selection, a population will show genetic traits over many generations that help it remain best suited to its environment.

Giraffes adapted to their environments through genetic changes to their skeletons. Giraffes developed long necks to reach food sources higher up in trees, so members of the giraffe population who didn't develop a long neck died out.

One of the physiological changes that different groups of human beings have made, involves the ability to digest cow's milk. In regions where cattle are not raised, the human population is often lactose intolerant, lacking the enzyme to break down the milk. However, in regions where cattle are grown domestically and their milk is used as a chief part of the food supply, those humans as a whole produce the enzyme needed to digest milk.

# 10 LIGHT—REFLECTION AND REFRACTION

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [I] Questions [2 Marks]**

**1. The absolute refractive index of Ruby is 1.7. Find the speed of light in Ruby. The speed of light in vacuum is $3 \times 10^8$ m/s.** **[AI Allahabad]**

**Ans.** Absolute refractive index of the medium is given by

$$n_m = \frac{\text{Speed of light in vacuum } (c)}{\text{Speed of light in medium } (v)} = \frac{c}{v}$$

Given, $c = 3 \times 10^8$ m/s, $n_m = 1.7$, $v = ?$

$$1.7 = \frac{3 \times 10^8}{v}$$

$$v = \frac{3 \times 10^8}{1.7} = 1.76 \times 10^8 \text{ m/s.}$$

READERS VENUE

**Short Answer Type [II] Questions [3 Marks]**

**2. A student holding a mirror in his hand, directed the reflecting surface of the mirror towards the Sun. He then directed the reflected light on to a sheet of paper held close to the mirror.**

**(*a*) What should he do to burn the paper?**

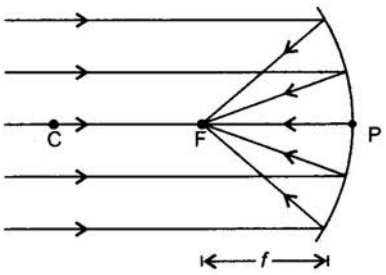
**(*b*) Which type of mirror does he have?**

**(*c*) Will he be able to determine the approximate value of focal length of this mirror from this activity? Give reason and draw ray diagram to justify your answer in this case.** **[AI Allahabad]**

**Ans.** (*a*) We should adjust the position of paper until bright sharp image of the Sun is obtained on the paper.

(*b*) Concave mirror.

(*c*) Yes, the distance between the mirror and paper gives an approximate value of focal length of the mirror.




**Focus of concave mirror**

**3. A 10 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 12 cm. The distance of the object from the lens is 18 cm. Find the nature, position and size of the image formed.** **[AI Allahabad]**

**Ans.** For convex lens,

Given, $h_o = +10$ cm, $f = +12$ cm, $u = -18$ cm.

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we have

$$\frac{1}{12} = \frac{1}{v} - \frac{1}{-18} = \frac{1}{v} + \frac{1}{18}$$

$$\therefore \quad \frac{1}{v} = \frac{1}{12} - \frac{1}{18} = \frac{3-2}{36} = \frac{1}{36}$$

$$\therefore \quad v = +36 \text{ cm}$$

Hence, the image is formed on the other side of the lens at a distance of 36 cm. Positive sign indicates that image is real.

READERS VENUE

Also, magnification '$m$' is given by

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

$$\Rightarrow \quad \frac{h_i}{+10} = \frac{+36}{-18} \Rightarrow h_i = -20 \text{ cm}$$

$\therefore$ Size of image is double to that of object. Negative sign indicate that image is inverted.

Hence, real inverted and twice the size of object image is formed at a distance of 36 cm from the lens on positive X-axis.

## Long Answer Type Questions [5 Marks]

**4. An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm.**

**(*a*) Use lens formula to find the distance of the image from the lens.**

**(*b*) List four characteristics of the image (nature, position, size, erect/inverted) formed by the lens in this case.**

**(*c*) Draw ray diagram to justify your answer of part (*ii*).** **[Delhi]**

**Ans.** (*a*) Given: $u = -60$ cm, $f = -30$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

we get $\frac{1}{-30} - \frac{1}{-60} = \frac{1}{-30} - \frac{1}{-60} = \frac{1}{v} + \frac{1}{60}$

$\therefore \quad \frac{1}{v} = \frac{1}{-30} - \frac{1}{60} = -\frac{3}{60} = -\frac{1}{20}$

$\therefore \quad v = -20$ cm

(*b*) • Nature of image : Virtual

• Position of image : Between optical centre and focus of concave lens.

• Size of image : Smaller than the object using

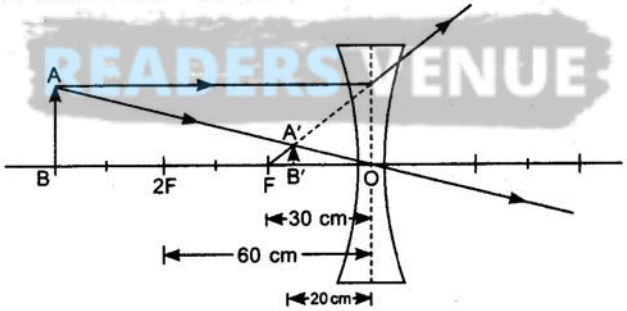
$$m = \frac{h_i}{h_o} = \frac{v}{u} \qquad \left(h_i = +\frac{h_o}{3}\right)$$

$$h_i = \frac{v}{u} \times h_o = \frac{-20}{-60} \times h_o = \frac{h_o}{3}$$

So size of image is one third of the object.

• Erect/inverted : Erect image

(*c*) Ray diagram : Scale 1 cm = 10 cm




**5. An object is placed at a distance of 30 cm from a concave lens of focal length 30 cm.**

**(*a*) Use lens formula to determine the distance of the image from the lens.**

**(*b*) List four characteristics of the image (nature, position, size, erect/inverted) in this case.**

**(*c*) Draw a labelled diagram to justify your answer of part (*ii*).** **[Delhi]**

**Ans.** (*a*) For concave lens, $u = -30$ cm, $f = -30$ cm.

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

We have, $\frac{1}{-30} = \frac{1}{v} - \frac{1}{-30}$

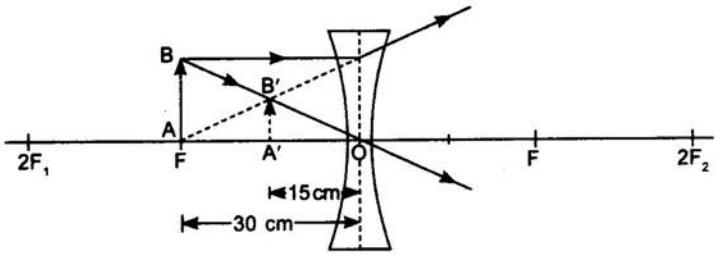
$$\therefore \quad \frac{1}{v} = -\frac{1}{30} - \frac{1}{30} = -\frac{1}{15}$$

$$\Rightarrow \quad v = -15 \text{ cm}$$

Also, magnification, $m = \frac{v}{u} = \frac{-15}{-30} = +\frac{1}{2} < 1.$

(*b*) Therefore, virtual, erect, diminished (half of the size of object) image is obtained at the distance of 15 cm on the same side of the object, i.e., lies between the optical centre and focus of concave lens.

(*c*)




## 2018

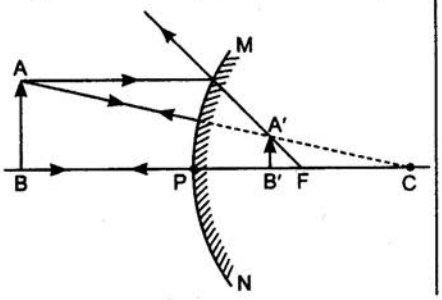
### Short Answer Type [I] Questions [2 Marks]

**6. If the image formed by a spherical mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it? Draw a labelled ray diagram to support your answer.** [CBSE]

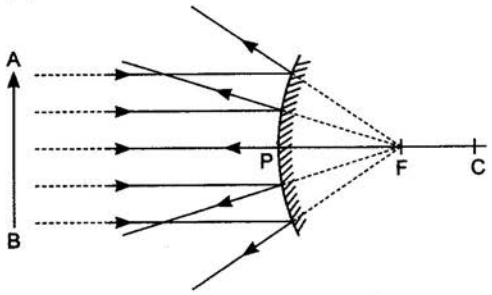
READERS VENUE

**Ans.** The required spherical mirror is convex mirror because the image formed by a convex mirror for all position of the object placed in front of it is always erect and diminished.

(*a*) **Object between pole and infinity**




(*b*) **At infinity**




### Short Answer Type [II] Questions [3 Marks]

**7. State the laws of refraction of light. Explain the term 'absolute refractive index of a medium' and write an expression to relate it with the speed of light in vacuum.** [CBSE]

**Ans. Laws of refraction of light:**

(*a*) The incident ray, the normal at the point of incidence and the refracted ray, all lie in the same plane for the two given transparent media.

(*b*) The ratio of sine of angle of incidence, i.e. sin $i$ to the sine of angle of refraction, i.e. sin $r$ is always constant, for the light of a given colour and for the given pair of media.

$$\text{Mathematically, } \frac{\sin i}{\sin r} = \text{constant} = n_{21}$$

The constant $n_{21}$ is called the refractive index of the second medium with respect to the first medium.

**Absolute Refractive Index:** The refractive index of medium 2 with respect to vacuum or air is considered to be its absolute refractive index. It is represented by $n_2$. It is also equal to the speed of light in vacuum to the speed of light in the medium.

i.e. $$n_2 = \frac{\text{Speed of light in air or vacuum } (c)}{\text{Speed of light in the medium } (v)} = \frac{c}{v}$$

**8. What is meant by power of a lens? Write its SI unit. A student uses a lens of focal length 40 cm and another of –20 cm. Write the nature and power of each lens.**

**[CBSE]**

Ans. **Power of a Lens:** The ability of a lens to converge or diverge the ray of light after refraction, is called power ($P$) of the lens. It is defined as the reciprocal of the focal length, i.e. $P = \frac{1}{f}$.

The SI unit of power of a lens is 'dioptre'. A lens of focal length 100 cm has a power of 1 dioptre = 1 $m^{-1}$.

Given: $f_A = +40$ cm $= 0.4$ m, $f_B = -20$ cm $= -0.20$ m

Power of lens $A$, $P_A = \frac{1}{f_A} = 1/0.40 = +2.5$ D

Power of lens $B$, $P_B = \frac{1}{f_B} = 1/(-0.20) = -5$ D

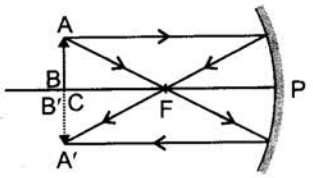
Hence, the nature of lens A is convex with power +2.5D and lens B is concave with power –5D.

## 2018 (Compartment)

### Short Answer Type [I] Questions [2 Marks]

**9. An object is kept 40 cm in front of a concave mirror of focal length 20 cm. Find the position and nature of the image. Draw a ray diagram to show the formation of image in this case.** [CBSE]

**Ans.** According to the given condition, object is placed at 2F ($u = -40$ cm) in front of concave mirror, the real, inverted image is also formed at 2F i.e. $v = -40$ cm.




**Ray diagram**

### Short Answer Type [II] Questions [3 Marks]

**10. We wish to obtain an equal sized inverted image of a candle flame on a screen kept at distance of 4 m from the candle flame.**

**(*a*) Name the type of lens that should be used.**

**(*b*) What should be the focal length of the lens and at what distance from the candle flame the lens be placed.**

**(*c*) Draw a labelled diagram to show the image formation in this case.** [CBSE]

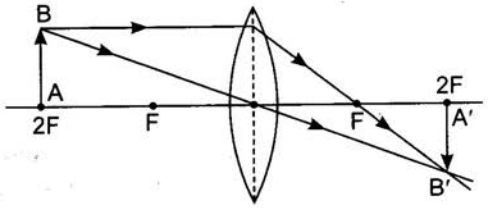
READERS VENUE

**Ans.** (*a*) Convex lens.

(*b*) $2f = 4 \Rightarrow f = 2$ m

Distance of candle flame from the lens = 4 m.

(*c*)




**11. A 5 cm tall object is placed at a distance of 30 cm from a convex mirror of focal length 15 cm. Find the position, size and nature of the image formed.** [CBSE]

**Ans.** Given: $h_1 = +5$ cm, $u = -30$ cm, $f = +15$ cm, $v = ?$

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\therefore \quad \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{+15} - \frac{1}{-30} = \frac{1}{15} + \frac{1}{30} = \frac{2+1}{30} = \frac{1}{10}$$

$$\therefore \quad v = +10 \text{ cm}$$

Hence, the image is formed behind the convex mirror at a distance of 10 cm.

Now, $$m = \frac{h_2}{h_1} = -\frac{v}{u}$$

$\Rightarrow$ $$h_2 = -\frac{+10}{-30} \times (+5) = +\frac{5}{3} = +1.66 \text{ cm}$$

Positive sign indicates that image is virtual, erect and diminished.

## 2017

### Short Answer Type [I] Questions [2 Marks]

**12. An object is placed at a distance of 30 cm in front of a convex mirror of focal length 15 cm. Write four characteristics of the image formed by the mirror. [Delhi]**

**Ans.** The four characteristics of the image formed by the convex mirror are virtual, erect, diminished and laterally inverted.

**13. An object is placed at a distance of 40 cm in front of a convex mirror of radius of curvature 40 cm. List four characteristics of the image formed by the mirror. [Delhi]**

**Ans.** The four characteristics of the image formed by the convex mirror are virtual, erect, diminished and laterally inverted.

**14. An object is placed at a distance of 12 cm in front of a concave mirror of radius of curvature 30 cm. List four characteristics of the image formed by the mirror. [Delhi]**

**Ans.** The focal length of concave mirror = R/2= – 30/2 = – 15 cm. So, object is placed between pole and focus of a concave mirror. The four characteristics of the image formed by the concave mirror in the given case are "Virtual, erect, magnified and laterally inverted".

**15. An object is placed at a distance of 30 cm from a concave lens of focal length 15 cm. List four characteristics (nature, position, etc.) of the image formed by the lens. [All India]**

**Ans.** Four characteristics of the image formed by concave lens for the given condition are virtual, erect, diminished and on the same side as the object.

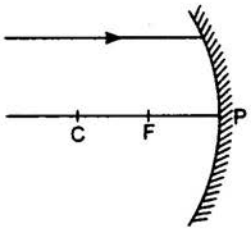
**16. An object is placed at a distance of 15 cm from a convex lens of focal length 20 cm. List four characteristics (nature, position, etc.) of the image formed by the lens. [All India]**

**Ans.** Four characteristics of the image formed by convex lens for the given condition are virtual, erect, enlarged and on the same side as the object.

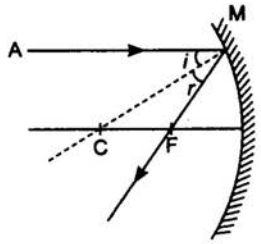
**17. An object is placed at a distance of 15 cm from a concave lens of focal length 30 cm. List four characteristics (nature, position, etc.) of the image formed by the lens. [All India]**

**Ans.** The four characteristics of the image formed by the concave lens are virtual, errect, diminished and laterally inverted.

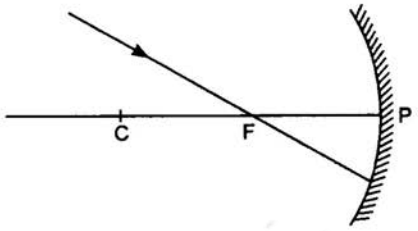
**18. Redraw the following diagram on your answer-sheet and show the path of the reflected ray. Also mark the angle of incidence ($\angle i$) and the angle of reflection ($\angle r$) on the diagram. [Foreign]**



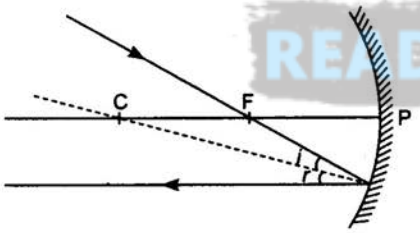

**Ans.**




**19. Redraw the following diagram on your answer-sheet and show the path of the reflected ray. Also mark the angle of incidence ($\angle i$) and the angle of reflection ($\angle r$) on the diagram. [Foreign]**

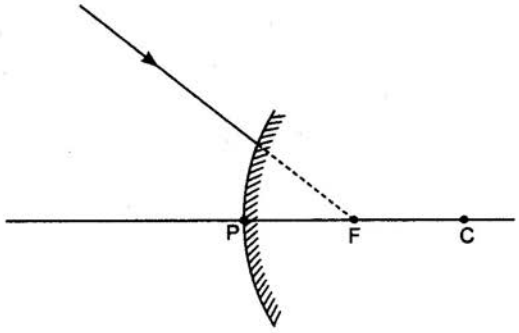



**Ans.**

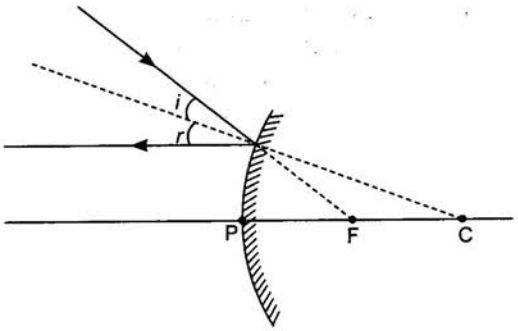



READERS VENUE

**20. Redraw the following diagram on your answer-sheet and show the path of the reflected ray. Also mark the angle of incidence ($\angle i$) and the angle of reflection ($\angle r$) on the diagram. [Foreign]**



**Ans.**




## Short Answer Type [II] Questions [3 Marks]

**21. An object 4 cm in height, is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed to obtain a sharp image of the object. Calculate the height of the image.** **[Delhi]**

**Ans.** Given: $h_1 = +4$ cm, $f = -10$ cm, $u = -15$ cm, $v = ?$ and $h_2 = ?$

Using spherical mirror formula, we get

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{f} - \frac{1}{u}$$

$$\frac{1}{v} = \frac{1}{-10} - \frac{1}{-15} = \frac{-3+2}{30} = -\frac{1}{30}$$

$$\therefore \quad v = -30 \text{ cm}$$

READERS VENUE

Thus, screen should be placed at a distance of 30 cm on the same side of the object to obtain its sharp image.

Now, $$\frac{h_2}{h_1} = -\frac{v}{u}$$

$$\therefore \quad h_2 = -\frac{v}{u} \times h_1 = \frac{-30 \text{ cm}}{-15 \text{ cm}} \times 4 \text{ cm} = -8 \text{ cm}$$

The height of real and inverted image is 8 cm.

**22. A 3 cm tall object is placed 18 cm in front of a concave mirror of focal length 12 cm. At what distance from the mirror should a screen be placed to see a sharp image of the object on the screen. Also calculate the height of the image formed.** **[Delhi]**

**Ans.** $h_1 = +3$ cm, $f = -12$ cm, $u = -18$ cm, $v = ?$ and $h_2 = ?$

Using the mirror formula, $$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-12} - \frac{1}{-18} = \frac{-3+2}{36} = \frac{-1}{36}$$

$$= \frac{-3+2}{36} = \frac{-1}{36}$$

$\therefore \quad v = -36 \text{ cm}$

$$m = \frac{h_2}{h_1} = -\frac{v}{u}$$

$\therefore \quad h_2 = -h_1 \times \frac{v}{u} = -3 \text{ cm} \times \frac{-36 \text{ cm}}{-18 \text{ cm}} = -6 \text{ cm}.$

**23. The image of a candle flame placed at a distance of 30 cm from a mirror is formed on a screen placed in front of the mirror at a distance of 60 cm from its pole. What is the nature of the mirror? Find its focal length. If the height of the flame is 2.4 cm, find the height of its image. State whether the image formed is erect or inverted.**
**[Delhi]**

**Ans.** Given: $h_1 = +2.4$ cm, $u = -30$ cm, $v = -60$ cm and $f = ?$

Using the mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$= \frac{1}{-60 \text{ cm}} + \frac{1}{-30 \text{ cm}}$$

$\therefore \quad f = -20 \text{ cm}$

$$m = \frac{h_2}{h_1} = -\frac{v}{u}$$

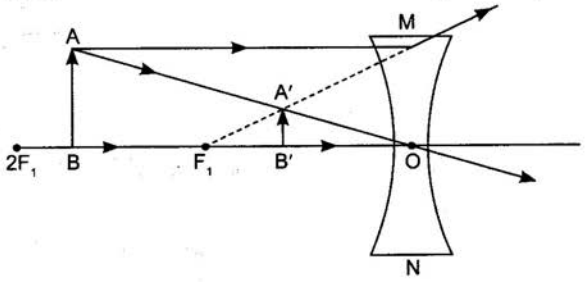
$\therefore \quad h_2 = -h_1 \times \frac{v}{u} = -2.4 \text{ cm} \times \frac{-60 \text{ cm}}{-30 \text{ cm}} = -4.8 \text{ cm}.$

READERS VENUE

The negative sign of $h_2$, i.e. image size indicates that the image is inverted.

**24. If the image formed by a lens for all positions of an object placed in front of it is always erect and diminished, what is the nature of this lens? Draw a ray diagram to justify your answer. If the numerical value of the power of this lens is 10 D, what is its focal length in the Cartesian system?** **[All India]**

**Ans.** It is a concave or diverging lens.




$$f = \frac{1}{P},$$

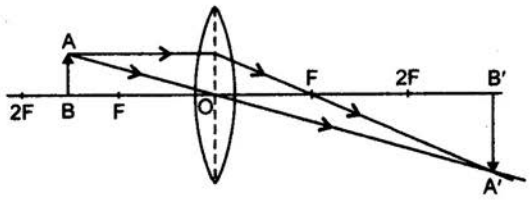
$$P = -10\text{D},$$

$$f = \frac{1}{-10\text{D}} = -0.1 \text{ m}$$

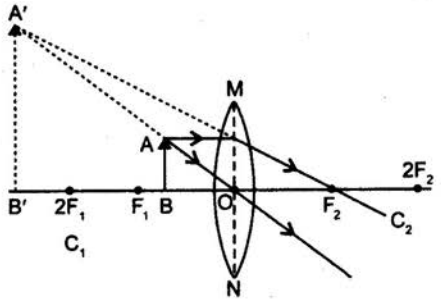
or $\quad f = -10 \text{ cm}.$

**25. Draw ray diagrams to show the formation of three times magnified (*a*) real, and (*b*) virtual image of an object by a converging lens. Mark the positions of O, F and 2F in each diagram.** **[All India]**

**Ans.** (*a*) Three times magnified, real image formed by convex lens.




(*b*) Three times magnified virtual image formed by convex lens.



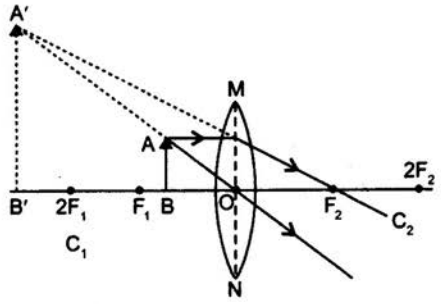

**26. "A lens can form a magnified erect image as well as magnified inverted image of an object placed in front of it." State the nature of this lens and draw ray diagrams to justify the above statement. Mark the positions of O, F and 2F in the diagram.**

**[All India]**

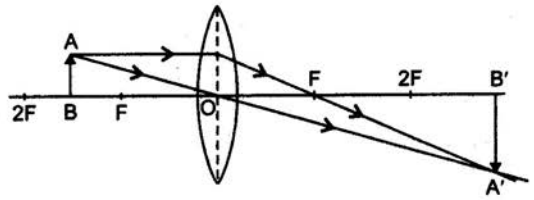
READERS VENUE

**Ans. Nature of lens:** Convex (converging)

Ray diagram for magnified erect image formed by convex lens.




Ray diagram for magnified inverted image formed by convex lens



**27. The magnification of an image formed by a lens is –1. If the distance of the image from the optical centre of the lens is 25 cm, where is the object placed? Find the nature and focal length of the lens. If the object is displaced 15 cm towards the optical centre of the lens, where would the image be formed? Draw a ray diagram to justify your answer.** **[Foreign]**

**Ans.** For real image, $m = -1$

Therefore, $m = \frac{v}{u} = -1$ or $u = -v$, $v = -u$, $-u = v = -25$

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{25} - \frac{1}{-25} = \frac{2}{25} = \frac{1}{12.5}$$

$$f = +12.5 \text{ cm}$$

Thus, the positive focal length shows that the given lens is a convex lens of focal length 12.5 cm.

If the object is now displaced 15 cm towards the optical centre of the lens i.e. object is now placed at a distance of $25 - 15 = 10$ cm from the optical centre.

Therefore $u = -10$ cm, and $f = +12.5$ cm.

Using lens formula again,

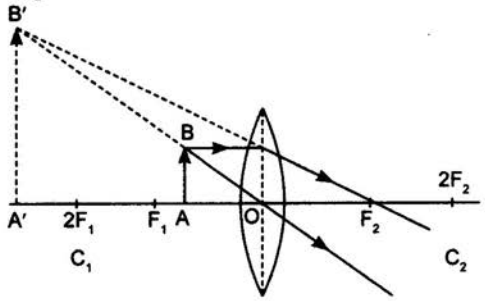
$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

or
$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{2}{25} + \frac{1}{-10} = \frac{2}{25} - \frac{1}{10} = \frac{-1}{50}$$

$$v = -50$$

READERS VENUE

So, in this case, virtual image is formed on the same side of the object at a distance of 50 cm from the optical centre of the lens as shown in figure .




**28. The magnification of an image formed by a lens is –1. If the distance of the image from the optical centre of the lens is 35 cm, where is the object placed? What is the nature and focal length of the lens? If the object is displaced 20 cm towards the optical centre of the lens, where would the image be formed and what will be its nature? Draw a ray diagram to justify your answer.** **[Foreign]**

**Ans.** Given: $m = -1$

i.e. Image is real, inverted and same size as the object and,

Object distance = Image distance = $2f$ = 35 cm

Nature of lens: Convex/Converging

As $2f$ = 35 cm, $f$ = 35 cm = + 17.5 cm

If the object is now displaced 20 cm towards the optical centre of the lens i.e. object is now placed at a distance of 35 – 20 = 15 cm from the optical centre i.e. it lies between F and O of the lens.

Therefore $u$ = –15 cm, and $f$ = +17.5 cm.

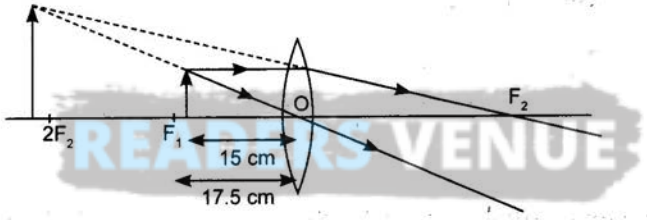
Using lens formula again,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

or
$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{2}{35} + \frac{1}{-15} = \frac{2}{35} - \frac{1}{15} = \frac{6-7}{105} = \frac{-1}{105}$$

$$v = -105 \text{ cm}$$

Image formed now is virtual/ on the same side of lens as the object at a distance of 105 cm as shown below:




**29. The magnification of an image formed by a lens is –1. If the distance between the object and its image is 60 cm, what is the distance of the object from the optical centre of the lens? Find the nature and focal length of the lens. If the object is displaced 20 cm towards the optical centre of the lens, where would the image be formed and what would be its nature? Draw a ray diagram to justify your answer.** **[Foreign]**

**Ans.** For real image, $m = -1$

Therefore, $m = \frac{v}{u} = -1$ or $v = u$ or $u = -v$

When object is at 2F, image is also at 2F distance i.e. $u = 2f$ and $v = 2f$

Now, $u + v$ = 60 cm (given) i.e. $4f$ = 60 cm. $\Rightarrow$ $f$ = +15 cm

Thus, the positive focal length shows that the given lens is a convex lens of focal length 30 cm.

Original image distance, $u = 2f = 2 \times 15 = 30$ cm.

If the object is now displaced 20 cm towards the optical centre of the lens i.e. object is now placed at a distance of 30 – 20 = 10 cm from the optical centre.

Therefore, $u = -10$ cm, and $f = +15$ cm.

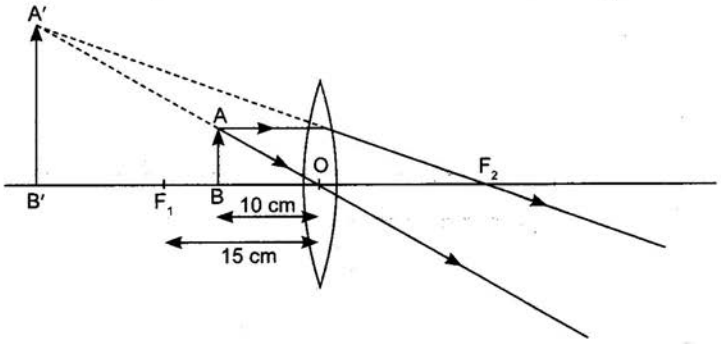
Using lens formula again,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

or
$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{15} + \frac{1}{-10} = \frac{2}{30} - \frac{3}{30} = \frac{-1}{30}$$

$$v = -30 \text{ cm}$$

So, in this case, virtual image is formed on the same side of the object at a distance of 30 cm from the optical centre of the lens as shown in figure.




## Long Answer Type Questions [5 Marks]

**30. Analyse the following observation table showing variation of image distance ($v$) with object distance ($u$) in case of a convex lens and answer the questions that follow, without doing any calculations:**

| S. No. | Object distance $u$ (cm) | Image distance $v$ (cm) |
|---|---|---|
| 1 | – 90 | + 18 |
| 2 | – 60 | + 20 |
| 3 | – 30 | + 30 |
| 4 | – 20 | + 60 |
| 5 | – 18 | + 90 |
| 6 | – 10 | + 100 |

**(*a*) What is the focal length of the convex lens? Give reason in support of your answer.**

**(*b*) Write the serial number of that observation which is not correct. How did you arrive at this conclusion?**

**(*c*) Take an appropriate scale to draw ray diagram for the observation at S. No. 4 and find the approximate value of magnification.** **[Delhi]**

**Ans.** (*a*) The focal length of the convex lens is $f = 15$ cm.

Reason: Objects at S. No. (3) indicates that $u = -30$ cm, $v = 30$ cm

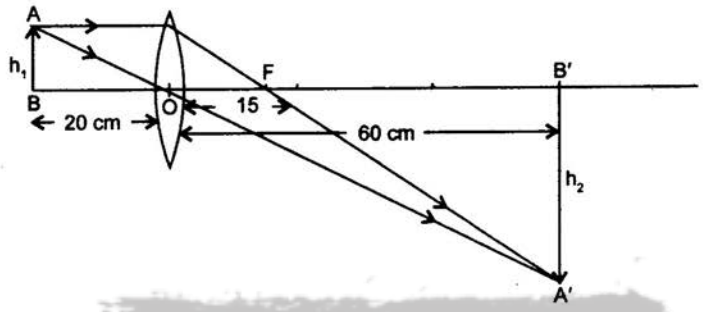
Thus, object is at 2F.

Therefore, $2f = 30$ cm or $f = 15$ cm

(*b*) Observation at S. No. 6 is not correct.

The value, $u = 10$ cm, indicates that the object is in between the optical centre and the focus, i.e. less than the focal length of the lens and hence the image should be on the same side as the object. Hence, the image distance should be negative and cannot be positive as shown in table.

(*c*) Ray diagram for the observation at S. No. 4 : Given: $u = -20$ cm; $v = 60$ cm; $f = 15$ cm




*Magnification*, $m = \frac{h_2}{h_1} = \frac{-4.5\text{ cm}}{+1.5\text{ cm}} = -3$

READERS VENUE

**31.** (*a*) **To construct a ray diagram we use two rays which are so chosen that it is easy to know their directions after reflection from the mirror. List two such rays and state the path of these rays after reflection in case of concave mirrors. Use these two rays and draw ray diagram to locate the image of an object placed between pole and focus of a concave mirror.**

(*b*) **A concave mirror produces three times magnified image on a screen. If the object is placed 20 cm in front of the mirror, how far is the screen from the object?**

**[Delhi]**

**Ans.** (*a*) **Rays which are chosen to construct a ray diagram for reflection are:**

(*i*) A ray parallel to the principal axis and

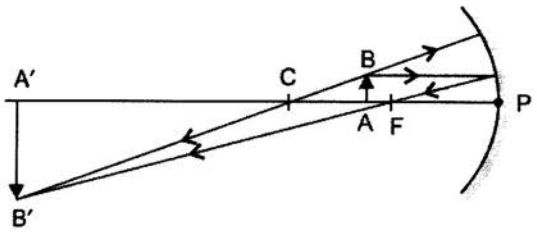
(*ii*) A ray passing through the centre of curvature of a concave mirror.

**Path of these light rays after reflection:**

(*i*) It will pass through the principal focus of a concave mirror

(*ii*) It gets reflected back along the same path.

When an object is placed between the pole and the principal focus of a concave mirror, a virtual, erect and enlarged image is formed behind the concave mirror as shown in the figure.




(*b*) Given: $u = -20$ cm and $m = 3$

Magnification, $m$, is given by

$$m = \frac{v}{-u}$$

$$\therefore \quad v = -m \times u = -(-3)(-20 \text{ cm}) = -60 \text{ cm}$$

Distance between the object and the screen is

$$= -60 \text{ cm} - (-20 \text{ cm}) = -40 \text{ cm}.$$

**32. Analyse the following observation table showing variation of image-distance ($v$) with object-distance ($u$) in case of a convex lens and answer the questions that follow, without doing any calculations:** **[All India]**

| S. No. | Object distance $u$ (cm) | Image distance $v$ (cm) |
|---|---|---|
| 1 | – 100 | + 25 |
| 2 | – 60 | + 30 |
| 3 | – 40 | + 40 |
| 4 | – 30 | + 60 |
| 5 | – 25 | + 100 |
| 6 | – 15 | + 120 |

**(*a*) What is the focal length of the convex lens? Give reason to justify your answer.**

**(*b*) Write the serial number of the observation which is not correct. On what basis have you arrived at this conclusion?**

**(*c*) Select an appropriate scale and draw a ray diagram for the observation at S.No. 2. Also find the approximate value of magnification.** **[All India]**

**Ans.** (*a*) The focal length of the convex lens is $f = 20$ cm.

**Reason:** Objects at S.No. 3 indicates that $u = -40$ cm, $v = +40$ cm

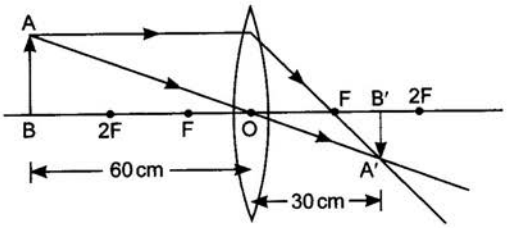
Thus, object is at 2F.

Therefore, $2f = 40 \text{ cm} \Rightarrow f = 20 \text{ cm}$

(*b*) Observation at S.No. 6 is not correct.

The value, $u = -15$ cm, indicates that the object is in between the optical centre and the focus (i.e., less than the focal length) of the lens and hence, the image should be on the same side as the object. Accordingly, the image distance should be negative and cannot be positive (+120 cm) as shown in table.

(*c*) Ray diagram for the observation at S.No. 2: Given: $u = -60$ cm; $v = +30$ cm; $f = 20$ cm



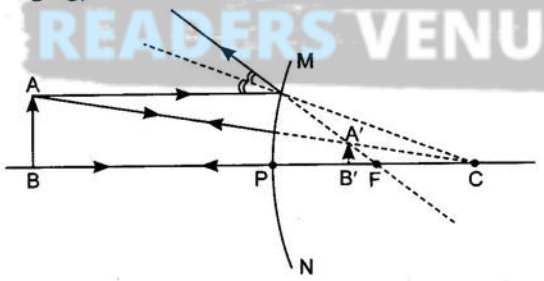

Magnification, $m = \frac{v}{u} = \frac{30\text{ cm}}{-60\text{ cm}} = -\frac{1}{2} = -0.5$

**33. (*a*) If the image formed by a mirror for all positions of the object placed in front of it is always diminished, erect and virtual, state the type of the mirror and also draw a ray diagram to justify your answer. Write one use such mirrors are put to and why.**

**(*b*) Define the radius of curvature of spherical mirrors. Find the nature and focal length of a spherical mirror whose radius of curvature is +24 cm.** **[All India]**

**Ans.** (*a*) Convex (diverging) mirror

READERS VENUE




**Use:** The convex mirror can be used as a rear view mirror.

**Reason:** (*i*) It always produces a virtual and erect image.

(*ii*)The size of image formed is smaller than the object.

Therefore, it enables the driver to see a wide field view of the traffic behind the vehicle in a small mirror.

(*b*) **Radius of Curvature:** The separation between the pole and the centre of curvature or the radius of the hollow sphere, of which the mirror is a part, is called radius of curvature ($R$), i.e., $PC = R$.

Since focal length of the mirror is +24 cm. It indicates that nature of the given spherical mirror is convex/diverging mirror.

As $R = 2f = 24$ cm

Therefore, $f = +12$ cm

**34. Analyse the following observation table showing variation of image-distance ($v$) with object-distance ($u$) in case of a convex lens and answer the question that follow without doing any calculations:** **[Foreign]**

| S. No. | Object-distance $u$ (cm) | Image-distance $v$ (cm) |
|---|---|---|
| 1 | – 60 | + 12 |
| 2 | – 30 | + 15 |
| 3 | – 20 | + 20 |
| 4 | – 15 | + 30 |
| 5 | – 12 | + 60 |
| 6 | – 9 | + 90 |

**($a$) What is the focal length of the convex lens? State reason for your answer.**

**($b$) For what object-distance ($u$) is the corresponding image-distance ($v$) not correct? How did you arrive at this conclusion?**

**($c$) Choose an appropriate scale to draw a ray diagram for the observation at S. No. 4 and find the approximate value of magnification.**

**Ans.** ($a$) The focal length of the convex lens is $f$ = 10 cm.

**Reason:** Objects at S.No.3 indicates that $u$ = 20 cm, $v$ = 20 cm

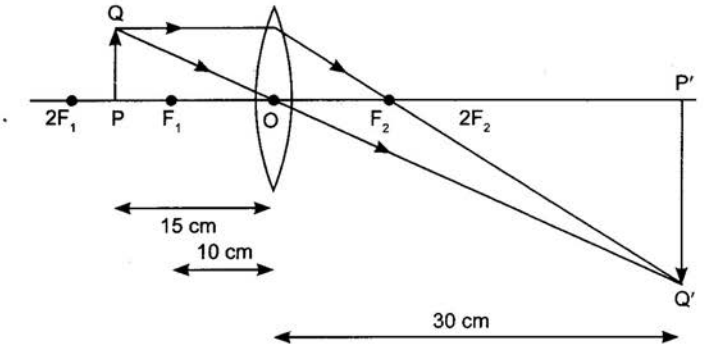
Thus, object is at 2F.

Therefore, $2f$ = 20 cm or $f$ = 10 cm

($b$) Observation at S.No.6 for $u$ = +9 cm and $v$ = +90 cm is not correct.

The value, $u$ = 9 cm, indicates that the object is in between the optical centre and the focus (i.e. less than the focal length) of the lens and hence the image should be on the same side as the object. Accordingly, the image distance should be negative and cannot be positive as shown in table.

($c$) Ray diagram for the observation at S.No.4: Given: $u$ = –15 cm; $v$ = 30 cm; $f$ = 10 cm




Magnification, An approximate value of magnification is –2 as

$$m = \frac{v}{u} = \frac{30}{-15} = -2.$$

**35.** **(*a*) Define the following terms in the context of spherical mirrors:**

**(*i*) Pole**

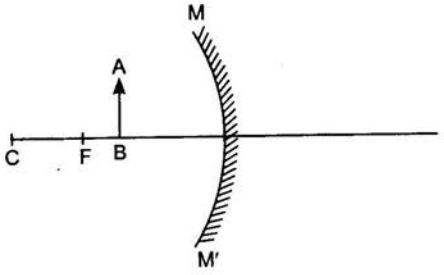
**(*ii*) Centre of curvature**

**(*iii*) Radius of curvature**

**(*iv*) Principal axis**

**(*b*) Draw ray diagrams to show the principal focus of (*i*) a concave mirror, and (*ii*) a convex mirror.**

**(*c*) In the following diagram, MM′ is a concave mirror and AB is an object. Draw on your answer-sheet a ray diagram to show the formation of image of this object.** **[Foreign]**



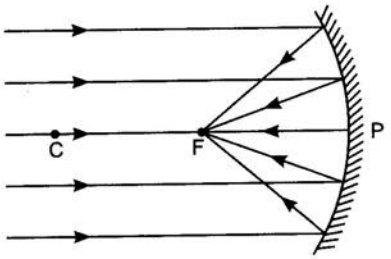

**Ans.** (*a*) (*i*) **Pole.** The central point of the reflecting spherical surface is called pole (P). It lies on the surface of the mirror.

(*ii*) **Centre of Curvature.** The centre of the hollow sphere of which, the spherical mirror is a part, is called centre of curvature (C).

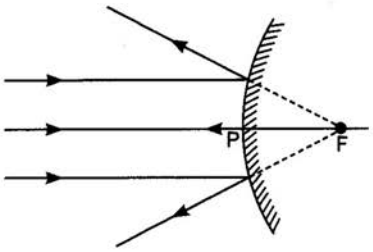
(*iii*) **Radius of Curvature.** The separation between the pole and the centre of curvature or the radius of the hollow sphere, of which the mirror is a part, is called radius of curvature(R), i.e. PC = R.

(*iv*) **Principal Axis.** The straight line joining the pole and the centre of curvature is called principal axis.

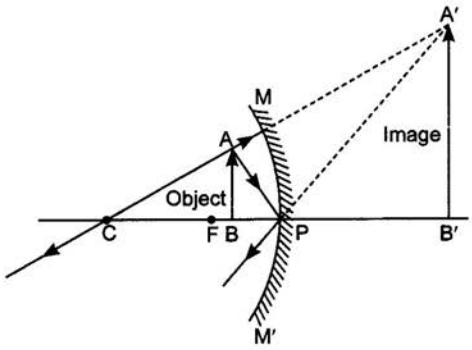
(*b*) (*i*) **Principal focus 'F' of a concave mirror:** The point F on the principal axis, where a beam of light parallel to the principal axis actually meet after reflection is called its principal focus (F).



(*ii*) **Principal focus 'F' of a convex mirror:** The point F on the principal axis, where a beam of light parallel to the principal axis appears to come from a fixed point on the principle axis is called its principal focus (F).




(*c*)




## 2017 (Compartment)

### Very Short Answer Type Questions [1 Mark]

**36. Write two different uses of concave mirrors.** **[Delhi]**

**Ans.** (*i*) In solar furnace (*ii*) In shaving mirror.

**37. Define power of a lens.** **[All India]**

**Ans.** The ability of lens to converge or diverge the ray of light is called power of lens. It is equal to the reciprocal of focal length, i.e. $P = \frac{1}{f}$.

### Short Answer Type [I] Questions [2 Marks]

**38. List four characteristics of the images formed by plane mirrors.** **[Delhi]**

**Ans.** The following are the four characteristics of the images formed by a plane mirror.

(*i*) The image is always virtual and erect.

(*ii*) The size of image is equal to that of the object.

(*iii*) The image is formed at the same distance behind the mirror as the object is in front of the mirror.

(*iv*) The image is laterally inverted.

## Short Answer Type [II] Questions [3 Marks]

**39. An object is placed perpendicular to the principal axis of a convex lens of focal length 8 cm. The distance of the object from the lens is 12 cm. Find the position and nature of the image.** **[Delhi]**

**Ans.** Given: $f = +8$ cm, $u = -12$ cm

Using, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we get

$$\frac{1}{8} = \frac{1}{v} - \frac{1}{-12} = \frac{1}{v} + \frac{1}{12}$$

$$\frac{1}{v} = \frac{1}{8} - \frac{1}{12} = \frac{3-2}{24} = \frac{1}{24}$$

$\therefore$ $v = +24$ cm.

Real, inverted and magnified image is formed on the opposite side of convex lens at a distance of 24 cm from its optical centre.

**40. Define the term magnification as referred to spherical mirrors. If a concave mirror forms a real image 40 cm from the mirror, when the object is placed at a distance of 20 cm from its pole, find the focal length of the mirror.** **[Delhi]**

**Ans. Magnification of spherical mirror ($m$):** It is equal to the ratio of size (height) of the image to the size (height) of the object. Thus,

$$m = \frac{\text{Size of image } (h_2)}{\text{Size of object } (h_1)}$$

READERS VENUE

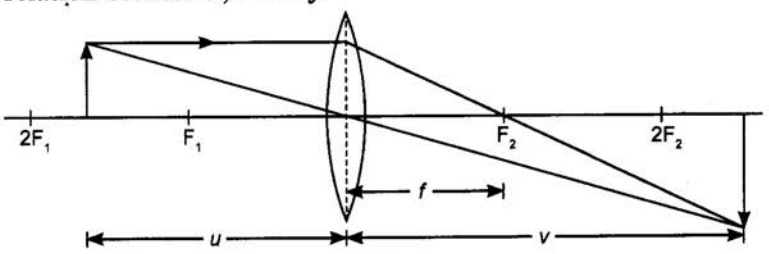
**Given:** For concave mirror, $u = -20$ cm; $v = -40$ cm

Using mirror equation, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{-40} + \frac{1}{-20} = -\frac{3}{40} \Rightarrow f = -\frac{40}{3}$ cm

The relative extent to which the image of an object is magnified with respect to the size of object.

**41. Draw a ray diagram to show the formation of real image of an object when refraction of light takes place through a convex lens. Mark as per the new Cartesian sign convention the object-distance ($u$), image distance ($v$) and the focal length ($f$) and also write the relation between $u$, $v$ and $f$.** **[All India]**

**Ans.**




The relation between $u$, $v$ and $f$ is

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

**42. State Snell's law of refraction of light. Express it mathematically. Write the relationship between absolute refractive index of a medium and speed of light in vacuum. [All India]**

**Ans. Laws of refraction of light**

(*i*) The incident ray, the normal and the refracted ray at the point of incidence, all lie in the same plane for the two given transparent media.

(*ii*) **Snell's law:** The ratio of sine of angle of incidence (i.e. sin $i$) to the sine of angle of refraction (i.e. sin $r$) is always constant for the light of given colour and for the given pair of media.

Mathematically, $\frac{\sin i}{\sin r} = \text{constant} = n_{21}$

The constant $n_{21}$ is called refractive index of the second medium with respect to the first medium.

Absolute refractive index of the medium is given by

$$n_m = \frac{\text{Speed of light in vacuum } (c)}{\text{Speed of light in medium } (v)} = \frac{c}{v}$$

## Long Answer Type Questions [5 Marks]

**43. (*a*) Draw labelled ray diagrams for each of the following cases to show the position, nature and size of the image formed by a convex lens when the object is placed**

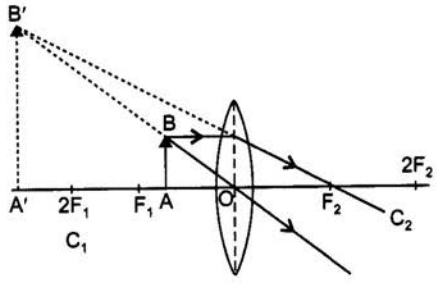
**(*i*) between its optical centre (O) and principal focus (F)**

**(*ii*) between F and 2F**

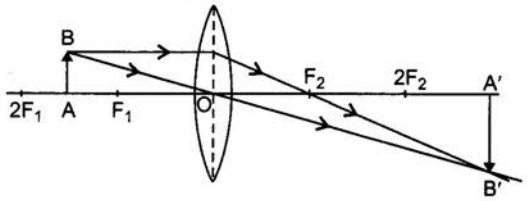
READERS VENUE

**(*b*) How will the nature and size of the image formed in the above two cases, (*i*) and (*ii*) change, if the convex lens is replaced by a concave lens of same focal length? [Delhi]**

**Ans.** (*a*) (*i*) a magnified and erect image only when the object is placed between its focus '*F*' and optical centre '*O*' of the lens.



(*ii*) a magnified and inverted image when an object is placed in the following positions between $F_1$ and $2F_1$




(*b*) Whatever be the position of object as given in case (*i*) and (*ii*), the image formed by the concave lens is always virtual, erect and diminished.

**44. State the laws that are followed when light is reflected by spherical mirrors. Draw a ray diagram to show the formation of image of an object placed infront of a convex mirror. List two characteristics of the image formed. Briefly explain one use of convex mirrors.** **[All India]**

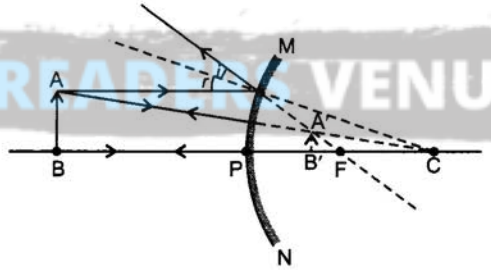
**Ans.** (*a*) The two laws of reflection of light are:

(*i*) The angle of incidence is equal to the angle of reflection.

(*ii*) The incident ray, the normal to the reflecting surface at the point of incidence and the reflected ray from that point, all lie in the same plane.

(*b*) (*i*) Image formed is behind the mirror between pole (P) and focus (F).

(*ii*) Virtual, erect and diminished image is formed.




(*c*) **Rear-view mirror of vehicles:** Convex mirror

Convex mirror is used because it always produces a virtual and erect image whose size is smaller than the object. Therefore, it enables the driver to see wide field view of the traffic behind the vehicle in a small mirror.

## 2016

### Short Answer Type [I] Questions [2 Marks]

**45. State two positions in which a concave mirror produces a magnified image of a given object. List two differences between the two images.** **[Delhi]**

**Ans.** The following are the two positions in which a concave mirror produces a magnified image of the given object.

When the object is placed between:

(*i*) focus (F) and centre of curvature(C).

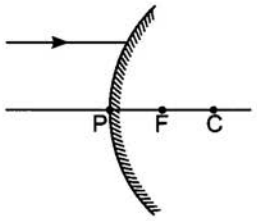
(*ii*) focus (F) and pole (P).

Two differences between the two images are that the image formed in case

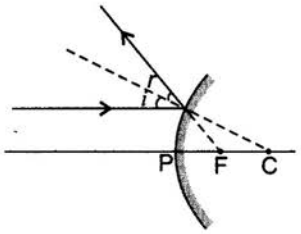
(*i*) is real and inverted, whereas in case

(*ii*) is virtual and erect.

**46. A ray of light is incident on a convex mirror as shown. Redraw the diagram and complete the path of this ray after reflection from the mirror. Mark angle of incidence and angle of reflection on it.** **[Delhi]**




**Ans.**




**47. What is meant by power of a lens? What does its sign (+ve or –ve) indicate? State its S.I unit. How is this unit related to food length of lens?** **[Delhi]**

**Ans.** The ability of a lens to converge or diverge the rays of light is called power (P) of the lens. It is equal to the reciprocal of the focal length, i.e. $P = 1/f$.

The positive (+ve) sign of power indicates that the given lens is a converging or convex lens, while the negative (–ve) sign of power for a diverging or concave lens.

The SI unit of power of a lens is 'dioptre (D)'. If the focal length of the lens is expressed in metre, then power is in dioptre. A lens of focal length 100 cm has a power of 1 dioptre, i.e. 1 dioptre = 1 $m^{-1}$.

**48. Name the type of the mirrors used in design of solar furnaces. Explain how high temperature is achieved by this device?** **[All India]**

**Ans.** A concave mirror is used in design of solar furnaces. High temperature is achieved by this device by focussing the light energy incident on the concave mirror to its focal point.

**49. "The magnification produced by a spherical mirror is – 3." List four information you obtain from this statement about the mirror/image.** **[All India]**

**Ans.** (*i*) Concave mirror

(*ii*) Real image

(*iii*) Inverted and

(*iv*) Three times magnified image is formed.

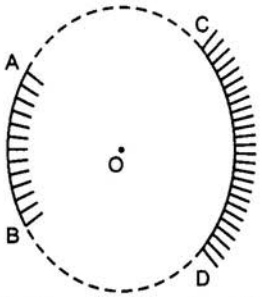
**50. The refractive indices of glass and water with respect to air are 3/2 and 4/3 respectively. If speed of light in glass is $2 \times 10^8$ m/s, find the speed of light in water.** **[All India]**

**Ans.** Given: $n_g = \frac{3}{2}, n_w = \frac{4}{3}, v_g = 2 \times 10^8$ m/s

We know that $n_w = \dfrac{\text{Speed of light in vaccum}}{\text{Speed of light in water}}$

$$\frac{4}{3} = \frac{3\times10^8}{v_w} \Rightarrow v_w = \frac{9}{4} \times 10^8 = 2.25 \times 10^8 \text{ ms}^{-1}$$

**51. AB and CD, two spherical mirrors, form parts of a hollow spherical ball with its centre at O as shown in the diagram. If arc AB = $\frac{1}{2}$ arc CD, what is the ratio of their focal lengths? State which of the two mirrors will always form virtual image of an object placed in front of it and why.** **[Foreign]**




**Ans.** The focal length of a spherical mirror depends only on the radius of curvature of the hollow sphere of which the mirror is a part ($f$ = R/2). Both spherical mirrors are the part of the same hollow spherical ball. Hence, their radius of curvature is same. Therefore, ratio of their focal lengths will be 1: 1.

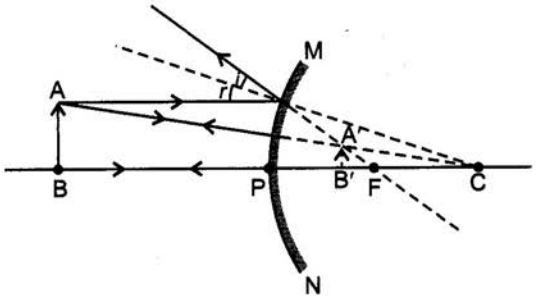
Mirror AB will always form a virtual image of an object placed in front of it because it is a convex mirror.

READERS VENUE

**52. List two properties of the images formed by convex mirrors. Draw ray diagram in support of your answer.** **[Foreign]**

**Ans.** (*i*) Image formed is behind the mirror between pole (P) and focus (F).

(*ii*) Virtual, erect and diminished image is formed.




**53. The linear magnification produced by a spherical mirror is +3. Analyse this value and state the (*i*) type of mirror and (*ii*) position of the object with respect to the pole of the mirror. Draw ray diagram to show the formation of image in this case.** **[Foreign]**

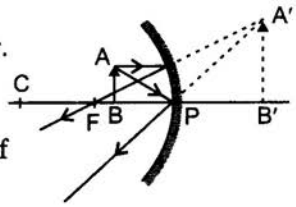
**Ans.** The linear magnification produced by a spherical mirror is +3. It shows that:

- the size of image is three times the size of object, and
- the image is virtual and erect, and formed behind the mirror.

Hence,

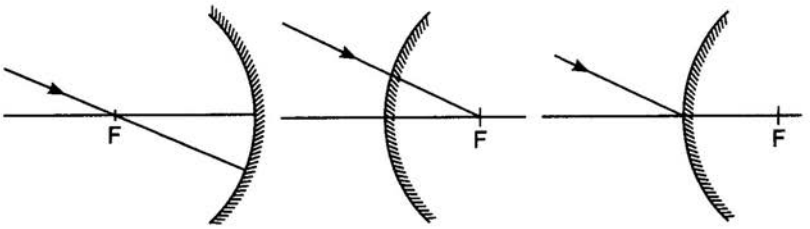
(*i*) the mirror is a concave mirror, and

(*ii*) the object is placed between the pole and the focus of a concave mirror.

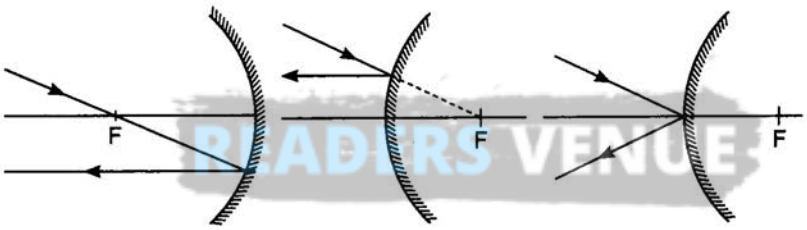



## Short Answer Type [II] Questions [3 Marks]

**54. Draw the following diagram, in which a ray of light is incident on a concave/convex mirror, on your answer sheet. Show the path of this ray, after reflection, in each case.** **[Delhi]**




**Ans.**




READERS VENUE

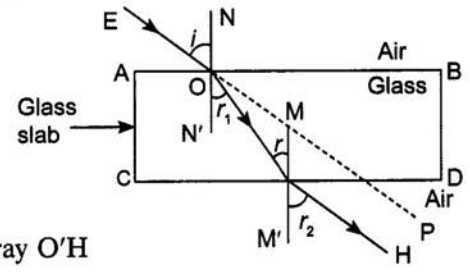
**55. (*a*) Draw a ray diagram to show the refraction of light though a glass slab and mark angle of refraction and the lateral shift suffered by the ray of light while passing through the slab.**

**(*b*) If the refractive index of glass for light going from air to glass is 3/2, find the refractive index of air for light going from glass to air.** **[Delhi]**

**Ans.** (*a*) $\angle r_1$ = angle of refraction when light propagate from air to glass.

$\angle r_2$ = angle of emergence of light ray from glass slab to air.

$\angle i_1$ = angle of incidence.




Incident ray EF is parallel to emergent ray O'H

O'L is lateral displacement of emergent ray from incident ray.

(*b*) Given: $n_{ga} = \frac{3}{2}$ (∴ refractive index of glass with respect to air)

as $n_{ag} = \frac{1}{n_{ga}} = \frac{3}{2}$

**56. The image of an object formed by a mirror is real, inverted and is of magnification –1. If the image is at a distance of 40 cm from the mirror, where is the object placed? Where would the image be if the object is moved 20 cm towards the mirror? State reason and also draw ray diagram for the new position of the object to justify your answer.** **[All India]**

**Ans.** Given: Magnification of spherical mirror, $m = -1$, Image distance, $v = -40$ cm

$$m = -\frac{v}{u} \Rightarrow u = -\frac{v}{m} = -\frac{-40}{-1} = -40 \text{ cm}$$

Therefore, the object is placed at a distance of 40 cm in front of the spherical mirror.

**Case I:** When $u = -40$ cm and $v = -40$ cm

Using mirror formula, we get

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \Rightarrow \frac{1}{f} = \frac{1}{-40} + \frac{1}{-40} = -\frac{2}{40} \Rightarrow f = -\frac{40}{2} = -20 \text{ cm}$$

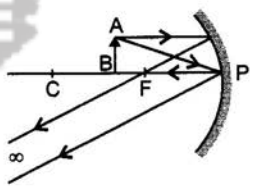
Hence, the focal length of the mirror is 20 cm and the negative focal length shows that it is a concave mirror.

The new position of the object when it moves 20 cm towards the concave mirror, $u' = -(40 - 20) = -20$ cm.

**Case II:** $u' = -20$ cm, $f = -20$ cm, $v' = ?$

READERS VENUE

Using mirror formula, $\frac{1}{f} = \frac{1}{v'} + \frac{1}{u'}$




$$\Rightarrow \frac{1}{-20} = \frac{1}{v'} + \frac{1}{-20}$$

$$\Rightarrow \frac{1}{v'} = -\frac{1}{20} + \frac{1}{20} = -\left(\frac{1}{20} - \frac{1}{20}\right) = -\frac{0}{20}$$

$$\Rightarrow v' = -\frac{20}{0} = \infty \text{ (infinity)}$$

Thus, the image is formed at infinity.

Hence, when the object is moved 20 cm towards the mirror, a real, inverted and highly enlarged image is formed at infinity.

**57. Describe an activity to show that the colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism. Also draw ray diagram to show the recombination of the spectrum of white light.** **[All India]**

**Ans.** Given: $m = -2$, $v = -30$. So the mirror used is concave.

Using formula, Magnification, $m = \frac{-v}{u}$ for mirror.

$$\frac{-(-30)}{4} = -2$$

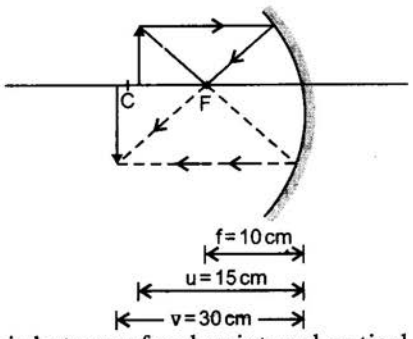
$$\Rightarrow \quad u = -15 \text{ cm.}$$

Using mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

$$\frac{1}{f} = \frac{-1}{30} - \frac{1}{15} = \frac{-1-2}{30} = \frac{-3}{30} = \frac{-1}{10}$$

$$\Rightarrow \quad f = -10.$$



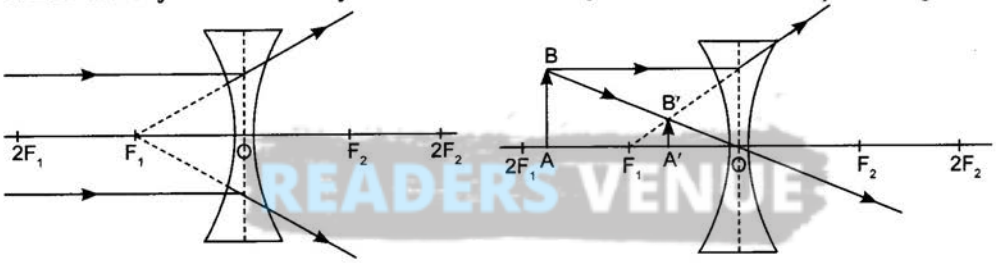

When object is moved 10 cm toward mirror then it is between focal point and optical centre. Thus, image is formed behind the mirror. It is virtual erect and enlarged.

**58. If the image formed by a lens for all positions of the object placed in front of it is always virtual, erect and diminished, state the type of the lens. Draw a ray diagram in support of your answer. If the numerical value of focal length of such a lens is 20 cm, find its power in new cartesian sign conventions.** **[Foreign]**

**Ans.** Concave lens.

When the object is at infinity

When the object is in between $F_1$ and $2F_1$




READERS VENUE

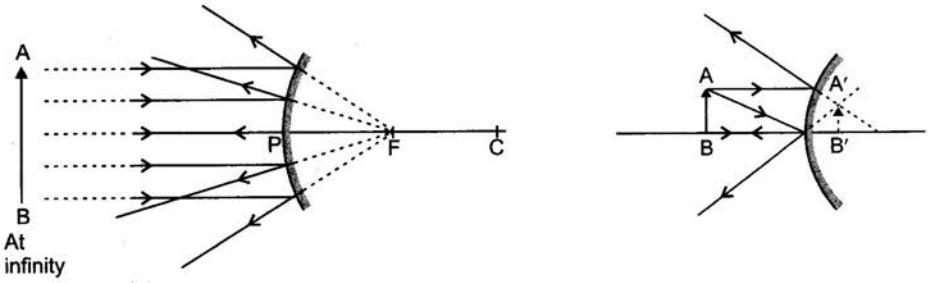
Thus, from the figure, it is clear that whatever be the position of the object in front of a concave lens, the image formed is always virtual, erect and diminished,

Power of the given lens is calculated as

$$\text{Power} = \frac{1}{\text{Focal length}} = \frac{1}{f(m)} = \frac{100 \text{ cm}}{-20 \text{ cm}} = -5\text{D}$$

**59. If the image formed by mirror for all positions of the object placed in front of it is always virtual and diminished, state the type of the mirror. Draw a ray diagram in support of your answer. Where are such mirrors commonly used and why?** **[Foreign]**

**Ans.** Convex mirror



A convex mirror is used as rear-view mirror in vehicles because it always produces a virtual and erect image whose size is smaller than the object. Therefore, it enables the driver to see a wide field view of the traffic behind the vehicle in a small mirror.

## Long Answer Type Questions [5 Marks]

**60.** **(*a*) Define the following terms in the context of spherical mirrors:**

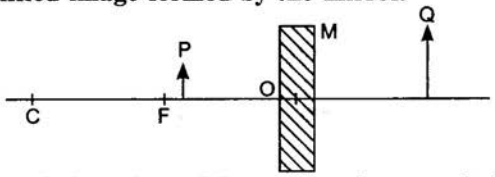
**(*i*) Pole** **(*ii*) Centre of curvature**

**(*iii*) Principal axis** **(*iv*) Principal focus**

**(*b*) Draw ray diagrams to show the principal focus of a:**

**(*i*) Concave mirror** **(*ii*) Convex mirror**

**(*c*) Consider the following diagram in which M is a mirror and P is an object and Q is its magnified image formed by the mirror.**




**State the type of the mirror M and one characteristic property of the image Q. [Delhi]**

**Ans.** (*a*) (*i*) Refer to Ans. 35 (*a*) (*i*).

(*ii*) Refer to Ans. 35 (*a*) (*ii*).

(*iii*) Refer to Ans. 35 (*a*) (*iv*).

(*iv*) **Principal focus:** The point 'F' on the principal axis, where the incident light rays parallel to the principal axis actually meet (converge) (in case of concave mirror) or appear to diverge or come from a point on the principal axis (in case of convex mirror) after reflection is called its principal focus (F).

(*b*) Refer to Ans. 35 (*b*) (*i*) & (*ii*).

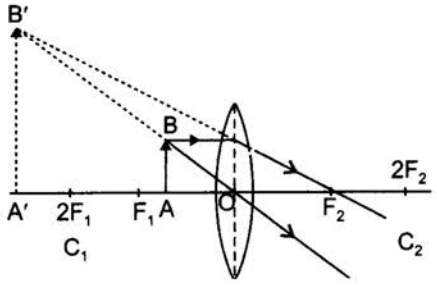
(*c*) The given mirror M is a concave spherical mirror. When the object lies between the pole and focus of a concave mirror, an erect, virtual and enlarged image is formed. So one characteristic property of the image Q formed in the given figure is that it is virtual.

**61.** **(*a*) Draw a ray diagram to show the formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus.**

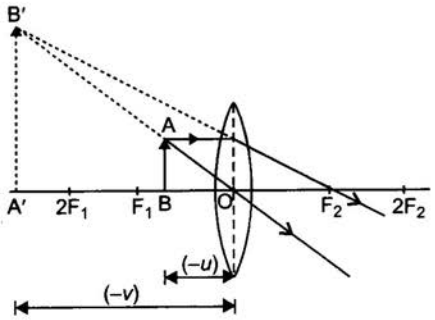
**(*b*) In the above ray diagram mark the object-distance (*u*) and the image-distance (*v*) with their proper signs (+ve or –ve as per the new Cartesian sign convention) and state how these distances are related to the focal length (*f*) of the convex lens in this case.**

**(*c*) Find power of a convex lens which forms a real, and inverted image of magnification –1 of an object placed at a distance of 20 cm from its optical centre. [Delhi]**

**Ans.** (*a*) The formation of image by a convex lens when an object is placed in front of the lens between its optical centre and principal focus is shown below.




(*b*) All the distances measured to the right of the origin (along + $x$-axis), i.e. along the direction of incident ray are taken as positive, while those measured to the left of the origin (along – $x$-axis), i.e. opposite to the direction of incident ray are taken as negative. Accordingly object distance '$u$' and image distance '$v$' both are negative as they are measured opposite to the direction of incident ray.




The object distance ($u$), image distance ($v$) and the focal length ($f$) of a convex lens in the above case are related as given below.

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

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(*c*) Given: object distance, $u$ = –20 cm, Image distance, $v$ =?
Linear magnification, $m$ = –1

For spherical lens, linear magnification is given by $m = \frac{v}{u}$

$$\Rightarrow \qquad -1 = \frac{v}{-20} \quad \Rightarrow \quad v = +20 \text{ cm}$$

Focal length of convex lens is calculated as

$$\therefore \qquad \frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{20} - \frac{1}{-20} = \frac{1}{10} \quad \Rightarrow \quad f = +10 \text{ cm}$$

Therefore, the power of the given convex lens is

$$\text{Power} = \frac{1}{\text{Focal length}}$$

$$= \frac{1}{f(m)} = \frac{100}{10} = +10\text{D}$$

**62. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.**

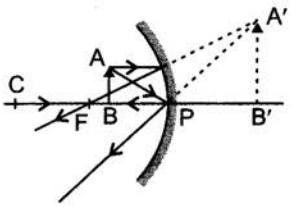
**(*i*) What should be the range of distance of an object placed in front of the mirror?**

**(*ii*) Will the image be smaller or larger than the object. Draw ray diagram to show the formation of image in this case.**

(*iii*) **Where will the image of this object be, if it is placed 24 cm in front of the mirror? Draw ray diagram for this situation also to justify your answer.**

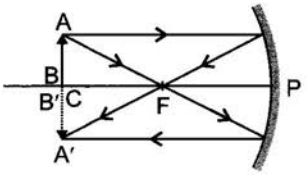
**Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.** **[All India]**

**Ans.** (*a*) (*i*) To obtain an erect image of an object, using concave mirror of focal length of 12 cm, the object should be placed at a distance less than its focal length, i.e. 12 cm.




(*ii*) The obtained image will be larger than the object and the formation of image in this case is shown.

(*iii*) If object is placed at C ( = 24 cm) in front of the concave mirror of focal length of 12 cm, then a real, inverted and same size image as that of object is formed at C. For this situation, the diagram is shown.




**63.** (*a*) **Define optical centre of a spherical lens.**

(*b*) **A divergent lens has a focal length of 20 cm. At what distance should an object of height 4 cm from the optical centre of the lens be placed so that its image is formed 10 cm away from the lens. Find the size of the image also.**

(*c*) **Draw a ray diagram to show the formation of image in above situation.**

**[All India]**

READERS VENUE

**Ans.** (*a*) **Optical centre:** The central point 'O' on the principal axis of a spherical lens, through which an incident ray of light passes (refracted) without suffering any deviation is called optical centre of the spherical lens.

(*b*) Given: $f = -20$ cm, $h_o = 4$ cm, $v = -10$ cm

Using lens formula,

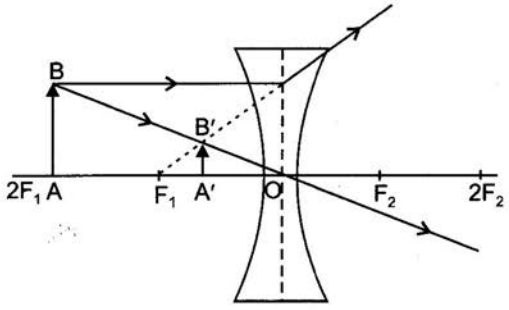
$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{u} = \frac{1}{v} - \frac{1}{f} \Rightarrow \frac{1}{-10} - \frac{1}{-20} = -\frac{1}{20} \Rightarrow u = -20 \text{ cm}$$

Magnification produced by lens is given by

$$m = \frac{h_i}{h_o} = \frac{v}{u}, \text{ we get } h_i = \frac{v}{u} \times h_o = \frac{-10}{-20} \times 4 = +2 \text{ cm}$$

Therefore, a diminished image is formed and its size is 2 cm.

(*c*)



**64.** (*a*) **Define focal length of a divergent lens.**

(*b*) **A divergent lens of focal length 30 cm forms the image of an object of size 6 cm on the same side as the object at a distance of 15 cm from its optical centre. Use lens formula to determine the distance of the object from the lens and the size of the image formed.**

(*c*) **Draw a ray diagram to show the formation of image in the above situation.**

**[All India]**

**Ans.** (*a*) **Focal length of a divergent lens:** When a parallel beam of light is incident on either of the spherical surface of a divergent lens, i.e. concave lens, after refraction through it, it appears to come from a fixed point on the principal axis. This point is called the principal focus of a concave lens. The distance of the principal focus from the optical centre of the divergent lens is called the focal length '*f*' of the lens.

(*b*) Given: $f = -30$ cm, $h_o = 6$ cm, $v = -15$ cm

Focal length of concave lens is given by

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-15} - \frac{1}{-30} = -\frac{1}{30}$$

$$\Rightarrow \quad u = -30 \text{ cm}$$

Using the formula, $m = \dfrac{h_i}{h_o} = \dfrac{v}{u}$

we get $h_i = \dfrac{v}{u} \times h_o = \dfrac{-15}{-30} \times 6 = +3$ cm

Therefore, a diminished image is formed and its size is 3 cm.

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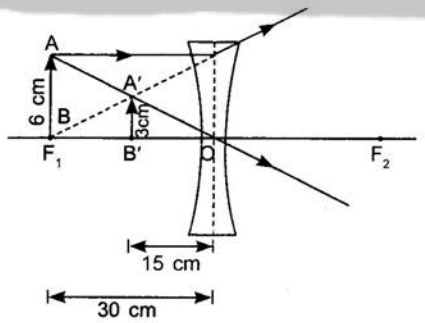
(*c*)




**65. Suppose you have three concave mirrors A, B and C of focal length 10 cm, 15 cm and 20 cm. For each concave mirror you perform the experiment of image formation for three values of object distance of 10 cm, 20 cm and 30 cm. Giving reason answer the following:**

(*a*) **For the three object distances, identify the mirror/mirrors which will form an image of magnification –1.**

(*b*) **Out of the three mirrors identify the mirror which would be preferred to be used for shaving purposes/makeup.**

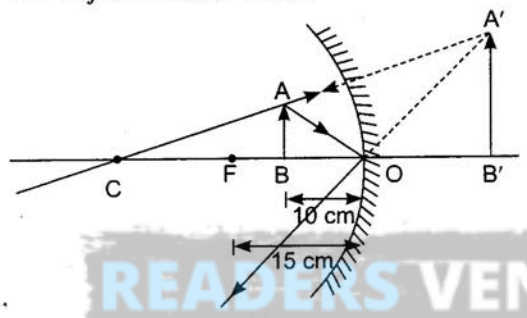
(*c*) **For the mirror B draw ray diagram for image formation for object distances 10 cm and 20 cm.** **[Foreign]**

**Ans.** (*a*) A real, inverted and same size image as that of object formed by the concave mirror will form an image of magnification –1. It is possible only when the object is placed at C ( R = 2*f*). Hence, for the object distances of 20 cm and 30 cm ,concave mirrors 'A' and 'B' will form the real, inverted and same size images as that of the object. Therefore, the mirrors 'A' and 'B' will form an image of magnification –1.

(*b*) Concave mirror 'C' of focal length 20 cm will be preferred to be used for shaving purposes/makeup. This is because when we bring our face within its focal length, it forms a virtual, erect and enlarged image of our face.

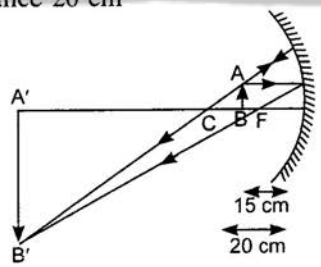
(*c*) Ray diagram for image formation by mirror 'B'

(*i*) For object distance 10 cm




READERS VENUE

(*ii*) For object distance 20 cm




**66. At what distance from a concave lens of focal length 20 cm a 6 cm tall object be placed so as to obtain its image at 15 cm from the lens? Also calculate the size of the image formed. Draw a ray diagram to justify your answer for the above situation and label it.** **[Foreign]**

**Ans.** Given: $f = -20$ cm, $h_o = 6$ cm, $v = -15$ cm

Using lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

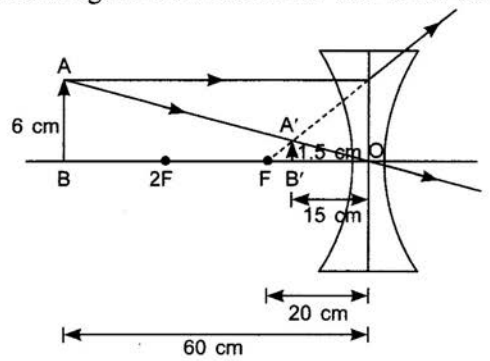
$$= \frac{1}{-15} - \frac{1}{-20} = -\frac{1}{60}$$

$$\Rightarrow \quad u = -60 \text{ cm}$$

Using magnification formula, $m = \frac{h_i}{h_o} = \frac{v}{u}$

we get $h_i = \frac{v}{u} \times h_o = \frac{-15}{-60} \times 6 = +1.5$ cm

Therefore, a diminished image is formed and its size is 1.5 cm.




READERS VENUE

## 2015

### Very Short Answer Type Questions [1 Mark]

**67. What is the magnification of the images formed by plane mirrors and why? [Delhi]**

**Ans.** The magnification of the images formed by plane mirrors is 1 as the size of image is equal to the size of object.

**68. What is meant by power of a lens? [Delhi]**

**Ans.** The ability of a lens to converge or diverge the rays of light is called power of a lens.

### Short Answer Type [I] Questions [2 Marks]

**69. List four characteristics of the images formed by plane mirrors. [Delhi]**

**Ans.** The following are the four characteristics of the images formed by a plane mirror.

(*i*) The image is always virtual and erect.

(*ii*) The size of image is equal to that of the object.

(*iii*) The image is formed at the same distance behind the mirror as the object is in front of the mirror.

(*iv*) The image is laterally inverted.

**70. List four specific characteristics of the images of the object formed by convex mirrors.** **[Delhi]**

**Ans.** The following are the four specific characteristics of the images of the object formed by a convex mirror.

(*i*) The image is always formed behind the mirror, between the pole and its focus.

(*ii*) The image is always virtual and erect.

(*iii*) The size of image is always smaller than the object i.e. diminished.

(*iv*) Magnification is always positive.

**71. The absolute refractive indices of glass and water are 3/2 and 4/3 respectively. If the speed of light in glass is $2 \times 10^8$ m/s, calculate the speed of light in (*i*) vacuum, (*ii*) water.** **[All India]**

**Ans.** Given: $n_g = \frac{3}{2}$, $n_w = \frac{4}{3}$, $v_g = 2 \times 10^8$ m/s

(*i*) We know that $n_g = \dfrac{\text{Speed of light in vacuum}}{\text{Speed of light in glass}} = \dfrac{c}{v_g}$

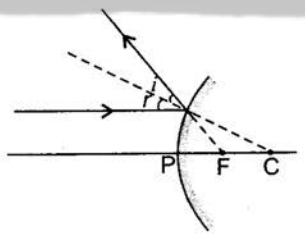
$$\frac{3}{2} = \frac{c}{2 \times 10^8} \Rightarrow c = 3 \times 10^8 \text{ ms}^{-1}$$

So, speed of light in vacuum $= 3 \times 10^8$ m/s

(*ii*) Refer to Ans. 50.

**72. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror and show the angle of incidence and angle of reflection on it.** **[All India]**

**Ans.**




## Short Answer Type [II] Question [3 Marks]

**73. To construct a ray diagram we use two rays of light which are so chosen that it is easy to determine their directions after reflection from the mirror. Choose these two rays and state the path of these rays after reflection from a concave mirror. Use these two rays to find the nature and position of the image of an object placed at a distance of 15 cm from a concave mirror of focal length 10 cm.** **[Delhi]**

**Ans.** The two rays which are chosen to construct a ray diagram for reflection from the mirror are:

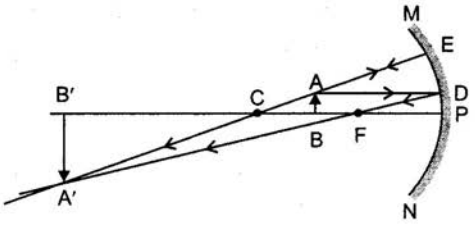
(*i*) a ray parallel to the principal axis, and

(*ii*) a ray passing through the centre of curvature of a concave mirror.

The path of these rays after reflection from a concave mirror:

(*i*) A ray parallel to the principle axis, after reflection, will pass through the principal focus of a concave mirror.

(*ii*) A ray passing through the centre of curvature, after reflection, will reflected back along the same path.




For a concave mirror, $f = -10$ cm, $u = -15$ cm, $v = ?$

Using the mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$, we get

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-10} - \frac{1}{-15} = -\frac{1}{10} + \frac{1}{15} = \frac{-3+2}{30} = -\frac{1}{30}$$

$\therefore \quad v = -30$ cm

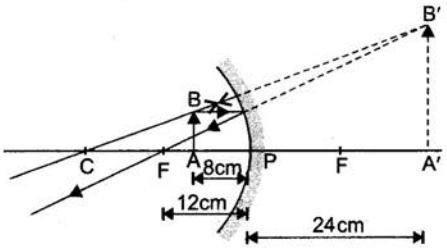
So the screen should be placed at a distance of 30 cm on the same side of the object in order to obtain a sharp image.

READERS VENUE

Nature of image: Real, inverted and enlarged.

**74. To construct ray diagrams, two rays of light are generally so chosen that it is easy to determine their directions after reflection from a mirror. Choose two such rays and state the path/direction of these rays after reflection from a concave mirror. Use these two rays to find the position and nature of the image of an object placed at a distance of 8 cm from a concave mirror of focal length 12 cm.** **[Delhi]**

**Ans.** Refer to Ans. 73.




For a concave mirror, $f = -12$ cm, $u = -8$ cm, $v = ?$

Using the mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\therefore \quad \frac{1}{-12} = \frac{1}{v} + \frac{1}{-8}$

$\Rightarrow \quad \frac{1}{v} = \frac{1}{8} - \frac{1}{12} = \frac{3-2}{24} = \frac{1}{24}$

$\therefore \quad v = +24 \text{ cm}$

So, the image is formed behind the mirror at a distance of 24 cm from its pole and it is virtual, erect and magnified.

**75. If the image formed by a mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it? Draw a ray diagram to justify your answer. Where and why do we generally use this type of mirror?**

**[All India]**

**Ans.** Refer to Ans. 59.

**76. An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10 cm. If the distance of the object from the optical centre of the lens is 20 cm, determine the position, nature and size of the image formed using the lens formula.** **[All India]**

**Ans.** For concave lens,

Given: $h_o = +5$ cm, $f = -10$ cm, $u = -20$ cm, $v = ?$, $h_2 = ?$

Using the lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

READERS VENUE

$\therefore \quad \frac{1}{-10} = \frac{1}{v} - \frac{1}{-20} \Rightarrow \frac{-1}{10} = \frac{1}{v} + \frac{1}{20}$

$\Rightarrow \quad \frac{1}{v} = -\frac{1}{10} - \frac{1}{20} = \frac{-2-1}{20} = -\frac{3}{20}$

$v = -\frac{20}{3} = -6.67 \text{ cm}$

So, the image is formed on the same side of the object at a distance of 6.67 cm. The negative sign indicates that the image is virtual.

Also $|v| < |u|$, so the image is diminished.

$\because \quad m = \frac{v}{u} = \frac{h_i}{h_o} \Rightarrow \frac{-20/3}{-20} = \frac{h_i}{5} \Rightarrow h_i = \frac{5}{3} = 1.66 \text{ cm}$

So the image is virtual, erect, diminished and of size 1.66 cm.

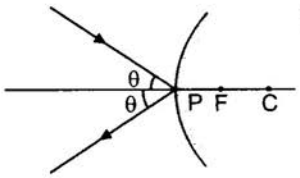
**77. Draw a ray diagram to show the path of the reflected ray in each of the following cases. A ray of light incident on a convex mirror**

**(*a*) strikes at its pole making an angle θ from the principal axis.**

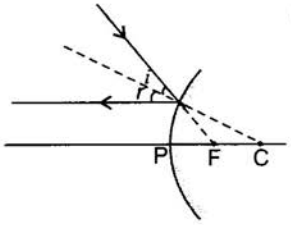
**(*b*) is directed towards its principal focus.**

**(*c*) is parallel to its principal axis.** **[Foreign]**

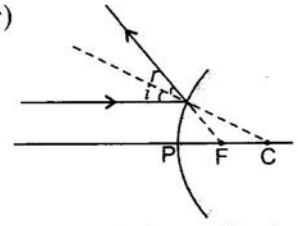
**Ans.** (*a*)




(*b*)




(*c*)




**78. State the laws of refraction of light. If the speed of light in vacuum is $3 \times 10^8$ m/s, find the absolute refractive index of a medium in which light travels with a speed of $1.4 \times 10^8$ m/s.** **[Foreign]**

**Ans.** Refer to Ans. 7.

Given: $c = 3 \times 10^8$ m/s, $v = 1.4 \times 10^8$ m/s

$$\therefore \quad n_m = \frac{c}{v} = \frac{3 \times 10^8}{1.4 \times 10^8} = \frac{3}{1.4} = 2.14$$

**79. A student wants to project the image of a candle flame on a screen 80 cm in front of a mirror by keeping the candle flame at a distance of 20 cm from its pole.**

**(*i*) Which type of mirror should the student use?**

**(*ii*) Find the magnification of the image produced.**

**(*iii*) Find the distance between the object and its image.**

**(*iv*) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.** **[Foreign]**

**Ans.** (*i*) Concave mirror (*ii*) Magnification, $m = -\frac{v}{u} = -\frac{-80}{-20} = -4$

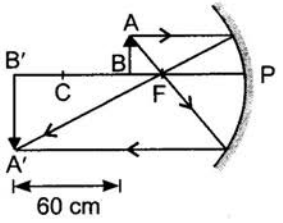
(*iii*) Distance between the object and its image = 80 – 20 = 60 cm

(*iv*) The focal length of the concave mirror is calculated by

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{-80} + \frac{1}{-20} = -\frac{5}{80} = -\frac{1}{16}$$

$$\therefore \quad f = -16 \text{ cm} \Rightarrow R = 2f = -32 \text{ cm}$$

Since $u = -20$ cm, it implies that the object lies in between $F$ and $C$.

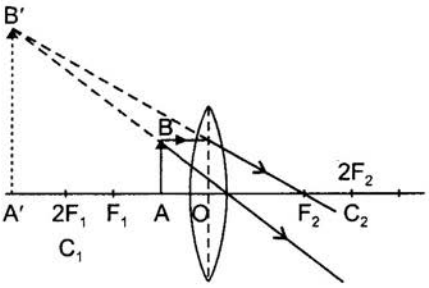


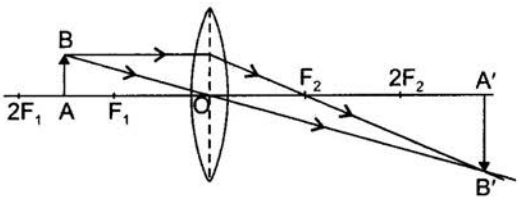

## Long Answer Type Questions [5 Marks]

**80. "A convex lens can form a magnified erect as well as magnified inverted image of an object placed in front of it". Draw ray diagram to justify this statement stating the position of the object with respect to the lens in each case.**

**An object of height 4 cm is placed at a distance of 20 cm from a concave lens of focal length 10 cm. Use lens formula to determine the position of the image formed.** **[Delhi]**

**Ans.**
- When object AB lies between focus ($F_1$) and optical centre (O) of a convex lens, virtual, erect and magnified image is formed as shown in figure (*a*).
- When object AB lies between $F_1$ and $2F_1$ of a convex lens magnified inverted image is obtained.




Given: $h_i = +4$ cm, $u = -20$ cm, $v = ?$, $f = -10$ cm

Using the lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\therefore \quad \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{-10} + \frac{1}{-20} = -\frac{3}{20}$

or $\quad v = \frac{-20}{3} = -6.67$ cm

So, the image is formed on the same side of object at a distance 6.67 cm from the concave lens.

**81. The image of a candle flame placed at a distance of 30 cm from a spherical lens is formed on a screen placed on the other side of the lens at a distance of 60 cm from the optical centre of the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 3 cm, find the height of its image.** **[Delhi]**

**Ans.** Given: $u = -30$ cm, $v = +60$ cm, $h_o = +3$ cm

Using the lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{60} - \frac{1}{-30} = \frac{1}{60} + \frac{1}{30} = \frac{3}{60} = \frac{1}{20}$

$\Rightarrow \quad f = +20$ cm

The positive sign of focal length indicates that the given lens is convex in nature whose focal length is 20 cm.

Again, $m = \frac{h_i}{h_o} = \frac{v}{u} \quad \Rightarrow \quad h_i = \frac{v}{u} \times h_o = \frac{+60}{-30} \times 3 = -6$ cm

So, the height of image is 6 cm. The negative sign indicates that it is formed below the principal axis and is real and inverted.

**82. (*a*) State the laws of refraction of light. Explain the term absolute refractive index of a medium and write an expression to relate it with the speed of light in vacuum.**

**(*b*) The absolute refractive indices of two media 'A' and 'B' are 2.0 and 1.5 respectively. If the speed of light in medium 'B' is $2 \times 10^8$ m/s, calculate the speed of light in: (*i*) vaccum, (*ii*) medium 'A'.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 7.

(*b*) Given: $n_A = 2.0$, $n_B = 1.5$

From the above relation,

(*i*) $$n_B = \frac{c}{v_B}$$

where $c$ = speed of light in vacuum.

and $v_B$ = speed of light in medium '*B*' = $2 \times 10^8$ m/s

$\therefore$ $$1.5 = \frac{c}{2 \times 10^8}$$

$\Rightarrow$ $$c = 1.5 \times 2 \times 10^8 = 3 \times 10^8 \text{ ms}^{-1}$$

So, speed of light in vacuum = $3 \times 10^8$ ms$^{-1}$.

(*ii*) Again, $n_A = \frac{c}{v_A}$, where $n_A$ = Absolute refractive index of medium '*A*'

and $v_A$ = Speed of light in medium '*A*'.

$\therefore$ $$2.0 = \frac{3 \times 10^8}{v_A}$$

$\Rightarrow$ $$v_A = \frac{3 \times 10^8}{2.0} = 1.5 \times 10^8 \text{ ms}^{-1}$$

So, speed of light in medium 'A' is $1.5 \times 10^8$ ms$^{-1}$.

**83. What is meant by power of a lens? Define its SI unit.**
**You have two lenses A and B of focal lengths +10 cm and –10 cm respectively. State the nature and power of each lens. Which of the two lenses will form a virtual and magnified image of an object placed 8 cm from the lens? Draw a ray diagram to justify your answer.** **[All India]**

**Ans.** The ability of a lens to converge or diverge the ray of light after refraction is called power (P) of the lens. It is defined as the reciprocal of the focal length, i.e. $P = \frac{1}{f}$. Its SI unit is 'dioptre'.

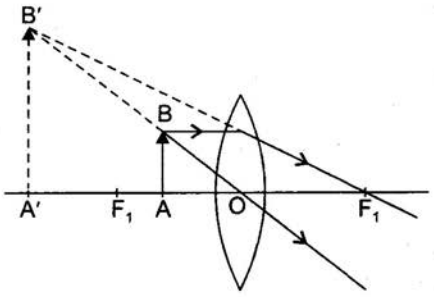
The nature of lens 'A' of focal length + 10 cm is convex and its power,

$$P = \frac{100}{f(\text{cm})} = \frac{100}{10} = +10 \text{ D}.$$

The nature of lens 'B' of focal length 10 cm is concave and its power,

$$P = \frac{100}{f(\text{cm})} = \frac{100}{-10} = -10 \text{ D}.$$

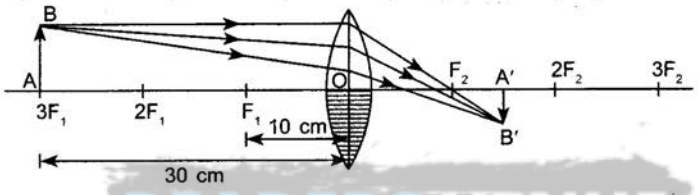
Convex lens 'A' will form a virtual and magnified image of an object placed 8 cm (less than its focal length) from the lens.




**84. One half of a convex lens of focal length 10 cm is covered with a black paper. Can such a lens produce an image of a complete object placed at a distance of 30 cm from the lens? Draw a ray diagram to justify your answer.**

**A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 15 cm. Find the nature, position and size of the image.** **[All India]**

**Ans.** Yes, the complete image of an object will be formed but of less intensity, the light falling on the covered portion will not reach at the image position.




READERS VENUE

For convex lens, $h_1 = +4$ cm, $f = +20$ cm, $u = -15$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{20} = \frac{1}{v} - \frac{1}{-15} = \frac{1}{v} + \frac{1}{15}$$

$$\therefore \quad \frac{1}{v} = \frac{1}{20} - \frac{1}{15} = \frac{3-4}{60} = -\frac{1}{60}$$

$$\therefore \quad v = -60 \text{ cm}$$

Thus, the image is formed on the same side of the object at a distance of 60 cm from the optical centre of the lens. The negative sign indicates that the image is virtual.

Using the formula, $m = \frac{h_2}{h_1} = \frac{v}{u}$

$$\Rightarrow \quad h_2 = \frac{v}{u} \times h_1 = \frac{-60}{-15} \times 4 = +16 \text{ cm}$$

So, the image is four times larger than the size of object, i.e. 16 cm. The positive sign indicates that the image is erect.

**85. A student has focused the image of a candle flame on a white screen using a concave mirror. The situation is as given below:**
**Length of the flame = 1.5 cm**
**Focal length of the mirror = 12 cm**
**Distance of flame from the mirror = 18 cm**
**If the flame is perpendicular to the principal axis of the mirror, then calculate the following:**
**(*a*) Distance of the image from the mirror**
**(*b*) Length of the image.**
**If the distance between the mirror and the flame is reduced to 10 cm, then what would be observed on the screen? Draw ray diagram to justify your answer for this situation.** **[Foreign]**

**Ans.** Given: For a concave mirror, $h_1 = +1.5$ cm, $f = -12$ cm, $u = -18$ cm, $v = ?$, $h_2 = ?$

(*a*) Using the mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-12} - \frac{1}{-18}$$

$$= -\frac{1}{12} + \frac{1}{18} = \frac{-3+2}{36} = -\frac{1}{36}$$

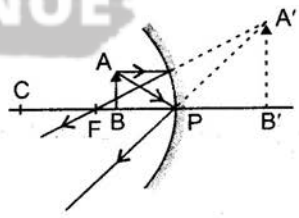
$$\therefore \quad v = -36 \text{ cm}$$

Thus, the image is formed at a distance 36 cm from the mirror on the same side of object.

READERS VENUE

(*b*) Magnification of spherical mirror is given by

$$m = \frac{h_2}{h_1} = -\frac{v}{u}$$




$$\therefore \quad \frac{h_2}{1.5} = -\frac{-36}{-18} = -2$$

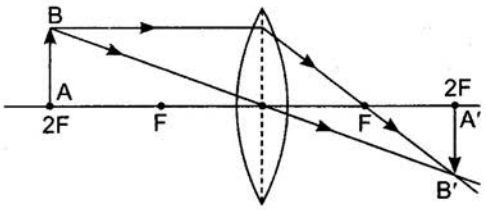
$$\Rightarrow \quad h_2 = -2 \times 1.5 = -3.0 \text{ cm}$$

So, a real, inverted and magnified image of height 3.0 cm is obtained on the screen.

Now in the second case, the object is placed within the focal length of the concave mirror, i.e. $u = -10$ cm, an erect and virtual image is obtained. Therefore, no distinct image would be formed on the screen.

**86. What is meant by the power of a lens? What is its S.I. unit? Name the type of lens whose power is positive.**
**The image of an object formed by a lens is real, inverted and of the same size as the object. If the image is at a distance of 40 cm from the lens, what is the nature and power of the lens? Draw ray diagram to justify your answer.** **[Foreign]**

**Ans.** **Power of lens:** Refer to Ans. 8.




According to the given condition, a real, inverted and same size image is formed by a convex lens only when the object is placed at $2f$. The image is formed at $2f$ on the other side of it.

$\therefore \quad 2f = +40$ ...(as $v = +40$ cm and $h_2 = h_1$)

$\Rightarrow \quad f = +20$ cm

So, power of lens,

$$P = \frac{1}{f(\text{m})} = \frac{100}{f(\text{cm})} = \frac{100}{20}$$

$\therefore \quad P = +5$ D

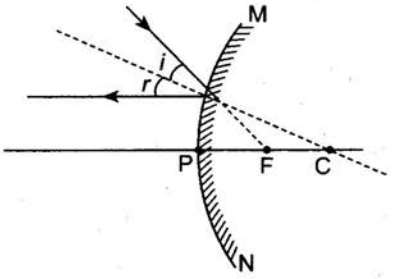
## 2014

### Short Answer Type [I] Questions [2 Marks]

READERS VENUE

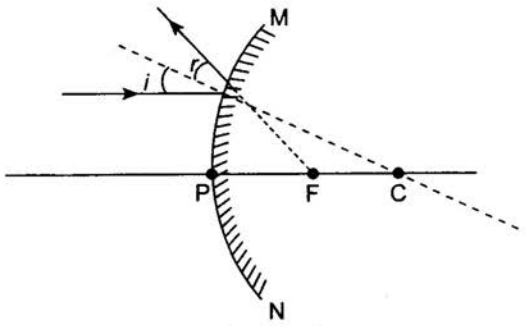
**87. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray which is directed towards the principal focus of a convex mirror. Mark on it the angle of incidence and the angle of reflection.** **[Delhi]**

**Ans.** The required ray diagram is as follows.



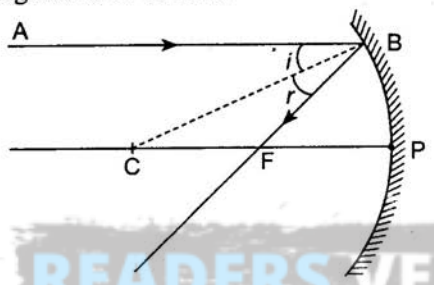

**88. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray which is directed parallel to the principal axis of a convex mirror. Mark on it the angle of incidence and the angle of reflection.** **[Delhi]**

**Ans.** The required ray diagram is as follows:




**89. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a concave mirror. Mark the angle of incidence and angle of reflection on it.** **[Delhi]**

**Ans.** The required ray diagram is as follows.




READERS VENUE

**90. List two possible ways in which a concave mirror can produce a magnified image of an object placed in front of it. State the difference, if any, between these two images.** **[All India]**

**Ans.** A concave mirror produces a magnified image if an object is placed:

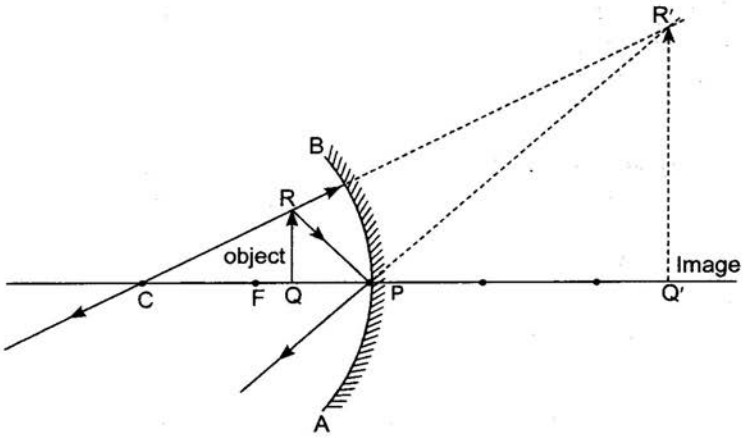
(*i*) within its pole and its focus.

(*ii*) in between its focus and centre of curvature.

The image in the first case will be virtual and erect while in the second case, it will be real and inverted.

**91. The image formed by a concave mirror is observed to be virtual, erect and larger than the object. Where should the position of the object be relative to the mirror? Draw ray diagram to justify your answer.** **[All India]**

**Ans.** When the object is placed between the focus (F) and pole (P) of a concave mirror, the image is formed behind the mirror; this image is virtual, erect and enlarged.




**92. "A concave mirror of focal length 15 cm can form a magnified erect as well as inverted image of an object placed in front of it." Justify this statement stating the position of the object with respect to the pole of the mirror in both cases for obtaining the images.** **[All India]**

**Ans.** (*i*) When the object is placed between P (pole) and F (focus) of the concave mirror, we get a magnified and erect image.

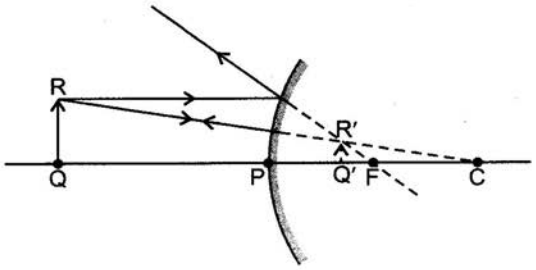
(*ii*) When the object is placed between C (centre of curvature) and F (focus), we get a magnified and inverted image.

**93. The linear magnification produced by a spherical mirror is $+\frac{1}{3}$. Analysing this value, state the (*i*) type of mirror and (*ii*) position of the object with respect to the pole of the mirror. Draw ray diagram to justify your answer.** **[Foreign]**

**Ans.** (*i*) Since the magnification is $+\frac{1}{3}$, the image formed is virtual. It is a convex mirror.

(*ii*) $m = -\frac{\text{Image distance}}{\text{Object distance}} = \frac{\text{height of image}}{\text{height of object}} = \frac{h_2}{h_1} = +\frac{1}{3} \Rightarrow h_2 = +\frac{1}{3}h_1$

A virtual, erect and one-third in size, i.e. diminished image is formed. It is only when an object is placed anywhere between pole (P) and infinity in front of a convex mirror.

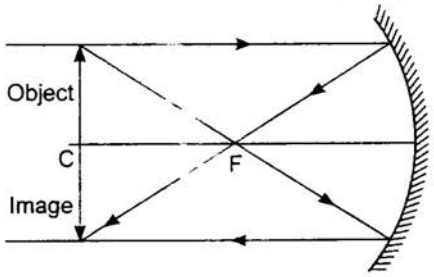


**94. The linear magnification produced by a spherical mirror is –1. Analysing this value, state the (*i*) type of mirror and (*ii*) position of the object with respect to the pole of the mirror. Draw ray diagram to justify your answer.** **[Foreign]**

**Ans.** (*i*) As the magnification is negative, the image formed is real. Hence, it is a concave mirror.

(*ii*) $$m = \frac{-v}{u} = -1$$

The object is placed at the centre of curvature of the mirror. The image formed is of equal size of the object placed in front of the mirror.

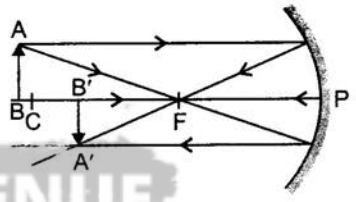



**95. The linear magnification produced by a spherical mirror is $-\frac{1}{5}$. Analysing this value, state the (*i*) type of spherical mirror and (*ii*) the position of the object with respect to the pole of the mirror. Draw ray diagram to justify your answer.** **[Foreign]**

**Ans.** (*i*) Since the magnification is $-\frac{1}{5}$, the image is real and the mirror is a concave mirror.

(*ii*) $$m = \frac{h_2}{h_1} = -\frac{1}{5}$$

The image formed is of smaller in size than that of the object placed in front of the mirror. The object is placed beyond C.




READERS VENUE

## Short Answer Type [II] Questions [3 Marks]

**96. A spherical mirror produces an image of magnification –1 on a screen placed at a distance of 50 cm from the mirror.**
**(*a*) Write the type of mirror.**
**(*b*) Find the distance of the image from the object.**
**(*c*) What is the focal length of the mirror?**
**(*d*) Draw the ray diagram to show the image formation in this case.** **[Delhi]**

**Ans.** (*a*) As the magnification is negative, the image formed is real. Hence, it is a concave mirror.

(*b*) $\because$ $$m = \frac{-v}{u} = -1$$

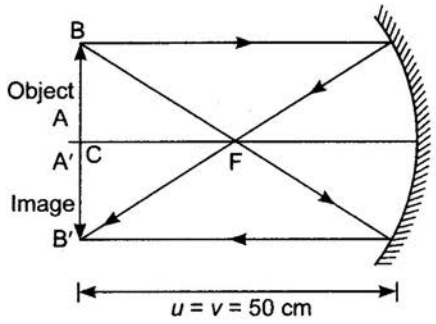
$\therefore$ $$u = v = -50 \text{ cm}$$

Distance of the image from the object = $|u| + |v| = 100$ cm

(*c*) Using mirror formula, $$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{(-50)} + \frac{1}{(-50)} = \frac{-1}{25}$$

$\therefore$ $$f = -25 \text{ cm}$$

(*d*)




**97. State the laws of refraction of light. If the speed of light in vacuum is $3 \times 10^8$ $ms^{-1}$, find the speed of light in a medium of absolute refractive index 1.5.** **[Delhi]**

**Ans.** Refer to Ans. 7.

Given: Speed of light in vacuum $= 3 \times 10^8$ m/s

The refractive index of the medium $n_m$ is given by

$$\therefore \quad n_m = \frac{\text{Speed of light in vacuum}}{\text{Speed of light in medium}}$$

$$\Rightarrow \quad 1.5 = \frac{3 \times 10^8}{v}$$

$$\therefore \quad v = \frac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s}$$

READERS VENUE

Hence, the speed of light in the given medium of absolute refractive index 1.5 is $2 \times 10^8$ m/s.

**98. A spherical mirror produces an image of magnification –1 on a screen placed at a distance of 40 cm from the mirror:**

**(*i*) Write the type of mirror.**

**(*ii*) What is the nature of the image formed?**

**(*iii*) How far is the object located from the mirror?**

**(*iv*) Draw the ray diagram to show the image formation in this case.** **[Delhi]**

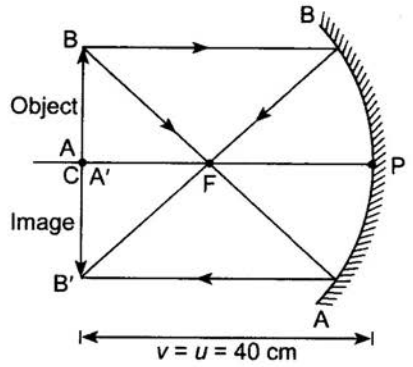
**Ans.** (*i*) The mirror is concave.

(*ii*) The image formed is real and inverted and of the same size as that of the object.

(*iii*) In this case, the object is placed at the centre of curvature of the mirror, so the object distance is equal to the image distance. Here, the screen is placed 40 cm from the mirror.

$\therefore$ Image distance = Object distance = 40 cm

(*iv*)




**99. A student wants to project the image of a candle flame on a screen 60 cm in front of a mirror by keeping the flame at a distance of 15 cm from its pole.**

**(*a*) Write the type of mirror he should use.**

**(*b*) Find the linear magnification of the image produced.**

**(*c*) What is the distance between the object and its image?**

**(*d*) Draw a ray diagram to show the image formation in this case.** **[All India]**

**Ans.** (*a*) He should use a concave mirror, as it forms a real image on the same side of the mirror.

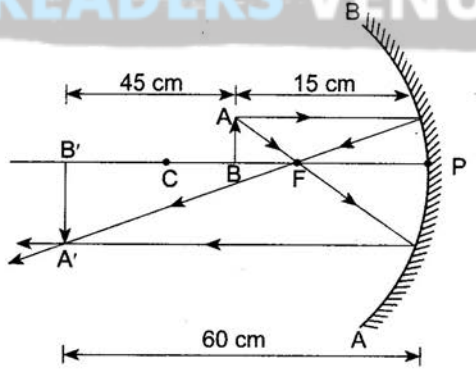
(*b*) Object distance, $u = -15$ cm; Image distance, $v = -60$ cm

Magnification, $m = -\frac{v}{u} = -\left(\frac{-60}{-15}\right) = -4$ cm

The negative sign shows that the image formed is real and inverted.

(*c*) The image is formed at a distance of 45 cm from the object.

(*d*)




The image is formed beyond the centre of curvature. This image is real, inverted and enlarged.

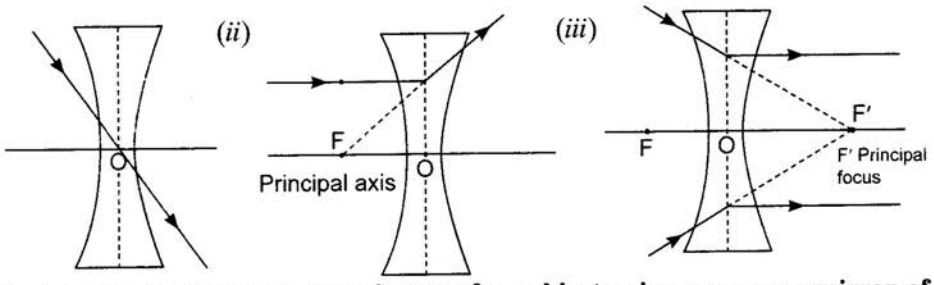
**100. Draw a ray diagram to show the path of the refracted ray in each of the following cases: A ray of light incident on a concave lens is**

**(*i*) passing through its optical centre.**

**(*ii*) parallel to its principal axis.**

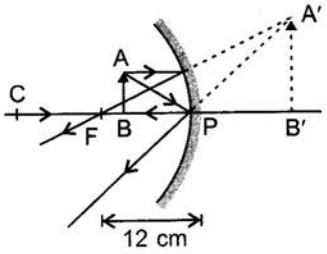
**(*iii*) directed towards its principal focus.** **[All India]**

**Ans.** (*i*) (*ii*) (*iii*)




**101. A student wants to obtain an erect image of an object using a concave mirror of 12 cm focal length. What should be the range of distance of the object from the mirror? State the nature and size of the image he is likely to observe. Draw a ray diagram to justify your answer.** **[Foreign]**

**Ans.** If a student wants to obtain an erect image of an object using a concave mirror of 12 cm focal length, he should keep the object between the pole of the mirror and the focus of the mirror. The image will be formed behind the mirror, enlarged in size, virtual and erect.




**102. The image of a candle flame placed at a distance of 40 cm from a spherical lens is formed on a screen placed on the other side of the lens at a distance of 40 cm from the lens. Identify the type of lens and write its focal length. What will be the nature of the image formed if the candle flame is shifted 25 cm towards the lens? Draw a ray diagram to justify your answer.** **[Foreign]**

LEADERS VENUE

**Ans.** The lens is a convex lens, as the real image is formed.

Given: $v = +40$ cm, $u = -40$ cm, $f = ?$

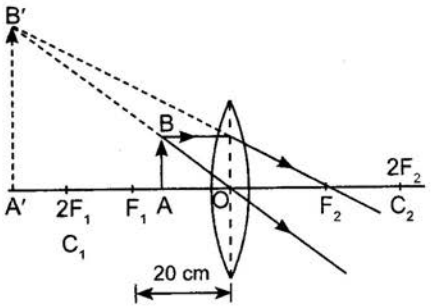
Using lens formula, $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$

$\therefore \quad \frac{1}{40} - \left(\frac{1}{-40}\right) = \frac{1}{f}$

$\Rightarrow \quad \frac{1}{40} + \frac{1}{40} = \frac{1}{f}$

$\Rightarrow \quad f = +20$ cm

$\therefore$ Image is formed at $2F_2$ as object is at $2F_1$. The image is of same size, real and inverted. If the candle is shifted 25 cm towards the lens, then the object lies in between $F_1$ and optical centre O, the image is formed on the same side of the lens as the object. It is an enlarged, virtual and erect.



## Long Answer Type Questions [5 Marks]

**103. A student wants to project the image of a candle flame on the walls of school laboratory by using a lens.**

**(*a*) Which type of lens should he use and why?**

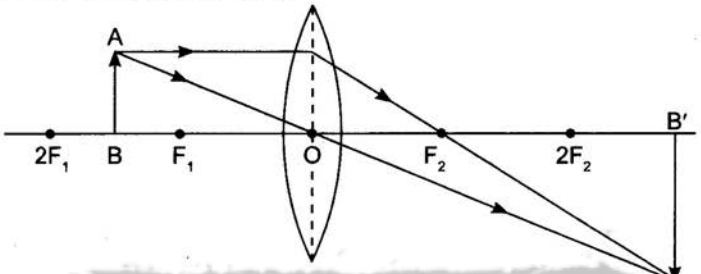
**(*b*) At what distance in terms of focal length '*f*' of the lens should he place the candle flame so as to get (*i*) a magnified, and (*ii*) a diminished image respectively on the wall?**

**(*c*) Draw ray diagram to show the formation of the image in each case. [Delhi]**

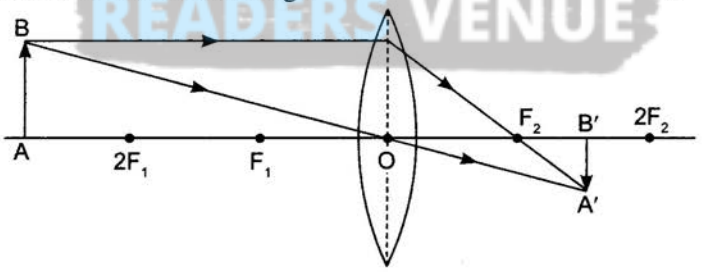
**Ans.** (*a*) He should use a convex lens, as it forms a real image.

(*b*) He should place the candle flame between $F_1$ and $2F_1$ (the focus and the centre of curvature of the lens) to get a magnified image on the wall, while the diminished image is obtained when the object is located at a distance greater than $2F_1$.

(*c*) Ray diagram for a magnified image




Ray diagram for a diminished image




READERS VENUE

**104. A student wants to project the image of a candle flame on the walls of school laboratory by using a mirror.**

**(*a*) Which type of mirror should he use and why?**

**(*b*) At what distance in terms of focal length '*f*' of the mirror should he place the candle flame so as to get the magnified image on the wall?**

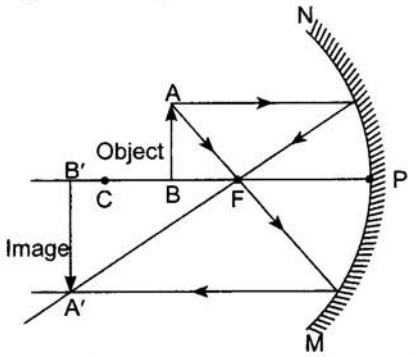
**(*c*) Draw a ray diagram to show the formation of image in this case.**

**(*d*) Can he use this mirror to project a diminished image of the candle flame on the same wall? State 'how' if your answer is 'yes' and 'why not' if your answer is 'no'. [Delhi]**

**Ans.** (*a*) He should use a concave mirror, as it forms a real image.

(*b*) He should place the candle flame between the focus and centre of curvature of the mirror to get the magnified image on the wall.

(*c*)




Then, this point on the principal axis is called principal focus of that lens.

(*d*) Yes, he can get a diminished image of the candle flame, when the object is located at infinity.

**105.** (*a*) **Explain the following terms related to spherical lenses:**

(*i*) **Optical centre** (*ii*) **Centre of curvature**

(*iii*) **Principal axis** (*iv*) **Aperture**

(*v*) **Principal focus** (*vi*) **Focal length**

(*b*) **A converging lens has focal length of 12 cm. Calculate at what distance should the object be placed from the lens so that it forms an image at 48 cm on the other side of the lens.** **[All India]**

READERS VENUE

**Ans.** (*a*) (*i*) **Optical centre:** The centre point of a lens is known as its optical centre. It always lies inside the lens. A light beam passing through the optical centre emerges out without any deviation.

(*ii*) **Centre of curvature:** It is defined as the centre of the spheres, of which, the lens is orginally a part of. Because the spherical lens consist of two spherical surfaces, the lens has two centres of curvature.

(*iii*) **Principal axis:** The line joining the centre of curvature and the optical centre is called the principal axis.

(*iv*) **Aperture:** This is the length or breadth of the lens, through which, refraction takes place.

(*v*) **Principal focus:** It is a point on principal axis to which rays parallel to the principal axis converge after passing through the lens. When a beam of light parallel to the principal axis are incident on a spherical lens, after refraction.

(*i*) incase of convex lens, they are converging to a point on the principal axis, or

(*ii*) in case of concave lens, they are appearing diverging from a point on the principal axis.

(*vi*) **Focal length:** The distance of the focus point from the optical centre of lens, at which a parallel ray of beam converges (or diverges), is called focal length.

(*b*) Given: $f = -12$ cm, $v = -48$ cm (–ve sign is taken because of sign convention)

Using the lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{-12} = \frac{1}{-48} - \frac{1}{u}$$

$$\therefore \quad \frac{1}{u} = \frac{1}{-48} + \frac{1}{12}$$

$$u = 16 \text{ cm}$$

So, the distance of the object from the lens is 16 cm.

**106. Explain the following terms related to sphereical lenses:**

**(*a*) Centres of curvature** **(*b*) Principal axis**

**(*c*) Optical centre** **(*d*) Principal focus**

**At what distance from a concave lens of focal length 20 cm, should a 6 cm tall object be placed so that it forms an image at 15 cm from the lens? Also determine the size of the image formed.** **[All India]**

**Ans.** (*a*) Refer to Ans. 105 (*a*) (*ii*). (*b*) Refer to Ans. 105 (*a*) (*iii*).

(*c*) Refer to Ans. 105 (*a*) (*i*). (*d*) Refer to Ans. 105 (*a*) (*v*).

Given: $f = -20$ cm, $v = -15$ cm (using sign conventions), $h_i = 6$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{-20} = \frac{1}{-15} - \frac{1}{u}$

$$\Rightarrow \quad u = -60 \text{ cm}$$

The distance of the object from the lens is 60 cm.

Let $h_i$ = size of image; $h_o$ = size of object = 6 cm

$$\because \quad m = \frac{v}{u} = \frac{h_i}{h_o} = \frac{-15}{-60} = \frac{h_i}{6}$$

$$\therefore \quad h_i = 1.5 \text{ cm}$$

The image formed by the concave lens is virtual and erect.

**107. What is meant by power of a lens? Name and define its S.I. unit.**
**One student uses a lens of focal length +50 cm and another of –50 cm. State the nature and find the power of each lens. Which of the two lenses will always give a virtual, erect and diminished image irrespective of the position of the object?**
**[Foreign]**

**Ans.** Refer to Ans. 8.

The power of a convex lens is positive and that of a concave lens is negative.

$$f = +\ 50 \text{ cm} = 0.5 \text{ m}$$

$$P = \frac{1}{f} = \frac{1}{0.50 \text{ m}} = 2 \text{ D}$$

Hence, the power of given lens is +2 D that is, it is a convex lens.

$$f = -\ 50 \text{ cm} = -\ 0.50 \text{ m}$$

$$P = \frac{1}{f} = \frac{1}{-\ 0.50 \text{ m}} = -\ 2 \text{ D}$$

Hence, the power of given lens is – 2D, that is, it is a concave lens.

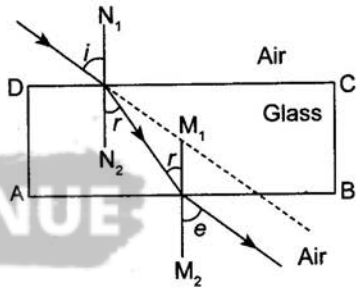
Concave lens will always give a virtual, erect and diminished image.

## 2013

### Short Answer Type [I] Questions [2 Marks]

**108. "A ray of light incident on a rectangular glass slab immersed in any medium emerges parallel to itself." Draw labelled ray diagram to justify the statement.** **[Delhi]**

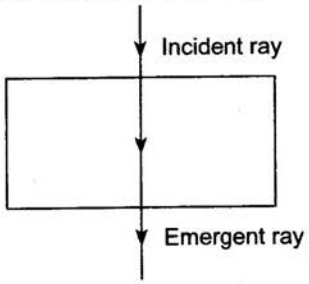
**Ans.** Due to variation in the speed of light in different media, the light bends as it moves from one medium to another. Since there are two surfaces for refraction which are parallel, the light ray should bend in them equally in opposite sense and hence, the emerging light ray is always parallel to the incident.




READERS VENUE

**109. A ray of light falls normally on the surface of a transparent glass slab. Draw a ray diagram to show its path and also mark angle of incidence and angle of emergence.** **[Delhi]**

**Ans.**




If the ray of light falls normally on the surface of a transparent glass slab, it will not refract and thus, $\angle i = \angle e = 0°$.

**110. "A concave mirror of focal length $f$ can form a magnified, erect as well as an inverted image of an object placed in front of it." Justify this statement stating the position of the object with respect to the mirror in each case for obtaining these images.** **[All India]**

**Ans.** A concave mirror of focal length $f$ can form:

($a$) a magnified and erect image only when the object is placed between the pole and focus of the mirror.

($b$) a magnified and inverted image in the following position of an object in front of the mirror:

($i$) at focus (F), and

($ii$) between the focus (F) and centre of curvature (C).

Therefore, for the given positions of the object with respect to mirror, the given statement is justified.

**111. "A convex lens of focal length $f$ can form a magnified erect as well as inverted image." Justify this statement stating the position of the object with respect to the lens in each case for obtaining these images.** **[All India]**

**Ans.** A convex lens of focal length $f$ can form:

($a$) a magnified and erect image only when the object is placed between the focal length and optical centre of the lens.

($b$) an inverted image when the object is placed beyond the focal length of the lens.

**112. What is meant by power of a lens? Define its SI unit.** **[All India]**

**Ans.** Refer to Ans. 8.

**113. State the meaning of linear magnification. How is it related to object distance and image distance? When is magnification positive or negative?** **[Foreign]**

**Ans.** Linear magnification is the ratio of the height of the image to the height of the object. It is represented by $m$.

READERS VENUE

$$m = \frac{h_i}{h_o}$$

$$m = -\frac{v}{u} \qquad \text{[For spherical mirror]}$$

$$m = \frac{v}{u} \qquad \text{[For spherical lens]}$$

where $h_i$ is the height of the image and $h_o$ is the height of the object.

If the image formed is virtual and erect, then the magnification is positive, and if the image formed is real and inverted, then the magnification is negative.

**114. List four properties of images formed by a plane mirror.** **[Foreign]**

**Ans.** Refer to Ans. 69.

**115. The magnification produced by a spherical mirror is "+1/4". Analysing this value, state ($i$) the type of the spherical mirror it is, ($ii$) three characteristics of the image formed by the mirror.** **[Foreign]**

**Ans.** ($i$) As the magnification is positive and less than 1, the spherical mirror is a convex mirror.

($ii$) The image formed by this mirror is virtual, erect and diminished.

## Short Answer Type [II] Questions [3 Marks]

**116. Mention the types of mirrors used as (*i*) rear-view mirrors, (*ii*) shaving mirrors. List two reasons to justify your answers in each case.** **[Delhi]**

**Ans.** (*i*) Convex mirror (*ii*) Concave mirror

**Justification:**

(*i*) Convex mirror is used as a rear-view mirror because:

(*a*) it gives a wider field of view as it is curved outwards, and

(*b*) it produces an erect and diminished image of the traffic behind the vehicle.

(*ii*) When the object lies in between the pole and principal focus of a concave mirror, it forms a virtual, erect and enlarged image behind it. So, the concave mirror can be used as a shaving mirror to see a large size image of the face.

**117. An object of height 6 cm is placed perpendicular to the principal axis of a concave lens of focal length 5 cm. Use lens formula to determine the position, size and nature of the image if the distance of the object from the lens is 10 cm.** **[Delhi]**

**Ans.** Given: $h_o = 6$ cm, $f = -5$ cm, $u = -10$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{-5} = \frac{1}{v} - \frac{1}{-10}$

$$\frac{1}{-5} = \frac{1}{v} + \frac{1}{10} \Rightarrow \frac{1}{v} = \frac{1}{-5} - \frac{1}{10}$$

$$\frac{1}{v} = \frac{-2-1}{10} \Rightarrow \frac{1}{v} = \frac{-3}{10}$$

$\therefore$ $v = -\frac{10}{3}$ cm

READERS VENUE

Thus, the image is formed on the same side of the object at a distance of $\frac{10}{3} = 3.3$ cm from the optical centre of the lens. The negative sign indicates that the image is virtual.

Using the formula, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$\Rightarrow$ $h_i = \frac{v}{u} \times h_o = \frac{-10}{3 \times -10} \times 6 = +2$ cm

$\therefore$ Image is virtual, erect and smaller in size (= 2 cm).

**118. Sign conventions followed in case of refraction of light through spherical lenses are as follows:**

**(*i*) All distances, i.e. distance, image distance ($v$) and focal length ($f$) are measured from optical centre of lens.**

**(*ii*) Distances measured in direction of incident light s taken as positive while in direction, opposite to incident light is negative.**

**(*iii*) Height measured upward the principal axis is taken positive while below (downward) the principal axis is negative.** **[All India]**

**Ans.** Given: magnification, $m = -4$, $u = -20$ cm.

Using formula, $m = \frac{v}{u} \Rightarrow \frac{v}{-20} = -4 \Rightarrow v = 80$ cm.

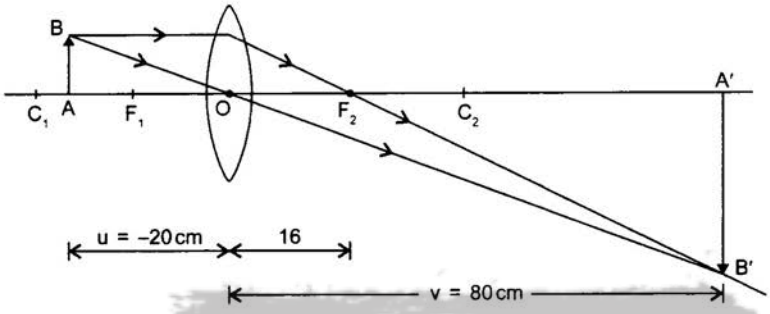
As magnification, $m = -4$, so image is real, enlarged and inverted, which is formed by convex lens.

Using lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \frac{1}{f} = \frac{1}{80} - \frac{1}{(-20)}$

$\Rightarrow \frac{1}{80} + \frac{1}{20} = \frac{5}{80}$

$\Rightarrow f = 16$ cm




**119. Name the type of mirror used (*i*) by dentists and (*ii*) in solar furnaces. Give two reasons why such mirrors are used in each case.** **[All India]**

**Ans.** (*i*) Dentists use a concave mirror because the concave mirror converges light rays. When the object lies in between the pole and principal focus of a concave mirror it forms a virtual, erect and enlarged image behind it. Hence, they use concave mirror so that they can see the cavity or plaque clearly inside the teeth.

(*ii*) In solar furnace, a concave mirror is used. It has the property to concentrate the light rays coming from the sun along with heat radiations at its focus. As a result, the temperature at its focus increases and the substance placed at the focal point gets heated to a high temperature.

**120. An object placed on a metre scale at 8 cm mark was focused on a white screen placed at 92 cm mark, using a converging lens placed on the scale at 50 cm mark.**

**(*i*) Find the focal length of converging lens.**

**(*ii*) Find the position of the image formed if the object is shifted towards the lens at a position of 29.0 cm.**

**(*iii*) State the nature of the image formed if the object is further shifted towards the lens.** **[All India]**

**Ans.** (*i*) $u = -(50 - 8) = -42$ cm,

$v = 92 - 50 = 42$ cm

Focal length of converging lens (convex lens) is given by

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \qquad \text{(lens formula)}$$

$$\frac{1}{f} = \frac{1}{42} - \frac{1}{-42} = \frac{2}{42} = \frac{1}{21}$$

$$\therefore \quad f = 21 \text{ cm}$$

(*ii*) Now, the object is shifted towards the lens at a position of 29.0 cm. Therefore, new object distance, $u' = -(50 - 29) = -21$ cm.

Again using, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{21} = \frac{1}{v'} - \frac{1}{-21} = \frac{1}{v'} + \frac{1}{21}$

$$\therefore \quad \frac{1}{v'} = \frac{1}{21} - \frac{1}{21} = 0$$

or $$v' = \frac{1}{0} = \infty$$

So, the image will be formed at infinity.

(*iii*) If the object is further shifted towards the lens, the object is now within the focus of a convex lens, the nature of image formed is

(*a*) virtual and erect, and

(*b*) enlarged or magnified, i.e. larger than the size of the object.

READERS VENUE

**121. A student focussed the image of a candle flame on a white screen using a convex lens. He noted down the positions of the candle flame, screen and the lens as given below:**

**Position of the candle flame = 12.0 cm**

**Position of the lens = 50.0 cm**

**Position of the screen = 88.0 cm**

**(*i*) Find the focal length of the convex lens.**

**(*ii*) Find the position of the image of the candle flame if it is shifted towards the lens at a position of 31.0 cm.**

**(*iii*) State the nature of the image formed if the candle flame is further shifted towards the lens.** **[All India]**

**Ans.** (*i*) Object distance, $u$ = Position of lens − Position of candle flame

$= -(50 - 12) = 38$ cm

Image distance, $v$ = Position of screen − Position of lens

$= 88 - 50 = 38$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\therefore \quad \frac{1}{f} = \frac{1}{38} - \frac{1}{(-38)} = \frac{1}{38} + \frac{1}{38} = \frac{2}{38} = \frac{1}{19}$

$\therefore \quad f = 19$ cm

(*ii*) If the candle flame is shifted towards the lens at a position of 31 cm, the object distance, $u$ will become $-(50 - 31) = -19$ cm, which is equal to its focal length. Hence, the image will be formed at infinity.

(*iii*) If the candle flame is further shifted towards the lens, the image will become virtual and erect.

**122. State the type of spherical mirrors used for (*i*) vehicles headlights, and (*ii*) rear-view mirrors in vehicles. List two reasons to justify the use of these mirrors in each case.** **[Foreign]**

**Ans.** The type of spherical mirrors used in

(*i*) **Headlights of vehicles:** Concave mirror

Concave mirror is used because the light, from the bulb placed at the focus of it, gets reflected and produces a powerful parallel beam of light to illuminate the road.

(*ii*) **Rear-view mirror of vehicles:** Convex mirror

Convex mirror is used because it always produces a virtual and erect image whose size is smaller than the object. Therefore, it enables the driver to see wide field view of the traffic behind the vehicle in a small mirror.

**123. A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 24 cm at a distance of 16 cm from it. Use lens formula to determine the position, size and nature of the image formed.** **[Foreign]**

**Ans.** Given: $h_o = 4$ cm, $f = +24$ cm, $u = -16$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{24} = \frac{1}{v} - \frac{1}{-16} \Rightarrow \frac{1}{v} = \frac{1}{24} - \frac{1}{16} = \frac{2-3}{48} = -\frac{1}{48}$$

$\therefore \quad v = -48$ cm

Magnification, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$\Rightarrow \quad h_i = \frac{v}{u} \times h_i = \frac{-48}{-16} \times 4 = +12$ cm

**Position of image:** Image is formed at a distance of 48 cm from the optical centre of the lens on the same side of the object. It is indicated by the negative sign.

**Size of image:** It is three times larger than the size of the object, i.e. 12 cm.

**Nature of image:** The positive sign of $h_i$ indicates that the image is virtual and erect.

**124. A 5 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 18 cm at a distance of 12 cm from it. Use lens formula to determine the position, size and nature to the image formed.** **[Foreign]**

**Ans.** Given: $h_o = 5$ cm, $f = +18$ cm, $u = -12$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \quad \frac{1}{18} = \frac{1}{v} - \frac{1}{-12} \quad \Rightarrow \quad \frac{1}{18} = \frac{1}{v} + \frac{1}{12}$$

$$\frac{1}{v} = \frac{1}{18} - \frac{1}{12} \quad \Rightarrow \quad \frac{1}{v} = \frac{2-3}{36}$$

$$\therefore \quad v = -36 \text{ cm}$$

Thus, the image is formed on the same side of the object at a distance of 36 cm from the optical centre of the lens. The negative sign indicates that the image is virtual.

Magnification, $m = \frac{h_i}{h_o} = \frac{v}{u} \Rightarrow h_i = \frac{v}{u} \times h_o = \frac{-36}{-12} \times 5 = +15$ cm

So, the image is three times larger than the size of the object.

## Long Answer Type Questions [5 Marks]

**125. (*a*) State the laws of refraction of light. Give an expression to relate the absolute refractive index of a medium with speed of light in vacuum.**

**(*b*) The refractive indices of water and glass with respect to air are 4/3 and 3/2 respectively. If the speed of light in glass is $2 \times 10^8$ ms$^{-1}$, find the speed of light in (*i*) air, (*ii*) water.** **[Delhi]**

READERS VENUE

**Ans.** (*a*) Refer to Ans. 7.

(*b*) (*i*) Refractive index of glass with respect to air $= \frac{3}{2}$

$$\therefore \quad n_{glass} = \frac{3}{2}$$

Now, $n_g = \frac{\text{Speed of light in air } (c)}{\text{Speed of light in glass } (v_g)}$

$$\Rightarrow \quad \frac{3}{2} = \frac{c}{2 \times 10^8}$$

$$c = 3 \times 10^8 \text{ ms}^{-1}$$

(*ii*) Speed of light in water, $v_w = \frac{c}{n_w} = \frac{3 \times 10^8}{4/3} = \frac{9}{4} \times 10^8$

$$v_w = 2.25 \times 10^8 \text{ ms}^{-1}$$

**126. State Snell's law of refraction of light. Write an expression to relate refractive index of a medium with speed of light in vacuum.**
**The refractive index of a medium *a* with respect to medium *b* is 2/3 and the refractive index of medium *b* with respect to medium *c* is 4/3. Find the refractive index of medium *c* with respect to medium *a*.** **[Delhi]**

**Ans.** Refer to Ans. 7.

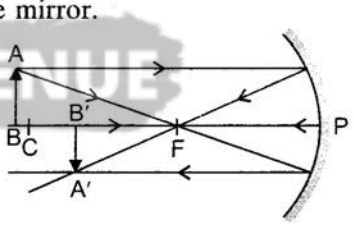
Given: $n_{ab} = \frac{2}{3}, n_{bc} = \frac{4}{3}, n_{ca} = ?$

We know that $n_{ab} \times n_{bc} \times n_{ca} = 1 \Rightarrow \frac{2}{3} \times \frac{4}{3} \times n_{ca} = 1 \Rightarrow n_{ca} = \frac{9}{8}$

**127. (*a*) To construct a ray diagram, we use two light rays which are so chosen that it is easy to know their directions after reflection from the mirror. List these two rays and state the path of these rays after reflection. Use these two rays to locate the image of an object placed between infinity and the centre of curvature of a concave mirror.**
**(*b*) Draw a ray diagram to show the formation of image of an object placed between the pole and principal focus of a concave mirror. How will the nature and size of the image formed change, if the mirror is replaced by a converging lens of same focal length?** **[All India]**

**Ans.** (*a*) The two rays which are chosen to construct a ray diagram for reflection are:
(*i*) a ray parallel to the principal axis and
(*ii*) a ray passing through the focus of a concave mirror.

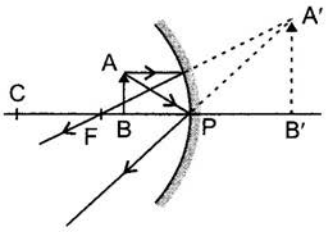
Path of these rays after reflection:
(*i*) It will pass through the principal focus of a concave mirror or appear to diverge in case of a convex mirror.
(*ii*) It will reflect parallel to the principal axis.




(*b*) The formation of image of an object placed between the pole and principal focus of a concave mirror is as shown below.

A virtual, erect and enlarged image is formed behind the concave mirror.

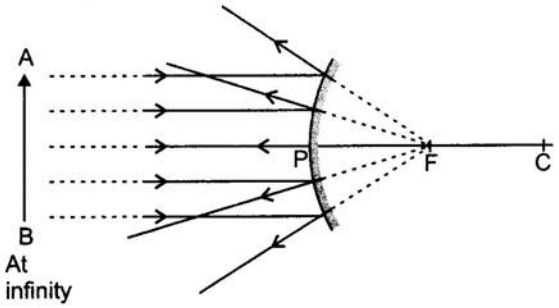
If the concave mirror is replaced by a converging lens of same focal length, a virtual, erect and enlarged image is formed but on the same side of the object for the same position of object, i.e. between the principal focus and optical centre of the lens.



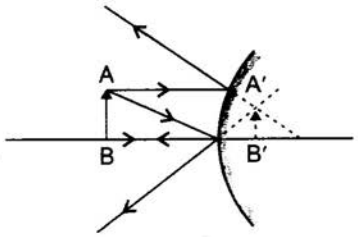

**128. A spherical mirror 'A' always forms an erect image of an object and another spherical mirror 'B' forms erect as well as inverted image of an object. State with reasons the type of spherical mirrors 'A' and 'B' and draw ray diagrams showing formation of images to justify your answer.** **[All India]**

**Ans.** 'A' is a convex mirror, as it always forms an erect image.

When the object is at infinity in front of a convex mirror, the image formed is as shown below:

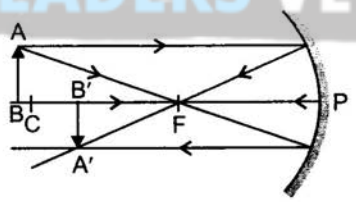



When the object is in between infinity and pole P of the convex mirror, the image formed is shown below.

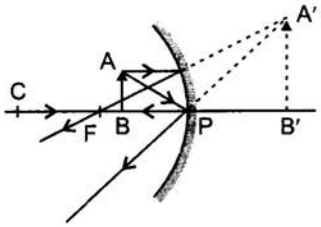



'B' is a concave mirror, as it gives erect as well as inverted images.

The case, in which, the concave mirror forms an inverted image, is shown below.




The case, in which, the concave mirror forms an erect image, is shown below.




**129. List the sign conventions that are followed in case of refraction of light through spherical lenses. Draw a diagram and apply these conventions in determining the nature and focal length of a spherical lens which forms a four times magnified real image of an object placed 20 cm from the lens.** **[All India]**

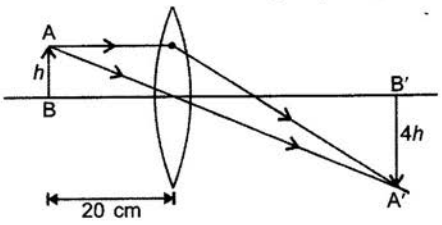
**Ans.** The following are the sign conventions that are followed in case of refraction of light through spherical lenses.

(*i*) The object is always placed to the left of the lens so that the incident of light rays moves from left to right.

(*ii*) All the distances are to be measured from the optical centre of the lens.

(*iii*) The distances measured in the direction of incident light (along +ve $x$-axis) will be taken as positive, while those measured to the left of the origin (along –ve $x$-axis) will be taken as negative.

(*iv*) All the measurements of heights above the principal axis (along +ve $y$-axis) will be considered as positive, while below it (along –ve $y$-axis) will be taken as negative.




According to the question,

$u = -20$ cm, $m = -4$ (real image)

But $$m = \frac{v}{u} = -4$$

$\Rightarrow$ $$v = -4 \times u = -4 \times -20 = +80 \text{ cm}$$

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{80} - \frac{1}{-20} = \frac{1}{80} + \frac{1}{20} = \frac{1+4}{80} = \frac{5}{80} = \frac{1}{16}$$

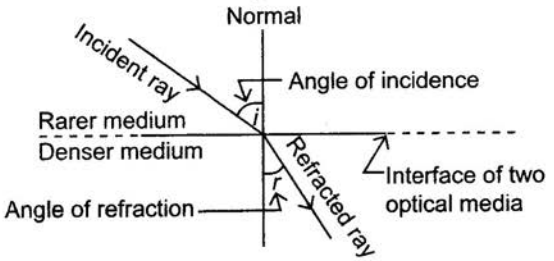
$$f = +16 \text{ cm}$$

So, the focal length of the given spherical lens is 16 cm. The positive sign of focal length shows that the nature of spherical lens is convex.

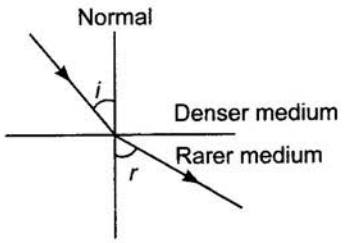
**130.** **(*a*) With the help of a ray diagram, state the meaning of refraction of light. State Snell's law of refraction of light and also express it mathematically.**

**(*b*) The refractive index of water with respect to vacuum is 4/3 and refractive index of vacuum with respect to glass is 2/3. If the speed of light in glass is $2 \times 10^8$ $ms^{-1}$, find the speed of light in (*i*) vacuum, (*ii*) water.** **[Foreign]**

**Ans.** (*a*) When light enters from one medium into another obliquely, the direction of propagation of light in the second medium changes. This phenomenon is known as refraction of light.




(*i*)




(*ii*)

Light bends on undergoing refraction. When light enters from a rarer medium into a denser medium, it will bend towards the normal as shown in the figure (*i*).

Similarly, when light gets into a rarer medium from a denser medium, it will bend away from the normal as shown in figure (*ii*).

For rarer medium to denser medium: $\angle i > \angle r$, and

For denser medium to rarer medium: $\angle i < \angle r$

**Snell's law:** Refer to Ans. 7.

(*b*) (*i*) Given: Refractive index of vacuum with respect to glass $= \frac{2}{3}$

$$\therefore \quad n_{\text{glass}} = \frac{1}{2/3} = \frac{3}{2}$$

$$\text{Now,} \quad n_g = \frac{\text{Speed of light in vacuum } (c)}{\text{Speed of light in glass } (v_g)} \Rightarrow \frac{3}{2} = \frac{c}{2 \times 10^8}$$

$$\Rightarrow \quad c = 3 \times 10^8 \text{ m/s} = \text{Speed of light in vacuum.}$$

(*ii*) Speed of light in water,

$$v_w = \frac{c}{n_w} = \frac{3 \times 10^8}{4/3} = \frac{9}{4} \times 10^8 = 2.25 \times 10^8 \text{ ms}^{-1}$$

## 2012

### Short Answer Type [I] Questions [2 Marks]

READERS VENUE

**131. List four properties of the image formed by a plane mirror.** **[Delhi]**

**Ans.** Refer to Ans. 69.

**132. List four properties of the image formed by a convex mirror.** **[Delhi]**

**Ans.** Refer to Ans. 70.

**133. List four properties of the image formed by a concave mirror, when object is placed between focus and pole of the mirror.** **[Delhi]**

**Ans.** The following are the four properties of the image formed by a concave mirror.

(*i*) The image is formed behind the mirror.

(*ii*) It is enlarged, i.e. magnified.

(*iii*) It is virtual.

(*iv*) It is erect.

**134. To construct a ray diagram, we use two light rays which are so chosen that it is easy to know their directions after reflection from the mirror. List these two rays and state the path of these rays after reflection. Use these rays to locate the image of an object placed between centre of curvature and focus of a concave mirror.**

**[All India]**

**Ans.** The following are the two rays which are chosen to construct ray diagram for reflection:

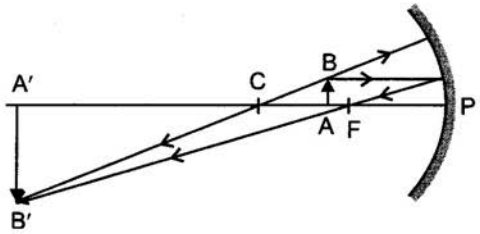
(*i*) a ray parallel to the principal axis, and

(*ii*) a ray passing through the centre of curvature of a concave mirror or appear to pass through the centre of curvature of convex mirror.

The path of these rays after reflections as follows:

(*i*) The first ray will pass through the principal focus of a concave mirror or appear to diverge i.e. appear to come from the principal focus in case of a convex mirror.

(*ii*) The second ray gets reflected back along the same path.




**135. To construct a ray diagram, we use two light rays which are so chosen that it is easy to know their directions after refraction from the lens. List these two rays and state the path of these rays after refraction. Use these two rays to locate the image of an object placed between '*F*' and '2*F*' of a convex lens.** **[Foreign]**

**Ans.** The following are the two rays chosen for refraction:

(*i*) a ray of light parallel to the principal axis, and

(*ii*) a ray of light passing through the optical centre of a lens.

READERS AVENUE

The path of these rays after refraction is as follows:

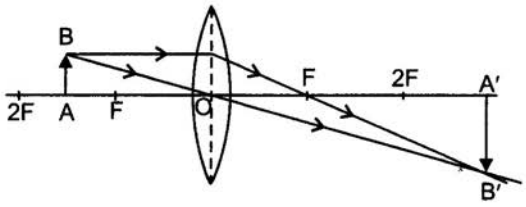
(*i*) In case of a convex lens, the first ray will pass through the principal focus on the other side of the lens.

(*ii*) In case of a concave lens, the first ray will

(*a*) appear to diverge or

(*b*) appear to come from the principal focus positioned on the same side of the object.

The second ray emerges from both the lenses without any deviation in the path.



## Short Answer Type Questions [II] [3 Marks]

**136. The image of a candle flame placed at a distance 30 cm from a spherical lens is formed on a screen placed at a distance of 60 cm from the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 2.4 cm, find the height of its image.** **[Delhi]**

**Ans.** Given $u = -30$ cm, $v = 60$ cm, $h_o = 2.4$ cm.

Image formed by lens is real, and inverted so lens used is convex.

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \quad \frac{1}{f} = \frac{1}{60} - \frac{1}{(-30)}$

$\Rightarrow \quad \frac{1}{f} = \frac{1}{60} + \frac{1}{30} \Rightarrow \frac{1+2}{60} = \frac{3}{60}$

$\Rightarrow \quad \frac{1}{f} = \frac{\mathbf{1}}{\mathbf{20}} \Rightarrow f = 20$ cm.

Magnification, $m = \frac{v}{u} = \frac{h_i}{h_o} = \frac{\text{Size of image}}{\text{Size of object}} = \frac{60}{(-30)} = \frac{h_i}{2.4}$

$\Rightarrow \quad h_i = -2.4 \times 2$

$\Rightarrow \quad h_i = -4.8$ cm.

Thus, image is inverted and twice in size to that of object.

**137. State the type of mirror preferred as (*i*) rear-view mirror in vehicles, (*ii*) shaving mirror. Justify your answer giving two reasons in each case.** **[Delhi]**

**Ans.** Refer to Ans. 116.

**138. The image of a candle flame placed at a distance of 45 cm from a spherical lens is formed on a screen placed at a distance of 90 cm from the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 2 cm, find the height of its image.** **[Delhi]**

**Ans.** The type of spherical lens is convex lens.

Given: $u = -45$ cm, $v = +90$ cm, $h_o = +2$ cm

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} = \frac{1}{90} - \frac{1}{-45} = \frac{1}{90} + \frac{1}{45} = \frac{1+2}{90} = \frac{3}{90} = \frac{1}{30}$$

$\therefore \quad f = +30$ cm

So, the focal length of convex lens is 30 cm.

Again, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$\Rightarrow \quad h_i = \frac{v}{u} \times h_o = \frac{90}{-45} \times 2 = -4$ cm

So, the height of image is 4 cm. The negative sign indicates that it is formed below the principal axis, i.e. inverted image is formed.

**139. A 2.4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 18 cm. The distance of the object from the lens is 12 cm. Find the position, size and nature of the image formed using the lens formula.** **[All India]**

**Ans.** Given size of object $(h_o)$ = 2.4 cm, Focal length $(f)$ = +18 cm

Distance of object $(u)$ = –12 cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u}$

$\Rightarrow \frac{1}{v} = \frac{1}{18} - \frac{1}{12} = \frac{2-3}{36} = -\frac{1}{36}$

$\Rightarrow m = \frac{v}{u} = \frac{\text{Size of image } (h_i)}{\text{Size of object } (h_o)}$

$\Rightarrow \frac{-36}{-12} = \frac{h_i}{2.4}$

Size of image $h_i = 3 \times 2.4 = 7.2$ cm

Thus, a virtual, erect and magnified image is formed on same side of object at distance 36 cm from lens.

**140. A 4 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 24 cm. The distance of the object from the lens is 16 cm. Find the position, size and nature of the image formed, using the lens formula.**

[All India, Foreign]

**Ans.** Refer to Ans. 123.

**141. Name the type of mirror used in the following situations:**

**(*i*) Headlights of a car**

**(*ii*) Rear-view mirror of vehicles**

**(*iii*) Solar furnace**

**Support your answer with reason.** [All India, Foreign]

**Ans.** (*i*) Refer to Ans. 122 (*i*).

(*ii*) Refer to Ans. 122 (*ii*).

(*iii*) Refer to Ans. 119 (*ii*).

**142. A 6 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 15 cm. The distance of the object from the lens is 10 cm. Find the position, size and nature of the image formed, using the lens formula.** **[Foreign]**

**Ans.** Given: $f = +15$ cm, $u = -10$ cm, $h_o = 6$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \quad \frac{1}{15} = \frac{1}{v} - \frac{1}{-10}$

$\Rightarrow \quad \frac{1}{v} = \frac{1}{15} - \frac{1}{10} = \frac{2-3}{30} = -\frac{1}{30}$

$\therefore \quad v = -30$ cm

Thus, the image is formed on the same side of the object at a distance of 30 cm from the optical centre of the lens.

The negative sign indicates that the image is virtual.

Now, $h_o = +6$ cm

Magnification, $m = \frac{h_i}{h_o} = \frac{v}{u} \Rightarrow h_i = \frac{v}{u} \times h_i = \frac{-30}{-10} \times 6 = +18$ cm

So, the image is three times larger than the size of object, i.e. 18 cm.

The positive sign indicates that the image is erect.

**143. A 3 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 30 cm. The distance of the object from the lens is 20 cm. Use lens formula to find the position, size and nature of the image formed.** **[Foreign]**

**Ans.** Given size of object $(h_o) = 3$ cm, focal length $(f) = 30$ cm

Distance of object from lens $(u) = -20$ cm

Using lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow \quad \frac{1}{30} = \frac{1}{v} - \frac{1}{(-20)}$

$\Rightarrow \quad \frac{1}{v} = \frac{1}{30} - \frac{1}{20} = \frac{2-3}{60} = -\frac{1}{60}$

$\Rightarrow \quad v = -60$ cm

Magnification, $m = \frac{v}{u} = \frac{h_i \text{ (size of image)}}{h_o \text{ (size of object)}}$

$\Rightarrow \quad \frac{-60}{-20} = \frac{h_i}{3}$

Thus, a virtual, erect and magnified image of size 9 cm is formed at 60 cm from optical centre on same side of object.

## Long Answer Type Questions [5 Marks]

**144. List the sign conventions for reflection of light by spherical mirrors. Draw a diagram and apply these conventions in the determination of focal length of a spherical mirror which forms a three times magnified real image of an object placed 16 cm in front of it.** **[Delhi]**

**Ans.** The following are the sign conventions for reflection of light by spherical mirror:

(*i*) The object is always placed to the left of the mirror.

(*ii*) All the distances parallel to the principal axis are always measured from the pole of the spherical mirror.

(*iii*) All the distances, measured along the direction of incident light (along +ve $x$-axis), are considered to be positive.

(*iv*) The distances, measured opposite to the direction of incidence light (i.e. along –ve $x$-axis), are taken as negative.

(*v*) The distances, measured in upward direction, i.e. perpendicular to and above the principal axis (along +ve $y$-axis), are taken as positive.

(*vi*) The distances, measured in downward direction, (along –ve $y$-axis), i.e. perpendicular to and below the principal axis, are taken as negative.

Given: $u = -16$ cm, $m = -3$ (for real image)

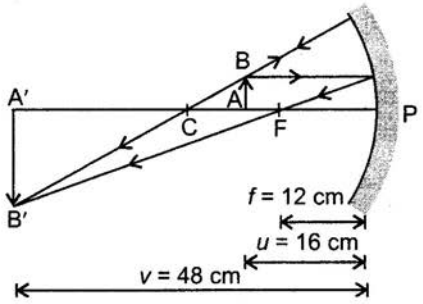
$\because$ $$m = -\frac{v}{u} = -3 \Rightarrow v = 3u = 3(-16) = -48 \text{ cm}.$$

Using mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\therefore$ $$\frac{1}{f} = \frac{1}{-48} + \frac{1}{-16} = \frac{1}{-48} - \frac{1}{16} = \frac{-1-3}{48} = \frac{-4}{48} = \frac{-1}{12}$$

$\Rightarrow$ $$f = -12 \text{ cm}$$

So, the focal length of spherical mirror is 12 cm. The negative sign of focal length indicates that the mirror is concave in nature.




**145. State the law of refraction of light that defines the refractive index of a medium with respect to the other. Express it mathematically. How is refractive index of any medium 'A' with respect to a medium 'B' related to the speed of propagation of light**

**in two media A and B? State the name of this constant when one medium is vacuum or air.**

**The refractive indices of glass and water with respect to vacuum are 3/2 and 4/3 respectively. If the speed of light in glass is $2 \times 10^8$ m/s, find the speed of light in (*i*) vacuum, (*ii*) water.** **[Delhi]**

**Ans.** **Snell's law:** Refer to Ans. 7.

Given: $n_g = \frac{3}{2}$, $n_w = \frac{4}{3}$

$v_g = 2 \times 10^8$ ms$^{-1}$, $c = ?$, $v_w = ?$

From the above relation, $n_g = \frac{c}{v} \Rightarrow \frac{3}{2} = \frac{c}{2 \times 10^8}$

$\Rightarrow \quad c = 3 \times 10^8$ m/s

So, the speed of light in vacuum is $3 \times 10^8$ m/s.

Also, $n_w = \frac{c}{v_w} \Rightarrow \frac{4}{3} = \frac{3 \times 10^8}{v_w}$

$\Rightarrow \quad v_w = \frac{9}{4} \times 10^8 = 2.25 \times 10^8$ m/s

So, the speed of light in water is $2.25 \times 10^8$ m/s.

**146. List the new Cartesian sign convention for reflection of light by spherical mirrors. Draw a diagram and apply these conventions for calculating the focal length and nature of a spherical mirror which forms a 1/3 times magnified virtual image of an object placed 18 cm in front of it.** **[All India]**

**Ans.** Cartesian sign conversion spherical mirrors are as follows:

(*i*) All the distances are mesured from pole of the mirror. Parallel to principal axis.

(*ii*) Distances measured in the direction incident ray is taken as positive and vice versa.

(*iii*) Distances measured perpendicular upward to principal axis is taken as positive while perpendicular downward is negative.

(*iv*) Focal length of concave mirror is taken as negative while that of converse mirror is positive.

(*v*) Virtual image distance is taken as positive while real image distance is taken as negative.

$$\text{Magnification of mirror, } m = -\frac{\text{Position of image } (v)}{\text{Position of object } (u)} = +\frac{\text{Size of image}}{\text{Size of object}}$$

$$m = \frac{-v}{u} = \frac{h_i}{h_o}$$

Given: $m = \frac{1}{3}$, $u = -18$ cm

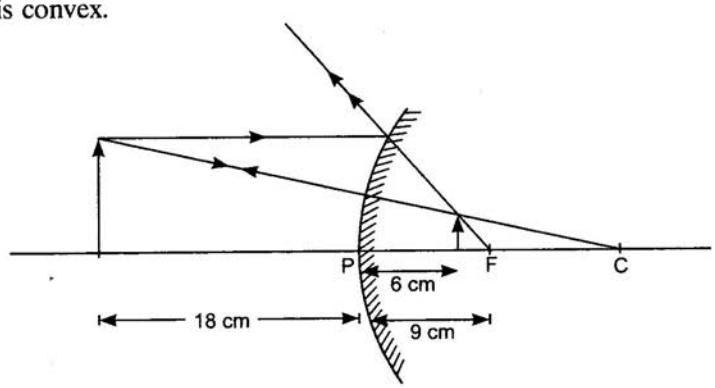
$\Rightarrow \quad \frac{-v}{(-18)} = \frac{1}{3} \Rightarrow v = \frac{18}{3} = 6$ cm

Using mirror formula, $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

$\Rightarrow \quad \frac{1}{f} = \frac{1}{6} + \frac{1}{(-18)} = \frac{3-1}{18} = \frac{2}{18} = \frac{1}{9}$

$\Rightarrow \quad f = 9$ cm

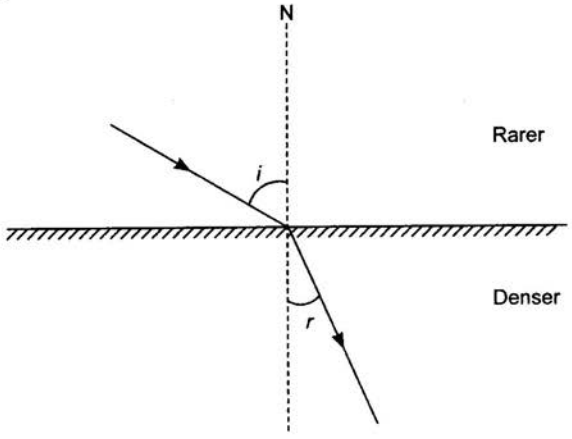
Thus, a diminished virtual image is formed behind the mirror, this indicate nature of mirror is convex.




**147. With the help of a ray diagram, state what is meant by refraction of light. State Snell's law for refraction of light and also express it mathematically.**
**The refractive index of air with respect to glass is 2/3 and the refractive index of water with respect to air is 4/3. If the speed of light in glass is $2 \times 10^8$ m/s, find the speed of light in (*a*) air, (*b*) water.**

**Ans.** Refraction of light: Phenomenon of bending of light rays when propagate from one medium to another. It is due to change in speed of ray of light.

Light rays when propagate from rarer to denser medium bend toward the normal and vice versa.



Snell's law of refraction: According to this ratio of sine of angle of incidence in one medium to sine of angle of refraction in other medium, is constant for a particular pair of media. This constant is known as refractive index of second medium with respect to first and it is measure of optical densers of the medium.

$$n_{dr} = \frac{\sin i}{\sin r} = \frac{\text{Speed of light in rarer medium}}{\text{Speed of light in denser medium}}$$

$$\Rightarrow \quad n_{dr} = \frac{\sin i}{\sin r} = \frac{v_r}{v_d}$$

Given $n_{ag} = \frac{2}{3}$, $n_{wa} = \frac{4}{3}$, $v_g = 2 \times 10^8$ m/s

Using formula, $$n_{ag} = \frac{v_g \text{ (speed of light in glass)}}{v_a \text{ (speed of light in air)}}$$

$$\Rightarrow \quad v_a = \frac{v_g}{n_{ag}} = \frac{2\times10^8}{\frac{2}{3}} = 3 \times 10^8 \text{ m/s}$$

Similarly, $$n_{wa} = \frac{v_a \text{ (speed of light in air)}}{v_w \text{ (speed of light in water)}}$$

$$\Rightarrow \quad v_w = \frac{v_a}{n_{wa}}$$

$$\Rightarrow \quad v_w = \frac{3\times10^8}{\frac{4}{3}} = 2.25 \times 10^8 \text{ m/s}$$

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**148. List the sign conventions that are followed in case of refraction of light through spherical lenses. Draw a diagram and apply these conventions in determining the nature and focal length of a spherical lens which forms three times magnified real image of an object placed 16 cm from the lens.** **[Foreign]**

**Ans.** Refer to Ans. 144 (*i*), (*ii*), (*iii*) and (*iv*).

Given: $u = -16$ cm, $m = -3$ (real image)

$\because$ $$m = \frac{v}{u} = -3$$

$\Rightarrow$ $$v = -3u = -3 \times (-16) = 48 \text{ cm}$$

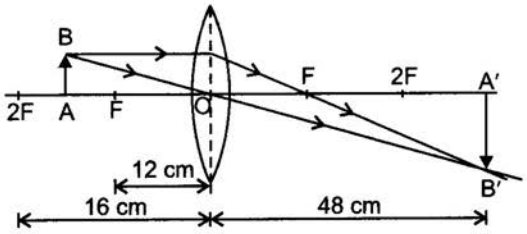
Using lens formula, $$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$\therefore$ $$\frac{1}{f} = \frac{1}{48} - \frac{1}{-16} = \frac{1}{48} + \frac{1}{16} = \frac{1+3}{48} = \frac{4}{48} = \frac{1}{12}$$

$\Rightarrow$ $$f = +12 \text{ cm}$$

So, the focal length of the given spherical lens is 12 cm. The positive sign of focal length indicates that the nature of spherical lens is convex.

**Ray diagram:**




**149. State the laws of refraction of light. Write an expression to relate absolute refractive index of a medium with speed of light in vacuum.**
**The refractive index of a medium 'x' with respect to 'y' is 2/3 and the refractive index of medium 'y' with respect to 'z' is 4/3. Calculate the refractive index of medium 'z' with respect of 'x'.** **[Foreign]**

**Ans.** Refer to Ans. 7.

Given: $n_{xy} = \frac{2}{3}, n_{yz} = \frac{4}{3}, n_{zx} = ?$

We know that, $n_{xy} \times n_{yz} \times n_{zx} = 1$

$\Rightarrow \quad \frac{2}{3} \times \frac{4}{3} \times n_{zx} = 1$

$\Rightarrow \quad n_{zx} = \frac{9}{8}$

## 2011

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### Short Answer Type [I] Questions [2 Marks]

**150. State the two laws of reflection of light.** **[Delhi]**

**Ans.** The two laws of reflection of light are:

(*i*) The angle of incidence is equal to the angle of reflection.

(*ii*) The incident ray, the normal to the reflecting surface at the point of incidence and the reflected ray from that point, all lie in the same plane.

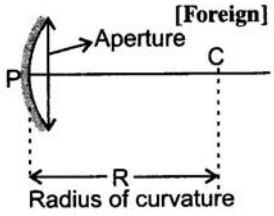
**151. State any four characteristics of the image of an object formed by a plane mirror.** **[All India]**

**Ans.** Refer to Ans. 69.

**152. Define and show on a diagram, the following terms relating to a concave mirror:**
**(*i*) Aperture (*ii*) Radius of curvature** **[Foreign]**

**Ans.** (*i*) The diameter of the reflecting surface of the mirror is called aperture.

(*ii*) The radius of the sphere of which the reflecting surface of a spherical mirror forms a part, is called the radius of curvature of the mirror.



**153. Define the focus of a concave mirror. If the radius of curvature of a convex mirror is 30 cm, what would be its focal length?** **[Foreign]**

**Ans.** The point on the principal axis, where all the rays incident parallel to it meet after reflection is called focus. Since, $R = 30$ cm and $f = \frac{R}{2}$ we have, $f = +15$ cm for a convex mirror.

**154. Distinguish between a real and a virtual image of an object. What type of image is formed (*i*) by a plane mirror, (*ii*) on a cinema screen?** **[Foreign]**

**Ans.** If the light rays after reflection or refraction converge to a point to form an image on its own, it is called a real image. If they are diverging, then they form a virtual image. A real image can be obtained on a screen, while a virtual image cannot be.

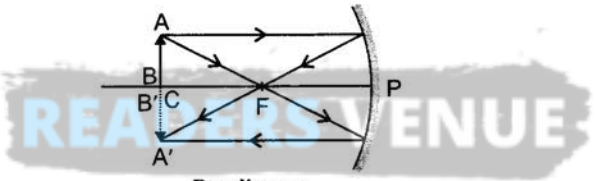
(*i*) Plane mirror forms a virtual image.

(*ii*) On cinema screen, a real image is formed.

## Short Answer Type [II] Questions [3 Marks]

**155. Draw a ray diagram and also state the position, the relative size and the nature of image formed by a concave mirror when the object is placed at the centre of curvature of the mirror.** **[Delhi]**

**Ans.** The image is formed at the centre of curvature. It is real, inverted and of same size as object.




**Ray diagram**

**156. Define 'refractive index of a transparent medium.' What is its unit? Which has a higher refractive index, glass or water?** **[Delhi]**

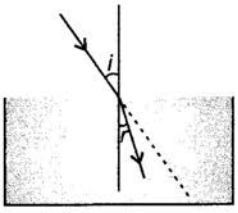
**Ans.** The ratio of the speed of light in the free space ($c$) to the speed of light in the given medium ($v$) is called its refractive index.

$$n = \frac{c}{v}$$

It has no unit. Glass has more refractive index than water.

**157. A ray of light travelling in air enters obliquely into water. Does the light ray bend towards or away from the normal? Why? Draw a ray diagram to show the refraction of light in this situation.** **[Delhi]**

**Ans.** The light ray bends towards the normal because water is denser than air, and the speed of light in denser medium decreases.




$i$ = Angle of incidence
$r$ = Angle of refraction
$r < i$

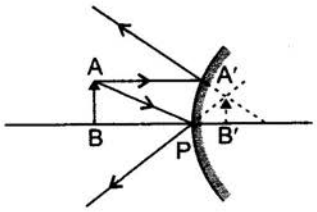
**158.** (*a*) **"The refractive index of diamond is 2.42." What is the meaning of this statement?**
(*b*) **Name a liquid whose mass density is less than that of water but it is optically denser than water.** **[Delhi]**

**Ans.** (*a*) This means that the ratio of speed of light in air to the speed of light in diamond is equal to 2.42.

(*b*) Kerosene as it has higher refractive index than water.

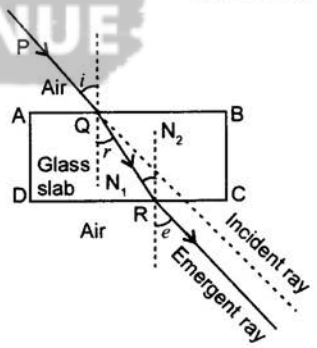
**159.** **An object is placed between infinity and the pole of a convex mirror. Draw a ray diagram and also state the position, the relative size and the nature of the image formed.** **[All India]**

**Ans.** The image is formed in between the pole and focus, behind the convex mirror. It is virtual, erect and diminished.




**160.** **What is the principle of reversibility of light? Show that the incident ray of light is parallel to the emergent ray of light when light falls obliquely on a side of a rectangular glass slab.** **[All India]**

**Ans.** The final path of the ray of light after reflection or refraction is reversed; the ray retraces its entire path. This principle is called the reversibility of light.




For a rectangular glass slab,

Apply Snell's law at Q on the side AB

$$\frac{\sin i}{\sin r} = \frac{n_g}{n_a} = {}_a n_g \qquad ...(i)$$

Apply Snell's law at R on the side DC,

$$\frac{\sin r}{\sin i} = \frac{n_a}{n_g} = {}_g n_a \qquad ...(ii)$$

$[\angle N_1QR = \angle QRN_2 = r$, alt. angles$]$

If the ray retraces its entire path, then for reversed ray

$$\frac{n_g}{n_a} = \frac{\sin e}{\sin r} = {}_a n_g \qquad ...(iii)$$

Multiplying (*ii*) by (*iii*), we get

$$\frac{\sin r}{\sin i} \times \frac{\sin e}{\sin r} = {}_{g}n_{a} \times {}_{a}n_{g} = 1 \qquad ...(iv)$$

Due to this property, we say refraction of light is reversible.

From (*iv*)

$$\frac{\sin i}{\sin r} = \frac{\sin e}{\sin r}$$

$$\Rightarrow \quad \sin i = \sin e$$

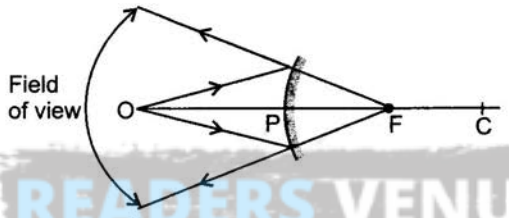
or $$\angle i = \angle e$$

Hence, the incident ray PQ is parallel to the emergent ray RS when the ray of light falls obliquely on a side of rectangular glass slab.

**161. With the help of a ray diagram explain why a convex mirror is preferred for rear-view mirrors in motorcars.** **[Foreign]**

**Ans.** (*i*) A convex mirror always forms a virtual, erect and diminished image.

(*ii*) The field of view increases, while using a convex mirror as shown below.

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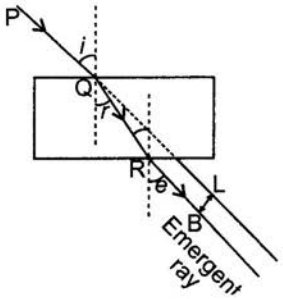
**162. What is understood by lateral displacement of light? Illustrate it with the help of a diagram. List any two factors on which the lateral displacement in a particular substance depends.** **[Foreign]**

**Ans.** Lateral displacement is the perpendicular distance between the incident ray produced and the emergent ray. Lateral displacement in the diagram is BL.

The lateral displacement depends on the thickness of the glass slab, the incident and refraction angles and refractive index of the glass.

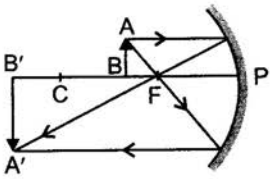


**163. Draw the ray diagram and also state the position, relative size and nature of the image formed by a concave mirror when the object is placed between its centre of curvature, C and focus, F.** **[Foreign]**

**Ans.** **Position of object:** Between F and C

**Position of image:** Beyond C

**Nature of image:** Real, inverted and enlarged.




## Long Answer Type Questions [5 Marks]

**164. (*a*) If the image formed by a lens is diminished in size and erect, for all positions of the object, what type of lens is it?**

**(*b*) Name the point on the lens through which a ray of light passes undeviated.**

**(*c*) An object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm. Find (*i*) the position (*ii*) the magnification and (*iii*) the nature of the image formed.** **[Delhi]**

**Ans.** (*a*) Concave lens.

(*b*) Optical centre.

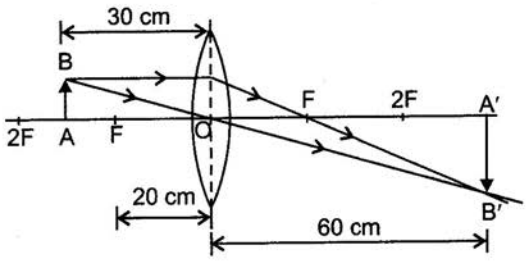
(*c*) Given: $u = -30$ cm, $f = 20$ cm

(*i*) Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \quad \frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{20} + \frac{1}{-30} = \frac{3-2}{60}$$

$$\Rightarrow \quad v = 60 \text{ cm}$$

Image is formed at a distance of 60 cm from the lens on the right side.



(*ii*) $m = \frac{v}{u} = \frac{60}{-30} = -2$

So, the image is inverted and double the size of the object.

(*iii*) Image is real (as $v > 0$), inverted and enlarged.

**165. (*a*) One-half of a convex lens is covered with a black paper. Will such a lens produce an image of the complete object? Support your answer with a ray diagram.**

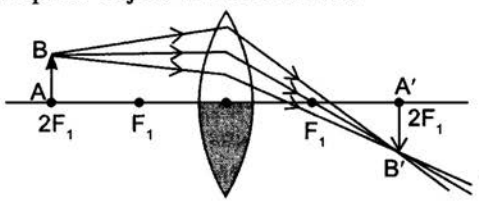
**(*b*) An object 5 cm high is held 25 cm away from a converging lens of focal length 10 cm.**

**(*i*) Draw the ray diagram.**

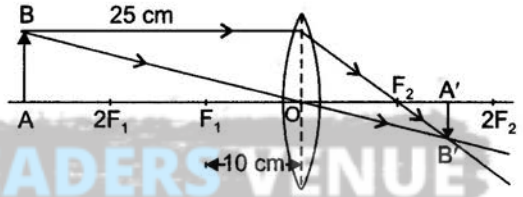
**(*ii*) Calculate the position and size of the image formed.**

**(*iii*) What is the nature of the image?** **[Delhi]**

**Ans.** (*a*) Yes, an image of complete object will be formed.




(*b*) (*i*)

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(*ii*) Given: $h_o = +5$ cm, $u = -25$ cm, $f = +10$ cm

Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{10} = \frac{1}{v} - \frac{1}{-25} = \frac{1}{v} + \frac{1}{25}$

$\therefore \quad \frac{1}{v} = \frac{1}{10} - \frac{1}{25} = \frac{5-2}{50} = \frac{3}{50}$

So $\quad v = \frac{50}{3} = +16.67$ cm

The positive sign indicates that the image is formed at a distance of 16.67 cm on the right side of the lens.

Also, magnification, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$\Rightarrow \quad h_i = \frac{v}{u} \times h_o = \frac{50/3}{-25} \times 5 = -\frac{10}{3} = -3.34$ cm

$\therefore$ Size of image = 3.34 cm

(*iii*) The positive sign of image distance or negative sign of magnification shows that real, inverted and diminished image is formed.

**166.** **(*a*) What is meant by 'power of a lens'?**
**(*b*) State and define the S.I. unit of power of a lens.**
**(*c*) A convex lens of focal length 25 cm and a concave lens of focal length 10 cm are placed in close contact with each other. Calculate the lens power of this combination.** **[All India]**

**Ans.** (*a*) Refer to Ans. 8.

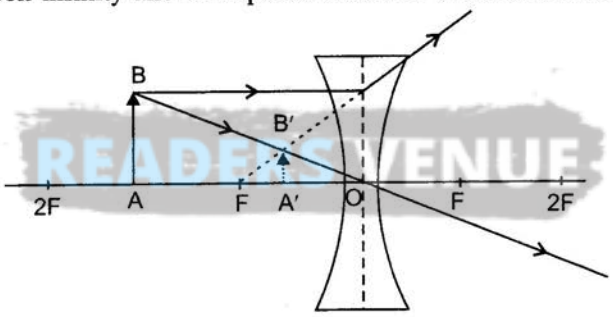
(*b*) Refer to Ans. 8.

(*c*) Power of the combination,

$$P = P_1 + P_2 = \frac{100}{25} + \frac{100}{-10} = 4 - 10 = -6 \text{ D}$$

**167.** **(*a*) Draw a ray diagram to show the formation of image of an object placed between infinity and the optical centre of a concave lens.**
**(*b*) A concave lens of focal length 15 cm forms an image 10 cm from the lens. Calculate**
**(*i*) the distance of the object from the lens.**
**(*ii*) the magnification for the image formed.**
**(*iii*) the nature of the image formed.** **[All India]**

**Ans.** (*a*) The following ray diagram shows the image formation when the object is at any position between infinity and the optical centre of a concave lens.




**Position of image:** Between F and optical centre

**Nature of image:** Virtual, erect and diminished.

(*b*) Given: $f = -15$ cm, $v = -10$ cm

(*i*) Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-10} - \frac{1}{-15} = -\frac{1}{30}$$

$$\therefore \quad u = -30 \text{ cm}$$

Therefore, the object is at 30 cm from the concave lens on its left side.

(*ii*) $m = \frac{v}{u} = \frac{-10}{-30} = \frac{1}{3}$

(*iii*) Since, $m$ is +ve, so the image is erect and $v$ is –ve, so the image is virtual. As $m < 1$, the image is diminished.

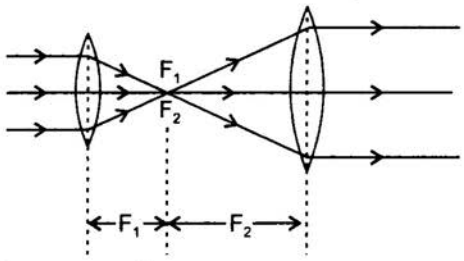
**168.** **(*a*) Under what condition will a glass lens placed in a transparent liquid become invisible?**

**(*b*) Describe and illustrate with a diagram, how we should arrange two converging lenses so that a parallel beam of light entering one lens emerges as a parallel beam after passing through the second lens.**

**(*c*) An object is placed at a distance of 3 cm from a concave lens of focal length 12 cm. Find the (*i*) position and (*ii*) nature of the image formed.** **[Foreign]**

**Ans.** (*a*) When the refractive index of a glass lens becomes equal to the refractive index of a transparent liquid, the glass lens will become invisible.

(*b*) The parallel beam converges at focus of the first lens and emerges parallel as it is at the focus of second lens.




(*c*) Given: $f = -12$ cm, $u = -3$ cm

(*i*) Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{-12} - \frac{1}{3} = \frac{-1-4}{12}$$

$$\Rightarrow \qquad v = -\frac{12}{5} \text{ cm}$$

(*ii*) $v < 0$, so the image is virtual.

$|v| < |u|$, so image is diminished.

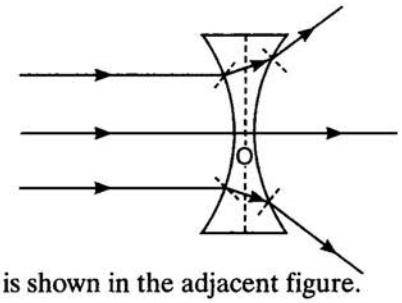
and $$m = \frac{v}{u} \frac{-\frac{12}{5}}{-3} = \frac{4}{5}$$

$m > 0$ but $|m| < 1$, so the image is erect and diminished.

**169.** **(*a*) With the help of a ray diagram explain why a concave lens diverges the rays of a parallel beam of light.**

**(*b*) A 2.0 cm tall object is placed perpendicular to the principal axis of a concave lens of focal length 15 cm. At what distance from the lens, should the object be placed so that it forms an image 10 cm from the lens? Also find the nature and the size of image formed.** **[Foreign]**

**Ans.** (*a*) When a parallel beam of light incident on a front face of concave lens, each ray of light will refract towards the normal to the surface as it moves from rarer to denser medium and travels in a straight line inside the lens until it reaches the back face of the lens. At the back face boundary, each ray of light will again refract and bend away from the normal to the surface as it moves from denser to rarer medium. The course of ray of light is shown in the adjacent figure.



Thus, because of the concave shape of both the faces, the double concave lens diverges the rays of parallel beam of incident light.

(*b*) Given: $h_o = 2.0$ cm, $f = -15$ cm

$v = -10$ cm as concave lens always forms virtual image on the same side of the object.

Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{-10} - \frac{1}{-15} = \frac{-15+10}{150}$$

$$\Rightarrow \quad u = -\frac{150}{5} = -30 \text{ cm}$$

Using the formula, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$$\Rightarrow \quad m = \frac{-10}{-30} = \frac{1}{3} < 1$$

$$h_i = 2 \times \frac{-10}{-30} = \frac{2}{3}$$

So, the image is virtual, erect and diminished.

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## 2010

### Very Short Answer Type Questions [1 Mark]

**170. What is the nature of the image formed by a concave mirror if the magnification produced by the mirror is +4?** **[Delhi]**

**Ans.** When magnification $M = +4$, image formed by concave mirror is virtual, erect and magnified.

**171. Explain why a ray of light passing through the centre of curvature of a concave mirror, gets reflected along the same path.** **[Delhi]**

**Ans.** The ray of light passing through the centre of curvature is incident to the mirror along its normal, so $\angle i = \angle r = 0$. Therefore, the ray of light retraces its path.

**172. What is the nature of the image formed by a concave mirror if the magnification produced by the mirror is +3?** **[Delhi]**

**Ans.** The positive sign of magnification indicates that the image is virtual, erect and enlarged.

**173. Between which two points of a concave mirror should an object be placed to obtain a magnification of –3?** **[Delhi]**

**Ans.** The negative sign of magnification indicates that the image is real and inverted. Also, the size of image is enlarged. So, the object must be positioned between F and 2F, i.e. C.

**174. "The refractive index of carbon disulphide is 1.63." What is the meaning of this statement in relation to speed of light?** **[Delhi]**

**Ans.** The speed of light in carbon disulphide is $\frac{1}{1.63}$ times the speed of light in free space.

**175. The outer surface of a hollow sphere of aluminium of radius 50 cm is to be used as a mirror. What will be the focal length of this mirror? Which type of spherical mirror will it provide?** **[Delhi]**

**Ans.** As we know, $f = \frac{R}{2} = 25$ cm

It will form a convex mirror.

**176. Between which two points related to a concave mirror should an object be placed to obtain on a screen an image twice the size of the object?** **[All India]**

**Ans.** Between F and C.

READERS VENUE

**177. How should a ray of light be incident on a rectangular glass slab so that it comes out from the opposite side of the slab without being displaced?** **[Foreign]**

**Ans.** Along the normal to the surface or at an incident angle of $i = 0°$.

**178. A girl was playing with a thin beam of light from her laser torch by directing it from different directions on a convex lens held vertically. She was surprised to see that in a particular direction the beam of light continues to move along the same direction after passing through the lens. State the reason for this observation.** **[Foreign]**

**Ans.** A ray of light passing through the optical centre of the convex lens will continue to move along the same direction after refracting through the lens.

**179. A ray of light enters a rectangular glass slab of refractive index 1.5. It is found that the ray emerges from the opposite face of the slab without being displaced. If its speed in air is $3 \times 10^8$ ms$^{-1}$ then what is its speed in glass?** **[Foreign]**

**Ans.** $\because \quad n = \frac{c}{v}$

$\Rightarrow \quad v = \frac{c}{n} = \frac{3 \times 10^8}{1.5} = 2 \times 10^8$ m/s

**180. The speed of light in a transparent medium is 0.6 times that of its speed in vacuum. What is the refractive index of the medium?** **[Foreign]**

**Ans.** Since, $n = \frac{c}{v}$

$\Rightarrow \quad n = \frac{c}{0.6c} = \frac{1}{0.6} \approx 1.67$

**181. An object is kept at a distance of 4 m in front of a spherical mirror which forms its erect image at a distance of 1.0 m from the mirror. What is magnification? Is the mirror concave or convex?** **[Foreign]**

**Ans.** Given: $u = -4$ m, $v = 1.0$ m

Magnification of a spherical mirror is given by

$$m = \frac{h_i}{h_o} = -\frac{v}{u} = -\frac{1}{-4} = +\frac{1}{4} = +0.25 < 1$$

So, a virtual, erect and diminished image is formed.

Accordingly, the given spherical mirror is a convex mirror.

**182. An object is kept at a distance of 3 m in front of a spherical mirror which forms its erect image at a distance of 0.5 m from the mirror. What is the magnification? Is the mirror concave or convex?** **[Foreign]**

**Ans.** Given: V = 0.5 m, u = – 3 m.

Magnification of mirror, $\quad m = -\frac{v}{u} \Rightarrow m = \frac{-0.5}{-3}$

$$m = + 0.17$$

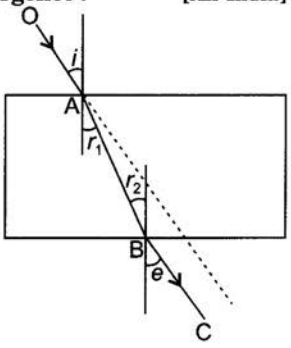
As magnification m < 1, so mirror is convex.

READERS VENUE

## Short Answer Type [I] Question [2 Marks]

**183. In an experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 55° with the normal on one face of the slab, after refraction strikes the opposite face of the slab before emerging out into air making an angle of 40° with the normal. Draw a labelled diagram to show the path of this ray. What value would you assign to the angle of refraction and angle of emergence?** **[All India]**

**Ans.** OA is incident ray and $i$ is angle of incidence = 55°.




Given: $r_2 = 40°$

Since $r_1$ and $r_2$ are the alternate interior angles,

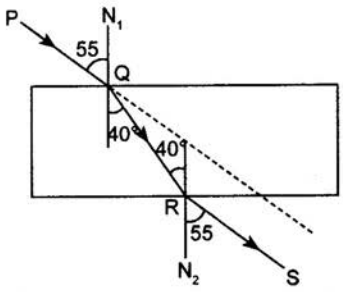
$\therefore \quad \angle r_1 = \angle r_2 = 40°$

So, angle of refraction = 40°

Since the emergent ray is parallel to the incident ray, the angle of emergent must be equal to angle of incidence, i.e. $\angle e = \angle i = 55°$.

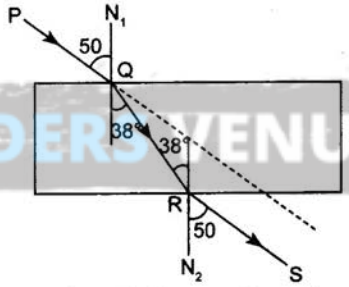
**184. In an experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 55° with the normal on one face of the slab, after refraction strikes the opposite face of the slab before emerging out into air making an angle of 40° with the normal. Draw a labelled diagram to show the path of this ray. What value would you assign to the angle of refraction and angle of emergence? [All India]**

**Ans.** Angle of refraction = 40°
Angle of emergence = 55°




**185. In an experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 50° with the normal on one face of the slab, after refraction strikes the opposite face of the slab before emerging out into air making an angle of 38° with the normal. Draw a labelled diagram to show the path of this ray. What value would you assign to the angle of refraction and angle of emergence? [All India]**

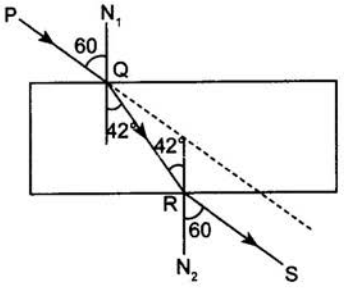
**Ans.** Angle of incidence = 50°
Angle of refraction = 38°
Angle of emergence = 50°




READERS VENUE

**186. In an experiment with a rectangular glass slab, a student observed that a ray of light incident at an angle of 60° with the normal on one face of the slab, after refraction strikes the opposite face of the slab before emerging out into air making an angle of 42° with the normal. Draw a labelled diagram to show the path of this ray. What value would you assign to the angle of refraction and angle of emergence? [All India]**

**Ans.** Angle of incidence = 60°
Angle of refraction = 42°
Angle of emergence = 60°



## Short Answer Type [II] Questions [3 Marks]

**187. At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 36 cm from it? What will be the magnification produced in this case?** **[Delhi]**

**Ans.** Given focal length ($f$) = 18 cm.
Image distance ($v$) = 36 cm
Using lens formula for convex lens

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

$$\Rightarrow \quad \frac{1}{u} = -\frac{1}{f} + \frac{1}{v}$$

$$\Rightarrow \quad \frac{1}{u} = -\frac{1}{18} + \frac{1}{36} = \frac{-2+1}{36} = \frac{-1}{36}$$

Hence object distance $u$ = –36 cm.

Magnification, $m = \frac{v}{u} = \frac{36}{-36} = -1$

Thus, magnification $m$ = –1, image formed is real, inverted and of same size as object. It is formed at centre of curvature of lens.

**188. At what distance should an object be placed from a lens of focal length 25 cm to obtain its image on a screen placed on the other side at a distance of 50 cm from the lens? What will be the magnification produced in this case?** **[Delhi]**

**Ans.** Given focal length ($f$) = 25 cm.
Image distance ($v$) = 50 cm
This indicates lens is convex.

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

$$\Rightarrow \quad \frac{1}{u} = \frac{1}{50} - \frac{1}{(25)} = \frac{1-2}{50} = -\frac{1}{50}$$

Hence, object distance ($u$) = – 50 cm.

Magnification, $m = \frac{v}{u}$

$$\Rightarrow \quad m = \frac{50}{-50} = -1$$

$$\therefore \quad m = -1$$

Thus, image is real, inverted and of same size of object.

**189. At what distance should an object be placed from a convex lens of focal length 18 cm to obtain an image at 24 cm from it on the other side. What will be the magnification produced in this case?** **[Delhi]**

**Ans.** Given: $f = +18$ cm, $v = 24$ cm

Using, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{24} - \frac{1}{18} = \frac{3-4}{72}$

$\Rightarrow \quad u = -72$ cm

The object should be kept at a distance of 72 cm on the left side of the convex lens.

Magnification, $m = +\frac{v}{u} = \frac{24}{-72} = \frac{-1}{3}$

The image is inverted, real and diminished.

**190. An object is placed at a distance of 20 cm from the optical centre of a convex lens of focal length 30 cm. Find the distance of the image from the lens. What will be the height of the image if the object is 2 cm tall?** **[All India]**

**Ans.** Given: $u = -20$ cm, $f = +30$ cm, $h_o = +2$ cm, $v = ?$, $h_i = ?$

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we get

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{30} + \frac{1}{-20} = \frac{2-3}{60} = -\frac{1}{60}$$

$\therefore \quad v = -60$ cm

Again, magnification, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$\therefore \quad h_i = \frac{v}{u} \times h_o = \frac{-60}{-20} \times 2 = +6$ cm

**Position of image:** Image is formed at a distance of 60 cm from the optical centre of the convex lens and is on the same side of the object as indicated by negative sign in image distance.

**Size of image:** It is three times the size of object, i.e. 6 cm.

So virtual, erect and magnified image is formed as the object is placed between optical centre and focal length of convex lens.

**191. An object is placed at a distance of 24 cm from the optical centre of a convex lens of focal length 18 cm. Find the distance of the image from the lens. What will be the height of the image if the object is 3.0 cm tall?** **[All India]**

**Ans.** For convex lens

Given: $u = -24$ cm, $f = +18$ cm, $h_o = 3.0$ cm, $v = ?$, $h_i = ?$

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we get

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{18} + \frac{1}{-24} = \frac{1}{18} - \frac{1}{24}$$

$$= \frac{4-3}{72} = \frac{1}{72}$$

$\therefore \quad v = +72$ cm

Again, magnification, $m = \frac{h_i}{h_o} = \frac{v}{u}$

$\therefore$ $h_i = \frac{v}{u} \times h_o = \frac{72}{-24} \times 3 = -9$ cm

Therefore, image is formed at a distance of 72 cm from the optical centre of convex lens on its right side and three times larger, i.e. 9 cm.

Negative sign indicates that image is formed below the principal axis. Thus, the image is real and inverted.

**192. How far should an object be placed from a convex lens of focal length 20 cm to obtain its image at a distance of 30 cm from the lens? What will be the height of the image if the object is 6 cm tall?** **[All India]**

**Ans.** Given: $f = +20$ cm, $v = +30$ cm

Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{30} - \frac{1}{20} = \frac{2-3}{60} = \frac{-1}{60}$

$\therefore$ $u = -60$ cm

The object should be placed at a distance of 60 cm on the left side of the convex lens.

Using the formula, $m = \frac{h_i}{h_o} = +\frac{v}{u}$

$\Rightarrow$ $h_i = +\frac{v}{u} h_o = +\frac{30}{(-60)} \times 6 = -3$ cm

READERS VENUE

The negative sign shows that the image is inverted and real and height of the image is 3 cm.

**193. The image of an object placed at 60 cm in front of a lens is obtained on a screen at a distance of 120 cm from it. Find the focal length of the lens. What would be the height of the image if the object is 5 cm high?** **[Foreign]**

**Ans.** Given: $u = -60$ cm, $v = +120$ cm

Using the formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow$ $\frac{1}{f} = \frac{1}{120} - \frac{1}{-60} = \frac{1+2}{120}$

$\therefore$ $f = 40$ cm

$m = \frac{v}{u} = \frac{h_i}{h_o}$

$\Rightarrow$ $h_i = h_o \times \frac{v}{u} = 5 \times \frac{120}{60} = 10$ cm

**194. Find out how far should an object be placed from a convex lens of focal length 20 cm to obtain its image on a screen kept 30 cm away from the lens. Find the height of the image if the height of the object is 6.0 cm.** **[Foreign]**

**Ans.** Given: $f = +20$ cm, $v = +30$ cm, $h_o = 6.0$ cm, $u = ?$, $h_i = ?$

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$, we get

$$\frac{1}{u} = \frac{1}{v} - \frac{1}{f} = \frac{1}{30} - \frac{1}{20} = \frac{2-3}{60} = -\frac{1}{60}$$

$\therefore$ $u = -60$ cm

Thus, object should be placed at a distance of 60 cm on the left side of convex lens to get the real image on the screen.

Magnification of lens is given by

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

$\therefore$ $$h_i = \frac{v}{u} \times h_o = \frac{+30}{-60} \times 6 = -3.0 \text{ cm}$$

Negative sign shows that image is inverted and its height is 3.0 cm.

**195. The image of an object placed at 24 cm in front of a lens is obtained on a screen at a distance of 72 cm from it. Calculate the focal length of the lens. What would be the height of the image if the object is 2.0 cm high?** **[Foreign]**

**Ans.** Given: $u = -24$ cm, $V = 72$ cm, $h_o = 2.0$ cm.

READERS VENUE

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$\Rightarrow$ $$\frac{1}{f} = \frac{1}{72} - \frac{1}{(-24)} = \frac{1+3}{72} = \frac{4}{72} = \frac{1}{18}$$

Hence, focal $f = 18$ cm, nature of lens is convex.

Magnification of lens, $m = \frac{v}{u} = \frac{h_i}{h_o}$

$\Rightarrow$ $$\frac{72}{-24} = \frac{h_i}{2.0}$$

Size of image $h_i = -6$ cm

Thus, image is real and magnified of size 6 cm.

# 11 THE HUMAN EYE AND THE COLOURFUL WORLD

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [I] Questions [2 Marks]**

1. **Define the term power of accommodation. Write the modification in the curvature of the eye lens which enables us to see the nearby objects clearly.** **[Delhi]**

**Ans.** **Power of accommodation:** The ability of eye lens to adjust its focal length to form the sharp image of the object at varying distances on the retina is called its power of accommodation.

When we looking at nearby object, the ciliary muscles contract, it increases the curvature of eye lens, which enable us to see the nearby objects clearly.

READERS VENUE

2. **Write the structure of eye lens and state the role of ciliary muscles in the human eye.** **[Delhi]**

**Ans.** Structure of eye lens — Convex

**Ciliary Muscle:**

- It modifies the curvature and thereby focal length of the eye lens by contracting or relaxing itself according to the distance of the object.
- It holds the eye lens in position.

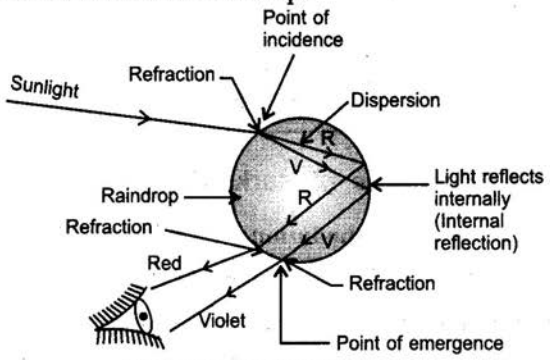
3. **What happens to the image distance in the normal eye when we decrease the distance of an object, say 10 m to 1 m? Justify your answer.** **[Delhi]**

**Ans.** There is no change in the image distance in the eye. The eye lens has the ability to adjust its focal length called **accommodation**. When object distance decreases ciliary muscles contract and lens becomes thick and its focal length decreases. It facilitate the near vision.

## Short Answer Type [II] Questions [3 Marks]

**4. What is a rainbow? Draw a labelled diagram to show the formation of a rainbow.** **[Delhi]**

**Ans. Rainbow:** It is an optical natural spectrum, produced by the nature in the sky, in the form of a multicoloured arc. The rainbow is formed due to the dispersion of sunlight by water droplets suspended in the atmosphere after rainfall. These water droplets act like small prisms. The Sunlight enters the water droplets. At the point of incidence, it refracts and disperses then gets reflected internally and finally gets refracted again at the point of emergence as it comes out of the rain-drop.




**Formation of primary rainbow**

Therefore, due to refraction, dispersion and internal reflection of the sunlight, different colours reach the observer's eye along different paths and become distinct. It creates a rainbow in the sky.

Hence "Rainbow is an example of dispersion of sunlight."

**Necessary conditions for the formation of a rainbow.**

(*i*) The presence of water droplets in the atmosphere, and

(*ii*) The sun must be at the back of the observer, i.e. the observer must stand with his back towards the sun.

## Long Answer Type Questions [5 Marks]

**5. When do we consider a person to be myopic or hypermetropic? List two causes of hypermetropia. Explain using ray diagrams how the defect associated with hypermetropic eye can be corrected.** **[AI Allahabad]**

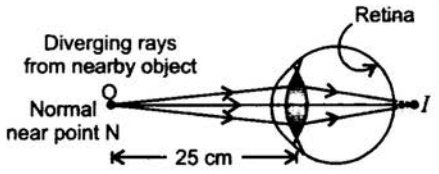
**Ans.** When eye cannot see distant object distinctly but can see nearby objects clearly, the person is *myopic*.

**Hypermetropia or Long-sightedness or Far-sightedness.** The defect of vision due to which an eye cannot see nearby objects clearly but can see distant objects distinctly. This defect of the eye is called hypermetropia.

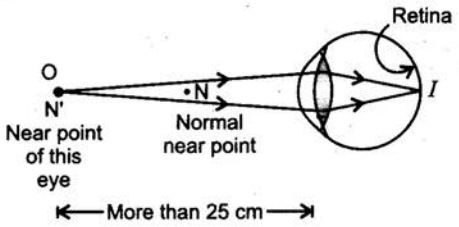
**Long-sightedness is caused due to**

(*i*) greater focal length of the eye lens or (*ii*) smaller eyeball.

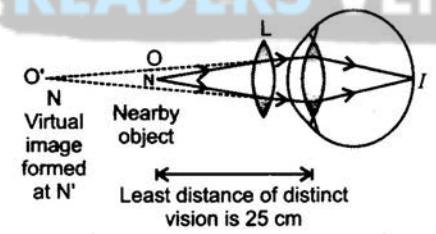
The image in this case, forms behind the retina, so the nearby objects looks blurred.




For every hypermetropic eye, there exists a near point N′ which is more than the least distance of distinct vision, i.e. 25 cm. The diverging rays from the object lying at the near point N′ is focussed on the retina by the eye lens and therefore, the object is clearly visible to the eye.




Therefore, long-sightedness is corrected by using a convex lens of suitable power placed in front of the eye. It converges the rays coming from the object lying at normal near point N and forms its virtual image at near point N′ of the hypermetropic eye. The rays appear to come from N′ enter into the eye and get focussed by the eye lens on the retina. Thus, convex lens provides additional focussing power to the eye lens and shifts the image back onto the retina from beyond and therefore, the defect is corrected.




**2018**

## Long Answer Type Questions [5 Marks]

6. **(*a*) A student is unable to see clearly the words written on the black board placed at a distance of approximately 3 m from him. Name the defect of vision the boy is suffering from. State the possible causes of this defect and explain the method of correcting it.**

   **(*b*) Why do stars twinkle? Explain.** **[CBSE]**

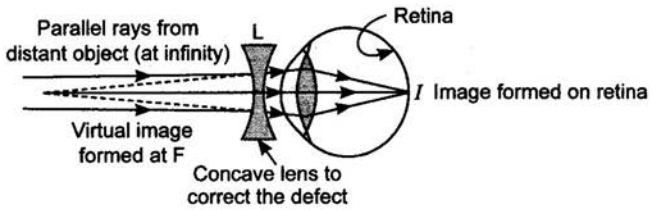
**Ans.** (*a*) The boy is suffering from myopia or Short-sightedness or Near sightedness.

Short-sightedness is caused due to

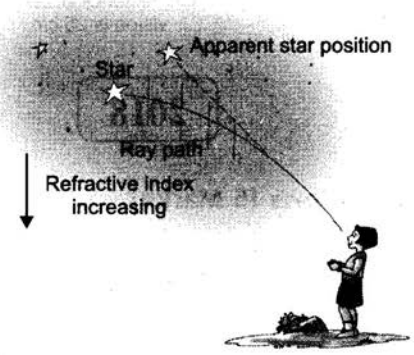
(*i*) excessive curvature of the eye lens or

(*ii*) elongation of eyeball.

The defect is corrected by using a concave lens of suitable power placed in front of eye as shown below. It diverge the rays and forms a virtual image of distant object at far point of the myopic eye. These diverged rays enter into the eye and form the image on the retina. Thus, the concave lens shifts the image back onto the retina instead of in front of it and the defect is corrected.




(*b*) **Twinkling of stars:** The hot layers (low densities) of air at a high altitude behave as an optically rarer medium for the rays, whereas the cold dense layers (high densities) of air, near the earth surface, behave as an optically denser medium for the light rays. So when the light rays (starlight) passing through the various layers of atmosphere, they get deviated and bend toward the normal. As a result, the apparent position of a star is slightly different from its actual position. Thus, the star appears slightly higher (above) than its actual position in the sky. The fluctuation in the position of the star occurs continuously due to the changing amount of light entering into the eye. The star sometimes appears brighter and at some other times, it appears fainter. This causes the twinkling of stars.



**7. (*a*) Write the function of each of the following parts of human eye:**
**(*i*) Cornea (*ii*) Iris (*iii*) Crystalline lens (*iv*) Ciliary muscles**
**(*b*) Why does the sun appear reddish early in the morning? Will this phenomenon be observed by an astronaut on the Moon? Give reason to justify your answer.**
**[CBSE]**

**Ans.** (*a*) (*i*) **Cornea:** It is a thin membrane, covering the surface of eyeball, through which light enters. It acts as a primary lens, which provides the refraction for light rays entering the eye.

(*ii*) **Iris:** It regulates and controls the amount of light entering into the eye by controlling the size of the pupil.

(*iii*) **Crystalline Lens:** It is converging in nature. Its function is to provide the finer adjustment of focal length required to focus the rays coming from the object at different distances. It forms a real, inverted and sharp image on the retina.

(*iv*) **Ciliary Muscle:** Refer to Ans. 2.

(*b*) At the time of sunrise, sun is near the horizon, sun rays have to travel through a larger atmospheric distance. The fine particles present in the atmosphere, having size smaller than the wavelength of visible light, scattered away the blue component and other smaller wavelengths present in the sunlight. Therefore, the least scattered light that reaches our eyes is of longer wavelengths and is of red colour. Hence the sun appears reddish early in the morning.

This phenomenon would not be observed on the moon due to absence of atmosphere on its surface due to which sunlight will not scatter. Therefore, the sun does not appear red early in the morning.

READERS VENUE

## 2018 (Compartment)

### Long Answer Type Questions [5 Marks]

**8. (*a*) What is presbyopia? State its causes. How is it corrected?**
**(*b*) Why does the Sun appear reddish early in the morning? Explain with the help of a labelled diagram.** **[CBSE]**

**Ans.** (*a*) (*i*) Presbyopia

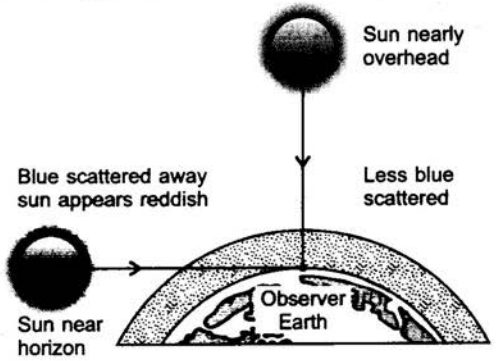
- Presbyopia is a condition that occurs as a part of normal ageing.
  Due to loss of power of accommodation of the eye, with age, objects at a normal near working distance will appear blurry. The near point gradually recedes away. This defect of eye is called Presbyopia.
- Sometimes, a person may suffer from both myopia and hypermetropia.

(*ii*) Presbyopia is caused due to

- weakening of ciliary muscles, and
- eye lens becomes less flexible and elastic, i.e. reducing ability of eye lens to change its curvature with the help of ciliary muscles.

(*iii*) **Bifocal lens** will be required to see clearly nearby as well as the distant object. For myopic defect, upper part of bifocal lens consists of a concave lens used for distant vision and to correct hypermetropia, lower part of bifocal lens consists of a convex lens. It facilitates near vision.

(*b*) At the time of sunrise/sunset, the sun is near the horizon, so the sunrays have to travel through a larger atmospheric distance. The fine particles of the atmosphere scatter away the blue component and other shorter wavelengths of the sunlight. As $\lambda_b < \lambda_r$, only red colour having longer wavelength and least scattered, reaches our eyes. Hence, the sun appears red at sunrise or sunset.




## 2017

READERS VENUE

### Short Answer Type [II] Questions [3 Marks]

**9. Due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens a certain defect of vision arises. Write the name of this defect. Name the type of lens required by such persons to improve the vision. Explain the structure and function of such a lens.** **[Delhi]**

**Ans.** • The defect of vision is *Presbyopia*.

• *Bifocal lens* is required by such persons to improve the vision.

**Structure and function of Bifocal lens**

• To view far off objects, the upper part of the bifocal lens is *Concave* or *Diverging lens*.

• To facilitate or view nearby objects, the Lower part of the bifocal lens is *Convex* or *Converging lens*.

**10. With the help of ciliary muscles the human eye can change its curvature and thus alter the focal length of its lens. State the changes that occur in the curvature and focal length of the eye lens while viewing (*a*) a distance object, (*b*) nearby objects.**

**Explain, why a normal eye is not able to see distinctly the objects placed closer than 25 cm, without putting any strain on the eye.** [Delhi]

**Ans.** (*a*) Eye lens becomes thin while viewing a distance object

Curvature of the eye lens will decrease

Focal length of the eye lens will increase

(*b*) Curvature of eye lens will increase

Focal length of eye lens will decrease

- Focal length of the lens of a normal human eye cannot be decreased below a certain limit.

**11. Write about power of accommodation of human eye. Explain why the image distance in the eye does not change when we change the distance of an object from the eye?**

[Delhi]

**Ans.** Refer to Ans. 1.

- Image distance in the eye is the distance between the eye lens and the retina and it is fixed.
- As the object approaches from infinity towards the eye, the focal length of the eye lens decreases (or vice a versa) so as to maintain the same image distance.

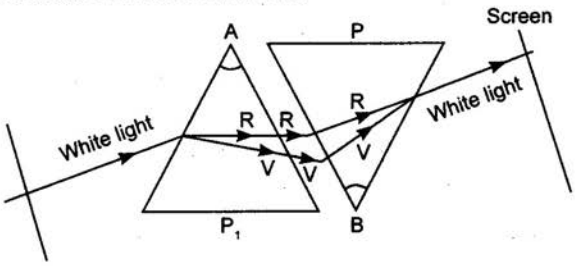
**12. State the cause of dispersion of white light by a glass prism. How did Newton, using two identical glass prisms, show that white light is made of seven colours? Draw a ray diagram to show the path of a narrow beam of white light, through a combination of two identical prisms arranged together in inverted position with respect to each other, when it is allowed to fall obliquely on one of the faces of the first prism of the combination.** **[All India]**

READERS VENUE

**Ans.** **Cause of dispersion:** From Snell's law of refraction, the angle of refraction of light in a prism depends on the refractive index of the prism material. Moreover, the refractive index of the material varies inversely with the speed of light and also varies inversely with the wavelength of light. Hence, different colours of white light bend through different angles with respect to the incident light, as they pass through the glass prism.

**Newton Experiment:** Consider a prism A. When a beam of white light falls obliquely on one of the faces of this prism, it splits up into seven constituent colours. The violet colour deviate the most and the red colour deviates the least.

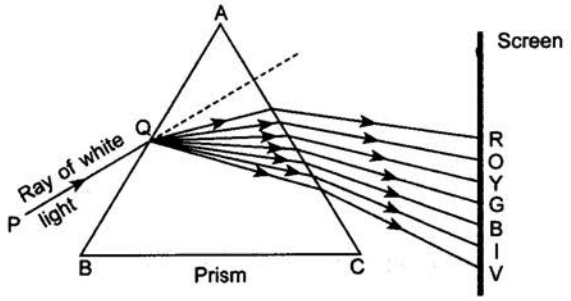
If another identical prism B is placed in an inverted position with respect to first prism A, the constituent coloured rays that emerge out of prism A will be made to merge together to come out as a beam of white light, as shown.



**13. What is 'dispersion of white light'? State its cause. Draw a ray diagram to show the dispersion of white light by a glass prism.** [All India]

**Ans. Dispersion of white light:** The splitting of white light into its constituent colours is called dispersion. The colour sequence is given by the acronym, VIBGYOR – Violet, Indigo, Blue, Green, Yellow, Orange and Red.

The dispersion of light is caused as the varying speeds of different colours of white light offer different refractive indices to the material of the prism. Therefore, different colours of light bend through different angles with respect to incident ray as they pass through prism.




**14. What is "dispersion of white light"? Draw a labelled diagram to illustrate the recombination of the spectrum of white light. Why is it essential that the two prisms used for the purpose should be identical and placed in an inverted position with respect to each other?** [All India]

READERS VENUE

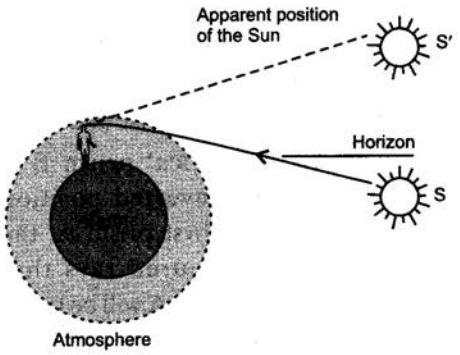
**Ans.** Refer to Ans. 13 and 12.

**15. With the help of a diagram, explain how atmospheric refraction is responsible for the advance sunrise and delayed sunset. How much time difference does it cause on the duration of day on the Earth?** [Foreign]

**Ans. Advanced sunrise and delayed sunset**

The sun is visible 2 minutes before sunrise and 2 minutes after sunset because of atmospheric refraction. This can be explained as below.

The figure shows the actual position of the sun $S$ at the time of sunrise or sunset, just below the horizon while the apparent position $S'$, above the horizon as appear to us.




**Atmospheric refraction effects at sunset or sunrise**

When the sun is slightly below the horizon, the light rays move through the different layers of varying refractive indices of air and get bent towards the normal. These rays appear to come from $S'$, which is the apparent position of the sun. That is why, the sun is visible to us when it has been actually below the horizon or before the actual crossing of horizon by the sun at the time of sunrise or sunset. So, due to the atmospheric refraction, the phenomenon of advanced advance sunrise and delayed sunset is observed.

**16. What is scattering of light? Use this phenomenon to explain why the clear sky appears blue and the sun appears reddish at sunrise.** **[Foreign]**

**Ans.** **Scattering of Light:** The phenomenon of the change in the direction of propagation of light caused by the large number of molecules, such as smoke, tiny water droplets, suspended particles of dust and molecules of air present in the earth's atmosphere, is called scattering of light.

**Sky appears blue:** When sunlight passes through the earth's atmosphere, it is scattered in all directions by the gaseous and other fine particles present in the atmosphere. The blue colour has a shorter wavelength than the red. So, according to Rayleigh scattering law, the blue colour of sunlight is scattered more strongly by the large number of fine particles having size smaller than the wavelength of visible light in the earth's atmosphere. The scattered blue light enters our eyes, hence the sky appears blue.

**Sun appears reddish at sunrise:** At the time of sunrise, the sun is near the horizon, so the sun rays have to travel through a larger atmospheric distance. The fine particles of the atmosphere scatter away the blue component and other smaller wavelengths present in the components of sunlight. As $\lambda_b < \lambda_r$, only red colour having longer wavelength and least scattered, reaches our eyes. Hence the sun appears red at sunrise.

**17. Using the phenomenon of scattering of light, explain why there is a difference in the colour of the sun as it appears during sunrise and at noon.** **[Foreign]**

**Ans.** Refer to Ans. 16.

**At noon sun appears white.**

At the time of noon, sun rays travel relatively travel through a smaller atmospheric distance. Therefore, only a little blue and violet colours are reflected due to which only white light reaches to our eyes.

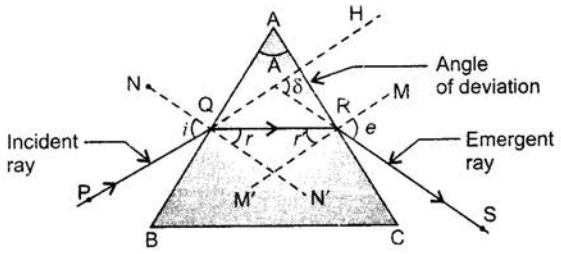
## Long Answer Type Questions [5 Marks]

**18. (*a*) Draw a ray diagram to explain the term angle of deviation.**

**(*b*) Why do the component colours of incident white light split into a spectrum while passing through a glass prism, explain.**

**(*c*) Draw a labelled ray diagram to show the formation of a rainbow.** **[Delhi]**

**Ans.** (*a*)




**Refraction of light through a glass prism**

(*b*) From Snell's law of refraction, the angle of refraction of light in a prism depends on the refractive index of the prism material. Moreover, the refractive index of the material varies inversely with the speed of light and also varies inversely with the wavelength of light. Hence Different colours of white light bend through different angles with respect to the incident light, as they pass through the glass prism. Thus, each colour emerges along a different path, forming a spectrum.

(*c*) **Labelled ray diagram to show the formation of a rainbow:**

Refer to Ans. 4.

**19.** (*a*) **A student suffering from myopia is not able to see distinctly the objects placed beyond 5 m. List two possible reasons due to which this defect of vision may have arisen. With the help of ray diagrams, explain:**

(*i*) **why the student is unable to see distinctly the objects placed beyond 5 m from his eyes.**

(*ii*) **the type of the corrective lens used to restore proper vision and how this defect is corrected by the use of this lens.**

(*b*) **If, in this case, the numerical value of the focal length of the corrective lens is 5 m, find the power of the lens as per the new Cartesian sign convention.**

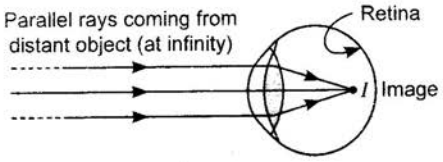
**[All India]**

**Ans.** (*a*) Two possible reasons are:

– excessive curvature of the eye lens.

– elongation of the eyeball.

(*i*) The image in this case, forms in front of the retina, so the distant object looks blurred.




(*ii*) **Corrected eye:** Refer to Ans. 6 (*a*).

(*b*) $f = -5$ m (since lens is concave)

$$P = \frac{1}{f(\text{metre})} = \frac{1}{-5} = -0.2\text{D}$$

**20. (*a*) Write the functions of each of the following parts of the human eye:**

**(*i*) Cornea** **(*ii*) Iris**

**(*iii*) Crystalline (Eye) lens** **(*iv*) Ciliary muscles**

**(*v*) Retina**

**(*b*) A person is unable to see distinctly the objects closer than 1 m. Name the defect of vision he is suffering from. Draw ray diagrams to illustrate the cause of the defect and its correction by suitable lens.** **[Foreign]**

**Ans.** (*a*) **Function of the given part of eye:**

(*i*) **Cornea:** Refer to Ans. 7 (*a*) (*i*).

(*ii*) **Iris:** Refer to Ans. 7 (*a*) (*ii*).

(*iii*) **Eye Lens:** It is converging in nature and focus the incoming light rays from the object at various distance on the retina using its refractive property.

(*iv*) **Ciliary Muscle:** Refer to Ans. 7 (*a*) (*iv*).

(*v*) **Retina:** It is a delicate membrane. It acts like a screen on which a real, inverted and diminished image of the object, is formed by the crystalline lens of the eye. It contains enormous number of light sensitive cells. These light receptors are known as rod and cone cells which generate electrical signals upon illumination. These electrical impulses are sent to the brain via optic nerves for further processing.

(*b*) Refer to Ans. 5.

## 2017 (Compartment)

### Short Answer Type [II] Questions [3 Marks]

**21. What is scattering of light? Why is the colour of the clear sky blue? Explain.**

[Delhi, All India]

**Ans.** Refer to Ans. 16.

**22. Name the type of defect of vision a person is suffering from, if he uses convex lenses in his spectacles for the correction of his vision. If the power of the lenses is + 0.5 D, find the focal length of the lenses.** **[All India]**

**Ans.** The defect of vision is hypermetropia. Focal length of lenses, $f = \frac{1}{P} = \frac{1}{+0.5\text{ D}} = +2$ m.

### Long Answer Type Questions [5 Marks]

**23. A person is unable to see distinctly the words printed on a newspaper. Name the defect of vision he is suffering from. Draw ray diagram to illustrate this defect. List its two possible causes. Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.** **[Delhi]**

**Ans.** Refer to Ans. 5.

**24. What is spectrum of white light? Why do different coloured rays deviate at different angles on passing through a glass prism? Explain the method of recombining the different components of white light.** **[All India]**

**Ans.** **Spectrum:** A band of colours, as seen in a rainbow, produced by the separation of the components of white light by their different degrees of refraction according to their wavelengths is called spectrum.

Refer to Ans. 12.

## 2016

### Short Answer Type [II] Questions [3 Marks]

**25. Why does the sun appear reddish early in the morning? Will this phenomenon be observed by an observer on the moon? Justify your answer with a reason.** **[Delhi]**

**Ans.** Refer to Ans. 8 (*b*).

READERS VENUE

This phenomenon would not be observed by an observer on the moon due to the absence of atmosphere on its surface due to which sunlight will not scatter. Therefore, the sun does not appear reddish early in the morning to the observer.

**26. State the cause of dispersion of white light passing through a glass prism. How did Newton show that white light of sun contains seven colours using two identical glass prisms. Draw a ray diagram to show the path of light when two identical glass prisms are arranged together in inverted position with respect to each other and a narrow beam of white light is allowed to fall obliquely on one of the focus of the first prism.** **[Delhi]**

**Ans.** Refer to Ans. 12.

**27. What is meant by scattering of light? The sky appears blue and the sun appears reddish at sunrise and sunset. Explain these phenomena with reason.** **[Delhi]**

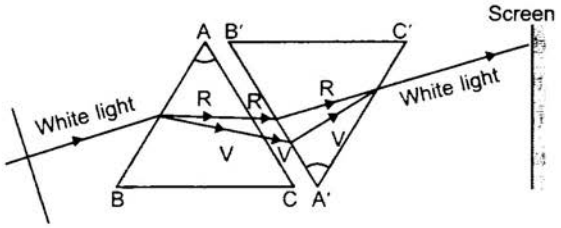
**Ans.** Refer to Ans. 16.

**28. Describe an activity to show that the colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism. Also draw ray diagram to show the recombination of the spectrum of white light.** **[All India]**

**Ans.** The colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism.
Newton demonstrated this phenomenon of recombination of the coloured rays of a spectrum to get back white light.

(*i*) A triangular prism *ABC* is placed on its base *BC*.

(*ii*) A similar prism *A'B'C'* is placed alongside with its refracting surface in the opposite direction, i.e. in an inverted position with respect to the first prism as shown in the figure.




(*iii*) A beam of white light entering the prism *ABC* undergoes refraction and is dispersed into its constituent seven colours.

(*iv*) The constituent seven colours rays are incident on the second inverted prism *A'B'C'* and get further refracted.

(*v*) The second prism recombines them into a beam of white light and emerges from the other side of the second prism and falls on a screen.

(*vi*) This is due to the fact that the refraction or bending produced by the second inverted prism is equal and opposite to the refraction or bending produced by the first prism. This causes the seven colours to recombine.

(*vii*) A white patch or spot of light is formed on the screen placed beyond the second prism.
This proves the phenomenon of the recombination of spectrum of white light.

**29. Explain in brief the reason for each of the following:**

**(*a*) Advanced sunrise**

**(*b*) Delayed sunset**

**(*c*) Twinkling of stars** **[Foreign]**

**Ans.** (*a*) **Advanced sunrise (*b*) delayed sunset:** Refer to Ans. 15.

(*c*) Refer to Ans. 6 (*b*).

**30. Explain in brief the reason for each of the following:**

**(*i*) The sun appears reddish during sunrise.**

**(*ii*) At noon the sun appears white.**

**(*iii*) To an astronaut the sky appears dark instead of blue.** **[Foreign]**

**Ans.** (*i*) Refer to Ans. 16.

(*ii*) Refer to Ans. 17.

(*iii*) The sky appears dark to the astronaut as scattering does not take place at very high altitude due to the absence of atmosphere.

### Long Answer Type Questions [5 Marks]

**31. What is atmospheric refraction? Use this phenomenon to explain the following natural events.**
**(*a*) Twinkling of stars**
**(*b*) Advanced sunrise and delayed sunset.**
**Draw diagrams to illustrate your answers.** **[All India]**

**Ans. Atmospheric Refraction:** The refraction of light caused by the earth's atmosphere due to the gradual change in the refractive indices of its different layers due to the varying conditions of it, is called atmospheric refraction.
(*a*) Refer to Ans. 6 (*b*).
(*b*) Refer to Ans. 15.

**32. (*a*) What is dispersion of white light? State its cause.**
**(*b*) "Rainbow is an example of dispersion of sunlight." Justify this statement by explaining, with the help of a labelled diagram, the formation of a rainbow in the sky. List two essential conditions for observing a rainbow.** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 13.
(*b*) Refer to Ans. 4.

## 2015

### Short Answer Type [I] Questions [2 Marks]

TOPPERS VENUE

**33. Draw a labelled diagram to explain the formation of a rainbow in the sky.** **[Foreign]**

**Ans.** Diagram: Refer to Ans. 4.

**34. Why do stars appear to twinkle? Explain.** **[Foreign]**

**Ans.** Refer to Ans. 6 (*b*).

### Short Answer Type [II] Questions [3 Marks]

**35. With the help of a labelled diagram, explain why the sun appears reddish at the sunrise and the sunset.** **[Delhi]**

**Ans.** Refer to Ans. 8 (*b*).

**36. What is meant by scattering of light? Use this phenomenon to explain why the clear sky appears blue or the sun appears reddish at sunrise.** **[All India]**

**Ans.** Scattering of Light and Blue Colour of Sky: Refer to Ans. 16.

**37. With the help of scattering of light, explain the reason for the difference in colours of the sun as it appears during sunrise/sunset and noon.** **[All India]**

**Ans.** Refer to Ans. 16.

**38. Explain why the planets do not twinkle.** [Foreign]

Ans. The planets are much nearer to the earth as compared to the star. so they can be treated as a collection of large number of point size source of light. Due to varying condition of atmosphere, the darkest part of the twinkling effect from one point source may be overlapped by focussed light from the point source of other region of the planet, so the total amount of light entering into the eye remains constant. Thus, the planets look steady and do not appear twinkle.

**39. What is meant by advance sunrise and delayed sunset? Draw a labelled diagram to explain these phenomena.** [Foreign]

**Ans.** Refer to Ans. 15.

**40. Explain giving reason why the sky appears blue to an observer from the surface of the earth. What should be the appearance of the sky during the day for an astronaut staying in the international space station orbiting the earth? State reason to justify your answer.** [Foreign]

**Ans.** When the sunlight passes through the earth's atmosphere, it is scattered in all directions by the gaseous molecules and other fine particles present in the air. Blue colour has a shorter wavelength than red. So, according to Rayleigh's scattering law, the blue colour of sunlight is scattered more strongly by the large number of molecules present in the earth's atmosphere. Hence, the sky appears blue.

For an astronaut staying in the international space station orbiting the earth, the colour of the sky will be black, i.e. the sky will appear dark.

**Reason:** Sunlight does not scatter in the absence of atmosphere.

READERS VENUE

## Long Answer Type Questions [5 Marks]

**41. A student is unable to see clearly the words written on the blackboard placed at a distance of approximately 4 m from him. Name the defect of vision the boy is suffering from. Explain the method of correcting this defect. Draw ray diagram for the:** [Delhi]

**(*i*) defect of vision and also**

**(*ii*) for its correction.**

**Ans. Defect of vision:** Refer to Ans. 19 (*a*) and (*b*).

## 2014

## Short Answer Type [II] Questions [3 Marks]

**42. Explain giving reason why the sky appears blue to an observer from the surface of the earth? What will the colour of the sky be for an astronaut staying in the international space station orbiting the earth? Justify your answer giving reason.** [Delhi]

**Ans.** Refer to Ans. 40.

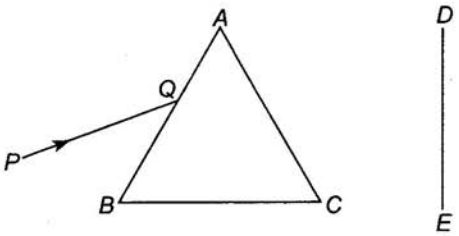
**43. Why does the sun seem to rise two minutes before the actual sunrise and set two minutes after the actual sunset? Explain with the help of labelled diagram. [Delhi]**

**Ans.** Advance sunrise and delayed sunset—Refer to Ans. 15.

**44. Explain with the help of a labelled diagram, the cause of twinkling of stars. [Delhi]**

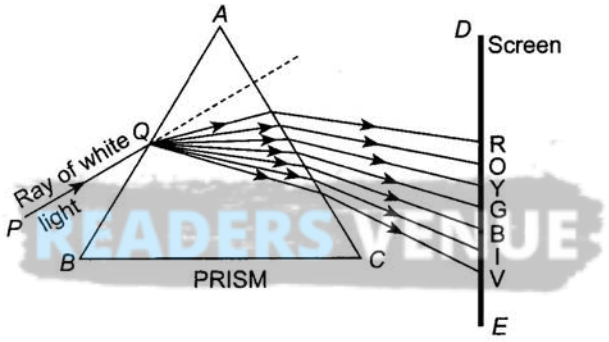
**Ans.** Refer to Ans. 6 (*b*).

**45. A narrow beam *PQ* of white light is passing through a glass prism *ABC* as shown in the diagram.**
**Trace it on your answer sheet and show the path of the emergent beam as observed on the screen *DE*.**




**(*i*) Write the name and cause of the phenomenon observed.**
**(*ii*) Where else in nature is this phenomenon observed?**
**(*iii*) Based on this observation, state the conclusion which can be drawn about the constituents of white light. [All India]**

**Ans.**




(*i*) Dispersion of light is caused because the different constituent colours of light offer different refractive indices to the material of the prism.
(*ii*) The formation of rainbow is caused by the dispersion of the white sunlight.
(*iii*) (*a*) White light consists of seven colours.
(*b*) The violet colour suffers maximum deviation and the red suffers minimum deviation.

**46. Define the term dispersion of white light. Name the colour of light which bends (*i*) the most, (*ii*) the least, while passing through a glass prism. Draw a ray diagram to justify your answer. [Foreign]**

**Ans.** Refer to Ans. 13.
(*i*) the most is violet, and (*ii*) the least is red, while passing through a glass prism.

**47. What is a spectrum? How can we recombine the components of white light after a glass prism has separated them? Illustrate it by drawing a diagram. [Foreign]**

**Ans.** Refer to Ans. 24 and Ans. 12.

**48. Draw a labelled ray diagram to show the formation of rainbow in the sky giving brief explanation of the phenomena involved at each stage. List two conditions necessary to observe a rainbow.** **[Foreign]**

**Ans.** Refer to Ans. 4.

## Long Answer Type Questions [5 Marks]

**49. (*a*) List three common refractive defects of vision. Suggest the way of correcting these defects.**

**(*b*) About 45 lac people in the developing countries are suffering from corneal blindness. About 30 lac children below the age of 12 years suffering from this defect can be cured by replacing the defective cornea with the cornea of a donated eye. How and why can students of your age involve themselves to create awareness about this fact among people?** **[Delhi]**

**Ans.** (*a*) The three common refractive defects of vision are:

(*i*) Myopia (Near-sightedness or short-sightedness): This is a defect of vision due to which a person can see nearby objects clearly, but cannot see the distant objects distinctly. It is corrected by using spectacles having concave lenses of appropriate power.

(*ii*) Hypermetropia (Far-sightedness or long-sightedness): In this defect, a person can see distant objects clearly, but cannot see the nearby objects distinctly. It is corrected by using spectacles having convex lenses of appropriate power.

(*iii*) Presbyopia: In this defect, the power of accommodation of the eye usually decreases with age. A person may suffer from both myopia and hypermetropia. This defect is corrected by using bifocal lenses of appropriate power in which the upper part consists of a concave lens and the lower part consists of a convex lens.

(*b*) Eyes can be donated after the death of a person. One pair of eyes can give vision to two corneal blind people. So, we should register ourselves to our nearest eye donation camps, who preserve our eyes after our death and donate them to the needy.

**50. (*a*) List the parts of the human eye that control the amount of light entering into it. Explain how they perform this function.**

**(*b*) Write the function of retina in human eye.**

**(*c*) Do you know that the corneal-impairment can be cured by replacing the defective cornea with the cornea of the donated eye? How and why should we organise groups to motivate the community members to donate their eyes after death?** **[All India]**

**Ans.** (*a*) The pupil is the perforation in the iris. It is the pupil, through which, the light enters our eyes. The relaxation and contraction of the muscular fibres of the iris regulate opening and closing of the pupil. Hence, it is the pupil that controls the amount of light entering our eyes.

(*b*) Refer to Ans. 20 (*a*) (*v*).

(*c*) Refer to Ans. 49 (*b*).

**Objective:** The objectives of organising corneal blindness campaign in the school are:

- To motivate and educate others about eye donation.
- To help in removing all the myths about eye donation and explain how one can get opportunity to restore someone's sight.

**51. What is myopia? List two causes for the development of this defect. How can this defect be corrected using a lens? Draw ray diagrams to show the image formation in case of (*i*) defective eye, and (*ii*) corrected eye.** **[Foreign]**

**Ans.** Refer to Ans. 19 (*a*) and 6(*a*).

## 2013

### Short Answer Type [II] Questions [3 Marks]

**52. State the difference in colours of the sun observed during sunrise/sunset and noon. Give explanation for each.** **[Delhi]**

**Ans.** **Scattering of light:** Refer to Ans. 16.

**53. When and where do we see a rainbow? How is a rainbow formed? Draw a labelled diagram to illustrate the formation of a rainbow.** **[All India]**

**Ans.** We see rainbow on a rainy day, when the sun is behind us and the rain in front of us.

Formation of rainbow: Refer to Ans. 4.

**54. Draw a diagram to show dispersion of white light by a glass prism. Label the colours that appears at the two ends of the colour bands. State the reason why different coloured rays deviate differently in the prism.** **[Foreign]**

**Ans.** Refer to Ans. 13.

### Long Answer Type Questions [5 Marks]

**55. (*a*) A person cannot read newspaper placed nearer than 50 cm from his eyes. Name the defect of vision he is suffering from. Draw a ray diagram to illustrate this defect. List its two possible causes. Draw a ray diagram to show how this defect may be corrected, using a lens of appropriate focal length.**

**(*b*) We see advertisements for eye donation on television or in newspapers. Write the importance of such advertisements.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 5.

(*b*) **The importance of advertisements on eye donation is as follows:**

(*i*) These advertisements encourage the eye donation, as one of the best means of social service.

(*ii*) These advertisements help in removing the myths about eye donation.

**56.** **(*a*) A student cannot see clearly a chart hanging on a wall placed at a distance 3 m from his eyes. Name the defect of vision he is suffering from. Draw a ray diagram to illustrate this defect. List its two possible causes.**

**(*b*) Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.**

**(*c*) An eye donation camp is being organised by social workers in your locality. How and why would you help in this cause?** **[All India]**

**Ans.** (*a*) Refer to Ans. 19 (*a*).

(*b*) Refer to Ans. 6 (*a*).

(*c*) **Reasons for donating eyes:**

(*i*) A person's corneal blindness can be elevated only by a human donor's cornea.

(*ii*) Opportunity to restore someone's sight.

**We can support this caused by:**

(*i*) Making it a family tradition of donating the eyes.

(*ii*) Motivating and educating others about eye donation.

(*iii*) Helping in removing all the myths about eye donation.

**57.** **(*a*) List the parts of human eye that control the amount of light entering into it. Explain how.**

**(*b*) Write the function of retina in human eye.**

**(*c*) If due to some disease or injury, the cornea of an eye is clouded, then the vision is impaired and the person may become blind. This type of blindness may be cured by replacing the defective cornea with the cornea of the donated eye. Suggest some measures for motivating people to donate their eyes after death.** **[Foreign]**

**Ans.** (*a*) Refer to Ans. 50 (*a*).

(*b*) Refer to Ans. 20 (*a*) (*v*).

(*c*) **Measures for motivating people to donate their eyes:**

Refer to Ans. 50 (*c*) (conjectives).

## 2012

### Very Short Answer Type Questions [1 Mark]

**58.** **What will be the colour of the sky when it is observed from a place in the absence of any atmosphere?** **[Delhi]**

**Ans.** The sky appears dark when it is observed from a place in the absence of any atmosphere.

**59.** **The sky appears dark instead of blue to an astronaut. State its reason.** **[Delhi]**

**Ans.** The sky appears dark to the astronaut as scattering does not take place at very high altitude due to the absence of atmosphere.

**60. Which phenomenon is responsible for making the path of light visible?** **[Delhi]**

**Ans.** Tyndall effect.

**61. State one function of iris in human eye.** **[All India]**

**Ans.** Iris controls the size of pupil.

**62. State one function of pupil in human eye.** **[All India]**

**Ans.** Pupil regulates and controls the amount of light entering the eye.

**63. State one role of ciliary muscles in the human eye.** **[All India]**

**Ans.** Ciliary muscles help the eye lens to focus the image of an object on the retina by increasing or decreasing the curvature of eye lens.

**64. State one function of the crystalline lens in the human eye.** **[Foreign]**

**Ans.** Crystalline (eye) lens forms a real and inverted image of the object on the retina.

**65. State two properties of the image formed by the eye lens on the retina.** **[Foreign]**

**Ans.** The following are the two properties of the image:

(*i*) The image on the retina is real and inverted.

(*ii*) The image is diminished in size.

**66. State one function of cornea in human eye.** **[Foreign]**

**Ans.** Cornea provides the refraction of light rays entering the eye.

## Short Answer Type [I] Questions [2 Marks]

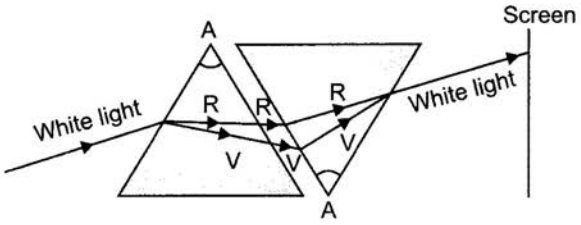
**67. A star sometimes appears brighter and some other times fainter. What is this effect called? State the reason for this effect.** **[Delhi]**

**Ans.** This effect is called twinkling effect.

**Reason:** It is due to the atmospheric refraction of starlight. The atmosphere has varying layers. The gradual change in the refractive indices of different layers of atmosphere causes atmospheric refraction and due to this phenomena starlight undergoes multiple refraction. So, the fluctuation in the position of star occurs continuously due to the changing amount of light entering the eye. The star sometimes appears brighter and at some other times, it appears fainter. This causes twinkling of star.

**68. When we place a glass prism in the path of a narrow beam of white light, a spectrum is obtained. What happens when a second identical prism is placed in an inverted position with respect to the first prism. Draw a labelled ray diagram to illustrate it.** **[Delhi]**

**Ans.** A second identical prism is placed in an inverted position with respect to the first prism. This allows all the colours of the spectrum to pass through the second prism. Where they recombine again. Hence, a beam of white light is emerged from the other side of the second prism. This is shown in the below diagram:



**69. What will be the colour of the sky when it is observed from a place in the absence of any atmosphere?** [Delhi]

**Ans.** Refer to Ans. 58.

**70. What is the colour of the clear sky during daytime? Give reason for it.** [All India]

**Ans.** The colour of clear sky appears blue during daytime.

**Reason:** The earth's atmosphere contains a large number of gaseous molecules and other fine particles whose size is smaller than the wavelength of visible light.

In the visible light, blue colour has shorter wavelength. So when sunlight passes through the atmosphere, its blue colour scatter more strongly than the red or other colours components by these gaseous molecules and particles.

This scattered blue colour enters our eye. Hence, the colour of sky appears blue to us during daytime.

**71. Draw a labelled ray diagram to illustrate the dispersion of a narrow beam of white light when it passes through a glass prism.** [All India]

**Ans.** Refer to Ans. 13 figure only.

**72. A star appears slightly higher (above) than its actual position in the sky. Illustrate it with the help of a labelled diagram.** [All India]

**Ans.** Refer to Ans. 15 (*diagram only*).

**73. Why does the sun appear reddish at sunrise?**

**or**

**The sun appears reddish early in the morning. Why?** [Foreign]

READERS VENUE

**Ans.** Refer to Ans. 8 (*b*).

**74. Draw a ray diagram to show the formation of rainbow and mark the point where (*i*) dispersion (*ii*) internal reflection occur.** [Foreign]

**Ans.** Refer to Ans. 4 (diagram only).

**75. "The time difference between the actual sunset and the apparent sunset is about 2 minutes." What is the reason for the same? Explain with the help of a diagram.** [Foreign]

**Ans.** Refer to Ans. 15.

## Short Answer Type [II] Questions [3 Marks]

**76. A student cannot see a chart hanging on a wall placed at a distance of 3 m from him. Name the defect of vision he is suffering from. How can it be corrected? Draw a ray diagram for the (*i*) defect of vision and also (*ii*) for its correction.** [Delhi]

**Ans.** Refer to Ans. 19 (*a*) and 6 (*a*).

**77. An old man cannot see objects closer than 1 m from the eye clearly. Name the defect of vision he is suffering from. How can it be corrected? Draw ray diagram for the (*i*) defect of vision and also (*ii*) for its correction.** [All India]

**Ans.** Refer to Ans. 5.

**78. What is meant by the term 'power of accommodation' of human eye? How does it help a person to see nearby as well as distant objects clearly?** [Foreign]

**Ans.** The maximum variation in the conversing power (focal length) of the eye lens so that the far-off and nearby objects are viewed clearly is called power of accommodation. When we see the nearby object, the ciliary muscles contract, it increases the thickness of eye lens. The eye lens then becomes thicker. As a result, the focal length of eye lens decreases in such a way that the clear sharp image of nearby object is formed on the retina. Thus, the object is seen clearly to us.

When we see the distant object, these muscles become relaxed, thus the eye lens becomes thinner, and consequently, the focal length of the eye lens increases. Therefore, the parallel rays coming from the distant object are focused on the retina and object is seen clearly to us. Thus, the accommodation power of an eye helps a person to see nearby as well as distant objects clearly.

**79. Draw a diagram to show why distant objects cannot be seen distinctly by a myopic eye. List two reasons due to which this defect of vision may be caused.**
**A person with a myopic eye cannot see objects clearly beyond a distance of 2 m. Name the type of the corrective lens that would be needed to correct the defect of vision and draw a ray diagram to show how the defect gets corrected.** [Foreign]

**Ans.** Refer to Ans. 19 (*a*) and 6 (*a*).

## 2011

### Very Short Answer Type Questions [1 Mark]

**80. What is Tyndall effect?** [Delhi]

**Ans.** The phenomenon of scattering of light by the colloidal particles is called Tyndall effect.

**81. Give an example of optical phenomena which occurs in nature due to atmospheric refraction.** [Delhi]

**Ans.** Twinkling of stars.

**82. Give an example of a phenomenon where Tyndall effect can be observed.** [All India]

**Ans.** When a fine beam of sunlight enters a room containing suspended particles of dust, the path of the beam of light is visible. It is due to the scattering of light (Tyndall effect).

**83. Name the type of particles which acts as a prism in the formation of rainbow in the sky.** [All India]

**Ans.** Water droplets present in the atmosphere.

**84. What is the cause of dispersion of white light on passing through a prism?** [Foreign]

**Ans.** The refractive index of the material of a prism is different for different colours of light, as different colours have different speeds through the material of the prism. Also, the prism has non-parallel surfaces.

**85. Name the atmospheric phenomenon due to which the sun can be seen above the horizon about two minutes before actual sunrise.** [Foreign]

**Ans.** Atmospheric refraction.

**86. Why is the colour of clear sky blue?** **[Foreign]**

**Ans.** When the sunlight reaches the earth's atmosphere, it is scattered in all directions by the gaseous molecules and other fine particles present in the air. Because of the shorter wavelength, the blue colour is scattered more strongly than the other colours. This is why, the colour of sky appears blue.

## Short Answer Type [I] Questions [2 Marks]

**87. A star appears slightly higher (above) than its actual position in the sky. Illustrate it with the help of a labelled diagram.** **[Delhi]**

**Ans.** Refer to Ans. 6 (*b*).

**88. What is meant by the dispersion of white light? Draw a diagram to show dispersion of white light by the glass prism.** **[Delhi]**

**Ans.** Refer to Ans. 13.

**89. Explain why the planets do not twinkle but the stars twinkle.** **[Delhi]**

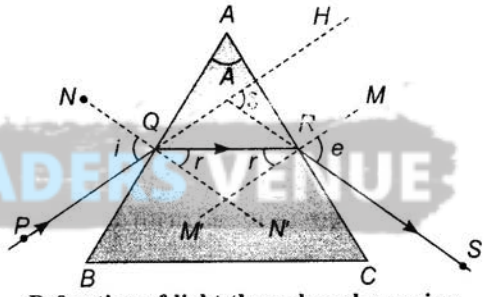
**Ans.** Refer to Ans. 38.

**90. Draw a ray diagram to show the refraction of light through a glass prism. Mark on it (*a*) the incident ray, (*b*) the emergent ray and (*c*) the angle of deviation.** **[All India]**

**Ans.** (*a*) $PQ$ – incident ray

(*b*) $RS$ – emergent ray.

(*c*) $\delta$ – angle of deviation.




**Refraction of light through a glass prism**

**91. Explain with the help of a diagram, how we are able to observe the sunrise about two minutes before the sun gets above the horizon.** **[All India]**

**Ans.** Refer to Ans. 15 (only diagram).

**92. Explain the formation of rainbow in the sky with the help of diagram.** **[Foreign]**

**Ans.** Refer to Ans. 4 (only diagram).

**93. Give reasons:**

**(*i*) The extent of deviation of a ray of light on passing through a glass prism depends on its colour.**

**(*ii*) Lights of red colour are used for danger signals.** **[Foreign]**

**Ans.** (*i*) Refractive index of a medium is different for different colours of light.

(*ii*) Due to large wavelength, the red colour is least scattered by fog or smoke paricles and travelled to large distance.

## Short Answer Type [II] Questions [3 Marks]

**94. What eye defect is hypermetropia? Describe with a ray diagram how this defect of vision can be corrected by using an appropriate lens.** **[Delhi]**

**Ans.** Refer to Ans. 5.

**95. What eye defect is myopia? Describe with a neat diagram how this defect of vision can be corrected by using a suitable lens.** **[All India]**

**Ans.** Refer to Ans. 19 (*a*) and 6 (*a*).

**96. (*a*) What is meant by the power of accommodation of an eye?**

**(*b*) A person with a myopic eye cannot see objects beyond 1.2 m directly. What should be the type of the corrective lens used? What would be its power?** **[All India]**

**Ans.** (*a*) Refer to Ans. 1.

(*b*) To correct virtual image an object at infinity image must be formed at the far point of myopic eye.

So, $u = -\infty$, $v = -120$ cm

Using lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

We get, $\frac{1}{f} = \frac{1}{-120} - \frac{1}{(-\infty)} = \frac{1}{-120}$

$\Rightarrow$ $f = -120$ cm

$\therefore$ $P = \frac{100}{f\,(\text{cm})} = \frac{100}{-120} = \frac{-5}{6}\,\text{D} = -0.83\,\text{D}$

READERS VENUE

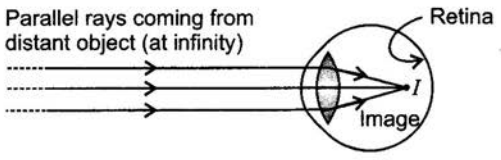
A concave lens of focal length 120 cm and power – 0.83 D is to be used to correct the defect.

**97. (*a*) What are the values of (*i*) near point and (*ii*) far point of vision of a normal adult person?**

**(*b*) A student has difficulty in reading the blackboard while sitting in the last row. What could be his defect of vision? Draw a ray diagram to illustrate this defect of vision.** **[All India]**

**Ans.** (*a*) (*i*) 25 cm (*ii*) Infinity ($\infty$)

(*b*) Short-sightedness or myopia. The image, in this case, falls before the retina. It can be corrected by using concave lens.




**Myopic eye**

Image is formed in front of the retina.

**98. Name the three common defects of vision. What are their causes? Name the type of lens used to correct each of them.** **[Foreign]**

**Ans.**

| Defects of vision | Causes | Correction (lens) |
|---|---|---|
| (*i*) Myopia | • Excessive curvature in cornea<br>• Elongation of eyeball. | Concave |
| (*ii*) Hypermetropia | • Greater focal length of the eye lens<br>• Smaller eye ball | Convex |
| (*iii*) Presbyopia | • Weakening of ciliary muscles<br>• Reducing ability of eye lens to change its curvature | Bifocal |

## 2010

### Very Short Answer Type Questions [1 Mark]

**99. Name the part of our eyes that helps us to focus near and distant objects in quick succession.** **[Delhi]**

**Ans.** Ciliary muscles help in changing the focal length of the eye lens.

**100. The sky appears dark instead of blue to an astronaut. State its reason.** **[Delhi]**

**or**

**To an astronaut why does the sky appear dark instead of blue?**

**Ans.** Refer to Ans. 59.

READERS VENUE

**101. Name the part of our eyes that helps us to focus near and distant objects in quick succession.** **[Delhi]**

**Ans.** Ciliary muscles change the focal length of eye lens. For object nearby or distant so that light rays always focussed at retina.

**102. A person is advised to wear spectacles with concave lenses. What type of defect of vision is he suffering from?** **[All India]**

**Ans.** Myopia or short-sightedness.

**103. A person is advised to wear spectacles with convex lenses. What type of defect of vision is he suffering from?** **[All India]**

**Ans.** Hypermetropia or far-sightedness.

**104. Why do different components of white light deviate through different angles when passing through a triangular glass prism?** **[All India]**

**Ans.** Due to change in refractive index offered by the medium.

**105. What will be the observed colour of the sky on a planet where there is no atmosphere? Why?** **[All India]**

**Ans.** Sky appears dark, because there would have been no scattering of sunlight at all in the absence of atmosphere.

**106. Name the component of white light that deviates the least and the component that deviates the most while passing through a glass prism.** **[All India]**

**Ans.** The least is red colour and the most is blue.

**107. A person can comfortably read a book but finds it difficult to read the number on a bus parked 5 m away from him. Name the type of defect of vision he is suffering from. Which type of lens should he use in his spectacles to correct his vision?** **[Foreign]**

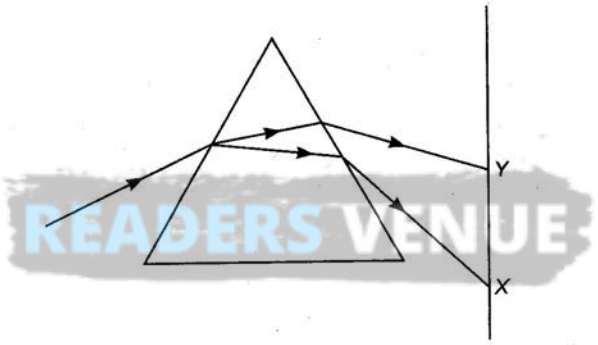
**Ans.** Myopia or short-sightedness. Concave lens should be used to correct his vision.

## Short Answer Type [I] Questions [2 Marks]

**108. What is myopia (near sightedness)? Draw a ray diagram to show how it can be corrected using a lens.** **[Delhi]**

**Ans.** Refer to Ans. 19 (*a*) and 6 (*a*).

**109. In the figure given below a narrow beam of while light is shown to pass through a triangular glass prism. After passing through the prism, it produces a spectrum *XY* on a screen.**




READERS VENUE

(*a*) **State the colour seen at *X* and *Y*.**

(*b*) **Why do different colours of white light bend through different angles with respect to the incident beam of light?** **[Delhi]**

**or**

**Name the component of white light that deviates the least and the component that deviates the most while passing through a glass prism. State the reason of this difference in deviation.** **[Foreign]**

**Ans.** (*a*) The colour seen at *Y*-Red and at *X*-Violet.

(*b*) This is because:

- Different colour components of white light travel at different speeds through a glass prism.
- The varying speeds for different colours lead to different refractive indices for different colours.

- The refractive index to glass for violet colour is more than that of red colour.
- The refractive index measures the ability of bending the light rays. Hence, the violet colour bends most, while the red bends least.

Therefore, the different colours of white light bend through different angles with respect to the incident beam of white light.

**110. What is hypermetropia (far-sightedness)? Draw a ray diagram to show how this defect can be corrected using a lens.** **[Delhi]**

**Ans.** Refer to Ans. 5.

**111. Define the term dispersion of white light. State the colour which bends (*i*) the least and (*ii*) the most while passing through a glass prism.** **[All India]**

**Ans.** Refer to Ans. 13 and 46.

**112. What is meant by scattering of light? State the relationship between the wavelength of light and the size of particle causing scattering.** **[Foreign]**

**Ans.** Scattering of Light: The phenomena of change in the direction of propagation of light caused by the large number of molecules, such as smoke, tiny water droplets, suspended particles of dust and molecules of air present in the earth's atmosphere is called scattering of light.

The colour of the scattered light perceived by us depends on the size of the particles.

(*i*) Very fine particles scatter mainly blue colour.

(*ii*) Large sized particles scatter the light of longer wavelengths.

(*iii*) Enough larger particles scatter the light which may appear white.

**113. What is meant by spectrum of white light? How can we recombine the components of white light after a prism has separated them? Draw a diagram to illustrate it.** **[Foreign]**

**Ans.** Refer to Ans. 24 and 12.

# 12 ELECTRICITY

## PREVIOUS YEARS' QUESTIONS

### 2019

#### Very Short Answer Type Questions [1 Mark]

**1. What is the function of a galvanometer in a circuit?** **[Delhi]**

**Ans.** Galvanometer is used to detect the presence of current in the circuit.

**2. Name and define the SI unit of current.** **[Delhi]**

**Ans.** SI unit of electric current is ampere (A).

Ampere is the flow of electric charges through a surface at the rate of one coulomb per second, i.e. if 1 coulomb of electric charge flows through a cross-section of wire for 1 second, then it would be equal to 1 ampere.

So, 1 ampere $= \frac{1\,C}{1\,s}$ i.e. $1A = 1\ Cs^{-1}$

READERS VENUE

**3. Why are the heating elements of electric toasters and electric irons made of an alloy rather than a pure metal?** **[AI Allahabad]**

**Ans.** The alloys are commonly used in electric heating device. This is because

(*i*) Alloy are combination of two or more metals.

(*ii*) Its resistivity is higher than that of its constituent metals.

(*iii*) It neither gets oxidised nor burn easily at high temperature.

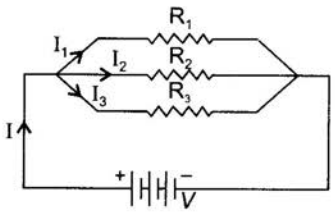
(*iv*) It shows less rapid variations of resistivity due to change in temperature.

#### Long Answer Type Questions [5 Marks]

**4. (*a*) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistance joined in parallel is equal to the sum of the reciprocals of the individual resistances.**

**(*b*) In an electric circuit two resistors of 12 Ω each are joined in parallel to a 6 V battery. Find the current drawn from the battery.** **[Delhi]**

**Ans.** (*a*) Consider the parallel circuit shown alongside:




[Parallel circuit]

Let $I_1$, $I_2$ and $I_3$ be the current flow through the resistor $R_1$, $R_2$ and $R_3$ connected in parallel.

Using Ohm's law, current through each resistor is

$$I_1 = \frac{V}{R_1},\ I_2 = \frac{V}{R_2} \text{ and } I_3 = \frac{V}{R_3}$$

Let their equivalent resistance be $R_P$ then

$$V = IR_P \Rightarrow I = \frac{V}{R_P}$$

Total current through the circuit is $I = I_1 + I_2 + I_3$

or $$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

or $$\frac{V}{R_P} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

or $$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

(*b*) Equivalent resistance in parallel combination is given by

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{12} + \frac{1}{12} = \frac{1}{6}$$

$\therefore$ $R_P = 6\ \Omega$

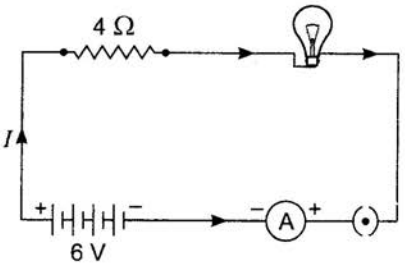
READERS VENUE

Current drawn from the battery

$$I = \frac{V}{R_P} \qquad \text{[From Ohm's law]}$$

$$= \frac{6}{6} = 1\ \text{A}$$

**5. An electric lamp of resistance 20 W and a conductor of resistance 4 W are connected to a 6 V battery as shown in the circuit. Calculate:**




**(*a*) the total resistance of the circuit,**

**(*b*) the current through the circuit,**

**(*c*) the potential difference across the (*i*) electric lamp and**
**(*ii*) conductor, and**

**(*d*) power of the lamp.** **[Delhi]**

**Ans.** (*a*) Total resistance in series combination,

$\therefore$ $R_S = R_1 + R_2 = 4 + 20 = 24\ \Omega$

(*b*) Current, $I = \frac{V}{R_S} = \frac{6}{24} = \frac{1}{4}$ A

$I = 0.25$ A

(*c*) (*i*) Potential difference across the electric lamp,

$V = IR_{bulb} = 0.25 \times 20 = 5$ V

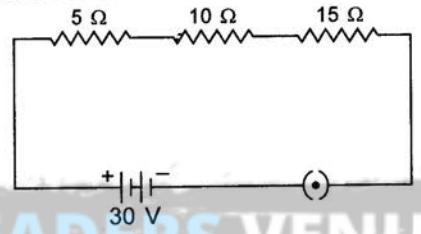
(*ii*) Potential difference across the conductor

$V = IR_{conductor} = 0.25 \times 4 = 1$ V.

(*d*) Power of the lamp, $P = VI = 5 \times 0.25 = 1.25$ W

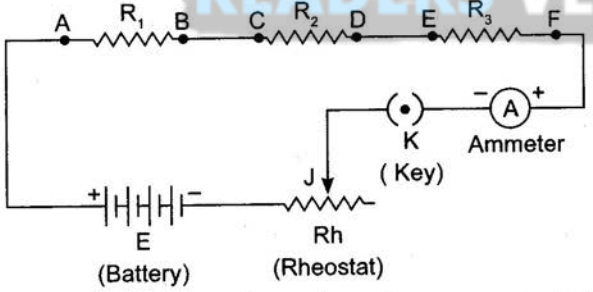
**6. (*a*) How will you infer with the help of an experiment that the same current flows through every part of a circuit containing three resistors in series connected to a battery?**

**(*b*) Consider the given circuit and find the current flowing in the circuit and potential difference across the 15 Ω resistor when the circuit is closed.** **[AI Allahabad]**




READERS VENUE

**Ans.** (*a*)




**Aim:** Same current flows through every part of the above circuit.

**Procedure:**

(*i*) Connect the another ammeters, '$A_1$' between B and C, and '$A_2$' between D and E.

(*ii*) Adjust the sliding contact 'J' of the rheostat initially for a small current.

(*iii*) Note all the ammeter readings. This reading gives us current flowing through the resistors $R_1$, $R_2$ and $R_3$.

(*iv*) The current in the circuit is now increased by changing the position of sliding contact 'J' of the rheostat.

(*v*) Note all the ammeter readings each time.

**Conclusion:** Same reading of all the ammeter in each observation concluded that same current flows through every part of the circuit.

**Precautions:**

(*i*) All the connection should be tight and properly connected as per circuit diagram.

(*ii*) The positive terminal of the ammeter and voltmeter must be connected to the positive terminal of the battery or battery eliminator.

(*b*) Resistors are connected in series, so their total resistance is

$$R_S = R_1 + R_2 + R_3 = 5 + 10 + 15 = 30\ \Omega$$

Current through the circuit

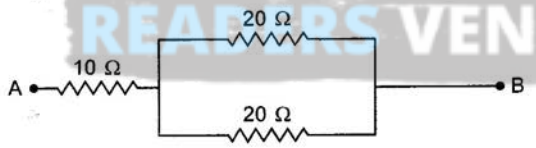
$$I = \frac{V}{R_S} = \frac{30}{30} = 1\ \text{A}$$

$\therefore$ Potential difference across 15 Ω resistors,

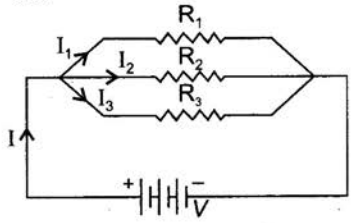
$$V = IR = 1 \times 15 = 15\ \text{V}$$

**7. (*a*) Three resistors $R_1$, $R_2$ and $R_3$ are connected in parallel and the combination is connected to a battery, ammeter, voltmeter and key. Draw suitable circuit diagram and obtain an expression for the equivalent resistance of the combination of the resistors.**

**(*b*) Calculate the equivalent resistance of the following network:** **[AI Allahabad]**




**Ans.** (*a*) Consider the following parallel circuit shown below :




[Parallel circuit]

Let $I_1$, $I_2$ and $I_3$ be the current flow through the resistor $R_1$, $R_2$ and $R_3$ connected in parallel.

Using Ohm's law, current through each resistor is

$$I_1 = \frac{V}{R_1},\ I_2 = \frac{V}{R_2} \text{ and } I_3 = \frac{V}{R_3}$$

Let their equivalent resistance be $R_P$ then

$$V = IR_P \Rightarrow I = \frac{V}{R_P}$$

Total current through the circuit is $I = I_1 + I_2 + I_3$

or $$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

or $$\frac{V}{R_P} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

or $$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

For the given circuit

(*i*) $R_5$ and $R_4$ with Parallel combination of $R_2$ and $R_3$ are in series

(*ii*) $R_2$ and $R_3$ are in parallel.

(*iii*) $R_2$ and $R_3$ in parallel gives $R_p = 1\ \Omega$

$R_p$, $R_5$ and $R_4$ are in series. So, $R_{eq} = 5\ \Omega$

$R_1$ is not to be taken as it is shorted.

Current flowing $= I = \frac{V}{E_{eq}} = \frac{5}{5} = 1\ \text{A}$

(*b*) Let: $R_1 = 10\ \Omega$, $R_2 = R_3 = 20\ \Omega$

$R_2$ and $R_3$ are connected in parallel so their equivalent resistance.

READERS VENUE

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{20} + \frac{1}{20} = \frac{1}{10}$$

$\therefore$ $$R_P = 10\ \Omega$$

Now, $R_1$ and $R_P$ are connected in series.

So, equivalent resistance of the circuit is

$$R = R_1 + R_P = 10 + 10 = 20\ \Omega$$

## 2018

### Short Answer Type [II] Questions [3 Marks]

**8. Show how would you join three resistors, each of resistance 9 Ω so that the equivalent resistance of the combination is (*a*) 13.5 Ω, (*b*) 6 Ω? [CBSE]**

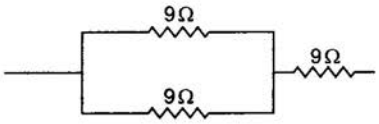
**Ans.** (*a*) When two 9 Ω resistances are in parallel and the third is in combination to this, the equivalent resistance will be 13.5 Ω as shown below:

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$$

$$\frac{1}{R_p} = \frac{1}{9} + \frac{1}{9} = \frac{2}{9}$$

$$R_p = \frac{9}{2}\ \Omega = 4.5\ \Omega$$

$$R_s = R_p + R_3 = 4.5 + 9 = 13.5\ \Omega$$



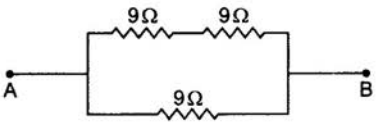

(*b*) When two 9 Ω resistances are in series and the third is in parallel to them, then it will be 6 Ω.

For series, $R_s = R_1 + R_2 = 9 + 9 = 18\ \Omega$

For parallel, $\frac{1}{R_p} = \frac{1}{R_s} + \frac{1}{R_3}$

$$= \frac{1}{18} + \frac{1}{9} = \frac{3}{18} = \frac{1}{6}$$

Therefore, $R_p = 6\ \Omega$




**9.** (*a*) **Write Joule's law of heating.**

(*b*) **Two lamps, one rated 100 W; 220 V, and the other 60 W; 220 V, are connected in parallel to electric mains supply. Find the current drawn by two bulbs from the line, if the supply voltage is 220 V.** **[CBSE]**

**Ans.** (*a*) **Joule's law of heating:** It states that the amount of heat produced in a conductor is

(*i*) directly proportional to the square of current flowing through it, i.e.

$$H \propto I^2.$$

(*ii*) directly proportional to the resistance of the conductor for a given current and time, i.e.

$$H \propto R$$

(*iii*) directly proportional to the time for which current is flowing through it, i.e.

$$H \propto t$$

$$H \propto I^2Rt$$

*or* $$H \propto KI^2Rt$$

But $K = 1$, so, $H = I^2 Rt$ (joule)

where $K$ is proportionality constant and in SI system, it is equal to one.

(*b*) Both the bulbs are connected in parallel. The resistance of each bulb is

$$R_{100} = \frac{220^2}{100},\quad R_{60} = \frac{220^2}{60}. \qquad \left[\because P = \frac{V^2}{R}\right]$$

$$\text{Current drawn by 100 W bulb} = \frac{220}{R_{100}} = \frac{100}{220}\ \text{A} = 0.45\ \text{A}$$

$$\text{Current drawn by 60 W bulb} = \frac{220}{R_{60}} = \frac{60}{220}\ \text{A} = 0.27\ \text{A} \qquad \left[\because I = \frac{V}{R}\right]$$

Total current drawn from the line = 0.45 A + 0.27 A = 0.72 A

**or**

For 1st bulb, $P = VI$

$P = 100$ W, $V = 220$ V, $I_1 = ?$

$$100 = 220 \times I_1$$

$$I_1 = \frac{100}{220} = \frac{5}{11} \text{ A}$$

For 2nd bulb, $P = VI$

$P = 60$ W, $V = 220$ V, $I_2 = ?$

$$60 = 220 \times I_2$$

$$I_2 = \frac{60}{220} = \frac{3}{11} \text{ A}$$

Total current drawn from the line,

$$I = I_1 + I_2$$

$$I = \frac{5}{11} + \frac{3}{11} = \frac{8}{11} \text{ A}$$

$$I = 0.72 \text{ A}$$

**10. (*a*) List the factors on which the resistance of a conductor in the shape of a wire depends.**

**(*b*) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.**

**(*c*) Why are alloys commonly used in electrical heating devices? Give reason.**

**[CBSE]**

READERS VENUE

**Ans.** (*a*) The factors on which the resistance of a conductor in the shape of wire depends

(*i*) Length of the conductor: Resistance is directly proportional to length of the conductor.

(*ii*) Area of cross section of the wire: The resistance is inversely proportional to area of cross section of the wire.

(*iii*) The resistance of the conductor depends on the nature of its material.

(*iv*) Temperature of the conductor: Resistance is directly proportional to the temperature of the conductor.

(*b*) Metals are good conductor of electricity as they have free electrons to conduct whereas glass is a bad conductor of electricity as it does not allow electric current to pass through it due to non-availability of free electrons.

(*c*) The alloys are commonly used in electric heating device. This is because

(*i*) Alloy are combination of two or more metals.

(*ii*) Its resistivity is higher than that of its constituent metals.

(*iii*) It neither gets oxidised nor burn easily at high temperature.

(*iv*) It shows less rapid variations of resistivity due to change in temperature.

## 2018 (Compartment)

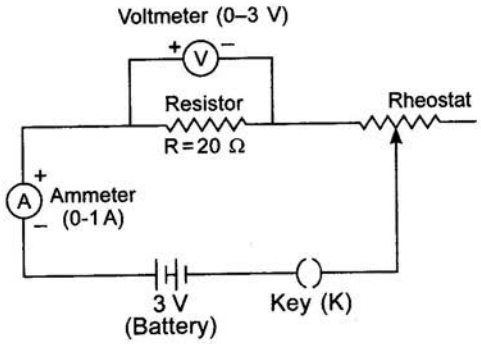
### Short Answer Type [I] Questions [2 Marks]

**11. You have following material:** [CBSE]

**An ammeter (0-1 A), a voltmeter (0-3 V), a resistor of 20 Ω, a key, a rheostat, a battery of 3 V and seven connecting wires.**

**Using this material draw a labelled circuit diagram to study the dependence of potential difference (V) across a resistor on the current (I) passing through it.**

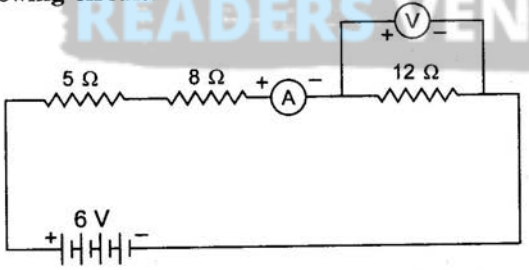
**Ans.**




### Short Answer Type [II] Questions [3 Marks]

**12. Consider the following circuit:** [CBSE]

READERS VENUE




**What would be the readings of the ammeter and the voltmeter when key is closed? Give reason to justify your answers.**

**Ans.** All the resistors are connected in series.

$$\therefore \quad R = R_1 + R_2 + R_3$$

$$= 5 + 8 + 12 = 25\ \Omega$$

$$\text{Current, } I = \frac{V}{R} = \frac{6}{25} = 0.24\ \text{A}$$

Hence, current through 12 Ω resistor

$$= \frac{6}{25} = 0.24\ \text{A}$$

Hence, reading of voltmeter,

$$V = IR = \frac{6}{25} \times 12 = \frac{75}{25}$$

or $V = 2.88$ V

**13. What is electrical resistivity? Derive its SI unit. In a series electrical circuit comprising a resistor made up of a metallic wire, the ammeter reads 100 mA. If the length of the wire is doubled, how will the current in the circuit change? Justify your answer.** **[CBSE]**

**Ans. Resistivity:** The resistance offered by the conductor of length 1 m and area of cross-section 1 $m^2$ is called electrical resistivity of the material of conductor.

It is given by $\rho = \frac{RA}{l}$

$\therefore$ $\rho = \frac{\text{ohm-m}^2}{\text{m}} = \text{ohm-meter}$

Since, $\rho \propto l$

$\therefore$ If length is doubled resistance of wire gets doubled and $I \propto \frac{1}{R}$

So current reduced to half.

$\therefore$ Ammeter reading $= \frac{100 \text{ mA}}{2} = 50 \text{ mA}$

**14. Calculate the total cost of running the following electrical devices in the month of September, if the rate of 1 unit of electricity is ₹ 6.00.**

**(*i*) Electric heater of 1000 W for 5 hours daily.**

**(*ii*) Electric refrigerator of 400 W for 10 hours daily.** **[CBSE]**

READERS VENUE

**Ans.** $P_1 = 1000$ W $= 1$ kW; $t_1 = 5$ h; September has 30 days $\therefore n = 30$

$P_2 = 400 \text{ W} = \frac{400}{1000} = \frac{2}{5} \text{kW} = t_2 = 10 \text{ h}$

So $E_1 = P_1 \times t_1 \times n = 1 \times 5 \times 30 = 150 \text{ kWh}$

and $E_2 = P_2 \times t_2 \times n = \frac{2}{5} \times 10 \times 30 = 120 \text{ kWh}$

$\therefore$ Total energy $= 150 + 120 = 270$ kWh

$\therefore$ Total cost of electrical energy consumed $= ₹270 \times 6 = ₹1620.00$

## 2016

### Short Answer Type [II] Questions [3 Marks]

**15. State three factors on which the heat produced by an electric current depends. How does it depend on these factors?** **[CBSE]**

**Ans.** Refer to Ans. 9 (*a*).

## Long Answer Type Questions [5 Marks]

16. **(*a*) Write two point of difference between electric energy and electric power.**
**(*b*) Out of 60 W and 40 W lamps, which one has higher electrical resistance when in use.**
**(*c*) What is the commercial unit of electric energy? Convert it into joules.** **[CBSE]**

**Ans.** (*a*) Difference between electric energy and electric power:

| Electrical energy | Electric power |
|---|---|
| (*i*) The work done or energy supplied by the source in maintaining the flow of electric current is called electrical energy. It appears in the form of heat given by $H = VIt = \frac{V^2t}{R} = I^2RT$ | (*i*) The time rate at which electric energy is consumed or dissipated by an electrical device is called electric power and is given by $P = VI = \frac{V^2}{R} = I^2R$ |
| (*ii*) It is equal to the product of power and time. $E = P \times t$ | (*ii*) It equal to the rate of doing work by an energy source. $P = \frac{W}{t}$ |
| (*iii*) Its SI unit is joule (J). $1\ J = 1\ W \times 1s$ | (*iii*) Its SI unit is watt (W). $1\ W = 1\ J\ s^{-1}$ |

(*any two*)

READERS VENUE

(*b*) For the same applied voltage, $P \propto \frac{1}{R}$ or $R \propto \frac{1}{P}$

i.e. less the power of electrical device, higher is its electrical resistance. Therefore, a 40 W lamp has higher electrical resistance when in use.

(*c*) Kilowatt hour – Commercial unit of electrical energy

$$1\ kWh = 1000\ Wh = 1000\ \frac{J}{S} \times 3600\ sec = 3600000\ J = 3.6 \times 10^6\ J$$

## 2015

## Very Short Answer Type Question [1 Mark]

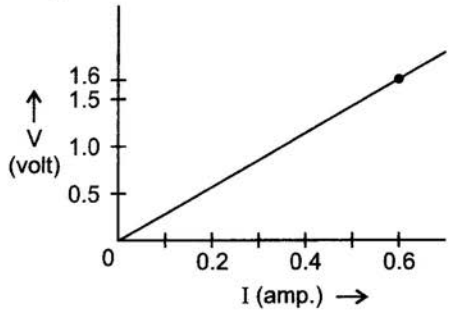
17. **Write S.I. unit of resistivity.** **[CBSE]**

**Ans.** Ohm-metre (Ωm).

## Short Answer Type [II] Questions [3 Marks]

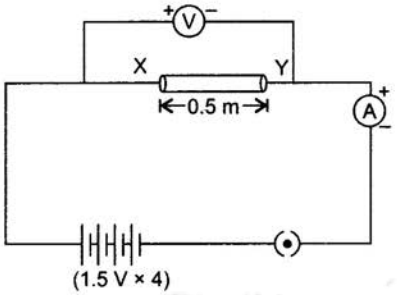
18. **(*i*) Draw a closed circuit diagram consisting of a 0.5 m long nichrome wire XY, an ammeter, a voltmeter, four cells of 1.5 V each and a plug key.**

(*ii*) **Following graph was plotted between V and I values:**




**What would be the values of V/I ratios when the potential difference is 0.8 V, 1.2 V and 1.6 V respectively? What conclusion do you draw from these values?** [CBSE]

**Ans.** (*i*)



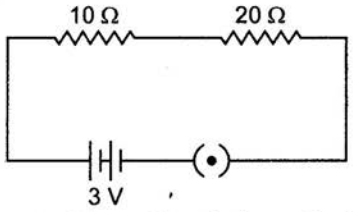

(*ii*) From the graph, when p.d is 1.6 volt and 0.6 A current.

$$\frac{V}{I} = \frac{1.6}{0.6} = 2.67\ \Omega.$$

Therefore, value of $\frac{V}{I}$ ratio for all potential difference of 0.8 V, 1.2 V and 1.6 volt will be equal to 2.67 Ω.

We conclude that at the given temperature, the resistance of wire is constant and is equal to 2.67 Ω.

**19. Study the following electric circuit and find (*i*) the current flowing in the circuit and (*ii*) the potential difference across 10 Ω resistor.** [CBSE]




**Ans.** 10 Ω and 20 Ω are connected in series, their equivalent resistance is

$$R_s = R_1 + R_2$$
$$= 10 + 20 = 30\ \Omega$$

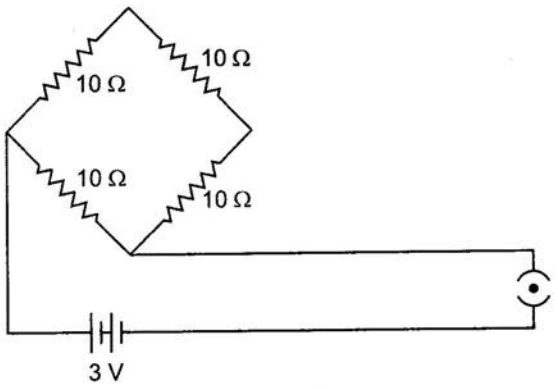
(*i*) Current flowing in the circuit

$$I = \frac{V}{R_s} = \frac{3}{30} = \frac{1}{10} = 0.1 \text{ A}$$

(*ii*) Potential difference across 10 Ω resistor

$$V = IR = \frac{1}{10} \times 10 = 1 \text{ volt.}$$

**20. Find the current drawn from the battery by the network of four resistors shown in the figure.** **[CBSE]**




**Ans.** Equivalent resistance of the given network is

$$\frac{1}{R} = \frac{1}{R_4} + \frac{1}{R_1 + R_2 + R_3}$$

$$= \frac{1}{10} + \frac{1}{10+10+10} = \frac{1}{10} + \frac{1}{30} = \frac{3+1}{30} = \frac{4}{30}$$

$$\therefore \quad R = \frac{30}{4} = 7.5\ \Omega$$

Current drawn from the battery

$$I = \frac{V}{R} = \frac{3}{7.5} = \frac{30}{75} = \frac{2}{5}$$

$$\Rightarrow \quad I = 0.4 \text{ A}$$

## Long Answer Type Questions [5 Marks]

**21. What is meant by electric current? Name and define its SI unit. In a conductor electrons are flowing from B to A. What is the direction of conventional current? Give justification for your answer.**

**A steady current of 1 ampere flows through a conductor. Calculate the number of electrons that flows through any section of the conductor in 1 second. (Charge on electron $1.6 \times 10^{-19}$ coulomb).** **[CBSE]**

**Ans.** • Electric Current: The amount of charge '*Q*' flowing through a particular area of cross section in unit time '*t*' is called electric current. i.e.

Electric current, $I = \frac{Q}{t}$

- SI unit of electric current is ampere.
- One ampere of current is that current which flow when one coulomb of electric charge flowing through a particular area of cross-section of the conductor in one second, i.e. $1A = 1\ Cs^{-1}$.
- The direction of conventional current is A to B, i.e. opposite to the direction of flow of electrons. In a metal, flow of electrons carrying negative charge constitutes the current. Direction of flow of electrons gives the direction of electronic current by convention, the direction of flow of positive charge is taken as the direction of conventional current.

Charge $= q = ne$

For $q = 1$ coulomb, $n = \frac{1\,C}{1.6 \times 10^{-19}\,C} = \frac{10^{19}}{1.6} = 6.25 \times 10^{18}$ electrons

**22. What is meant by electrical resistivity of a material? Derive its S.I. unit. Describe an experiment to study the factor on which the resistance of a conducting wire depends.**

**[CBSE]**

**Ans.** Mathematically, resistivity of the conducting material is given by

$$\rho = \frac{R \times A}{l}$$

If $l = 1$ m, $A = 1\ m^2$, then $\rho = R$

Hence, the resistivity of the material is defined as the resistance offered by a metallic wire having a unit length and a unit area of cross-section. Since unit length and unit area of cross-section forms a cube, the specific resistance or resistivity can also be defined as the resistance offered by a cube of a material of side 1 m when current flows perpendicularly through the opposite faces.

In SI system, its unit is

$$\text{Unit of } \rho = \frac{\text{Unit of R} \times \text{Unit of area of cross_section}}{\text{Unit of length of conductor}}$$

$$= \frac{\Omega \times m^2}{m} = \Omega m$$

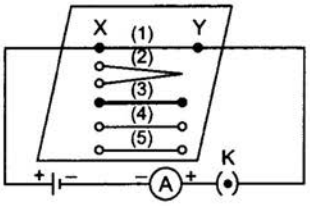
**Experiment:**

***Aim*: To study the factors on which resistance of conducting wires depends.**

***Apparatus Required:*** A cell, an ammeter, nichrome wires of different length but same area of cross-section (thickness), nichrome wires of same length but different thickness, copper and iron wire of the same length and same thickness as that of any nichrome wire.

***Procedure:***

1. Connect the cell, an ammeter and plug key in series with nichrome wire of length '*l*' (marked 1) in the gap XY as shown.




2. Close the key and note the reading of ammeter. It measures the current '$I_1$' through the nichrome wire (marked '1').
3. Replace the marked 1 wire with another nichrome wire having same area of cross-section (thickness) but of double length '2*l*' (marked 2).
4. Note the ammeter reading ($I_2$) again after closing the key.
5. Again replace the marked 2 wire with marked 3 wire which has the same length but is thicker than marked 1 and 2 nichrome wires. Again note down the current ($I_3$) through this wire.
6. Unplug the key. Remove marked 3 nichrome wire from the gap XY. Connect the copper wire marked 4 having same length and same area of cross-section as that of nichrome wire marked 1.
7. Plug the key again and note the ammeter reading. It measures the current ($I_4$) through copper wire.
8. Repeat the experiment with iron wire and measure the current ($I_5$).

***Observation:***

READERS VENUE

1. Current '$I_2$' is half of $I_1$, i.e. $I_2 = \frac{1}{2}I_1$.
2. Current $I_3$ increases when thicker wire of same length and of same material, i.e. nichrome is used.
3. Current $I_4$ and $I_5$ is different for copper and iron wire.

***Conclusion:***

1. Different wires drew different amount of current from the same cell.
2. First observation indicates that the resistance of the conductor increases with increase in length. So, resistance is directly proportional to length.
3. Second observation shows that thicker wires have lesser resistance. So, resistance is inversely proportional to area of cross section of the wire.
4. Third observation shows that resistance of the conductor depends on the nature of its material.

**23. (*a*) Write two points of difference between electric energy and electric power.**
**(*b*) Out of 60 W and 40 W lamps, which one has higher electrical resistance when in use.**
**(*c*) What is the commercial unit of electric energy? Convert it into joules. [CBSE]**

**Ans.** Refer to Ans. 16.

**24. State Ohm's law. Write the necessary conditions for its validity. How is this law verified experimentally? What will be the nature of graph between potential difference and current for a conductor? Name the physical quantity that can be obtained from this graph.** **[CBSE]**

**Ans. Ohm's law:** When the physical conditions such as temperature, etc. remain same, the current flowing through the conductor is directly proportional to the potential difference applied across the ends of the conductor, i.e.

$$I \propto V \quad \text{or} \quad V \propto I$$

$$\Rightarrow \quad \frac{V}{I} = \text{constant}$$

$$\Rightarrow \quad V = IR$$

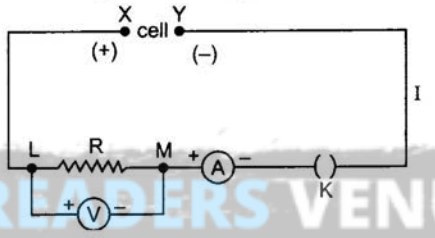
where $R$ is constant of proportionality and is called resistance of the conductor.

Necessary condition for validity of Ohm's law is that physical condition such as temperature of the conductor remains same.

Experimental verification:

***Procedure*:**

(*i*) Complete the circuit by connecting one cell in the gap XY. Plug the key.




READERS VENUE

(*ii*) Note the reading in the ammeter for the current $I$ and in the voltmeter for the potential difference, ($V$) across the nichrome wire.

(*iii*) Repeat the above steps using two cells in series and then three cells in the series in the gap XY separately.

(*iv*) Tabulate the readings in the table given:

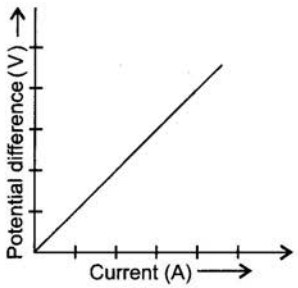
| S. No. | No. of cells in gap XY | Voltmeter reading V (Volt) | Ammeter reading I (ampere) | V/I (Volt/ampere) |
|---|---|---|---|---|
| 1<br>2<br>3 | 1<br>2<br>3 | | | |

(*v*) Find the ratio of $V$ to $I$ for each observation.

(*vi*) Plot a graph between $V$ ($y$-axis) and $I$ ($x$-axis).

***Observation*:**

1. Voltmeter and ammeter reading increases as the number of cells increase in series.
2. Same value of $\frac{V}{I}$ is obtained in each case.
3. $V - I$ graph is a straight line passing through the origin of the graph as shown.




***Conclusion*:** Straight line nature of graph shows that the current is proportional to the potential difference. Hence, Ohm's law verified.

The slope of *V-I* graph gives the value of resistance of the conductor at the given temperature.

## 2014

### Very Short Answer Type Question [1 Mark]

**25. Name a device that helps to maintain a potential difference across a conductor.** **[CBSE]**

**Ans.** Cell or battery.

### Short Answer Type [II] Questions [3 Marks]

**26. Define 1 volt. Express it in terms of SI unit of work and charge calculate the amount of energy consumed in carrying a charge of 1 coulomb through a battery of 3 V.** **[CBSE]**

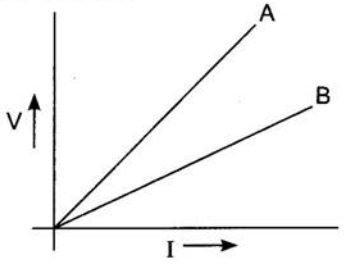
**Ans.** When 1 joule of work is done in carrying 1 coulomb of charge, from infinity to a point in the electric field, then potential at that point is called 1 volt.

Potential difference between two points is

$$V = \frac{W}{Q}$$

or $$W = Q \times V = 1 \times 3 = 3 \text{ J}$$

**27. V-I graph for two wires A and B are shown in the figure. If both wires are of same length and same thickness, which of the two is made of a material of high resistivity? Give justification for your answer.** **[CBSE]**



**Ans.** Greater the slope of V-I graph, greater will be the resistance of given metallic wire. In the given graph, wire A has greater slope than B. Hence, wire A has greater resistance.

For the wires of same length and same thickness, resistance depends on the nature of material of the wire, i.e.

$$R_1 = \rho_1 \frac{l}{A} \quad \text{and} \quad R_2 = \rho \frac{l}{A}$$

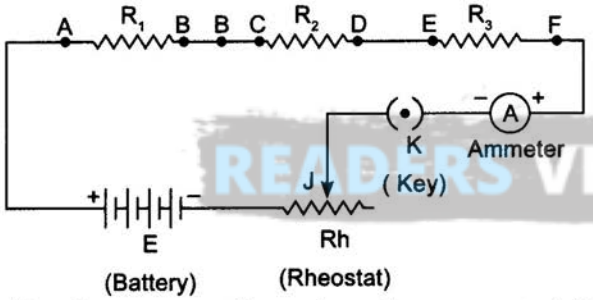
$$\Rightarrow \quad \frac{R_1}{R_2} = \frac{\rho_1}{\rho_2} \quad \text{or} \quad R \propto \rho$$

Hence, wire 'A' is made of a material of high resistivity.

## Long Answer Type Questions [5 Marks]

**28. Draw a labelled circuit diagram showing three resistors $R_1$, $R_2$ and $R_3$ connected in series with a battery (E), a rheostat (Rh), a plug key (K) and an ammeter (A) using standard circuit symbol. Use this circuit to show that the same current flows through every part of the circuit. List two precautions you would observe while performing the experiment.** **[CBSE]**

**Ans.**




READERS VENUE

**Aim:** Same current flows through every part of the above circuit.

**Procedure:**

(*i*) Connect ammeters, '$A_1$' between B and C, and '$A_2$' between D and E.

(*ii*) Adjust the sliding contact 'J' of the rheostat initially for a small current.

(*iii*) Note all the ammeter readings. These readings give us current flowing through the resistors $R_1$, $R_2$ and $R_3$.

(*iv*) The current in the circuit is now increased by changing the position of sliding contact 'J' of the rheostat.

(*v*) Note all the ammeter readings each time.

**Conclusion:** Same reading of all the ammeter in each observation concluded that same current flows through every part of the circuit.

**Precautions:**

(*i*) All the connection should be tight and properly connected as per circuit diagram.

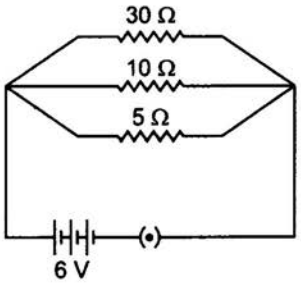
(*ii*) The positive terminal of the ammeter and voltmeter must be connected to the positive terminal of the battery or battery eliminator.

**29. Two wires A and B are of equal length and have equal resistance. If the resistivity of A is more than that of B which wire is thicker and why? For the electric circuit given below calculate:**

**(*i*) Current in each resistor,**

**(*ii*) Total current drawn from the battery, and**

**(*iii*) Equivalent resistance of the circuit.** **[CBSE]**




**Ans.** Using, $R = \rho\frac{l}{A}$

$\Rightarrow \quad \frac{\rho}{A} = \frac{R}{l}$ = Constant = $K$ (for same $l$ and $R$)

$\Rightarrow \quad \rho = kA$

$\Rightarrow \quad \rho \propto A$

So, for different materials having same resistance per unit length, greater resistivity material wire has more cross-sectional area.

Hence, wire A is thicker than that of B.

(*i*) Current through each resistor

$$I_1 = \frac{V}{R_1} = \frac{6}{5} = 1.2 \text{ A}$$

$$I_2 = \frac{V}{R_2} = \frac{6}{10} = 0.6 \text{ A}$$

$$I_3 = \frac{V}{R_3} = \frac{6}{30} = 0.2 \text{ A}$$

READERS VENUE

Current in 5 Ω, 10 Ω and 30 Ω are, therefore, 1.2 A, 0.6 A and 0.2 A respectively.

(*ii*) Total current drawn from the battery

$$I = I_1 + I_2 + I_3 = 1.2 + 0.6 + 0.2 = 2.0 \text{ A}$$

(*iii*) $R_1 = 5\ \Omega, R_2 = 10\ \Omega$ and $R_3 = 30\ \Omega$ are connected in parallel. So their equivalent resistance

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$= \frac{1}{5} + \frac{1}{10} + \frac{1}{30} = \frac{1}{3}$$

$$R = 3\ \Omega$$

**30. (*a*) Define electric power. Express it in terms of potential difference V and resistance R.**

**(*b*) An electrical fuse is rated at 2 A. What is meant by this statement?**

**(*c*) An electric iron of 1 kW is operated at 220 V. Find which of the following fuses that respectively rated at 1 A, 3 A and 5 A can be used in it.** **[CBSE]**

**Ans.** (*a*) **Electric power:** It is the rate of doing work by an energy source or the rate at which the electrical energy is dissipated or consumed per unit time in the electric circuit is called electric power.

So, $$\text{Power } P = \frac{\text{Work done } (w)}{\text{Time } (t)} = \frac{\text{Electrical energy dissipated}}{\text{Time } (t)}$$

$$= \text{VI} = \frac{V^2}{R}$$

(*b*) It means, the maximum current will flow through it is only 2 A. Fuse wire will melt if the current exceeds 2 A value through it.

(*c*) Given: $P = 1$ kW $= 1000$ W, $V = 220$ V

Current drawn, $$I = \frac{P}{V} = \frac{1000}{220} = \frac{50}{11} = 4.54 \text{ A}$$

To run electric iron of 1 kW, rated fuse of 5 A should be used.

## 2013

### Very Short Answer Type Questions [1 Mark]

**31. Write relation between heat energy produced in a conductor when a potential difference V is applied across its terminals and a current I flows through for 't'.** [CBSE]

**Ans.** Heat produced, H = VIt

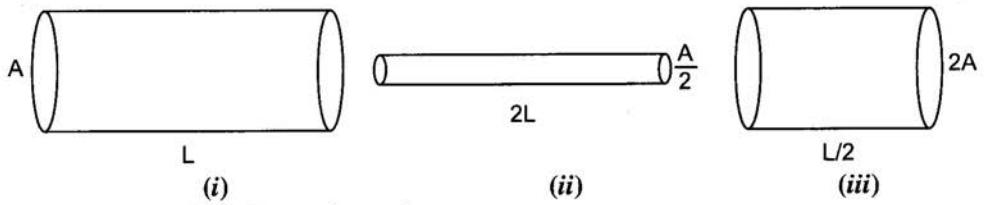
**32. State difference between the wire used in the element of an electric heater and in a fuse wire.** [CBSE]

**Ans.** The wire used in the element of electric heater has a high resistivity and has a high melting point, i.e. even at a high temperature element does not burn while fuse wire has a low melting point and high resistivity.

READERS VENUE

### Short Answer Type [II] Questions [3 Marks]

**33. The figure below shows three cylindrical copper conductors along with their face areas and lengths. Discuss in which geometrical shape the resistance will be highest.** [CBSE]




**Ans.** For geometrical shape shown in

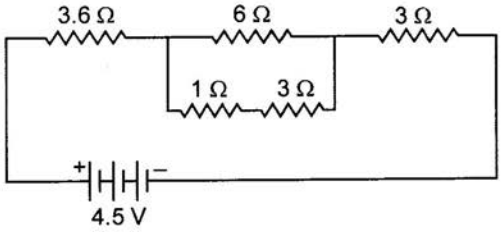
Figure (*i*) $$R_1 = \rho\frac{L}{A}$$

Figure (*ii*) $$R_2 = \rho\frac{2L}{A/2} = 4\left(\rho\frac{L}{A}\right) = 4R_1$$

Figure (*iii*) $$R_3 = \rho\frac{L/2}{2A} = \frac{1}{4}\left(\rho\frac{L}{A}\right) = \frac{R_1}{4}$$

Therefore, resistance of geometrical shape shown in figure (*ii*) will be highest.

**34. Find the current flowing through the following electric circuit.** [CBSE]




**Ans.** Series combination of 1 Ω and 3 Ω resistance is in parallel combination with 6 Ω. Their equivalent resistance is

$$\frac{1}{R_P} = \frac{1}{6} + \frac{1}{3+1} = \frac{1}{6} + \frac{1}{4} = \frac{2+3}{12}$$

$$\therefore \quad R_P = \frac{12}{5} = 2.4\ \Omega$$

Now, 3.6 Ω, 2.4 Ω and 3 Ω are in series, their equivalent resistance be

$$R_S = R_1 + R_2 + R_3$$
$$= 3.6 + 2.4 + 3 = 9\ \Omega$$

Hence, the current flowing through the circuit is

$$I = \frac{V}{R} = \frac{4.5}{9} = \frac{45}{90} = \frac{1}{2} = 0.5\ \text{A}.$$

**35. An electric bulb of resistance 200 Ω draws a current of 1 Ampere. Calculate the power of the bulb the potential difference at its ends and the energy in kWh consumed burning it for 5h.** [CBSE]

READERS VENUE

**Ans.** Power of the bulb, $P = I^2R = (1)^2 \times 200$

$\Rightarrow \quad P = 200\ \text{W}$

Energy consumed by bulb in 5h in burning = Power × Time
= 200 × 5
= 1000 Wh = 1 kWh

## Long Answer Type Questions [5 Marks]

**36. (*a*) Calculate the resistance of 1 km long copper wire of radius 1 mm. Resistivity of the copper is $1.72 \times 10^{-8}$ Ωm.**

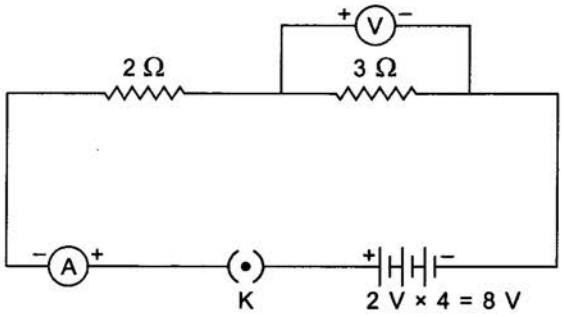
**(*b*) Draw a schematic diagram of a circuit consisting of a battery of 4 cells of 2 V each connected to a key, an ammeter and two resistors of 2 Ω and 3 Ω respectively in series and a voltmeter to measure potential difference across 3 Ω.** [CBSE]

**Ans.** (*a*) Resistance, $R = \rho\frac{l}{A} = \rho\frac{l}{\pi r^2}$

On substituting the values, we get

$$R = \frac{1.72 \times 10^{-8} \times 10^3}{3.14 \times (1 \times 10^{-3})^2} = \frac{1.72}{3.14} \times 10 = \frac{17.2}{3.14} = 5.47\ \Omega$$

(*b*)



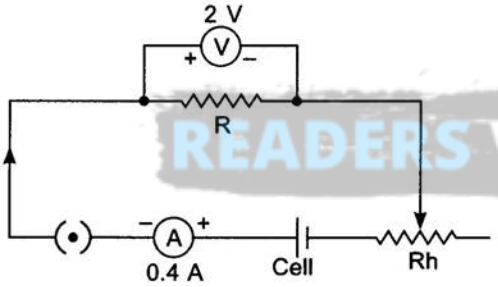

**37. When a high resistance voltmeter is connected directly across a resister its reading is 2 V. An electric cell is sending the current of 0.4 A, (measured by an ammeter) in the electric circuit in which a rheostat is also connected to vary the current.**

**(*a*) Draw an equivalent labelled circuit for the given data.**

**(*b*) Find the resistance of the resister.**

**(*c*) Name and state the law applicable in the given case. A graph is drawn between a set of values of potential difference (V) across the resister and current (I) flowing through it. Show the nature of graph thus obtained.** **[CBSE]**

**Ans.** (*a*)




READERS VENUE

(*b*) Resistance of resistor is

$$R = \frac{V}{I} = \frac{2}{0.4} = \frac{20}{4} = 5\ \Omega$$

(*c*) **Ohm's law:** When the physical conditions such as temperature etc. remain same, the current flowing through the conductor is directly proportional to the potential difference applied across the ends of the conductor, i.e.

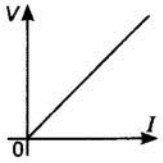
$$I \propto V \quad or \quad V \propto I$$

$$\Rightarrow \quad \frac{V}{I} = \text{constant}$$

$$\Rightarrow \quad V = IR$$

where $R$ is constant of proportionality and is called resistance of the wire.

Since current varies linearly with potential difference, the graph between $V$ and $I$ will be a linear in nature as shown




## 2012

### Short Answer Type [I] Questions [2 Marks]

**38. How much current will an electric bulb draw from 220 V source if the resistance of the bulb is 1200 Ω? If in place of bulb, a heater of resistance 100 Ω is connected to the sources, calculate the current drawn by it.** **[CBSE]**

**Ans.** Given: $V = 220$ V, $R_1 = 1200\ \Omega$, $I_1 = ?$, $R_2 = 100\ \Omega$, $I_2 = ?$

Using Ohm's law,

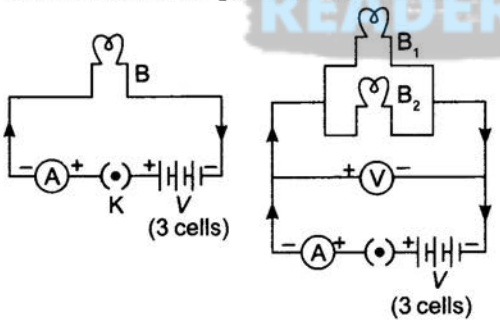
$$V = I_1 R_1$$

$$\Rightarrow \quad I_1 = \frac{V}{R_1} = \frac{220}{1200} = 0.18 \text{ A} \quad \text{and} \quad I_2 = \frac{V}{R_2} = \frac{220}{100} = 2.2 \text{ A}$$

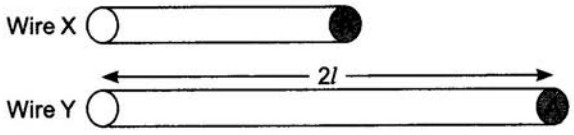
**39. Draw a schematic diagrams of an electric circuit comprising of 3 cells and an electric bulb, ammeter, plug-key in the ON mode and another with same components but with two bulbs in parallel and a voltmeter across the combination.** **[CBSE]**

READERS VENUE

**Ans.**




**40. Out of the two wires X and Y shown below, which one has greater resistance? Justify your answer.** **[CBSE]**




**Ans.** Wire 'Y' has greater resistance as it has more length than wire 'X'. It is because resistance of wire is directly proportional to the length of wire.

## Short Answer Type [II] Questions [3 Marks]

**41. Two identical wires one of nichrome and other of copper are connected in series and a current ($I$) is passed through them. State the change observed in the temperatures of the two wires. Justify your answer. State the law which explains the above observation.** **[CBSE]**

**Ans.** The resistivity of nichrome is more than that of copper so its resistance is also high. Therefore, a large amount of heat is produced in the nichrome wire for the same current as compared to that of copper wire. Accordingly, more change in temperature is observed in the nichrome wire. This is explained by Joule's law of heating.

**Joule's law of heating:** Refer to Ans. 9 ($a$).

**42. An electric bulb is rated at 60 W, 240 V. Calculate its resistance. If the voltage drops to 192 V, calculate the power consumed and the current drawn by the bulb. (Assume that the resistance of the bulb remain unchanged.)** **[CBSE]**

**Ans.** Given: $P_1 = 60$ W, $V_1 = 240$ V, $R = ?$, $P_2 = ?$, $V_2 = 192$ V, $I_1 = ?$

Using, $$P_1 = \frac{V^2}{R}$$

We get $$R = \frac{V_1^2}{P_1} = \frac{240^2}{60} = 960\ \Omega$$

Again $$P_2 = \frac{V_2^2}{R} = \frac{192 \times 192}{960} = 38.4\ \text{W}$$

Current drawn by bulb at 192 V is

$$I = \frac{V}{R} = \frac{192}{960} = 0.2\ \text{A}$$

READERS VENUE

## Long Answer Type Questions [5 Marks]

**43. Three bulbs each having power $P$ are connected in series in an electric circuit. In another circuit, another set of three bulbs of same power are connected in parallel to the same source.**

**(*i*) Will the bulbs in both the circuits glow with the same brightness? Justify your answer.**

**(*ii*) Now let one bulb in each circuit get fused. Will the rest of the bulbs continue to glow in each circuit? Give reason.**

**(*iii*) Representing each bulb by a resistor, draw circuit diagram for each case.** **[CBSE]**

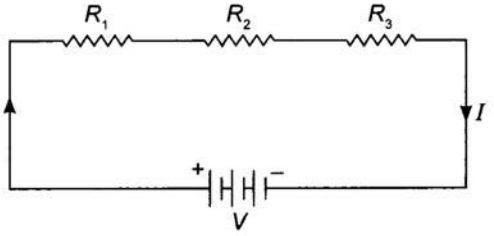
**Ans.** (*i*) Bulbs in parallel provide more illumination. This is because

($a$) each bulb gets same voltage and is equal to the applied voltage.

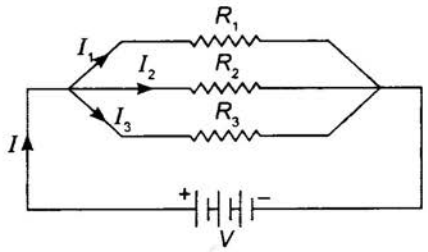
($b$) each bulb draws required current from the mains. Hence, they work properly.

(*ii*) When one bulb in each circuit gets fused,
**In series:** Rest of the bulbs will not glow. This is because in series arrangement, there is only a single path for the flow of current.
**In parallel:** Rest of the bulbs will continue to glow as in parallel connection,
(*a*) individual branch in the circuit completes its own circuit. or
(*b*) different paths are available for the flow of current.

(*iii*) Circuit diagram
For series,




For parallel,




**44.** (*a*) **Though same current flows through the electric line wires and the filament of bulb, yet only the filament glows. Why?**
(*b*) **The temperature of the filament of bulb is 2700°C when it glows. Why does it not get burnt up at such high temperature?**
(*c*) **The filament of an electric lamp, which draws a current of 0.25 A is used for four hours. Calculate the amount of charge flowing through the circuit.**
(*d*) **An electric iron is rated 2 kW at 220 V. Calculate the capacity of the fuse that should be used for the electric iron.** **[CBSE]**

**Ans.** (*a*) Electric line wires offer extremely low resistance to the flow of current, so they do not glow because negligible heat is produced in it.
The filament of bulb glows because it becomes red hot due to large amount of heat produced, as it offers high resistance to the flow of current through it.

(*b*) The filament of bulb when it glows at 2700°C does not get burnt because the tungsten metal of filament has
(*i*) a very high melting point (of 3380°C) and
(*ii*) a high resistivity.

(*c*) Given: $I = 0.25$ A, $t = 4$ h $= 4 \times 60 \times 60$ sec.
So, amount of charge flowing the filament of electric lamp

$$q = It = 0.25 \times 4 \times 60 \times 60 = 3600 \text{ C}$$

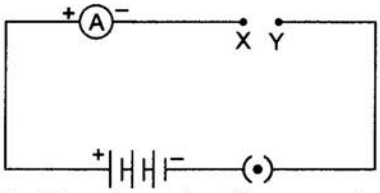
(*d*) Given: $P = 2$ kW $= 2000$ W, $V = 220$ V

Using, $P = VI$

$$2000 = 220 \times I \Rightarrow I = \frac{2000}{220} = 9.09 \text{ A}$$

So, the capacity of the fuse that should be used for the electric iron is of the order of 10 A.

**45.** (*a*)




**In the given circuit, connect a nichrome wire of length 'L' between points X and Y and note the ammeter reading.**

(*i*) **When this experiment is repeated by inserting another nichrome wire of the same thickness but twice the length (2L), what changes are observed in the ammeter reading?**

(*ii*) **State the changes that are observed in the ammeter reading if we double the area of cross-section without changing the length in the above experiment. Justify your answer in both the cases.**

(*b*) **"Potential difference between points A and B in an electric field is 1 V." Explain the above statement.** **[CBSE]**

**Ans.** (*a*) (*i*) Ammeter reading in the second case is half of the ammeter reading in first case. This is because

$R \propto l$ and $I \propto \frac{1}{R}$ ($V$ = constant, $A$ = constant)

$\Rightarrow$ i.e. when length is doubled, the resistance is doubled, this means the current is halved.

(*ii*) On doubling the area of cross-section without changing the length of the conductor, twice of the previous reading is observed in the ammeter. This is because

$$R \propto \frac{1}{A} \quad \text{(for the same length)}$$

and $$I \propto \frac{1}{R} \quad \text{(for the same voltage)}$$

So, when A is double, resistance becomes half, current will be doubled.

(*b*) "Potential difference between points A and B in an electric field is 1 V." It means 1 J work is done in moving 1 C of charge from point B to point A in an electric field.

## 2011

### Very Short Answer Type Questions [1 Mark]

**46. How is an ammeter connected in a circuit to measure current flowing through it?** **[CBSE]**

**Ans.** In series

**47. What happens to resistance of a conductor when its area of cross-section is increased?** **[CBSE]**

**Ans.** Resistance decreases as $R \propto \frac{1}{A}$.

**48. A given length of a wire is doubled on itself and this process is repeated once again. By what factor does the resistance of the wire change?** **[CBSE]**

**Ans.** Length becomes one-fourth of the original length and area of cross-section becomes four times that of original.

i.e. $$l_2 = \frac{1}{4}l_1 \text{ and } A_2 = 4A_1$$

$\therefore$ $$\frac{R_2}{R_1} = \frac{l_2}{l_1} \times \frac{A_1}{A_2} = \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$$

$\Rightarrow$ $$R_2 = \frac{1}{16}R_1$$

So, new resistance is $\left(\frac{1}{16}\right)$th of original resistance.

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### Short Answer Type [I] Questions [2 Marks]

**49. A 9 Ω resistance is cut into three equal parts and connected in parallel. Find the equivalent resistance of the combination.** **[CBSE]**

**Ans.** Resistance of each part $= \frac{R}{3} = \frac{9}{3} = 3\ \Omega$

$\therefore \quad R_1 = R_2 = R_3 = 3\ \Omega$

In parallel combination,

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1$$

$\therefore$ $$R_P = 1\ \Omega$$

**50. An electric iron has a rating of 750 W, 220 V. Calculate the**

**(*i*) current flowing through it, and**

**(*ii*) its resistance when in use.** **[CBSE]**

**Ans.** Given: $P = 750$ W, $V = 220$ V

(*i*) $$P = VI$$

$$750 = 220 \times I$$

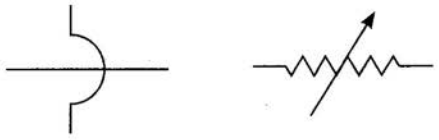
$$\Rightarrow \quad I = \frac{750}{220} = 3.40 \text{ A}$$

(*ii*) $$P = \frac{V^2}{R}$$

$$\Rightarrow \quad R = \frac{V^2}{P} = \frac{220^2}{750}$$

$$\Rightarrow \quad R = 64.53\ \Omega$$

**51. (*a*) What do the following circuit symbols represent?**



(*i*) (*ii*)

**(*b*) The potential difference between the terminals of an electric heater is 60 V when it draws a current of 4 A from the source. Find the resistance of heater when in use.** **[CBSE]**

**Ans.** (*a*) (*i*) Wires crossing without touching each other.

(*ii*) Rheostat/Variable resistor

(*b*) Given: $V = 60$ V, $I = 4$ A, $R = ?$

From Ohm's law, $V = IR$

$60 = 4 \times R \Rightarrow R = 15\ \Omega$

READERS VENUE

**52. The charge possessed by an electron is $1.6 \times 10^{-19}$ coulombs. Find the number of electrons that will flow per second to constitute a current of 1 ampere.** **[CBSE]**

**Ans.** Given: $q = 1.6 \times 10^{-19}$ C, $I = 1$ A, $n = ?$, $t = 1$ s

We know, $q = It$ and $q = ne$

$\therefore \quad ne = It$

$$\Rightarrow \quad n = \frac{It}{e} = \frac{1 \times 1}{1.6 \times 10^{-19}} = 6.25 \times 10^{18} \text{ electrons}$$

**53. Explain the role of fuse in series with any electrical appliance in an electric circuit. Why should a fuse with defined rating for an electric circuit not be replaced by one with a larger rating?** **[CBSE]**

**Ans.** Fuse wire is a safety device connected in series with the live wire of circuit. It has high resistivity and low melting point. It melts when a sudden urge of large current passes through it and disconnects the entire circuit from the electrical supply. But, in case if we use a larger rating instead of a defined rating, then it will not protect the circuit as high current will easily pass through it and it will not melt.

**54. The wattage of a bulb is 24 W when it is connected to a 12 V battery. Calculate its effective wattage if it operates on a 6 V battery (Neglect the change in resistance due to unequal heating of the filament in the two cases).** **[CBSE]**

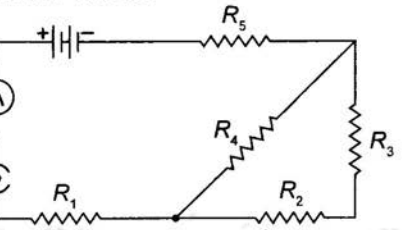
**Ans.** Given: $P_1 = 24$ W, $V_1 = 12$ V, $P_2 = ?$, $V_2 = 6$ V

Using $$P = \frac{V^2}{R}$$

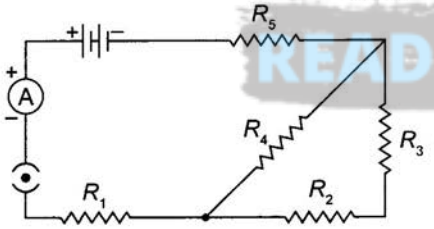
$$\frac{P_1}{P_2} = \frac{V_1^2}{V_2^2}$$

$$\Rightarrow \quad P_2 = \left(\frac{V_2}{V_1}\right)^2 \times P_1 = \left(\frac{6}{12}\right)^2 \times 24 = \frac{1}{4} \times 24 = 6 \text{ W}$$

**55. Consider the following circuit diagram. If $R_1 = R_2 = R_3 = R_4 = R_5 = 3\ \Omega$, find the equivalent resistance($R_S$) of the circuit.** **[CBSE]**




**Ans.**

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Given: $R_1 = R_2 = R_3 = R_4 = R_5 = 3\ \Omega$.

In circuit, $R_2$ and $R_3$ are connected in series,

$$\therefore \quad R_{S_1} = R_2 + R_3 = 3 + 3 = 6\ \Omega$$

$R_{S_1}$ and $R_4$ are in parallel

$$\frac{1}{R_P} = \frac{1}{R_{S_1}} + \frac{1}{R_4} = \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$$

$$\therefore \quad R_P = 2\ \Omega$$

Now, $R_1$, $R_P$ and $R_5$ are in series so equivalent resistance of the circuit is

$$R_S = R_1 + R_P + R_5 = 3 + 2 + 3 = 8\ \Omega$$

## Short Answer Type [II] Questions [3 Marks]

**56. A torch bulb is rated 2.5 V and 750 mA. Calculate (*i*) its power, (*ii*) its resistance and (*iii*) the energy consumed, if this bulb is lighted for four hours.** **[CBSE]**

**Ans.** Given: $V = 2.5$ V, $I = 750$ mA $= 750 \times 10^{-3}$ A

(*i*) $P = VI = 2.5 \times 750 \times 10^{-3} = 1.875$ W

(*ii*) $V = IR$

$$\therefore \quad R = \frac{V}{I} = \frac{2.5}{750 \times 10^{-3}} = 3.33\ \Omega$$

(*iii*) Energy consumed in four hour by the bulb $= P \times t = 1.875 \times 4$

$= 7.5$ Wh $= 7.5 \times 10^{-3}$ kWh

**57. Series arrangements are not used for domestic circuits. List any three reasons.**

**Ans.** Series arrangements are not used for domestic circuit because

(*i*) The electrical appliances need current of widely different values to operate properly.

(*ii*) In series arrangement, when one component fails, the circuit is broken and none of the components works.

(*iii*) All electrical appliances work at a constant voltage. But in series circuit, the current is constant throughout the electric circuit and potential is different across the different components. So, series arrangement is not suitable for domestic circuits.

**58. Name the physical quantity which is (*i*) same (*ii*) different in all the bulbs when three bulbs of:**

**(*a*) same wattage are connected in series.**

**(*b*) same wattage are connected in parallel.**

**(*c*) different wattage are connected in series.**

**(*d*) different wattage are connected in parallel.** **[CBSE]**

READERS VENUE

**Ans.** (*a*) **For identical bulbs in series–** same current, same potential difference.

(*b*) **For identical bulbs in parallel–** same potential difference, different current.

(*c*) **For unidentical bulbs in series–** same current, different potential difference.

(*d*) **For unidentical bulbs in parallel–** different current, same potential difference.

**59. Two devices of rating 44 W, 220 V and 11 W, 220 V are connected in series. The combination is connected across a 440 V mains. The fuse of which of the two devices is likely to burn when the switch is ON? Justify your answer.** **[CBSE]**

**Ans.** Using $P = \frac{V^2}{R}$

$$R_1 = \frac{V^2}{P_1} = \frac{220 \times 220}{44} = 1100\ \Omega$$

$$R_2 = \frac{V^2}{P_2} = \frac{220 \times 220}{11} = 4400\ \Omega$$

Equivalent resistance in series

$$R_S = R_1 + R_2 = 1100 + 4400 = 5500\ \Omega$$

Current, $$I = \frac{V}{R_S} = \frac{440}{5500} = 0.08\ \text{A}$$

According to Joule's law of heating

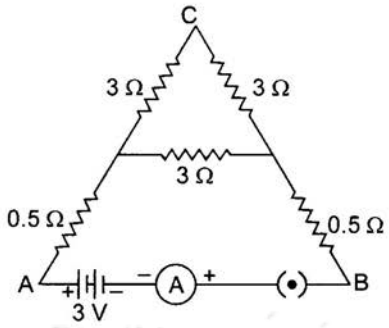
$$H_1 = I^2R_1t = (0.08)^2 \times 1100 \times 1 = 7.04\ \text{J}$$

$$H_2 = I^2R_2t = (0.08)^2 \times 4400 \times 1 = 28.16\ \text{J}$$

$$\Rightarrow \quad H_2 > H_1$$

So, fuse connected with 11 W, 220 V is likely to burn when the switch is ON.

**60. Five resistors are connected in a circuit as shown. Find the ammeter reading when circuit is closed.** **[CBSE]**




**Ans.** $R_1$ and $R_2$ are in series,

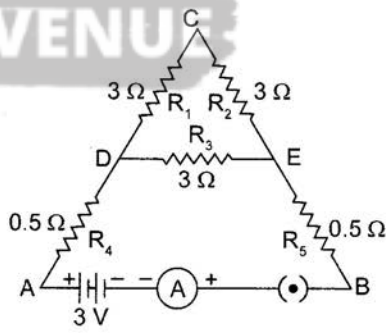
$$R_{S_1} = R_1 + R_2 = 3 + 3 = 6\ \Omega$$

READERS VENUE

$R_{S_1}$ and $R_3$ are in parallel,

$$\frac{1}{R_P} = \frac{1}{R_{S_1}} + \frac{1}{R_3} = \frac{1}{6} + \frac{1}{3} = \frac{1}{2}$$

$$R_P = 2\ \Omega$$




$R_4$, $R_P$ and $R_5$ are in series,

$$R_S = R_4 + R_P + R_5$$

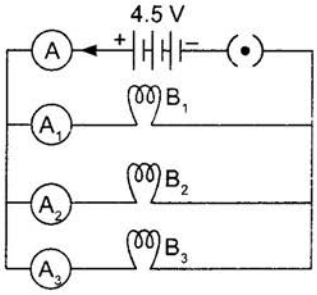
$$= 0.5 + 2 + 0.5 = 3\ \Omega$$

Current, $$I = \frac{V}{R_S} = \frac{3}{3} = 1\ \text{A}$$

**61. Study the circuit shown in which three identical bulbs $B_1$, $B_2$ and $B_3$ are connected in parallel with a battery of 4.5 V.**

**(*i*) What will happen to the glow of other two bulbs if the bulb $B_3$ gets fused?**

**(*ii*) If the wattage of each bulb is 1.5 W, how much reading will the ammeter A show when all the three bulbs glow simultaneously?**



***(iii)*** **Find the total resistance of the circuit.** **[CBSE]**

**Ans.** *(i)* The glow of other two bulbs remains the same.

*(ii)* In parallel combination, potential difference across each resistance will remain same.

So, potential across each bulb = 4.5 V

Wattage of each bulb = 1.5 W

Using, $P = VI$

For bulb $B_1$, $I_1 = \frac{P}{V} = \frac{1.5}{4.5} = \frac{1}{3}$ A

For bulb $B_2$, $I_2 = \frac{1.5}{4.5} = \frac{1}{3}$ A

For bulb $B_3$, $I_3 = \frac{1.5}{4.5} = \frac{1}{3}$ A

Total current, $I = I_1 + I_2 + I_3$

$$= \frac{1}{3} + \frac{1}{3} + \frac{1}{3} = \frac{3}{3} = 1 \text{ A}$$

Therefore, when all the three bulbs glow simultaneously, the ammeter A shows 1 A reading.

*(iii)* Potential difference across each bulb = 4.5 V

Wattage of each bulb = 1.5 W

$\therefore$ Resistance of each bulb,

$$R = \frac{V^2}{P} = \frac{4.5^2}{1.5} = 13.5\ \Omega$$

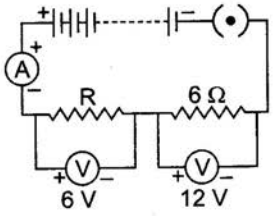
READERSVENUE

So, equivalent resistance of parallel combination

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{R} + \frac{1}{R} + \frac{1}{R} = \frac{3}{R}$$

$$R_P = \frac{R}{3} = \frac{13.5}{3} = 4.5\ \Omega.$$

**62. A circuit is shown in the diagram given below.**




***(a)*** **Find the value of *R*.**

***(b)*** **Find the reading of the ammeter.**

***(c)*** **Find the potential difference across the terminals of the battery.** **[CBSE]**

**Ans.** (*a*) Potential difference across 6 Ω = 12 V

∴ Current through 6 Ω,

$$I = \frac{V}{R} = \frac{12}{6} = 2 \text{ A}$$

As $R$ and 6 Ω are connected in series. So, the current through $R$ is 2 A.

Using Ohm's law,

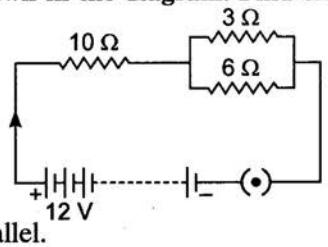
$$R = \frac{V}{I} = \frac{6}{2} = 3\ \Omega$$

(*b*) Reading of ammeter = 2 A

(*c*) Potential difference across the terminals of the battery

$$V = V_1 + V_2 = 6 + 12 = 18 \text{ V}$$

**63. Consider the circuit shown in the diagram. Find the current in 3 Ω resistor.** [CBSE]




**Ans.** 3 Ω and 6 Ω are in parallel.

$$\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{3} + \frac{1}{6} = \frac{1}{2}$$

$$\therefore \quad R_P = 2\ \Omega$$

$R_P$ and 10 Ω are connected in series. So,

$$R_S = R_P + R_3 = 2 + 10 = 12\ \Omega$$

Total current in the circuit,

$$I = \frac{V}{R_S} = \frac{12}{12} = 1 \text{ A}$$

Potential difference across, $R_P = IR_P = 1 \times 2 = 2$ V

So, Potential difference across, 3 Ω = 2 V

Current through 3 Ω, $I_1 = \frac{V}{R_1} = \frac{2}{3} = 0.67$ A

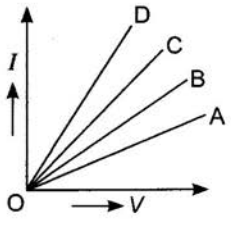
**64. Study the *I-V* graph for four conductors A, B, C and D having resistance $R_A$, $R_B$, $R_C$ and $R_D$ respectively, and answer the following questions:**

**(*i*) Which one of these is the best conductor?**

**(*ii*) If all the conductors are of same length and same material, which is the thickest?**

**(*iii*) If all the conductors are of same thickness and of same material, which is the longest?**

**(*iv*) If the dimensions of all the conductors are identical, but their materials are different which one would you use as (*a*) resistance wire (*b*) connecting wire?**



(v) **Which one of the following relations is true for these conductors?**

(a) $R_A > R_B > R_C > R_D$ (b) $R_A < R_B < R_C < R_D$

(c) $R_A = R_B = R_C = R_D$ (d) $R_A = R_B < R_C < R_D$

(vi) **If conductors A and B are connected in series and *I-V* graph is plotted for the combination, its slope would be**

(a) **less than that of A.** (b) **more than that of A.**

(c) **between A and B.** (d) **more than that of D.**

(vii) **If conductors C and D are connected in parallel and *I-V* graph is plotted for the combination, its slope would be**

(a) **lesser than that of A.** (b) **more than that of D.**

(c) **between C and D.** (d) **between B and C.** **[CBSE]**

Slope $= \frac{I}{V} = \frac{I}{R}$ is least for $R_A$.

$\therefore R_A > R_B > R_C > R_D$

(i) $D$ is the best conductor, as it has the least resistance among A, B, C and D.

(ii) Area of cross-section $\propto \frac{1}{\text{Resistance}}$. So, D is the thickest.

(iii) Resistance $\propto$ length. So, A is the longest.

(iv) (a) Resistance wire – A (b) Connecting wire – D

(v) Option (a) is correct.

(vi) (a) In series, resistances are added. ($R_S = R_A + R_B$). So, in the given *I–V* graph, slope of series combination would be less than that of A.

(vii) (b) In parallel combination, the equivalent resistance is less than the least value resistance in the circuit. So, in the given *I–V* graph, slope for parallel combination is more than that of D.

## 2010

### Short Answer Type [I] Question [2 Marks]

65. **In an experiment to study the relation between the potential difference across a resistor and the current through it, a student recorded the following observations:**

| Potential difference, $V$ (volts) | 1.0 | 2.2 | 3.0 | 4.0 | 6.4 |
|---|---|---|---|---|---|
| Current, $I$ (amperes) | 0.1 | 0.2 | 0.6 | 0.4 | 0.6 |

**On examining the above observations, the teacher asked the student to reject one set of readings as the values were out of agreement with the rest. Which one of the above sets of readings can be rejected? Calculate the mean value of resistance of the resistor based on the remaining four sets of readings.** **[CBSE]**

**Ans.** The third reading for $V = 3.0$ volt and $I = 0.6$ A will be rejected as it has larger deviation from the rest of the readings.

The value of resistance in the other four observations will be $\left(\text{using } R = \frac{V}{I}\right)$ 10 Ω, 11 Ω, 10 Ω and 10.67 Ω.

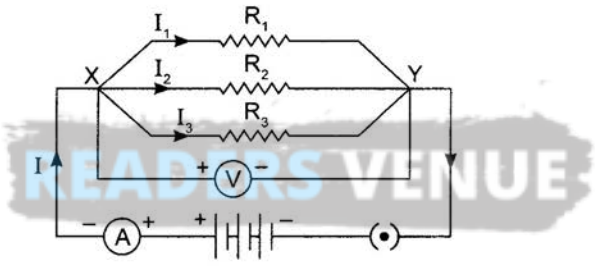
So, the mean value of resistance $= \frac{41.67}{4} = 10.417 = 10.42\ \Omega$

## Long Answer Type Questions [5 Marks]

**66. Explain with the help of a labelled circuit diagram, how will you find the resistance of a combination of three resistors, of resistance $R_1$, $R_2$ and $R_3$, joined in parallel. Also mention how will you connect the ammeter and the voltmeter in the circuit while measuring the current in the circuit and the potential difference across one of the three resistors of the combination.** [CBSE]

**Ans. Parallel combination:**

(*i*) Connect the three given resistor $R_1$, $R_2$ and $R_3$ in parallel between the point XY with a battery, a plug key and ammeter in series as shown in the figure.




READERS VENUE

(*ii*) Connect voltmeter in parallel with these resistors between the terminals X and Y.

(*iii*) Close the key and note the ammeter and voltmeter reading. Ammeter shows the total current drawn by the parallel combination of these resistors while voltmeter shows the voltage applied across the combination.

(*iv*) Using Ohm's law, find the equivalent resistance of the combination.
i.e. equivalent resistance,

$$R = \frac{\text{Voltmeter reading}}{\text{Ammeter reading}}$$

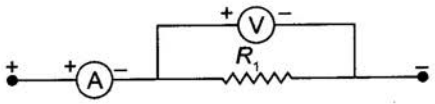
Thus, in parallel circuit,

$$I = I_1 + I_2 + I_3$$

$$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

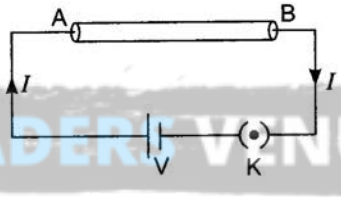
$$\Rightarrow \qquad \frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

To find the current flow through any one of the resistor, ammeter will be connected in series with that resistor and to measure the potential difference across that resistor, voltmeter must be connected in parallel with that resistor as shown.




**67. Derive the expression for the heat produced due to a current '*I*' flowing for a time interval '*t*' through a resistor '*R*' having a potential difference '*V*' across its ends. With which name is the relation known? How much heat will an instrument of 12 W produce in one minute if it is connected to a battery of 12 V?** **[CBSE]**

**Ans. Heat produced in a conductor:** Consider a wire AB having a resistance '*R*' connected across the terminals of a cell. Let *V* be the potential difference applied by cell across the ends of a wire.




READERS VENUE

Let *W* be the work done in carrying the charge *q* across the conductor, then

$$V = \frac{W}{q} \text{ or } W = V \times q \qquad (i)$$

but $q = I \times t$

So, $W = V \times It \qquad (ii)$

This work done will appear in the form of heat produced in the wire, i.e.

$$H = VIt \qquad (iii)$$

Using Ohm's law, $V = IR$

So, $H = (IR)\, It = I^2Rt$

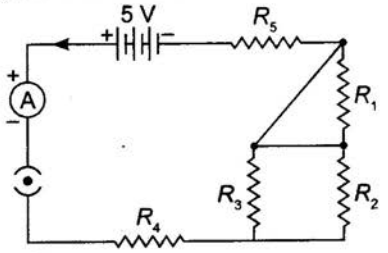
This is the expression for the heat produced in the wire. This is called Joule's law of heating.

Heat produced in one minute

$$H = P \times t = 12 \text{ W} \times 60 \text{ s} = 720 \text{ J}$$

**68. Deduce the expression for the equivalent resistance of the parallel combination of three resistors $R_1$, $R_2$ and $R_3$.**

**Consider the following electric circuit:**




**(*a*) Which two resistors are connected in series?**

**(*b*) Which two resistors are connected in parallel?**

**(*c*) If every resistor of the circuit is of 2 Ω, what current will flow in the circuit?**

**[CBSE]**

**Ans.** Consider the following parallel circuit shown below:

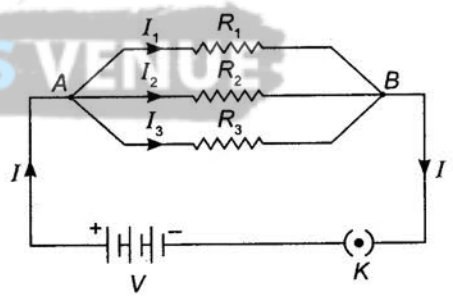
Let $I_1$, $I_2$ and $I_3$ be the current flow through the resistor $R_1$, $R_2$ and $R_3$ connected in parallel.

Using Ohm's law, current through each resistor is

$$I_1 = \frac{V}{R_1},\ I_2 = \frac{V}{R_2} \text{ and } I_3 = \frac{V}{R_3}$$

Let their equivalent resistance be $R_P$ then

$$V = IR_P \Rightarrow I = \frac{V}{R_P}$$




Total current through the circuit is

$$I = I_1 + I_2 + I_3$$

or $$\frac{V}{R_P} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

or $$\frac{V}{R_P} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right) \text{ or } \frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

(*a*) $R_5$ and $R_4$ with parallel combination of $R_2$ and $R_3$ are in series.

(*b*) $R_2$ and $R_3$ are in parallel.

(*c*) $R_2$ and $R_3$ in parallel gives $R_p = 1\ \Omega$.

$R_p$, $R_5$ and $R_4$ are in series. So, $R_{eq} = 5\ \Omega$

$R_1$ is not to be taken as it is shorted.

Current flowing $= I = \dfrac{V}{R_{eq}} = \dfrac{5}{5} = 1\ \text{A}$

# 13 MAGNETIC EFFECTS OF ELECTRIC CURRENT

## PREVIOUS YEARS' QUESTIONS

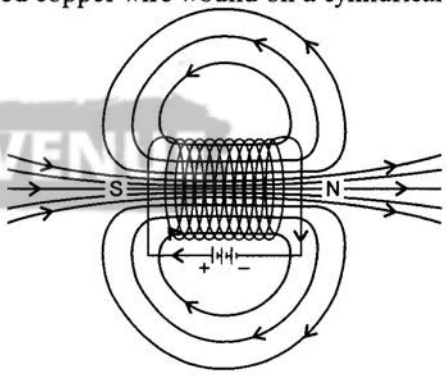
**2019**

### Long Answer Type Questions [5 Marks]

**1. What is a solenoid? Draw the pattern of magnetic field lines of (*i*) a current carrying solenoid and (*ii*) a bar magnet. List two distinguishing features between the two fields.**

**[Delhi]**

**Ans. Solenoid:** A coil of many circular turns of insulated copper wire wound on a cylindrical insulating body (i.e. cardboard etc.) such that its length is greater than its diameter is called solenoid.



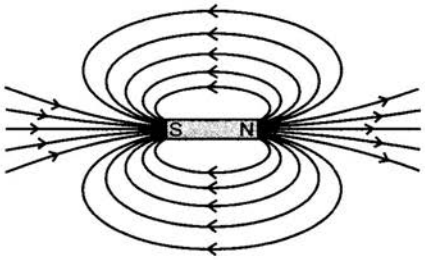

Pattern of magnetic field lines of

(*i*) Current carrying solenoid:

Outside the solenoid magnetic field is minimum. At the ends of solenoid, magnetic field strength is half that of inside it. So

Minimum – at point *B*; Maximum – at point *A*

(*ii*) A bar magnet



Two distinguish features between two fields

(*i*) Polarity of solenoid can be reversed by reversing the current but polarity of bar magnet cannot be reversed.

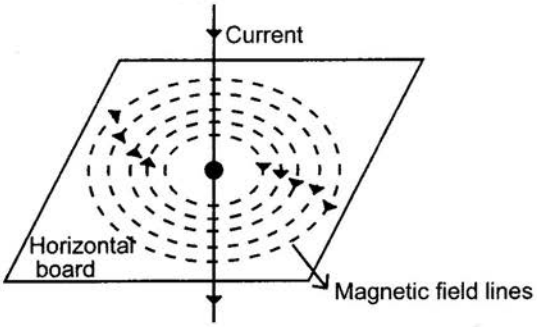
(*ii*) The magnetic field strength of current carrying solenoid can change easily but that of bar magnet cannot.

(*iii*) Magnetic field outside the solenoid is weak as compared to bar magnet.

**2. (*a*) Draw magnetic field lines produced around a current carrying straight conductor passing through a cardboard. Name, state and apply the rule to mark the direction of these field lines.**

**(*b*) How will the strength of the magnetic field change when the point where magnetic field is to be determined is moved away from the straight wire carrying constant current? Justify your answer.** **[Delhi]**

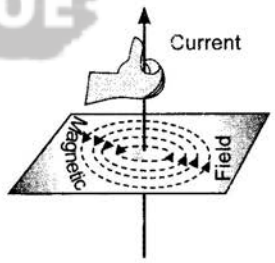
**Ans.** (*a*)




**Right-Hand Thumb Rule.** This rule is used to find the direction of magnetic field due to a straight current carrying wire.

It states that if we hold the current carrying conductor in the right hand in such a way that the thumb is stretched along the direction of current, then the curly finger around the conductor represent the direction of magnetic field produced by it. This is known as right-hand thumb rule.

**Direction of Field Lines** due to current carrying straight conductor as shown in figure.




(*b*) Using compass needle, we can determine the strength of magnetic field at various point. If the needle is moved away from the straight wire carrying constant current, the deflection in the needle decreases. It implies that magnetic field strength decreases as the distance increases.

**3. Draw the pattern of magnetic field lines produced around a current carrying straight conductor passing perpendicularly through a horizontal cardboard. State and apply right-hand thumb rule to mark the direction of the field lines. How will the strength of the magnetic field change when the point where magnetic field is to be determined is moved away from the straight conductor? Give reason to justify your answer.**

**[AI Allahabad]**

**Ans.** Refer to Ans. 2

## 2018

### Long Answer Type Questions [5 Marks]

**4. (*a*) State Fleming's left hand rule.**

**(*b*) Write the principle of working of an electric motor.**

**(*c*) Explain the function of the following parts of an electric motor.**

**(*i*) Armature (*ii*) Brushes (*iii*) Split ring [CBSE]**

**Ans.** (*a*) **Fleming's Left-Hand Rule:** Stretch the thumb, forefinger and middle finger of the left hand such that they are mutually perpendicular to each other. If the forefinger pointed towards the direction of magnetic field and middle finger in the direction of current, then the thumb will indicate the direction of motion or force experienced by the conductor. It is to be applied only when the current and magnetic field, both are perpendicular to each other.

(*b*) **Principle of an electric motor:** It works on the principle of magnetic effect of current. When a current carrying conductor is placed perpendicular to the magnetic field, it experiences a force. The direction of this force is given by Fleming's left hand rule.

(*c*) (*i*) **Armature:** It consists of a large number of turns of insulated current carrying copper wires wound over a soft iron core and rotated about an axis perpendicular to a uniform magnetic field supplied by the two poles of permanent magnet.

(*ii*) **Brushes:** Two conducting stationary carbon or flexible metallic brushes constantly touches the revolving split rings or commutator. These brushes act as a contact between commutator and terminal battery.

(*iii*) **Split ring:** The split ring acts as a commutator in an electric motor. With the help of split ring, the direction of current through the coil is reversed after every half of its rotation and make the direction of currents in both the arms of rotating coil remains same. Therefore, the coil continues to rotate in the same direction.

## 2018 (Compartment)

### Long Answer Type Questions [5 Marks]

**5. (*a*) What are field lines? How is the direction of magnetic field at a point in a magnetic field determined using field lines?**

**(*b*) Two circular coils 'X' and 'Y' are placed close to each other. If the current in the coil 'X' is changed, will some current be induced in the coil 'Y'? Give reason. [CBSE]**

**(*c*) State 'Fleming's right hand rule".**

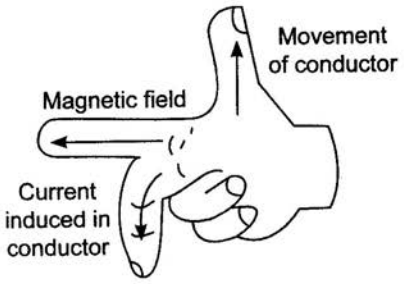
**Ans.** (*a*) It is defined as the path along which the hypothetical unit N-pole tends to move in a magnetic field, if free to do so.

By drawing a tangent at that point on the magnetic field lines one can find the direction of magnetic field at that point.

(*b*) Yes.

If the current in coil 'X' is changed, the magnetic field associated with it also changes around the coil 'Y' placed close to 'X'. This change in magnetic field lines linked with coil 'Y', according to Faraday law of electromagnetic induction, induces a current in the coil Y.

(*c*) **Fleming's Right-Hand Rule:** Stretch the thumb, forefinger and middle finger of the right hand mutually perpendicular to each other such that the forefinger gives the direction of magnetic field and the thumb points in the direction of the motion of a conductor then, the middle finger will give the direction of the induced current.




## 2016

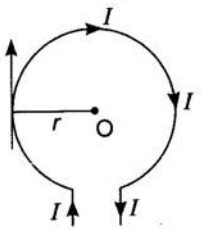
### Long Answer Type Questions [5 Marks]

READERS VENUE

**6.** (*a*) **Consider a circular loop of wire lying in the plane of table. Let the current pass through the loop clockwise. Apply the right-hand rule to find out the direction of the magnetic field inside and outside the loop.**

(*b*) **What is meant by solenoid? How does a current carrying solenoid behave ? Give its main use.** **[CBSE]**

**Ans.** (*a*) Consider a circular loop of wire of radius r with centre O lying in the plane of the paper. Let the current *I* pass through the loop clockwise. According to right hand thumb rule, direction of magnetic field due to any portion of small current-carrying length of the coil is:




Direction of magnetic field inside the loop

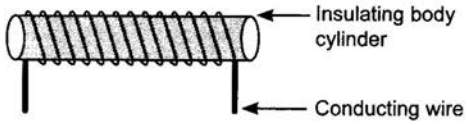
— Perpendicular to the plane of paper inwards and

Direction of magnetic field outside the loop

— Perpendicular to the plane of paper outwards.

So, the direction of magnetic field can be considered as the direction of total magnetic field due to circular coil as current through all the elements will contribute to the magnetic field in the same direction.

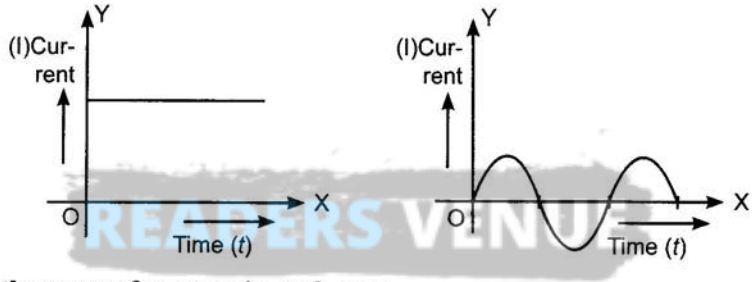
(*b*) **Solenoid:** A coil of many circular turns of insulated copper wire wound on a cylindrical insulating body (i.e. cardboard etc.) such that its length is greater than its diameter is called solenoid.




When current is flowing through the solenoid, the magnetic field line pattern resemble exactly with those of a bar magnet with the fixed polarity North and South pole at its ends and it acquires the directive and attractive properties similar to bar magnet. Hence the current carrying solenoid behaves a bar magnet.

**Use of current carrying solenoid:** It is used to form a temporary magnet called electromagnet as well as permanent magnet.

**7. In our daily life we use two types of electric current whose current time graphs are given below.**

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(*a*) **Identify the types of current in each case.**

(*b*) **Identify any one source of each type of current.**

(*c*) **What is frequency of current used in domestic supply in India?**

(*d*) **On the basis of graphs write difference between the two currents.**

(*e*) **Out of two which one is used in transmitting electric power over long distances and why?** **[CBSE]**

**Ans.** (*a*) DC in case I and AC in the case II.

(*b*) Cell or a battery – Source of DC.
Generator – Source of AC.

(*c*) Frequency of AC is 50 Hz in India while DC has zero frequency.

(*d*) In case I, current remains constant and frequency is zero whereas in case II, current varies periodically with a frequency of $\frac{1}{0.02 \text{ sec}} = 50$ Hz. in India.

(*e*) AC can be transmitted over a long distance without much loss of energy as compared to a DC transmission.

## 2015

### Short Answer Type [II] Questions [3 Marks]

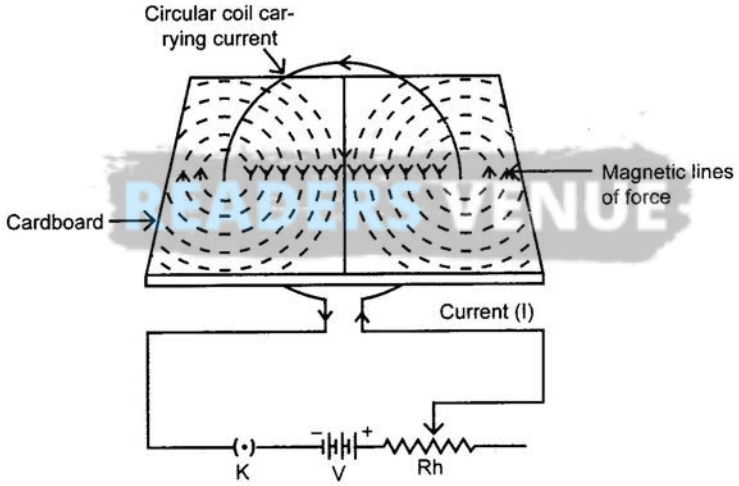
**8. Describe an activity to show that the magnetic field lines produced when current is passed through the circular coil.** [CBSE]

**Ans.** ***Aim*:** To study the characteristics of magnetic field produced by a current carrying circular coil at its centre.

***Apparatus Required:*** Rectangular cardboard having two holes, Thick copper circular coils of different radii having known number of turns, key, battery, rheostat, stand, iron filings.

***Procedure:***

1. Pass the coil through the two holes of cardboard in such a way that half of the loop is above the cardboard and remaining part should be below it and normal to the plane of cardboard.
2. Connect the circuit as shown.




3. Sprinkle iron filings uniformly on the cardboard.
4. Allow the current to pass though the coil by inserting plug in the key.
5. Note the pattern of iron filings that emerges on the cardboard after tapping gently a few times.

***Observations*:**

(*a*) Iron filings are arranged in the form of concentric circles.

(*b*) The concentric circles become larger and larger as we move away from the wire.

(*c*) At the centre of loop, lines are almost straight and perpendicular to the plane of the loop.

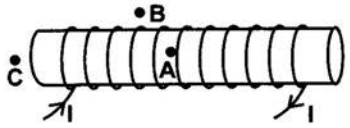
***Conclusion*:**

1. The concentric circles at every point of a current carrying circular loop represent the magnetic field around it.
2. Magnetic field line close to the axis of loop is straight and is perpendicular to the plane of the coil.
3. Field lines keep on diverging as we move away from the centre of loop.

**9. What is meant by solenoid? How does a current carrying solenoid behave? Give its main use.** **[CBSE]**

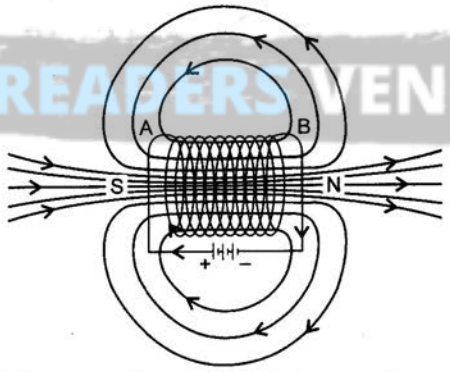
**Ans.** Refer to Ans. 6 (*b*).

**10. For the current carrying solenoid as shown below, draw magnetic field lines and giving reason explain that out of the three points A, B and C at which point the field strength is maximum and at which point it is minimum.** **[CBSE]**




**Ans.** Outside the solenoid magnetic field is minimum. At the ends of solenoid, magnetic field strength is half to that inside it. So

Minimum – at point B; Maximum – at point A



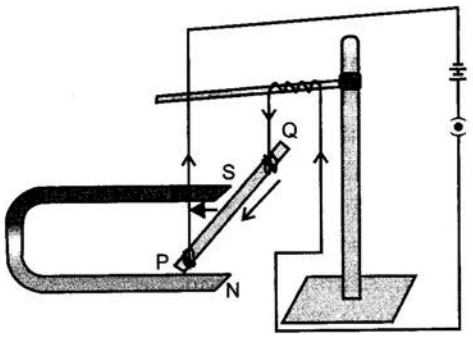

**11. With the help of a diagram of experimental setup describe an activity to show that the force acting on a current carrying conductor placed in a magnetic field increases with increase in field strength.** **[CBSE]**

**Ans.** ***Aim:*** To show that force acting on a current carrying conductor placed in a magnetic field increases with the field strength.

***Apparatus Required:*** Aluminium rod, stand horse shoe magnet of different intensity, cell, key and connecting wires.

***Procedure:***

1. Arrange the set-up as shown in figure.




**A current carrying rod, PQ is experiencing force F**

2. Plug the key, the current flowing through the rod from Q to P observe the displacement of rod.
3. Now unplug the key and remove the first horse shoe magnet and place the second horse shoe magnet of higher magnetic field strength in a similar manner to that of first.
4. Plug the key, the current again flow through the rod from Q to P. Again observe the deflection of rod.
5. Now bring both the magnet closer together (to ensure greater magnetic field than that of previous case). Again observe the motion of rod.

***Observations:*** Each time, the conductor moves faster than that of the previous one. It is possible only when conductor gets accelerated more each time which required more force. (F = ma)

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Thus, if the magnetic field strength is increased, the rod will experience a greater force and move faster.

***Conclusion:*** The force acting on a current carrying conductor placed in a magnetic field increases with increase in field strength.

**12. What are magnetic field lines? Justify the following statements**

**(*a*) Two magnetic field lines never intersect each other.**

**(*b*) Magnetic field lines are closed curves.** **[CBSE]**

**Ans. Magnetic field lines:** It is defined as the path along which the unit North pole (imaginary) tends to move in a magnetic field if free to do so.

(*a*) The magnetic lines of force do not intersect (or cross) one another. If they do so then at the point of intersection, two tangents can be drawn at that point which indicates that there will be two different directions of the same magnetic which field, i.e. the compass needle points in two different directions which is not possible.

(*b*) Magnetic field lines are closed continuous curves. They diverge from the north pole of a bar magnet and converge its south pole. Inside the magnet they move from south pole to north pole.

## Long Answer Type Question [5 Marks]

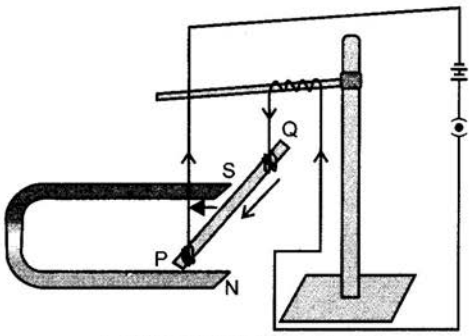
**13. (*a*) Describe activity with labelled diagram to show that a current carrying conductor experience a force in a magnetic field.**

**(*b*) State the rule to determine the direction of force.** **[CBSE]**

**Ans.** (*a*) Without using a magnet, magnetic field can be produced by flowing the current through a straight conductor or a solenoid.

***Aim:*** To show that magnetic field exerts a force on a current carrying conductor.

***Apparatus required:*** Aluminium rod, stand, strong horse shoe magnet, cell, key and connecting wires.




**A current carrying rod, PQ is experiencing force F**

***Procedure:***

1. Hang the aluminium rod with the help of clamp stand such that it passes between the North and South pole of the magnet with the magnetic field directed upwards and the rod being horizontal and perpendicular to the field.
2. Connect the aluminium rod in series with a battery, a key as shown in the figure.
3. Plug the key, the current flows through the rod from Q to P and observe the direction of motion of the rod.
4. Reverse the direction of current by reversing the battery connection. Again observe the direction of displacement of aluminium rod.
5. Restore the original direction of current and change the direction of field vertically downwards by interchanging the two poles of the magnet. Observe the deflection of rod again.
6. Place the wire parallel to magnetic field and allow the current to pass through it. Check the deflection of rod again.

***Observation:***

1. On plugging the key in step 3, the aluminium rod moves towards left.
2. In step 4, rod displaces towards right.
3. In step 5, rod moves towards right again.
4. In step 6, rod does not move in any direction.

***Conclusion:***

1. Magnetic field exerts a force on a current carrying conductor.
2. The force exerted on the current carrying conductor depends upon the direction of current and direction of magnetic field acting on it.

3. Displacement of the rod or the magnetic force on it is largest when the direction of current is at right angle to the direction of magnetic field.
4. When current carrying conductor is placed parallel to the magnetic field, it experiences no force.

(*b*) Direction of force experienced by a current carrying straight conductor placed in a magnetic field which is perpendicular to it is given by **Fleming's left hand rule.** Refer to Ans. 4 (*a*).

## 2014

### Short Answer Type [I] Questions [2 Marks]

**14. Why and when does a current carrying conductor kept in a magnetic field experience force? List the factors on which direction of this force depends.** [CBSE]

**Ans.** The drifting of free electrons of a conductor in a definite direction causes the current to flow through it. When such conductor is placed in a uniform magnetic field, each drifted electron of a conductor experience a magnetic force. This force is collectively experience by a conductor as a whole. Hence, a current carrying conductor kept in a magnetic field experience a force.

The direction of magnetic force depends on

(*i*) direction of current through the conductor, and

(*ii*) direction of magnetic field.

**15. How is the strength of magnetic field near a straight current-conductor**

**(*i*) related to the strength of current in the conductor?**

**(*ii*) is affected by changing the direction of flow of current in the conductor?** [CBSE]

**Ans.** (*i*) The strength of magnetic field around a straight current conductor increases on increasing the strength of current in the conductor or vice versa.

(*ii*) The direction of magnetic field around a straight current carrying conductor gets reversed if the direction of current through that conductor is reversed.

**16. What is meant by the term 'frequency of an alternating current'? What is its value in India? Why is an alternating current considered to be advantageous over direct current for long range transmission of electric energy?** [CBSE]

**Ans.**
- Frequency of alternating current is equal to the number of cycles completed in one second.
- In India, frequency of AC is 50 Hz i.e. 50 cycles per second.
- An alternating current is considered to be advantageous over direct current for long range transmission of electric energy because it can be transmitted over long distances to distant places without much loss of electric power as compared to direct current.

## Short Answer Type [II] Questions [3 Marks]

**17. State one main difference between A.C. and D.C. Why A.C. is preferred over D.C. for long range transmission of electric power? Name one source each of D.C. and A.C.**

**Ans. Difference between A.C. and D.C.** The alternating current (A.C.) reverses its direction periodically whereas the direct current (D.C.) always flows in one direction.

A.C. is preferred over D.C. because it can be transmitted over long distance without much loss of energy.

D.C. source: Battery

A.C. source: A.C. generator

**18. State the consequences that can lead to a short circuit.**

**or**

**One of the major causes of fire in office building is short circuiting. List three factors which may lead to the short circuit.** **[CBSE]**

**Ans.** It occurs as a consequence of

- failure of electrical insulations due to which live wire comes in direct contact with neutral or earth wire.
- presence of external conducting material such as water which is introduced accidently into the circuit.
- electrical appliances are forced to operate when its moving parts are jammed.
- connection of current carrying parts of electrical equipment's comes in contact to one another due to human or natural cause and
- use of less rating wires.

When this happens, there is an excessive electric current which can damage the circuit and may also cause electrical fires.

## Long Answer Type Questions [5 Marks]

**19. (*a*) Describe an activity to demonstrate the pattern of magnetic field lines around a straight conductor carrying current.**

**(*b*) State the rule to find the direction of magnetic field associated with a current carrying conductor.**

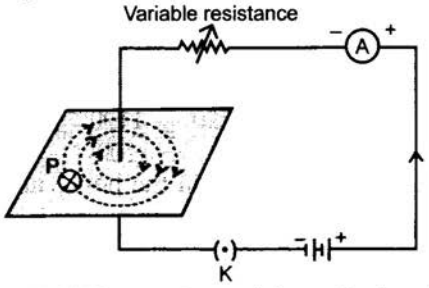
**(*c*) What is the shape of a current carrying conductor whose magnetic field pattern resembles that of a bar-magnet?** **[CBSE]**

**Ans.** (*a*) ***Aim:*** To study the magnetic field due to a straight current carrying conductor.

***Apparatus Required:*** A thick conducting wire, battery, rheostat, magnetic needle, ammeter (0-5 A), key, a cardboard, a stand to hold the wire, iron filings and sprinkler of iron filings.

***Procedure:***

1. Attach the thick wire through a hole at the middle of the cardboard and clamp it in a stand.
2. Attach the ends of the wire through a key, variable resistor and an ammeter on either side of a battery and hold it vertically and perpendicularly to the board.
3. Spread the iron filings uniformly on the cardboard and place the magnetic needle on the board.
4. Close the key and tap the cardboard slightly and observe the orientation of iron filings.




**Magnetic field around a straight conducting wire. Concentric circles indicate the field lines**

***Observation:***

1. Just on closing the key, the iron filings are aligned in the pattern of concentric circles around the wire.

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***Conclusion:***

1. Current carrying conductor is a source of magnetic field.
2. The magnetic field is in the form of concentric circles whose centre lies on the wire.

(*b*) **Right-Hand Thumb Rule.** Refer to Ans. 2 (*a*).

(*c*) Solenoid.

**20. (*a*) Explain why there are two separate circuits one for high power rating appliances and other for low power rating appliances.**

**(*b*) A domestic circuit has 5A fuse. How many bulbs of rating 100W, 220V can be safely used in this circuit? Justify your answer.** **[CBSE]**

**Ans.** (*a*) Two separate circuits are formed in the domestic wiring, one for high power rating appliances called power circuit and other for low power rating called lightning circuit.

**Power circuit:** The circuit which draws heavy current (15 A) from mains and used for high power rating devices such as microwave, oven, air conditioners, geysers, washing machine, etc. is known as power circuit.

**Lightning circuit:** The circuit which draws small amount of current from the mains and used for low power rating devices such as bulb, tube light, fans, T.V., Computer, etc. having a current rating of 5 A is known as lightning circuit.

(*b*) In India, the correct voltage is 220 V.

Electric current flowing in the circuit is given by

$$I = \frac{P}{V}$$

Hence, $I = 5$ A, $V = 220$ V and $P = n \times 100$

Where, $n$ = number of bulbs

$$\therefore \quad 5 = \frac{n \times 100}{220}$$

$$\therefore \quad n = \frac{5 \times 220}{100} = \frac{1100}{100} = 11$$

So, 11 bulbs of 100 W can be used in the house at correct voltage.

**21.** (*i*) **Design an activity with the help of two nails, very thin aluminium strip, a 12 V Battery and a key to illustrates.**

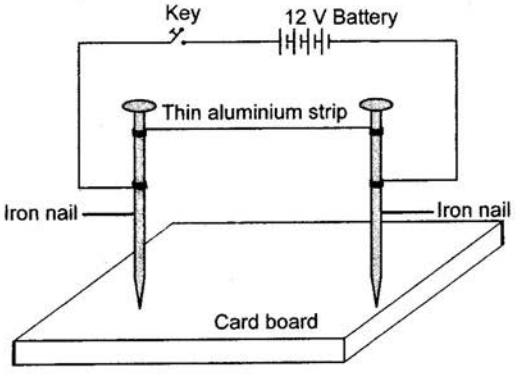
(*ii*) **Cable of a microwave oven has three wires inside it which have insulation of different colours–black, green and red. Mention the significance of the three colours and potential difference between red and black one.** **[CBSE]**

**Ans.** (*a*) ***Aim:*** How electric fuse works?

***Apparatus required:*** Two nails, card board, very thin aluminium strip, a 12 V battery, key and connecting wires.

***Procedure:***

1. Insert the two nails vertically on the card board.
2. Take very thin aluminium strip and tie it between the nails.
3. Make a circuit as shown in figure with 12 V battery and key with the help of connecting wires.



4. If there are any fans running in the room, switch them off.
5. Now switch on the current in the circuit by pressing the key or by moving the switch of the 'ON' position.
6. Now pass the current through the circuit for some time. Observe the strand of aluminium strip between the two nails carefully.

***Observation:*** The strand of aluminum strip melt and break quickly on passing the large electric current through it.

***Conclusion:*** When current flows through the circuit, exceed the rating of aluminium strip, i.e. safe limit, its temperature increases. This makes it overheated. As a result, aluminium strip melts and breaks the circuit. Hence, very thin aluminium strip between the two nails acts as a fuse wire.

This activity shows that how fuse works.

(*b*) **Significance of insulation colour:**

(*i*) Red colour insulation wire – Live wire

(*ii*) Black colour insulation wire – Neutral wire

(*iii*) Green colour insulation wire – Earth wire

Live wire is at higher potential of 220 V while neutral wire is at zero potential. So, potential difference between red and black insulation wire is 220 V.

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## 2013

### Short Answer Type [I] Questions [2 Marks]

**22. Explain any two situations that can cause electrical hazards in domestic circuits.** **[CBSE]**

**Ans.** (*i*) Connecting too many electrical devices to a single socket or in the extension cord for any length of time draws high current from the mains that will exceed the current rating of connecting wires. The wires cannot withstand such a high current and melt and may cause fire.

(*ii*) Most electrical hazards in domestic circuits are caused by the faulty electrical outlets, old and out-dated appliances. The chances of short circuit, i.e. contact of live wire and neutral wires with each other due to damage in their insulation or some fault in the appliances are very high. It may result spark at the contact point which may even cause fire.

**23. List in tabular form two major differences between an electric motor and a generator.** **[CBSE]**

**Ans.**

| Electric motor | Electric Generator |
|---|---|
| (*i*) It converts electrical energy into mechanical energy | (*i*) It converts mechanical energy into electrical energy. |
| (*ii*) It works on the principle of magnetic effect of electric current, i.e. when a current carrying conductor is placed perpendicular to the direction of magnetic field, it experiences a force. The direction of force can be found by using the Fleming's left hand rule. | (*ii*) It is based on the electromagnetic induction, i.e. current can be induced in a coil by moving it in a magnetic field. The direction of induced current can be found by using the Fleming's right hand rule. |
| (*iii*) Armature is rotated in the magnetic field by supplying electric current to it by some external source such as battery to get the mechanical work. | (*iii*) Armature is rotated in the magnetic field by some external mechanical force to produce electric current. |
| (*iv*) Split ring is used as a commutator to reverses the direction of flow of current and direction of force acting on the arms of the coil after every half of its rotation. This makes the coil to rotate continuously in the same direction. | (*iv*) The slip rings conduct the alternating current and split ring conduct the direct current to the external circuit through the brushes. |

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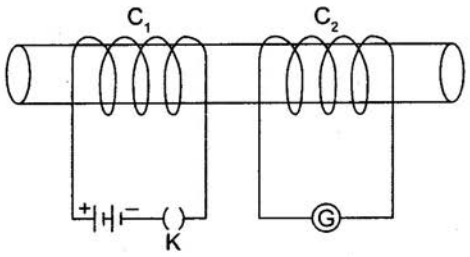
## Long Answer Type Question [5 Marks]

**24. Two coils $C_1$ and $C_2$ are wrapped around a non conducting cylinder. Coil $C_1$ is connected to a battery and key and $C_2$ with galvanometer G. On pressing the key (K), current starts flowing in the coil $C_1$. State your observation in the galvanometer:**




**(*i*) When key K is pressed on.**
**(*ii*) When current in the coil $C_1$ is switched off.**
**(*iii*) When the current is passed continuously through coil $C_1$.**
**(*iv*) Name and state the phenomenon responsible for the above observation.**
**Write the name of the rule that is used to determine the direction of current produced in the phenomena.** **[CBSE]**

**Ans.** (*i*) When key is pressed on, the galvanometer needle deflects momentarily in one direction.

(*ii*) When the current in the coil $C_1$ is switched off, the galvanometer needle deflects again momentarily but in opposite direction to that in the previous case.

(*iii*) When current is passed continuously through coil $C_1$, no deflection is observed in the galvanometer.

(*iv*) The phenomenon responsible for the above observations is electromagnetic induction.

**Electromagnetic Induction:** The process, by which a changing magnetic field in a conductor induces a current in another conductor placed nearby, is called electromagnetic induction.

- **Fleming's right hand rule** is used to determine the direction of current produced in the phenomena of electromagnetic induction.

## 2012

### Very Short Answer Type Questions [1 Mark]

**25. Name the type of current:**
**(*a*) used in household supply.** **(*b*) given by a cell.** **[CBSE]**

**Ans.** (*a*) Alternating current. (*b*) Direct current.

**26. State the direction of magnetic field in the following case.**

**Ans.** Perpendicular to the plane of paper in the outward direction by using Fleming's left hand rule.

**27. Give one application of electromagnetic induction.** **[CBSE]**

**Ans.** This phenomenon is used in electric generator.

**28. Name the physical quantities which are indicated by the direction of thumb and forefinger in the Fleming's right hand rule?** **[CBSE]**

**Ans.** In Fleming's right hand rule,
thumb indicates — direction of motion of the conductor;
forefinger indicates — direction of magnetic field.

**29. A positively charged particle (alpha-particle) projected towards west is deflected towards north by a magnetic field. The direction of magnetic field is**
**(*a*) towards north** **(*b*) towards east**
**(*c*) downward** **(*d*) upward** **[CBSE]**

**Ans.** (*d*) Upward (Apply Fleming's left hand rule).

## Short Answer Type [I] Questions [2 Marks]

**30. The given magnet is divided into three parts A, B, and C.**

**Name the parts where the strength of the magnetic field is: (*i*) maximum (*ii*) minimum. How will the density of magnetic field lines differ at these parts?** **[CBSE]**

**Ans.** (*i*) Maximum strength – at A and C

(*ii*) Minimum strength – at B

At A and C, magnetic field lines are crowded while at B, they are spread out.

**31. A compass needle is placed near a current-carrying wire. State your observation for the following cases, and give reason for the same in each case.**

**(*a*) Magnitude of electric current in the wire is increased.**

**(*b*) The compass needle is displaced away from the wire.** **[CBSE]**

**Ans.** (*a*) **Observation:** The deflection of the needle increases.

**Reason:** Magnetic field strength due to current-carrying wire increases as current in the wire increases. i.e. $B \propto I$.

(*b*) **Observation:** The deflection in the compass needle decreases as its displacement from the current-carrying wire increases.

**Reason:** The strength of magnetic field reduces with the increase in distance from the wire as $B \propto \frac{1}{r}$.

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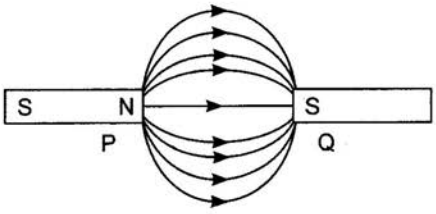
**32. (*a*) Two magnets are lying side by side as shown below. Draw magnetic field line between poles P and Q.**

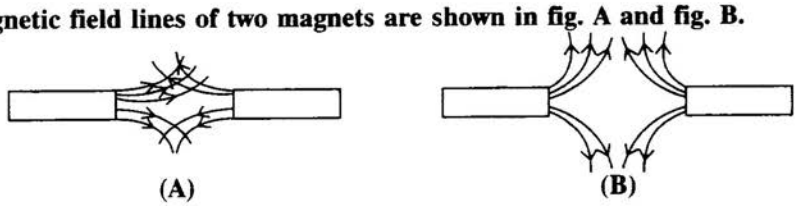
**(*b*) What does the degree of closeness of magnetic field lines near the poles signify?** **[CBSE]**

**Ans.** (*a*)




(*b*) The degree of closeness of magnetic field lines near the poles signify that the field is stronger there, i.e. the pole of another magnet when placed in the magnetic field experiences a greater force where the field lines are crowded.

**33. Magnetic field lines of two magnets are shown in fig. A and fig. B.**



(A) (B)

**Select the figure that represents the correct pattern of field lines. Give reasons for your answer. Also name the poles of the magnets facing each other.** [CBSE]

**Ans.** Figure B represents the correct pattern of field lines. In figure A, field lines cross each other which is not possible because if they cross each other, at the point of intersection, there would be two directions of field lines.

In figure B, field lines are emerging in nature. so poles of magnet facing each other are north poles while opposite faces will have south polarity.

## Short Answer Type [II] Questions [3 Marks]

**34. What is short circuiting? State one factor/condition that can lead to it. Name a device in the household that acts as a safety measure for it. State the principle of its working.** [CBSE]

**Ans.** **Short circuiting:** When electric circuit offers very low resistance to the flow of current through it, the current increases heavily and the circuit is said to be short circuited. It occurs when live wire touches the neutral wire. This happens due to the damage in insulation of the power lines.

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**Safety measure device:** Fuse.

**Working principle of fuse:** It works on the heating effect of electric current or Joule's law of heating. According to this law, the heat produced in a resistor is directly proportional to the

(*i*) square of current for a given resistance.

(*ii*) resistance for a given current and

(*iii*) time for which the current flows through the resistor.

$$H = I^2Rt$$

So, when current in the circuit increases, the wire with low melting point in it melts to the heat generated. Hence, the circuit breaks and electrical devices and appliances are saved.

**35. Write one application of each of the following:**

**(*a*) Right-hand thumb rule** **(*b*) Fleming's left hand rule**

**(*c*) Fleming's right hand rule** [CBSE]

**Ans.** (*a*) **Right-hand thumb rule** is used to find the direction of magnetic field in a coil of wire and the electric current in a straight conductor.

(*b*) **Fleming's left hand rule** is used to find the direction of force exerted on a current-carrying conductor placed in a magnetic field as in electric motor.

(*c*) **Fleming's right hand rule** is used to find the direction of induced current in a closed circuit placed in changing magnetic field as in electric generator.

**36. State one main difference between A.C. and D.C. Why is A.C. preferred over D.C. for long range transmission of electric power? Name one source each of D.C. and A.C.**

**[CBSE]**

**Ans. Difference between A.C. and D.C.:** The alternating current (A.C.) reverses its direction periodically whereas the direct current (D.C.) always flows in one direction.

A.C. is preferred over D.C. because it can be transmitted over long distance without much loss of energy.

D.C. source: Battery

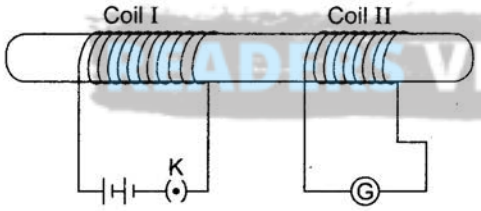
A.C. source: A.C. generator

## Long Answer Type Questions [5 Marks]

**37. Two coils of insulated copper wire are wound over a non -conducting cylinder as shown. Coil I has larger number of turns.**

**(*i*) Write your observations when,**

**(*a*) key K is closed, (*b*) key K is opened.**




**(*ii*) When the current is passed continuously through coil I.**
**Give reason for your observations.**

**(*iii*) Name and state the phenomenon responsible for the above observation.**

**(*iv*) Write the name of the rule that is used to determine the direction of current produced in the phenomenon.**

**(*v*) Name the two coils used in this experiment.** **[CBSE]**

**Ans.** (*i*) (*a*) When key is closed, the galvanometer needle deflects momentarily in one direction.

**Reason:** When key is closed, magnetic field lines around coil 2 increases momentarily. This causes an induced current to flow through it and hence deflection occurs in one direction.

(*b*) When key is opened, the galvanometer needle deflects again momentarily but in opposite direction.

**Reason:** When key is open, magnetic field lines around coil 2 decreases momentarily. This causes an induced current to flow in opposite direction. Hence, deflection occurs in opposite direction.

(*ii*) When current is passed continuously through coil I, no deflection is observed in the galvanometer.

**Reason:** There will be no change in magnetic field lines passing through the coil 2. Hence, no induced current will be set up in coil 2.

(*iii*) The phenomenon observed in above cases is electromagnetic induction. It is a process by which a changing magnetic field in a conductor induces a current in another conductor placed nearby.

(*iv*) **Fleming's right hand rule**

(*v*) Coil I – Primary coil

Coil II – Secondary coil

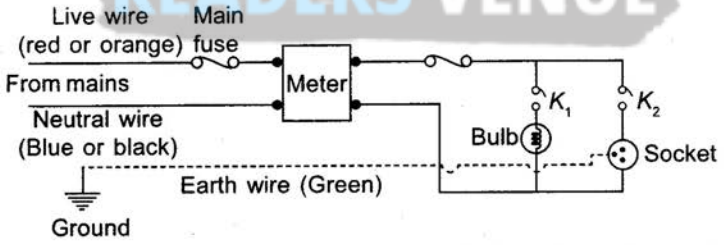
**38. (*a*) Mention the effect of electric current on which the working of an electrical fuse is based.**

**(*b*) Draw a schematic labelled diagram of a domestic circuit which has a provision of a main fuse, meter, one light bulb and a socket.**

**(*c*) Explain the term overloading of an electric circuit.** **[CBSE]**

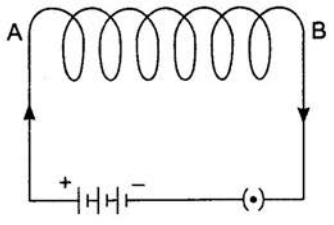
**Ans.** (*a*) Heating effect of electric current.

(*b*) Domestic circuit wiring consists of a main fuse, meter, one light bulb and a socket.




(*c*) The flow of large amount of current through the circuit beyond its bearing capacity due to use of many high power rating devices at the same time is called overloading.

**39. Observe the figure given below and answer the following questions:**

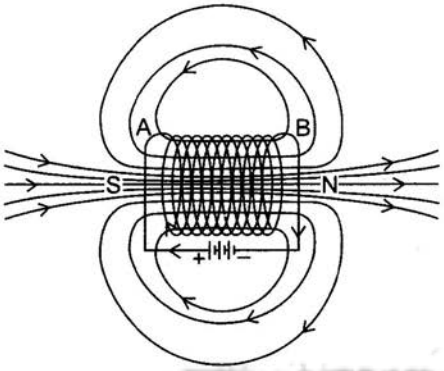


**(*a*) Write the special name given to the coil AB which has many circular turns of insulated copper wire.**
**(*b*) State the nature of magnetic field inside AB when a current is passed through it.**
**(*c*) Redraw the diagram and sketch the pattern of magnetic field lines through and around AB.**
**(*d*) List two factors on which the strength of the magnetic field produced by AB depends.**
**(*e*) What is the effect of placing an iron core in the coil AB?** **[CBSE]**

**Ans.** (*a*) Solenoid.

(*b*) Uniform magnetic field.

(*c*)




(*d*) (*i*) Magnitude of current flowing through it.
(*ii*) Number of turns of a circular coil.

(*e*) It becomes an electromagnet.

READERS VENUE

## 2011

### Short Answer Type [I] Questions [2 Marks]

**40. Insulation cover of which colour is conventionally used for earth wire? Why is an earth wire connected to metallic parts of appliances?** **[CBSE]**

**Ans.** For earth wire, green or yellow colour insulation is used. The earth wire provides the low resistance conducting path for the current and maintains the potential of appliances body with that of the earth. So, earth wire is used as a safety measure.

**41. Identify the poles of the magnet in the given figure (1) and (2).** **[CBSE]**

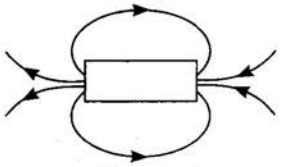


**Figure (1)**

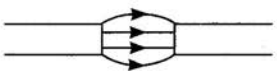


**Figure (2)**

**Ans.** Field lines emerge from north pole (N) and merge at the south pole (S) as shown in both the figures.

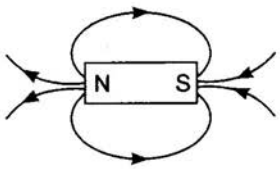



Figure (1)

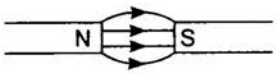



Figure (2)

**42. Explain the role of fuse in series with any electrical appliance in an electric circuit. Why should a fuse with defined rating for an electric circuit not be replaced by one with a larger rating?** **[CBSE]**

**Ans.** Fuse is a safety device connected in series with live wire or with any electrical appliance in an electric circuit. It stops the flow of unduly high electric current in the circuit by getting melted due to rise in temperature as per Joule's law of heating.

High rating fuse wire has the larger capacity. So, it will not stop the flow of any relatively high current. Therefore, electrical devices cannot be protected from the possible damage.

**43. The magnetic field associated with a current-carrying straight conductor is in anticlockwise direction. If the conductor was held along the east-west direction, what will be the direction of current through it? Name and state the rule applied to determine the direction of current.** **[CBSE]**

**Ans.** Direction of current – east to west as determined by Right-hand thumb rule.

**Right-Hand Thumb Rule:** Refer to Ans. 2 (*a*).

READERS VENUE

**44. Two circular coils A and B are placed close to each other. If the current in the coil A is changed, will some current be induced in the coil B? Give reason.** **[CBSE]**

**Ans.** Yes, when a current in coil A changes, magnetic field lines linked with coil B also change. Hence, due to change in number of magnetic field lines, there is an induced current in coil B.

## Short Answer Type [II] Questions [3 Marks]

**45. How will the magnetic field produced at a point due to a current-carrying circular coil change if we:**

**(*i*) increase the current flowing through the coil?**

**(*ii*) reverse direction of current through the coil?**

**(*iii*) increase the number of turns in the coil?** **[CBSE]**

**Ans.** Magnetic field ($B$) at the centre of the circular coil

(*i*) increases if the current is increased as $B \propto I$.

(*ii*) reverses on reversing the current.

(*iii*) increases if the number of turns in the coil increases as field is directly proportional to the number of turns.

**46. (*a*) Mention the factors on which the direction of force experienced by a current-carrying conductor placed in a magnetic field depend.**

**(*b*) Under what condition is the force experienced by a current-carrying conductor placed in a magnetic field maximum?**

**(*c*) A proton beam is moving along the direction of a magnetic field. What force is acting on proton beam?** **[CBSE]**

**Ans.** (*a*) The direction of force experienced by the current-carrying conductor depends on:

(*i*) direction of current and

(*ii*) direction of magnetic field.

(*b*) When the direction of current is at right angle to the direction of magnetic field, the force is maximum.

(*c*) No force is experienced by the proton beam. As proton beam is moving along the direction of magnetic field.

**47. A coil of insulated copper wire is connected to a galvanometer. What will happen if a bar magnet is**

**(*a*) pushed into the coil,**

**(*b*) withdrawn from inside the coil,**

**(*c*) held stationary inside the coil?** **[CBSE]**

**Ans.** (*a*) When a bar magnet is pushed into the coil, magnetic field lines linked with the coil changes (increases). It causes the electric current to get induced in it. The needle of galvanometer will move momentarily in one direction.

(*b*) When a bar magnet is withdrawn from inside the coil, the magnetic field lines linked with the coil changes but in decreasing order. Current will be induced in the coil which will be indicated by deflection of needle in the galvanometer. The deflection is opposite to that in case (*a*). This indicates that the direction of induced current is now opposite to the direction of induced current in case (*a*).

(*c*) When bar magnet is held stationary inside the coil, there is no deflection in the galvanometer. This is because there is no change in magnetic field lines linked with the coil. Hence, no induced current will flow through the coil.

**48. State the rule to determine the direction of a**

**(*a*) magnetic field produced around a straight conductor carrying current,**

**(*b*) force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it.** **[CBSE]**

**Ans.** (*a*) Direction of magnetic field produced around a straight current-carrying conductor is given by **right-hand thumb rule**.

Refer to Ans. 2 (*a*).

(*b*) Direction of force experienced by a current-carrying straight conductor placed in a magnetic field which is perpendicular to it, is given by **Fleming's left hand rule**.

Refer to Ans. 4 (*a*).

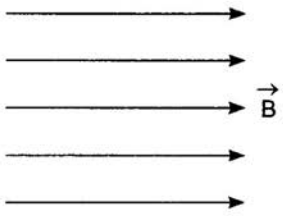
## Long Answer Type Questions [5 Marks]

**49.** **(*a*) Describe an activity to demonstrate the pattern of magnetic field lines around a straight conductor carrying current.**
**(*b*) State the rule to find the direction of magnetic field associated with a current-carrying conductor.**
**(*c*) What is the shape of a current-carrying conductor whose magnetic field pattern resembles that of a bar-magnet?** **[CBSE]**

**Ans.** (*a*) Refer to Ans. 19 (*a*).
(*b*) Refer to Ans. 2 (*a*).
(*c*) Refer to Ans. 19 (*c*).

**50.** **(*a*) Draw a diagram to represent a uniform magnetic field in a given region.**
**(*b*) List two properties of magnetic field lines.** **[CBSE]**

**Ans.** (*a*) Equidistance parallel line indicates a uniform magnetic field in a given region.




(*b*) **Properties of magnetic field lines are:**

(*i*) The magnetic field lines of a magnet form continuous closed loops, i.e. outside the magnet, they emerge from north pole and merge at the south pole and inside the magnet, the direction of field lines is from its south pole to its north pole.

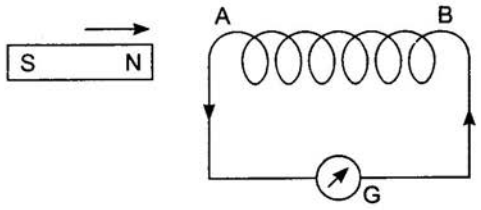
(*ii*) The degree of closeness of field lines indicates the strength of magnetic field.

(*iii*) Field lines never cross each other.

**51.** **(*i*) With the help of an activity, explain the method of inducing electric current in a coil with a moving magnet. State the rule used to find the direction of electric current thus generated in the coil.**
**(*ii*) Two circular coils P and Q are kept close to each other, of which coil P carries a current. What will you observe in Q**
**(*a*) if current in the coil P is changed?**
**(*b*) if both the coils are moved in the same direction with the same speed? Give reason.** **[CBSE]**

**Ans.** (*i*) Take a coil AB of wire having a large number of turns.

Connect the ends of coil to a sensitive galvanometer as shown in figure.




Take a strong bar magnet and move its north pole towards the end 'A' of coil. The deflection in the needle of galvanometer indicates that the induced current flows in the circuit in anticlockwise direction. The end A of the coil behaves as a north pole.

When north pole of the magnet moves away from the coil, the deflection in the galvanometer occurs but in opposite direction.

Similar observations can be made when south pole of the magnet is moved towards the coil or away from it.

When magnet is kept at rest with respect to the coil, the deflection in the needle of galvanometer drops to zero.

Thus, the motion of a magnet, with respect to the coil, produces an induced potential difference which sets up an induced electric current in the circuit.

The direction of electric current thus generated in the coil can be found by using the **Fleming's right-hand rule.**

**Fleming's right-hand rule:** Refer to Ans. 5(*c*).

(*ii*) (*a*) If current in the coil P is changed, the magnetic field lines of forces linked with coil Q also change. So, induced potential difference is set up in the coil Q. This results in induced electric current in coil Q which opposes the change in current in coil P.

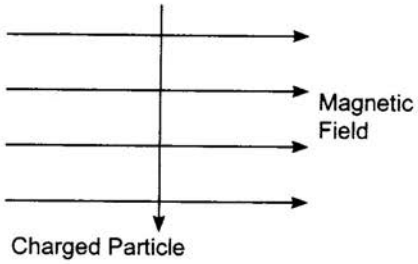
(*b*) If both the coils are moved in the same direction with the same speed, there will be no relative motion between them and hence, there will be no change in magnetic field lines of force associated with the secondary coil. Hence, no current will be induced in the coil.

## 2010

### Very Short Answer Type Question [1 Mark]

**52. A charged particle enters at right angle into a uniform magnetic field as shown. What should be the nature of charge on the particle if it begins to move in a direction pointing vertically out of the page due to its interaction with the magnetic field?**

**[CBSE]**




**Ans.** Using Fleming's left hand rule, the nature of charged particle is positive.

## Short Answer Type [I] Questions [2 Marks]

**53. A coil of insulated wire is connected to a galvanometer. What would be seen if a bar magnet with its north pole towards one face of the coil is**

**(*i*) moved quickly towards it,**

**(*ii*) moved quickly away from the coil and**

**(*iii*) placed near its one face?**

**Name the phenomenon involved.** **[CBSE]**

**Ans.** (*i*) Deflection in the galvanometer needle will be more on right-side.

(*ii*) Larger deflection in opposite direction as compared to the case (*i*) will be seen.

(*iii*) No deflection.

The phenomenon involved is electromagnetic induction.

READERS VENUE

**54. Two coils A and B of insulated wires are kept close to each other. Coil A is connected to a galvanometer while coil B is connected to a battery through a key. What would happen if**

**(*i*) a current is passed through coil B by plugging the key, and**

**(*ii*) the current is stopped by removing the plug from the key?**

**Explain your answer mentioning the name of the phenomenon involved.** **[CBSE]**

**Ans.** In both the given cases, galvanometer shows momentary deflection but in opposite direction. In coil A, magnetic field lines [increased in case (*i*) and decreased in case (*ii*)] induce a potential difference across the coil A which sets up induced electric current in coil A. It is shown by the deflection in galvanometer. This is known as electromagnetic induction.

# 14 SOURCES OF ENERGY

## PREVIOUS YEARS' QUESTIONS

### 2019

#### Very Short Answer Type Questions [1 Mark]

**1. Why is biogas considered an excellent fuel?** **[Delhi]**

**Ans.** Biogas is excellent fuel because it does not create pollution and has high calorific value.

**2. Write the name of the main constituent of biogas. Also its percentage.** **[Delhi]**

**Ans.** Biogas contains methane as a major constituent. Its percentage is 65.

**3. If you could use any source of energy for heating your food which one would you prefer? State one reason for your choice.** **[Delhi]**

**Ans.** LPG because it does not leave any residue on burning.

READERS VENUE

#### Short Answer Type [I] Questions [3 Marks]

**4. What are solar cells? Explain the structure of solar panel. List two principal advantages associated with solar cells.** **[AI Allahabad]**

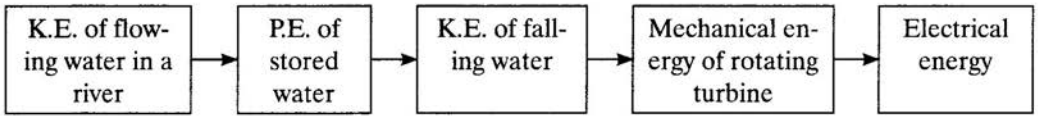
**Ans.**
- **Solar cell** is a device which converts solar energy directly into the electrical energy.
- **Solar cell panel:** A large number of solar cells connected together in a particular arrangement is called solar cell panel.
- **Advantages associated with solar cell:**
  - (*i*) It has no moving parts and eco-friendly too.
  - (*ii*) It requires little maintenance, compare to the maintenance cost of other renewable energy system.
  - (*iii*) It can be set up in remote, inaccessible or very sparsely inhabited areas where the laying of usual power transmission lines is difficult and expensive.
  - (*iv*) Easy to install on rooftops or on the ground without any interference in residential lifestyle. (*any two*)

## 2018

### Very Short Answer Type Questions [1 Mark]

**5. Write the energy conversion that takes place in a hydropower plant.** [CBSE]

**Ans.** The energy transformation taking place at hydropower plants is shown below:




## 2018 (Compartment)

### Very Short Answer Type Questions [1 Mark]

**6. Name two constituents of biogas.** [CBSE]

**Ans.** Methane – $CH_4$

Hydrogen – $H_2$

Carbon dioxide – $CO_2$

Hydrogen sulphide – $H_2S$ (*any two*)

READERS VENUE

## 2016

### Very Short Answer Type Questions [1 Mark]

**7. Mention any two renewable sources of energy.** [CBSE]

**Ans.** (*i*) Energy due to flow of water – due to continuous water cycle in nature.

(*ii*) Wind energy – repetitive currents of wind are more or less available at all the places.

### Short Answer Type [II] Question [3 Marks]

**8. List any three parameters on the basis of which a source of energy can be categorised as a good source of energy?** [CBSE]

**Ans.** A source of energy can be called a good source of energy if:

(*a*) it provides the large amount of work per unit volume or mass.

(*b*) it can be easily accessible and easily transportable.

(*c*) it should be economic and has high calorific value.

(*d*) it has moderate ignition temperature. (*any three*)

**9. Define nuclear fission. Write the steps involved in generating electricity in a nuclear reactor.** **[CBSE]**

**Ans.** **Nuclear Fission.** The process in which a heavy nucleus (such as uranium, plutonium or thorium) is broken into two nearly equal fragments when bombarded with low-energy neutrons and a tremendous amount of energy is released. This process is called nuclear fission.

**Steps involved in generating electricity:**

(*i*) Fuel rods full of uranium pellets are placed in a nuclear reactor chamber.
(*ii*) Low-energy neutrons are bombarded on uranium fuel rod.
(*iii*) A self-sustaining fission chain reaction starts that releases energy at a controlled rate
(*iv*) With this heat the reactor converts water to steam at a high temperature and pressure
(*v*) This high temperature and pressure steam spins generator turbines producing electricity.
(*vi*) The steam cools back into water, which can then be used over again.

## 2015

### Very Short Answer Type Questions [1 Mark]

**10. Name any two fossil fuels.** **[CBSE]**

**Ans.** (*i*) Coal
(*ii*) Petroleum

READERS VENUE

**11. Mention the purpose of blackening the interior of a solar cooker.** **[CBSE]**

**Ans.** The purpose of blackening the interior of a solar cooker is that the black surface absorbs more heat radiations of incident solar energy (about 98%) as compared to white or other light coloured surface.

### Short Answer Type [II] Question [3 Marks]

**12. Why do people oppose the construction of Tehri Dam on the river Ganga and Sardar sarover project on the river Narmada.** **[CBSE]**

**or**

**Mention three disadvantage of producing hydroelectricity by constructing the dams.**

**or**

**List any three ways in which construction of dams for production of electricity adversely affects the environment of that place.**

**Ans.** (*i*) Large area is required to build the dam that result rehabilitation of displaced people.
(*ii*) Large eco-systems are destroyed when submerged under the water in dams.
(*iii*) The vegetation which is submerged rots under anaerobic conditions and gives rise to large amounts of methane gas which leads to a green-house effect.

**13. Reena's father works with a company that builds dams. Once he took her to the site where a dam was being built. Reena saw a group of people sitting there and shouting slogans against the building of dam. She talked the group of people and asked them about their problems and then discussed it with her father. She then tried to convince the people to talk with the authorities and come to an amicable solution. The discussion was successful. Reena's father was very proud of his daughter. Now answer the following questions:**

**(*i*) Why was Reena's father proud of his daughter?**

**(*ii*) Why was the group of people protesting against the building of dam?**

**(*iii*) Reena's contribution to the peaceful resolution of the conflict proved to boon for many citizens of the country. How? [CBSE]**

**Ans.** (*i*) Because she convinced the people by explaining them the advantage of constructing dam and come with a solution of rehabilitation of displaced peoples. So, the contribution to the peaceful resolution of the conflict makes Reena's father proud of his daughter.

(*ii*) The group of people were protesting against the building of dam because of following disadvantages:

(*a*) A large area of agricultural land and human habitation are sacrificed as it gets submerged at the dam site.

(*b*) Large ecosystems are destroyed when submerged under water.

(*c*) The decomposition of vegetation under anaerobic condition produces methane gas which is also a greenhouse gas.

(*iii*) (*a*) The citizens are not affected by flood as it can be controlled by storing the water behind the dam.

(*b*) Farmers get benefited as water for irrigation is available for the whole year.

(*c*) Low cost of production of electricity gives monetary gain which is a boon to citizens.

**14. Biogasis an excellent fuel. Justify the statement by giving two reasons. Mention the main constituents of bio gas along with its percentage. [CBSE]**

**Ans.** (*i*) It burns without smoke and leave no residue, therefore, causes no atmospheric pollution.

(*ii*) Its heating capacity is high, i.e. it has high calorific value.

**Main constituents of bio gas:** The composition of bio gas varies depending upon the nature of organic matter feeding in the digester and advanced waste treatment technology. The typical composition of bio gas is

| | |
|---|---|
| Methane | 50 – 75% |
| Carbon dioxide | 25 – 50% |
| Nitrogen | 0 – 10% |
| Hydrogen | 0 – 1% |
| Hydrogen sulphide | 0 – 3% |

**15. (*a*) Define tidal energy.**
**(*b*) Explain how the tidal energy is harnessed and write one limitation of the use of tidal energy.** **[CBSE]**

**Ans.** (*a*) **Tidal energy:** The energy produced by the surge of ocean water during high and low tides due to difference in sea-levels is called tidal energy. The high and low tides occur due to the gravitational pull of the moon. This causes enormous movement of water.

(*b*) Tidal energy is harnessed by constructing a dam near the shores. During the high tides water flows into the dam and during the low tides, water flows out. This flowing water rotates the turbine, present at the opening of the dam and produces electricity.

**16. Define process of nuclear fission. Write the steps involved in generating electricity in a nuclear reactor.** **[CBSE]**

**Ans.** Refer to Ans. 9.

## Long Answer Type Question [5 Marks]

**17. Solar cooker takes more time as compared to the LPG to boil potato or rice, yet Kunal uses solar cooker for such type of cooking:**
**(*i*) Why does Kunal uses Solar cooker instead of LPG? Give reasons for your answer.**
**(*ii*) Name the phenomenon which is responsible for obtaining high temperature in solar cooker.** **[CBSE]**

**Ans.** (*a*) (*i*) There are no energy losses while cooking on the solar cooker as the food gets cooked in a controlled environment whereas cooking on the LPG leads to maximum percentage of energy loss.

(*ii*) Temperature controlled cooking retains the nutrient value of the food.

(*iii*) Using the solar cooker, LPG can be saved which result reduction in the emission of $CO_2$.

(*iv*) It saves a lot of prestigious time which is normally consumed for cooking purpose.

(*b*) Greenhouse effect.

**18. Manoj's father works in a nuclear power reactor. He asked his father to take him for a visit to nuclear power reactor. But his father was not keen to take him there. Now answer the following questions:**
**(*i*) What could be the possible reason of Manoj's father not taking him to the nuclear power reactor?**
**(*ii*) Write one advantages and one disadvantage of setting up a nuclear power reactor.** **[CBSE]**

**Ans.** (*a*) (*i*) Safety concerns.

(*ii*) Health concerns.

(*b*) Advantage: From a small amount of nuclear fuel, a large amount of energy is released in a nuclear power reactor.

Disadvantage: There is risk of harmful radiation leakage from nuclear waste.

## 2014

### Very Short Answer Type Questions [1 Mark]

**19. Name the part of a biogas plant where reactions take place in the absence of oxygen.** **[CBSE]**

**Ans.** Digester chamber.

**20. Name the kind of energy possessed by wind and the device used to harness it.** **[CBSE]**

**Ans.** Kinetic energy, wind mill.

**21. List two non-conventional sources of energy.** **[CBSE]**

**Ans.** Geothermal, solar, biomass, water, wind are the non-conventional sources of energy. (*any two*)

**22. A black surface absorbs more heat radiations as compared to a white or a reflecting surface under identical conditions. List two solar devices which make use of this property in their design.** **[CBSE]**

**Ans.** Solar cooker, solar water heater.

**23. Name any two elements that are used in fabricating solar cells.** **[CBSE]**

**Ans.** Germanium, Silicon.

READERS VENUE

**24. Why a solar cooker painted black form outside?** **[CBSE]**

**Ans.** Black surface absorbs more heat as compared to white or reflecting surface under identical conditions.

### Short Answer Type [I] Question [2 Marks]

**25. Define fuel. List any two characteristics that you would look for in a good fuel.** **[CBSE]**

**Ans.** A substance that produces useful energy when it burns or undergoes a chemical or nuclear reaction. The fuel such as coal, wood, oil, or gas provides energy when burned.

(*i*) A good fuel is the one which produces a huge amount of heat on burning.

(*ii*) It does not produce a lot of smoke and is easily available.

### Short Answer Type [II] Question [3 Marks]

**26. State any three reasons to justify that LPG is considered as an ideal fuel.** **[CBSE]**

**Ans.** LPG is considered as an ideal fuel because

(*i*) It is easy to store, handle and transport.

(*ii*) It produces large amount of heat on burning.

(*iii*) It does not leave any residue on burning.

**27. Sate any three advantages of charcoal over wood.** [CBSE]

**Ans.** Advantages of charcoal over wood

(*i*) It has higher calorific value, i.e. higher heat generating efficiency.

(*ii*) Charcoal does not produce smoke on burning so it is a clean fuel.

(*iii*) It is easier to transport and ready to use in a convenient dry and broken-up form.

## 2013

### Very Short Answer Type Questions [1 Mark]

**28. What is acid rain?** [CBSE]

**Ans.** **Acid rain:** The rain contains the acidic oxides such as oxides of carbon, nitrogen and sulphur.

**29. Write the name of the substance whose vapours are used to run the turbine of the generator of ocean thermal energy plant.** [CBSE]

**Ans.** Ammonia.

**30. Mention the minimum temperature difference required between surface water and water at a depth of upto 2 km in an ocean thermal energy plant.** [CBSE]

**Ans.** 20 °C or 293 K in trapping geothermal energy

### Short Answer Type [II] Questions [3 Marks]

**31. Distinguish between renewable and non-renewable sources of energy. Also give an example of each of these sources.** [CBSE]

**Ans.**

| Renewable Source of Energy | Non-renewable Source of Energy |
|---|---|
| (*i*) They are constantly supplied by nature and are inexhaustible. | (*i*) They do not renew or regenerate and are exhaustible. |
| (*ii*) Low cost of operation. | (*ii*) High cost of operation. |
| (*iii*) They produce little or no pollutants. Thus minimum impact on environment. e.g. wind energy, solar energy. | (*iii*) They produce a lot of pollutants, e.g. coal, petroleum etc. |

**32. State the principle of working of ocean thermal energy conversion plant. Explain how the plant works? Write one essential condition for it to operate properly.** [CBSE]

**Ans.** **Principle of working of OTEC:** The water at the surface of the ocean is warmer than the water at deeper depths. This temperature difference can be used by Ocean Thermal Energy Conversion (OTEC) systems to generate electricity.

**Working of OTEC:**

- In OTEC plant, the energy of warm surface water is used to convert low boiling point liquid ammonia into gaseous state.

- The vapour of ammonia at high pressure is used to spin the turbines of generators converting the Ocean thermal energy to electricity.
- The used vapour passes through the condenser where cold water, pumped from the deeper parts of ocean condenses ammonia vapour back into a liquid.
- This process is repeated again and again to get continuous production of electricity.

**Essential condition for it to operate properly:** The temperature difference between the warmer water at the surface and colder water at depths up to 2 km should be 293 K (20°C) or more.

## 2012

### Very Short Answer Type Questions [1 Mark]

**33. Name one fuel used in nuclear reactor.** **[CBSE]**

**Ans.** Uranium-235.

**34. Name any two elements that are used in fabricating solar cells.** **[CBSE]**

**Ans.** Germanium, Silicon.

**35. Name the reaction responsible for large energy production in the sun.** **[CBSE]**

**Ans.** Nuclear fusion.

### Short Answer Type [II] Questions [3 Marks]

**36. Mention why is it not possible to make use of solar cells to meet all our energy needs? State three reasons to support your answer. Also mention three uses of solar cells.** **[CBSE]**

**Ans.** It is not possible to make use of solar cells to meet all our energy needs because:

(*i*) of limited availability of special grade semiconducting materials such as silicon and germanium.

(*ii*) solar cells have lower efficiency as they depend entirely on intensity of solar radiation.

(*iii*) the process of manufacturing of solar cells is very expensive, silver used for interconnection of cells in the panel further adds to the cost.

**Uses of solar cells:**

(*i*) They provide electric power to satellites and space probes.

(*ii*) They provide electric power to off-shore drilling platforms and light houses.

(*iii*) TV relay stations or wireless transmission systems located in remote areas use solar panels to get electric power.

**37. Out of two elements A and B with mass number 2 and 235 respectively, which one is suitable for making**

**(*a*) a nuclear reactor,**

**(*b*) a hydrogen bomb?**

**Name the nuclear reaction involved in each case. Write one difference between the two types of nuclear reactions.** **[CBSE]**

**Ans.** (*a*) **For a nuclear reactor—** element 'B' with mass number 235 is suitable as a fuel in a nuclear reactor.

(*b*) **For a hydrogen bomb—** element 'A' with mass number 2 is suitable for making the hydrogen bomb.

The nuclear reaction involved in

(*a*) nuclear reactor is nuclear fission reaction and

(*b*) nuclear bomb is nuclear fusion reaction.

**Difference between fission and fusion:**

Fusion reaction releases much greater energy with non-radioactive products than the energy released in fission reaction with radioactive products.

## 2011

### Very Short Answer Type Questions [1 Mark]

**38. List two nutrients that the slurry left behind in the biogas plant contain.** [CBSE]

**Ans.** Nitrogen and phosphorous.

**39. Biogas is also known as gobar gas. Justify.** [CBSE]

**Ans.** Starting material for biogas is mainly cow dung. So, it is also known as gobar gas.

**40. List two practical uses of biogas in rural areas.** [CBSE]

**Ans.** Practical uses of biogas in rural area are:

(*i*) It is an excellent fuel which burns without smoke with high heating capacity.

(*ii*) It is also used for lighting.

READERS VENUE

### Short Answer Type [I] Questions [2 Marks]

**41. Biogas is considered to be a boon to the farmers. Give reasons.** [CBSE]

**Ans.** (*i*) It is the source of excellent manure, rich in nitrogen and phosphorous which can be obtained from the biogas plant in addition to biogas.

(*ii*) It provides the safe, efficient and profitable disposal method for bio-waste and sewage material.

**42. What are the advantages of nuclear energy?** [CBSE]

**Ans.** Advantages of nuclear energy are:

(*i*) A small quantity of nuclear fuel is needed to produce a large amount of useful energy.

(*ii*) Nuclear power plant produces less atmospheric pollution than thermal power plants, if the nuclear fission reaction is performed properly.

(*iii*) Small amount of nuclear fuel can run a nuclear power plant over a long period of time. There is no need of inserting the nuclear fuel in the nuclear reactor again and again in a short period as in case of thermal power plant.

**43. What is a solar cell panel? Mention any three of its applications.** [CBSE]

**Ans.** A large number of solar cells combined in an arrangement to obtain large electrical power is called solar cell panel.

Applications of solar cell panel are:

It provides the electric power for the:

(*i*) working of artificial satellites stationed in outer space,

(*ii*) running of irrigation water pumps by the farmers in rural areas,

(*iii*) street lighting in remote areas.

**44. Out of two solar cookers, one was covered with a plane glass slab and the other was left open. Which of the two solar cookers will be more efficient and why?** [CBSE]

**Ans.** The solar cooker which was covered with a plane glass slab would be more efficient. The glass lid allows the heat radiation from sun to enter the solar cooker but does not allow the reflected heat radiation to escape or go outside the box. Thus, heat trapped inside the box increases the temperature. Glass lid also reduces heat loss due to reflection.

## Short Answer Type [II] Questions [3 Marks]

**45. List any three hazards of nuclear waste. How does the disposal of nuclear waste pose a problem for the plant and animal life?** [CBSE]

**Ans.** Hazards of nuclear wastes are:

READERS VENUE

(*i*) Nuclear waste contains radioactive substances which emit harmful nuclear radiations.

(*ii*) There is a high risk of environmental contamination.

(*iii*) It is highly toxic.

Effect of nuclear waste on plant and animal life is:

The radiations emitted from the nuclear waste penetrate deep inside the human or animal body where they can damage biological cells thereby initiate cancer or causes genetic disease.

Increased mortality of plants, soil invertebrates and mammals and reproductive losses in plants and animals have also been observed.

**46. (*a*) Charcoal is a better fuel than wood. Why?**

**(*b*) How does biogas plant help to reduce the problem of pollution?** [CBSE]

**Ans.** (*a*) Charcoal is considered to be a better fuel than wood because:

(*i*) It burns without flames.

(*ii*) It is comparatively smokeless.

(*iii*) It has higher calorific value, i.e. higher heat generating efficiency than wood.

(*b*) Biogas plant helps to reduce the problem of pollution in the following ways.

(*i*) It provides better sanitation due to safe disposal of bio-waste and sewage material.

(*ii*) Biogas obtained from this plant produces less smoke on burning.

(*iii*) The residue left can be used as a manure which can be used as an alternative of fertilizers. Thus, it prevents soil and water from degradation.

**47. (*a*) What is geothermal energy?**

**(*b*) What are the advantages of wind energy?** **[CBSE]**

**Ans.** (*a*) The heat energy obtained from the molten rocks formed in the deeper hot regions inside the earth are called geothermal energy.

(*b*) Advantages of wind energy are:

(*i*) It is an inexhaustible source of energy.

(*ii*) It does not cause any environmental pollution.

(*iii*) It is available at free of cost.

**48. (*a*) How does construction of dams across the river get linked with production of greenhouse gases?**

**(*b*) How do technological inputs improve the efficiency of biomass fuels?** **[CBSE]**

**Ans.** (*a*) A vast variety of plants get submerged in water, rot under anaerobic conditions and produce large amount of greenhouse gases such as methane.

(*b*) Traditional uses of biomass fuels are not only efficient but they also produce a lot of pollutants which are hazardous to health. Therefore, technological inputs are necessary to improve the efficiency of these fuels and make them environment friendly. With the help of technology, smokeless chulhas and biogas plants have been designed.

## 2010

### Short Answer Type [I] Questions [2 Marks]

**49. Mention any four limitations in harnessing wind energy on a large scale.** **[CBSE]**

**Ans.** Limitations in harnessing wind energy are:

(*i*) Speed of wind is not available at all time and at all places.

(*ii*) To establish the wind energy farm, a large area of land is needed.

(*iii*) Speed of wind should be higher than 15 km/h to harness the wind energy.

(*iv*) Construction of windmill and its installation is very expensive.

**50. What happens when wood is burnt in a limited supply of oxygen? Name the residue left behind after the reaction and state two advantages of using this residue as a fuel over wood.** **[CBSE]**

**Ans.** When wood is burnt in a limited supply of oxygen, volatile materials present in it get removed and cooled to get wood tar and wood gas.

The black residue left behind after the reaction is known as charcoal.

Advantages of using charcoal as a fuel over wood are:

(*i*) Burning of charcoal does not produce smoke. On the other hand, wood produces a lot of smoke on burning.

(*ii*) For a given quantity, charcoal produces more heat than wood.

**51. Name four gases commonly present in biogas. State two advantages of using this gas over fossil fuels.** **[CBSE]**

**Ans.** Methane, carbon dioxide, hydrogen and hydrogen sulphide.

Advantages of using biogas over fossil fuels are:

(*i*) Biogas burns without smoke, leaves no residue unlike coal.

(*ii*) Biogas is cheaper as compared to fossil fuels.

**52. How are the wastes produced in nuclear power plants different from those produced in a thermal power plants? What happens to the waste of a nuclear power plant?** **[CBSE]**

**Ans.** The waste obtained from nuclear power plants is highly radioactive in nature which emits harmful radiations, whereas waste produced in a thermal power plant is non-radioactive.

READERS VENUE

Management of nuclear waste is given as follows:

(*i*) Some products of nuclear waste are buried in sealed steel/lead containers for a long term storage, buried under the ground or dumped in vacated coal mines.

(*ii*) Other waste products transform into less harmful products or to products with a shorter half life.

# 15 OUR ENVIRONMENT

## PREVIOUS YEARS' QUESTIONS

### 2019

**Short Answer Type [II] Questions [3 Marks]**

1. **How can we help in reducing the problem of waste disposal? Suggest any three methods.** **[Delhi]**

**Ans.** Three method used in reducing the problem of waste disposal are as follows:

(*i*) By segregating biodegradable substances from non-biodegradable substances.

(*ii*) By reducing, reusing and recycling non-biodegradable substances.

(*iii*) By composting organic waste. The nutrient rich compost can be used as plant manure.

2. **Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem.** **[Delhi]**

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An ecosystem is the structural and functional unit of biosphere, comprising of all the interacting organisms in an area together with the non-living constituents of the environment. Ecosystems are of two types, Natural Ecosystem and Artificial Ecosystem.

Example of natural ecosystem:

Forest, desert, Pond

Example of artificial ecosystem:

Crop field, garden, aquarium.

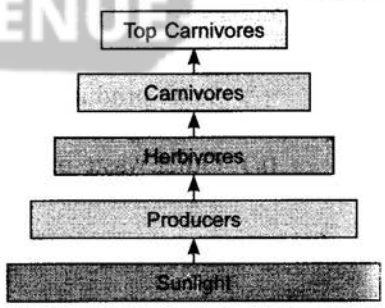


**Diagram showing flow of energy in an ecosystem**

3. **Write the essential function performed by ozone at the higher levels of the Earth's atmosphere? How is it produced? Name the synthetic chemicals mainly responsible for the drop of amount of ozone in the atmosphere. How can the use of those chemicals be reduced?** **[AI Allahabad]**

**Ans.** Ozone layer in earth's atmosphere prevents the high energy ultra violet radiations from passing through it and reaching earth. Ozone layer thus protects organisms from skin cancer , eye damage and immune deficiency.

Ozone at higher level of atmosphere is a product of UV radiations acting on Oxygen molecules. The high energy UV radiations split apart molecular oxygen into free oxygen atoms. These atoms then combine with molecular oxygen to form ozone.

UV radiations:

$$O_2 \longrightarrow O + O$$

$$O + O_2 \longrightarrow O_3$$

Synthetic chemical mainly responsible for drop of amount of ozone in the atmosphere is Chloroflurocarbon (CFC).

Use of these chemicals can be reduced by the following methods:

(*a*) Enforcing regulations to reduce use of CFC.

(*b*) Using alternatives of CFCs.

## 2017

### Very Short Answer Type Questions [1 Mark]

**4. What is an ecosystem?** **[Delhi]**

**Ans.** An ecosystem is a unit consisting of all the interacting organisms in an area and the non-living constituents of the environment with which the living organisms interact.

**5. Why forest considered a natural ecosystem?** **[Delhi]**

**Ans.** A forest is a natural ecosystem because a large number of organisms of different species interacting among themselves and with the non-living constituents of the environment and they are not under the control of humans.

**6. Why is lake considered to be a natural ecosystem?** **[Delhi]**

**Ans.** A lake is considered to be a natural ecosystem because there are a large number of organisms of different species interacting among themselves and with the non-living constituents of the environment and they are not under the control of humans.

**7. In the following food chain, 100 J of energy is available to the lion. How much energy was available to the producer?** **[All India]**

**Plants ⟶ Deer ⟶ Lion**

**Ans.** 1,000,000 J of energy was available to the producer.

**8. In the following food chain, plants provide 500 J of energy to rats. How much energy will be available to hawks from snakes?** **[All India]**

**Plants ⟶ Rats ⟶ Snakes ⟶ Hawks**

**Ans.** 0.5 J of energy.

**9. In the following food chain, 20,000 J of energy was available to the plants. How much energy would be available to man in this chain?** **[All India]**

**Plants ⟶ Sheep ⟶ Man**

**Ans.** 2 J of energy.

**10. Name any two man-made ecosystems.** **[Foreign]**

**Ans.** Agricultural/crop fields, aquarium, gardens. (*any two*)

**11. List any two natural ecosystems.** **[Foreign]**

**Ans.** Forest, grassland, lake. (*any two*)

**12. List any two abiotic components of an ecosystem.** **[Foreign]**

**Ans.** Temperature, Rainfall, Nature of soil, wind (*any two*)

## Short Answer Type [I] Questions [2 Marks]

**13. Mention three harmful effects of using polythene bags on the environment. Suggest an effective alternative to these bags.** **[Foreign]**

**Ans.** Harmful effects:

(*a*) They are non-biodegradable and persist in the environment for long periods.

(*b*) Burning them produces poisonous gases that pollute the air.

(*c*) When ingested by the animals, it cannot be digested and the animals suffer from indigestion and some may die.

**Alternatives:** Jute bags/cloth bags.

**14. "Burning fossil fuels is a cause of global warming." Give reason in support of this statement.** **[Foreign]**

**Ans.** Burning of fossil fuels produces greenhouse gases like carbon dioxide and carbon monoxide. They trap infrared rays reflected by earth and leads to excessive heating of the earth. This harmful for all the living beings on earth.

**15. List the products of combustion of fossil fuels. State the harmful effect of these products on the environment.** **[Foreign]**

**Ans.** The products of combustion of fossil fuels are carbon dioxide, water, sulphur dioxide and nitrogen oxides.

(*a*) Carbon dioxide is a greenhouse gas which traps sun's infrared rays and increase earth's temperature which leads to global warming.

(*b*) Oxides of nitrogen and sulphur cause respiratory problems as well as acid rain.

**16. Suggest any two ways by which the balance between the environment and industrial development is maintained so as to help undisturbed survival of the organisms on the Earth.** **[Foreign]**

**Ans.** (*a*) Change of perception of the socio-economic and environmental conditions around.

(*b*) Readiness of each individual to alter their present use of natural resources to a minimum.

## Short Answer Type [II] Questions [3 Marks]

**17. You have been selected to talk on "ozone layer and its protection" in the school assembly on 'Environment Day.'** **[Delhi]**

**(*a*) Why should ozone layer be protected to save the environment?**

**(*b*) List any two ways that you would stress in your talk to bring in awareness amongst your fellow friends that would also help in protection of ozone layer as well as the environment.**

**Ans.** (*a*) Ozone layer at the higher levels of the atmosphere, acts as a shield to protect earth from the harmful effects of the ultraviolet (UV) radiations; hence, it should be protected.

(*i*) There should be judicious use of these chemicals; the united nations environment programme (UNEP) has succeeded in forging an agreement to freeze CFC production.

(*ii*) Conducting poster making competition or street plays presenting the importance of ozone layer on earth.

**18. Your mother always through that fruit juices are very healthy for everyone. One day she read in the newspaper that some brands of fruit juices in the market have been found to contain certain level of pesticides in them. She got worried as pesticides are injurious to our health.** **[Foreign]**

**(*a*) How would you explain to your mother about fruit juices getting contaminated with pesticides?**

**(*b*) It is said that when these harmful pesticides enter our body as well as in the bodies of other organisms they get accumulated and beyond a limit cause harm and damage to our organs. Name the phenomenon and write about it.**

**Ans.** (*a*)
- Pesticides are the chemicals used to protect our crops from diseases and pests.
- These chemicals are washed down either into the soil or into water bodies.
- From the soil, they are absorbed by the terrestial plants along with water and minerals.
- From the water bodies, they are absorbed by the aquatic plants.
- When the fruits of these plants are used to prepare fruit juices, they are contaminated with the pesticides.

(*b*)
- The phenomenon is called biomagnification. It is the phenomenon in which certain harmful chemicals enter the food chain and get accumulated and increase in concentration at successive trophic levels.
- It is because they are not degradable.
- The maximum concentration of these chemicals is found in the top level consumers.

## 2017 (Compartment)

### Very Short Answer Type Questions [1 Mark]

**19. Name two natural ecosystems.** **[Delhi]**

**Ans.** An aquarium and crop fields.

**20. Why should biodegradable and non-bidegradable wastes be discarded in two different dustbins?** **[All India]**

**Ans.** – The biodegradable wastes can be buried in a bit and they will be converted into manure for plants by biological processes.
– The non-biodegradable wastes can be reused or recycled, because they are not broken down by biological processes.

### Short Answer Type [I] Questions [2 Marks]

**21. What is ozone? Name the chemicals that damage the ozone layer.** **[Delhi]**

**Ans.** – Ozone is a molecule formed by three atoms of oxygen.
– Chlorofluorocarbons are the chemicals that damage the ozone layer.

**22. What are decomposers? State the role of decomposers in the environment.** **[All India]**

**Ans.** Decomposers are those microorganisms, which break down the complex organic materials into simple inorganic substances that can be used by the plants as nutrients.

**Role of decomposers:**
– They break down the dead remains and waste products of organisms, which otherwise would be accumulating in our environment.
– They help in the replenishment of nutrients in the soil, that can be absorbed by the plants.

## 2016

### Very Short Answer Type Questions [1 Mark]

READERS VENUE

**23. List two natural ecosystems.** **[Delhi]**

**Ans.** Natural ecosystems are lake and pond.

**24. List two biotic components of a biosphere.** **[Delhi]**

**Ans.** Plants (producers), animals (consumers) and micro-organisms (decomposers). (*any two*)

**25. Why are green plants called producers?** **[Delhi]**

**Ans.** The green plants are called producers because they can prepare food by photosynthesis by trapping the heat from the sun by chlorophyll, and with the help of water and carbon dioxide converting it into food.

**26. The depletion of ozone layer is a cause of concern. Why?** **[All India]**

**Ans.** The layer of ozone gas is what which protects us from the harmful ultraviolet radiations of the sun. The ozone layer absorbs these harmful radiations and thus prevents these rays from entering the earth's atmosphere. Exposure to these ultraviolet rays can cause skin cancer, eye damage, damage to immune system. It can also lead to difficulty in breathing, chest pain, throat irritation, etc.

**27. Write one negative effect, on the environment, of affluent life style of few persons of a society.** **[All India]**

**Ans.** One negative effect of our affluent life style on the environment is Global Warming.

**28. In a food chain of frog, grass, insect and snake, assign trophic level to frog.** **[All India]**

**Ans.** Secondary consumer.

**29. We often use the word environment. What does it mean?** **[Foreign]**

**Ans.** All of the physical, chemical, and biological conditions that together act on an organism or an ecological community and influence its growth and development. Soil, air, water, climate, plant and animal life, noise level, and pollution are all components of an environment.

**30. Why do producers always occupy the first trophic level on every food chain?** **[Foreign]**

**Ans.** Producers are the plants which make their own food from the inorganic substances in the presence of sunlight. The plants are the source of energy for all herbivorous animals. Thus, they occupy the first trophic level.

**31. Why is excessive use of CFCs a cause of concern?** **[Foreign]**

**Ans.** CFCs are a cause of concern because they are the prime reason for the depletion of the ozone layer in the atmosphere.

## Short Answer Type [I] Questions [2 Marks]

**32. "Burning of fossil fuels results in global warming." Give reasons to justify this statement.** **[All India]**

**Ans.** Refer to Ans. 14.

**33. "Industrialisation has adversely deteriorated the environment." Give four reasons in support of this statement.** **[Foreign]**

**Ans.** The four reasons that has caused environment to deteriorate are:

(*i*) Loss of biodiversities due to deforestation, buildings construction etc.

(*ii*) Global warming and Acid rain is caused due to the release of harmful chemicals like CFC in the atmosphere.

(*iii*) Air, water, noise and soil pollution.

(*iv*) Nuclear power plants generating nuclear radiation that causes the adjoining environment (plants, animals and human) to be affected by its radiation.

READERS VENUE

## Short Answer Type [II] Questions [3 Marks]

**34. Give reason to justify the following:**

**(*a*) The existence of decomposers is essential in a biosphere.**

**(*b*) Flow of energy in a food chain is unidirectional.** **[Delhi]**

**Ans.** (*a*) Organic matter is recycled in an ecosystem by **decomposers. Decomposers** are organisms such as bacteria and fungi that break down the organic matter in the dead bodies of plants and animals. As the **decomposers** feed from the dead animals, they break down the organic compounds into simple nutrients.

(*b*) The flow of energy in the ecosystem is unidirectional. The energy enters the plants (from the sun) through photosynthesis during the making of food. This energy is then passed on from one organism to another in a food chain.

Energy given out by the organisms as heat is lost to the environment, it does not return to be used by the plants again. This makes the flow of energy in ecosystem 'unidirectional'.

During the transfer of energy through successive trophic levels in an ecosystem, there is a loss of energy all along the path. No transfer of energy is 100 per cent. The energy available at each successive trophic level is 10 per cent of the previous level. Thus, there is a progressive decline (gradual reduction) in the amount of energy available as we go from producer level to the higher trophic levels of organisms.

## 2015

### Very Short Answer Type Questions [1 Mark]

**35. Why should biodegradable and non-biodegradable wastes be discarded in two separate dustbins?** **[Delhi]**

**Ans.** So that the time and energy required in segregation may be saved and waste may be disposed off quickly.

**36. The first trophic level in a food chain is always a green plant. Why?** **[All India]**

**Ans.** Green plants act as producers and prepare food for all the life forms of the ecosystem. They convert the energy obtained from the Sun into a usable form of energy for the next trophic level. Therefore, the first trophic level in a food chain is always a green plant.

**37. Which of the following are always at the second trophic level of food chains? Carnivores, Autotrophs, Herbivores** **[All India]**

**Ans.** Herbivores – the Primary consumers of green plants are always at the second trophic level.

READERS VENUE

**38. What will be the amount of energy available to the organisms of the 2nd trophic level of food chain, if the energy available at the first trophic level is 10,000 joules?**

**Ans.** 100 joules.

**39. The following organisms form a food chain. Which of these will have the highest concentration of non-biodegradable chemicals? Name the phenomenon associated with it. Insects, Hawk, Grass, Snake, Frog.** **[Foreign]**

**Ans.** Hawk ; Biomagnification

**40. List two examples of natural ecosystem.** **[Foreign]**

**Ans.** Lakes, ponds, forests.

**41. Write the full name of the group of compounds mainly responsible for the depletion of ozone.** **[Foreign]**

**Ans.** CFCs → Chlorofluoro carbons.

### Short Answer Type [I] Questions [2 Marks]

**42. We often observe domestic waste decomposing in the by lanes of our homes. List four ways to make the residents aware that the improper disposal of wastes is harmful to the environment and also for their own health.** **[All India]**

**Ans.** Improper disposal of wastes is harmful to the environment and for our own health in the following ways:

(*a*) Accumulated wastes serve as breeding grounds for mosquitoes. This creates favourable conditions for the spread of several diseases.

(*b*) Decomposition of wastes emits harmful gases in the environment which results in unhygienic living conditions and loss of aesthetic beauty of a place.

(*c*) Some of the waste gets discharged to nearby water bodies along with rainwater and proves fatal for aquatic flora and fauna.

(*d*) It reduces the fertility of the soil and results in soil pollution.

**43. List two problems that may arise by planting trees of single variety over vast tracts of a forest.** **[Foreign]**

**Ans.** (1) Loss of biodiversity.

(2) Varied needs of the local people can no longer be met.

(3) Degradation of soil.

## Short Answer Type [II] Questions [3 Marks]

**44. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.** **[All India]**

**Ans.** Biodegradable substances can be broken down into simpler substances by nature - decomposers, bacteria, saprophytes. e.g. Human Excreta/ Vegetable peels, etc.

Non-biodegradable substances can't be broken down into simpler substances by nature - decomposers. e.g. Plastic, glass.

**Habits:**

– Use of separate dustbins for biodegradable and non-biodegradable waste,

– Reuse of things such as poly-bags, etc. or cotton/jute bags can be used.

READERS VENUE

**45. What is an ecosystem? List its two main components. We do not clean natural ponds or lakes but an aquarium needs to be cleaned regularly. Why is it so? Explain.** **[All India]**

**Ans.** Refer to Ans. 4.

(*a*) Biotic or living components

(*b*) Abiotic or non-living components

An aquarium represents an artificial ecosystem which contains fish as the biotic component. In natural ecosystems, along with fish, several other organisms are present in sufficient numbers to maintain a balance in the ecosystem. In an aquarium, the leftover fish feed or fish waste gets converted into ammonia. The nitrifying and denitrifying bacteria present in the aquarium convert toxic ammonia into non-toxic nitrates and make nitrogen available to fish. Therefore, if the water of the aquarium is not changed regularly, then wastes would go on accumulating to a fatal level, which can result in the death of fish.

**46. What is ozone? How and where is it formed in the atmosphere? Explain how does it affect ecosystem.** **[Foreign]**

**Ans.** Ozone ($O_3$) is a molecule formed by three atoms of oxygen. Ozone is formed at the higher levels of the atmosphere by action of UV radiation on oxygen ($O_2$) molecule. The higher energy UV radiations split apart some molecules of oxygen ($O_2$ ) into free oxygen (O) atoms. These atoms then combine with the molecular oxygen to form ozone as shown:

$$O_2 \xrightarrow{UV} O + O \qquad \text{then,} \qquad O + O_2 \longrightarrow O_3 \text{ (Ozone)}$$

Ozone shields the surface of the earth from ultraviolet (UV) radiation from the Sun. This radiation is highly damaging to organisms, for example, it is known to cause skin cancer in human beings.

**47. "Energy flow in food chains is always unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.** **[Foreign]**

**Ans.** In a food chain, the energy moves progressively through the various trophic levels and is no longer available to the organisms of the previous trophic level. Energy captured by the autotrophs does not revert back to the solar input.

Pesticides used for crop protection when washed away into the soil or water bodies absorbed by plants. On consumption they enter our food chain and being non – biodegradable these chemicals get accumulated progressively and enter our body.

## 2014

READERS VENUE

### Very Short Answer Type Questions [1 Mark]

**48. Write negative effect of affluent lifestyle of few people on the environment.** **[All India]**

**Ans.** Affluent lifestyle is directly concerned with the use of big vehicles and electrical appliances. It depletes fuels and causes air pollution.

**49. List two criteria of measuring the biodiversity of an area.** **[Foreign]**

**Ans.** 1. Area of forest, agricultural and aquaculture ecosystems along with range of different life forms.
2. Number of species and their population found there.

### Short Answer Type [I] Questions [2 Marks]

**50. List two environment friendly practices or habits which need to be followed by every member of family/community. Explain how these practices will support the "Save the Environment" mission.** **[Delhi]**

**Ans.** Environment friendly practices:

(*i*) Use of paper cloth or jute bags instead of plastic bags. Jute, cloth and paper are biodegradable.

(*ii*) Switching off lights and fans when not in use. It will help to save the electricity. This will limit the use of our natural resources fossil like fuels.

**51. Why is Government of India imposing a ban on the use of polythene bags? Suggest two alternatives to these bags and explain how this ban is likely to improve the environment.** **[Delhi]**

**Ans.** Plastic being non-biodegradable is a cause of concern in the environment.

- Blocks drains and causes floods and blocks run off.
- If consumed may cause death to animals.
- If added to the soil the roots cannot penetrate and wither off and water cannot seep in to the soil.
- If burnt gives out highly poisonous gases causing air pollution.

Jute, cloth or paper bags can be used instead of plastic bags.

Advantages of these bags to improve the environment:

(*i*) Since jute, cloth and paper are plant products they can be easily decomposed.

(*ii*) They can be made from home waste, thus are recycled.

(*iii*) Jute and cloth bags can be used for a long time. Thus, need not procure new bags frequently.

**52. "Affluent life style has a negative effect on the environment." Justify this statement with the help of an example.** **[Delhi]**

**Ans.** Affluent life style is directly concerned with big vehicles and electrical appliances for the comfort of the individual. Vehicles consume our depleting fuels and also cause acid rain and pollution in the atmosphere.

Appliances demand energy for their operation which is causing drain on the resources along with the usage of CFC's leading to depletion of the Ozone layer.

**53. What are decomposers? List two important roles they play in the environment.** **[All India]**

**Ans.** Refer to Ans. 22.

**54. List two reasons to show that the existence of decomposers is essential in an ecosystem.** **[All India]**

**Ans.** (*i*) Recycle the minerals found in dead plants and animals back into the food chain.

(*ii*) They help to clean the environment by decomposing dead and decaying material.

**55. State with reason any two possible consequences of elimination of decomposers from the Earth.** **[All India]**

**Ans.** Role of decomposers is significant in keeping ecological balance. The possible consequences of elimination of decomposers from the earth are:

(*a*) All the surface of the earth would be filled with dead organisms as decomposition would not happen.

(*b*) Nutrient cycle would get disturbed and soil will not become fertile without the decomposition of plant and animal parts.

**56. List two products of combustion of fossil fuels other than carbon dioxide. What happens when combustion takes place in insufficient air? Name a green house gas.** **[Foreign]**

**Ans.** Burning of fossil fuels produces oxides of nitrogen and sulphur. Carbon monoxide is produced when combustion takes place in insufficient air.
Greenhouse gas: Methane/Nitrous oxide/Carbon dioxide.

**57. We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make people realize that the improper disposal of waste is harmful to the environment.** **[Foreign]**

**Ans.** (*i*) Educating people about the harmful effects by organizing meetings and street plays.
(*ii*) Informing the harmful effects through the radio, banners, TV, messages, etc.
(*iii*) Doing community activity of teaching and training by the children of the school in the evening time.

**58. Suppose you find a heap of domestic waste, in a nearby park, which is decomposing. What would you do to make the people of the surrounding area realise that such type of disposal of domestic waste is harmful to the environment?** **[Foreign]**

**Ans.** Refer to Ans. 57.

**59. "To discard the household waste we should have two separate dustbins, one for the biodegradable waste and the other for the non-biodegradable waste." Justify this statement, suggesting the proper way of disposal of these wastes.** **[Foreign]**

**Ans.** Household waste should be segregated in two different dustbins according to them being biodegradable or not.
Biodegradable waste can be composted, turned into manure and decomposed very easily.
Non-biodegradable waste should be collected and disposed off at the right place from where it can be used for recycling.

READERS VENUE

## Short Answer Type [II] Questions [3 Marks]

**60. "Our food grains such as wheat and rice, the vegetables and fruits and even meat are found to contain varying amounts of pesticide residues." State the reason to explain how and why it happens?** **[Delhi]**

**Ans.** Farmers use large amounts of pesticides and chemicals to protect the crops from pests, insects and weeds too. These chemicals get carried to the soil or to the water bodies.
In the soil they get dissolved with water and absorbed by the roots of the plants.
In the water bodies they are taken up by the aquatic plants and the animals.
Since these chemicals are non-biodegradable they get accumulated in the systems of the organisms they enter into. As these are consumed by the next level of organisms the level of the chemicals increases.
This increase in the concentration of harmful chemicals with each step of the food chain is called biomagnification. That is why food grains, such as wheat and rice, vegetables, fruits and even meat are found to contain pesticide residues.

**61. "Energy flow in a food chain is unidirectional." Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.** **[All India]**

**Ans.** Refer to Ans. 47.

**62. What is meant by food chain? "The number of trophic levels in a food chain is limited." Give reason to justify this statement.** **[Foreign]**

**Ans.** Food chain is a simple linear pathway through which food, energy and nutrients travel in the ecosystem.

Members of higher trophic level feed on single type of organisms of the lower trophic level, the energy transferred from the lower trophic level to the higher is only 10%. After, the 3rd consumer there isn't that much energy left over. Thus, the number of trophic levels get limited.

## 2013

### Very Short Answer Type Questions [1 Mark]

**63. Why should biodegradable and non-biodegradable wastes be discarded in two separate dustbins?** **[Delhi]**

**Ans.** Refer to Ans. 35.

**64. Mention one negative effect of our affluent life style on the environment.** **[Delhi]**

**Ans.** Due to the use of deodrants, refrigerators, etc. (containing FCs), the ozone layer present in the atmosphere is affected.

READERS VENUE

**65. Name any two items which can be easily recycled but are generally thrown in the dustbins by us.** **[All India]**

**Ans.** (*i*) Newspapers (*ii*) Jam bottles

### Short Answer Type [I] Questions [2 Marks]

**66. We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make people realize that the improper disposal of waste is harmful to the environment.** **[Delhi]**

**Ans.** Refer to Ans. 57.

**67. Write the harmful effects of using plastic bags on the environment. Suggest alternatives to plastic bags.** **[All India]**

**Ans.** Refer to Ans. 51.

### Short Answer Type [II] Questions [3 Marks]

**68. (*a*) What is an ecosystem? List its two main components.**

**(*b*) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Explain.** **[Delhi]**

**Ans.** Refer to Ans. 4 and 45.

**69.** **(*a*) "Energy flow in a food chain is unidirectional." Justify.**
**(*b*) How do pesticides enter the food chain and subsequently get into the human body? Explain.** **[Foreign]**

**Ans.** (*a*) & (*b*) Refer to Ans. 47.

## 2012

### Very Short Answer Type Questions [1 Mark]

**70.** **Which class of chemicals is linked to the decrease in the amount of ozone in the upper atmosphere of the earth?** **[Delhi]**

**Ans.** The chemical compound Chlorofluorocarbon is responsible for decrease of ozone in the upper atmosphere of the earth.

**71.** **Select two non-biodegradable substances from the following waste generated in a kitchen:**
**Spoilt food, paper bags, milk bags, vegetable peels, tin cans, used tea leaves.** **[Delhi]**

**Ans.** Milk bags and tin cans.

**72.** **Bacteria and fungi are called decomposers. Why?** **[Delhi]**

**Ans.** Bacteria and Fungi are microorganisms that obtain energy from the chemical break down of dead organisms of animals or plants. These microorganisms break down the complex organic substances of dead organisms into simple inorganic substances that go into the soil and are used up once more by the plants. Thus, they are known as decomposers which help in recycling of matter.

**73.** **Depletion in the ozone layer is a cause of worry. Why?** **[Delhi]**

**Ans.** Ozone layer prevents the harmful ultraviolet radiation to enter the atmosphere and reach the earth's surface. Depletion of ozone layer has become a cause for concern because it can cause serious effects on human body and other organisms of the environment like fatal diseases such as skin cancer, changes in genetic material DNA, eye damage, etc.

**74.** **Which class of carbon compounds is responsible for the depletion of ozone layer at the higher level of the atmosphere?** **[Delhi]**

**Ans.** Refer to Ans. 70.

**75.** **Write the name and formula of a molecule made up of three atoms of oxygen.** **[All India]**

**Ans.** Ozone and its chemical formula is $O_3$.

**76.** **What happens when higher energy ultraviolet radiations act on the oxygen at the higher level of the atmosphere?** **[All India]**

**Ans.** Ozone layer forms due to combination of molecular and elemental form of oxygen in the presence of UV rays.

$$O_3 \underset{\text{UV rays}}{\rightleftharpoons} O_2 + O$$

So, when high energy of ultraviolet rays act on oxygen ozone is formed.

**77. In a food chain, 10,000 joules of energy is available to the producer. How much energy will be available to the secondary consumer to transfer it to the tertiary consumer?** **[All India]**

**Ans.** At each trophic level, 90% of the energy is used and only 10% is transferred to the next trophic level.
If 10,000 joules of energy is available to the producer then the secondary consumer will have 100 joules of energy available.

**78. List two man-made ecosystems.** **[All India]**

**Ans.** Park and aquarium are man-made ecosystems.

**79. Name two decomposers operating in our ecosystem.** **[All India, Delhi]**

**Ans.** Bacteria and fungi.

**80. State one harmful effect of depletion of ozone layer on the living organisms of the ecosystem.** **[All India]**

**Ans.** Skin cancer is caused in human beings due to the depletion of ozone layer in the atmosphere.

**81. List two components of an ecosystem.** **[All India]**

**Ans.** The two main components of our environment are the biotic or living components and abiotic or non-living components.

**82. Consider the following food chain which occurs in a forest:**
**Grass → Deer → Lion**
**If 10000 J of solar energy is available to the grass, how much energy would be available to the deer to transfer it to the lion?** **[Foreign]**

READERS VENUE

**Ans.** 10 J energy would be available to deer to transfer to lion.

**83. Which of the following belong to the first trophic level of a food chain?**
**Grass, grasshopper, plants, rat, tiger** **[Foreign]**

**Ans.** Grass and plants belong to the 1st trophic level of a food chain.

**84. Name the phenomenon in which non-biodegradable chemicals get accumulated progressively at each trophic level of a food chain.** **[Foreign]**

**Ans.** Biological magnification.

**85. What is the function of Ozone at the higher level of atmosphere?** **[Foreign]**

**Ans.** The important function of presence of ozone in earth's atmosphere is that it shields the surface of the earth from ultraviolet (UV) radiations of the sun.

**86. State one role played by Ozone in the ecosystem.** **[Foreign]**

**Ans.** In humans, UV radiation causes skin cancer and cataracts. UV radiation also affects the fertility of other animals. Plants are affected by UV radiation because it affects their ability to grow and develop correctly. UV radiation also influences how chemicals break down and react, and this can lead to catastrophic changes in environments and ecosystems.

**87. Name the product formed when high energy UV radiations act on oxygen molecules at the higher level of atmosphere.** **[Foreign]**

**Ans.** The high energy UV radiations split apart some molecules of oxygen ($O_2$) into free oxygen (O) atoms. These atoms then combine with the molecular oxygen to form ozone as shown:

$$O_2 \xrightarrow{\text{UV rays}} O + O \quad \text{then,} \quad O + O_2 \longrightarrow O_3 \text{ (Ozone)}$$

## Short Answer Type [I] Questions [2 Marks]

**88. List the products of combustion of fossil fuels. What are their adverse effects on the environment?** **[All India]**

**Ans.** Combustion of fossil fuels produces air pollutants, such as nitrogen oxides, sulphur dioxide, organic compounds. They also produces greenhouse gases like $CO_2$ and CO. Acid rain is caused due to nitrogen oxides, sulphur dioxide, volatile organic compounds. Greenhouse gases like carbon dioxide, carbon monoxide and methane traps the heat of sun from the surface of earth and do not allow them to reflect back in space, resulting in constant increase of earth's temperature and due to which polar caps are melting and sea level is rising higher.

# 2011

## Very Short Answer Type Questions [1 Mark]

**89. What will happen if we kill all the organisms in one trophic level?** **[Delhi]**

**Ans.** If all the organisms in one trophic level are killed, it will disturb the whole ecosystem. Let us take a hypothetical example to understand this. If all the deer are killed in a jungle, the lions would be left with no food. This would endanger the existence of lions. Once the lions and deer would be finished, it would result in population explosion of green plants. If all the lions die in a jungle, it would create another problem. Since no lion would be left to kill the deer, the population of deer would increase substantially. This will finish off all the green plants and finally even the deer would be left with no food for them.

**90. Why did United Nations act to control the production of chlorofluorocarbons (CFCs) used in refrigerators?** **[Delhi]**

**Ans.** CFCs deplete the ozone layer around the earth, hence their production is controlled by United Nations.

**91. Which compounds are responsible for the depletion of ozone layer?** **[Delhi]**

**Ans.** The compounds responsible for the depletion of ozone layer are chlorofluorocarbons (CFCs).

**92. Define 'trophic level'.** **[Delhi]**

**Ans.** A particular level in a food chain is called trophic level. Following example shows trophic levels in a food chain:

**Trophic Levels:** Producer → Primary consumer → Secondary consumer → Tertiary consumer

**Food Chain:** Grass → Grasshopper → Frog → Snake

**93. What are the various steps in a food chain called?** **[Delhi]**

**Ans.** The various steps in a food chain are called trophic levels.

**94. What is the important function of presence of ozone in earth's atmosphere?** **[Delhi]**

**Ans.** Refer to Ans. 86.

**95. Give an example to illustrate that indiscriminate use of pesticides may result in the degradation of the environment.** **[All India]**

**Ans.** Pesticides can degrade the environment in many ways:

(*i*) When pesticides are sprayed in the air, it can cause air pollution.

(*ii*) Sometimes, pesticides remain in the soil for long periods of time and thus cause soil pollution.

(*iii*) In many cases, the excess pesticides get washed off and reach the water bodies. Here they cause water pollution and affect aquatic life. These pesticides may accumulate in the food chain and cause biomagnification.

**96. What is meant by biological magnification?** **[All India]**

**Ans.** The process in which harmful chemicals enter a food chain and get accumulated progressively at each trophic level is called biological magnification.

**97. Why is decrease of ozone in our ozone layer a cause for our worry?** **[Foreign]**

**Ans.** Refer to Ans. 73

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**98. Why are bacteria and fungi called decomposers?** **[Foreign]**

**Ans.** Refer to Ans. 72.

## Short Answer Type [I] Questions [2 Marks]

**99. What is meant by a biodegradable waste?** **[All India]**

**Ans.** Biodegradable waste includes any organic matter in waste which can be broken down into carbon dioxide, water, methane or simple organic molecules by micro-organisms and other living things with the help of micro-organisms like fungi and bacteria.
e.g. Urine and faecal matter, sewage, agricultural residue, paper, wood, cloth and cattle dung.

**100. What is the role of decomposers in the ecosystem?** **[Foreign]**

**Ans.** Refer to Ans. 22.

**101. What step is being taken to limit the damage to the ozone layer?** **[Foreign]**

**Ans.** (*i*) By reducing the use of CFCs, many countries have already banned the use of CFCs.

(*ii*) By developing substitutes to replace CFCs. Scientists have already developed some substitutes which are ozone-friendly.

**102. Why are some substances non-biodegradable?** **[Foreign]**

**Ans.** Substances which cannot be broken down into simpler substances in nature by the decomposers are known as non-biodegradable. e.g. glass, metals.

## 2010

### Very Short Answer Type Questions [1 Mark]

**103. How is the increasing demand for energy adversely affecting our environment?** **[Delhi]**

**Ans.** Population increase is causing demand for space, transport, water, electricity, etc. Most of us are dependent on natural resources for all the activities. We are cutting down forests for urbanization, industrialization and infrastructural development. Excessive use of land, water and resources is effecting our environment by increasing in global warming, pollution, diseases caused due to pollution.

### Short Answer Type [I] Questions [2 Marks]

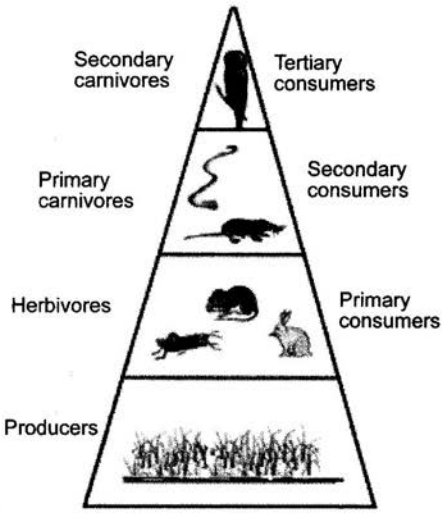
**104. Mention the basis of clarifying substances as biodegradable and non-biodegradable. Give two examples of each.** **[Foreign]**

**Ans.** Refer to Ans. 44.

### Short Answer Type [II] Questions [3 Marks]

**105. Explain the phenomenon of "biological magnification". How does it affect organisms belonging to different trophic levels particularly the tertiary consumers?** **[Delhi]**

**Ans.** Certain harmful substances, usually ones not found in nature but introduced by man, may get into plants and animals. These poisonous substances are difficult to be broken down in the body or excreted easily. They accumulate in the tissues, and as the living organism eats more, the concentration of these substances increases and they pass from one trophic level to the next. This phenomenon is called 'Biological magnification'.




According to this picture the herbivores eating the grass and plants consume pesticides and insecticides sprayed on the crops. The snakes which are consuming the rabbit have more concentration of the pesticides not digested by the rabbit. Thus, the owl would have the maximum concentration of the pesticides.

**106. "Damage to the ozone layer is a cause for concern." Justify this statement. Suggest any two steps to limit this damage.** **[Delhi]**

**Ans.** The stratosphere is the portion of the atmosphere located at an altitude of in between 10 to 60 km. Within the stratosphere, the ozone layer is the portion that contains the highest proportion of ozone gas. Stratospheric ozone layer absorbs virtually all the ultraviolet rays our planet receives from the sun (particularly UVa and UVb rays), which are harmful to life. Without this protective shield, no life forms could have evolved outside the oceans.

Exposure to UV rays affects our health. It is the main factor influencing the development of skin cancers.

Severe exposure to UV rays is a cause of cataracts, it is currently believed that UV rays affect our immune systems, lowering resistance to various diseases and reducing the effectiveness of certain vaccines.

Plant life is effected, lower yields from some plants and cereal crops, negative effects on plant growth, falling plankton populations, which are a primary source of food in marine ecosystems.

Two steps to limit this damage are as follows:

(*i*) Reduce the use of aerosol spray propellants such as fluorocarbon and chlorofluorocarbons which cause depletion or hole in ozone layer.

(*ii*) Control over large scale nuclear explosions and limited use of supersonic planes.

**107. Construct an aquatic food chain showing four trophic levels.** **[All India]**

**Ans.** Food chain in aquatic ecosystem:

Phytoplankton → Zooplankton → Crustacean → Fish → Crane
(Producer) (Herbivore) (Carnivore) (Carnivore) (Top carnivore).

Phytoplanktons are the green microscopic plants which are the producers as they are green and are able to photosynthesise. Zooplanktons are the small animals which feed on phytoplanktons crustaceans like the crabs feed on zooplankton, fish feed on the lower trophic level, and cranes pick up the fish as food.

**108. Explain 'biological magnification' with the help of an example.** **[All India]**

**Ans.** Refer to Ans. 105.

**109. Describe how decomposers facilitate recycling of matter in order to maintain balance in the ecosystem.** **[Foreign]**

**Ans.** When a plant or animal dies, it leaves behind nutrients and energy in the organic material that comprised its body. Decomposers complete decomposition by breaking down the organic matter. Decomposers eventually convert all organic matter into carbon dioxide (which they respire) and nutrients. This releases raw nutrients (such as nitrogen, phosphorus, and magnesium) in a form usable to plants, which incorporate the chemicals into their own cells.

By breaking down dead material, they provide the nutrients that other organisms need to survive. As decomposers feed on dead organisms, they leave behind nutrients. These nutrients become part of the soil. Therefore, more plants can grow and thrive.

# 16 MANAGEMENT OF NATURAL RESOURCES

## PREVIOUS YEARS' QUESTIONS

**2019**

### Very Short Answer Type Questions [1 Mark]

1. **Name two industries based on forest produce.** **[AI Allahabad]**

**Ans.** Match industry and paper industry.

### Short Answer Type [II] Questions [3 Marks]

2. **What is water harvesting? List two main advantages associated with water harvesting at the community level. Write two causes for the failure of sustained availability of groundwater.** **[Delhi]**

**Ans.** Water harvesting is the process of capturing rain water where it falls or capturing the run off in the local area for future use. Two advantage of water harvesting at community are:

(*i*) Water harvested will percolate down and will increase the ground water level

(*ii*) Water harvested at community level can be used for drinking and irrigation purpose.

Two causes of failure of sustained availability of ground water are:

(*i*) **Growing population** as the population increases demand for water increases resulting in depletion of ground water level.

(*ii*) **Industrialisation:** With growing industries demand for water increases which results in reduction in availability of ground water.

3. **Why should there be equitable distribution of resources? List three forces that would be working against and equitable distribution of our resources.** **[Delhi]**

**Ans.** Everybody has equal rights over natural resources and also everybody should get the benefits from them. Therefore, equitable distribution of resources is essential to ensure that everybody gets their due benefit.

But many forces go against the equitable distribution of natural resources.

- The geographical factors are the most important factors which do not allow equitable distribution of natural resources.

- Economy is another factor which prevents equitable distribution of these resources.
- Human greed and corruption are other major factors which prevent equitable distribution of our resources.

**4. List three advantages each of:** **[Delhi]**

**(*i*) exploiting resources with short term aims, and**

**(*ii*) using a long term perspective in managing our natural resources.**

**Ans.** (*i*) Advantages of exploiting resources with short term gain:

- It meets the immediate human needs.
- Accelerates Fast industrialization and development
- Improves the lifestyle of people.

(*ii*) Advantages of exploiting resources with long term gain:

- The resources last for longer period
- Benefits from resources can be obtained by future generations also.
- Minimum Environmental pollution.

## 2018

### Long Answer Type Questions [5 Marks]

**5. What is a dam? Why do we seek to build large dams? While building large dams, which three main problems should particularly be addressed to maintain peace among local people? Mention them.** **[CBSE]**

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**Ans.** A dam is a manmade large structure barrier that stops or restricts the flow of water or diverts the flow of water as per our need.

We seek to build large dam because the water reservoirs created by dams not only suppress floods but also provide water for activities such as irrigation, human consumption, industrial use, aquaculture, harnessing the hydroelectric power and navigability.

The three major problems in building the large dams are

(*a*) Large areas of agricultural land and human habitation are to be sacrificed as they get submerged. It creates the problem of satisfactory rehabilitation of displaced people

(*b*) Large eco-systems i.e. areas of ecological, culture and social importance for the local population are destroyed.

(*c*) The vegetation which is submerged rots under anaerobic conditions and gives rise to large amounts of methane gas which leads to a green-house effect.

So while constructing the large dam, the local interest and welfare along with above problem should be taken into consideration to maintain the peace among local people.

## 2018 (Compartment)

### Short Answer Type [II] Questions [3 Marks]

**6. What is "Sustainable Management of Natural Resources"? Why is it necessary? Which one out of reuse and recycle, would you practise in your daily life and why? [CBSE]**

**Ans.** – Sustainable management of natural resources refers to the type of management that meets the needs of the present generation without foreclosing the options/needs of the future generations.

– It is necessary because, the natural resources are not unlimited and with the human population increasing at a tremendous rate, the demand for these resources is increasing at an exponential rate.

– I would practise reuse, because recycling requires some energy, but reuse does not need any energy.

## 2017

### Short Answer Type [I] Questions [2 Marks]

**7. What is sustainable management? Why is reuse considered better in comparison to recycle? [Delhi]**

**Ans.** Refer to Ans. 6.

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**8. Management of forest and wild life resources is a very challenging task. Why? Give any two reasons. [Delhi]**

**Ans.** (*i*) It has to take into account the interests of various stakeholders.

(*ii*) The conservation of biodiversity must include, the conservation of the number as well as the range of all different life forms.

**9. Why is sustainable management of natural resources necessary? Why is reuse better as compared to recycle? [Delhi]**

**Ans.** Refer to Ans. 6.

**10. Explain how would the involvement of local people be useful for successful management of forests. [Delhi]**

**Ans.** Involvement of local people in the management of forests can help in increasing forest produce as well as in their conservation. For example,

- The Sal forests of Midnapore district in West Bengal got reduced alarmingly in 1972.
- Surveillance and policing to protect the forest resulted in frequent clash between forest officials and the villagers.

- The department then changed its strategy and in Arabari forest, villagers were involved in protection of the badly damaged Sal forest.
- In return, villagers were given employment and were allowed to collect firewood and fodder at nominal fee.
- By 1983, the Arabari forest showed a remarkable recovery.

**11. How do advantages of exploiting natural resources with short term gains in mind differ from the advantages of managing our resources with a long-term perspective?** **[Delhi]**

**Ans.** Exploiting resources with short-term aim is just to reap huge profit, whereas using resources with a long-term perspective is to reap the benefit in a sustainable manner so that these will last for generations to come.

**12. What is meant by wildlife? How is it important for us?** **[Delhi]**

**Ans.** Wildlife refers to all those living organisms, which manage to live without human care.

— They are important because loss/absence of them can lead to loss of ecological stability.

**13. State two advantages of conserving (*i*) forests and (*ii*) wild-life.** **[All India]**

**Ans.** (*a*) Advantages of conserving forests

(*i*) Quality of soil can be maintained.

(*ii*) Floods can be prevented.

(*iii*) The $O_2$-$CO_2$ ratio in the atmosphere can be maintained. (*any two*)

READERS VENUE

(*b*) Wild-life

(*i*) Ecological stability is maintained.

(*ii*) The varied human needs can be met with.

**14. Explain two main advantages associated with water harvesting at the community level.** **[All India]**

**Ans.** Refer to Ans. 2.

**15. Why is an equitable distribution of resources essential in a society? List two forces which are against such distribution.** **[All India]**

**Ans.** – Equitable distribution of resources is essential because the benefit from the development of these resources should go to all people.

– (*i*) The powerful people and

(*ii*) The rich ones are against such distribution.

**16. Why must we conserve our forests? List two factors responsible for causing deforestation.** **[All India]**

**Ans.** Forests are storehouse of biodiversity and provide important support system for mankind. Two factors responsible for causing deforestation are:

(*a*) Due to increase in population, forests are being converted into residential, agricultural and industrial locations.

(*b*) The need for timber, fuel wood and other medicinal plants, resulting in illegal logging and smuggling of the precious forest products.

**17. Why are coal and petroleum categorised as natural resources? Give a reason as to why they should be used judiciously.** **[All India]**

**Ans.** Coal and petroleum are formed by the degradation of biomass of plants of animals which were burried deep under the earth for millions of years. Therefore, they are categorised as natural resource.

Coal and petroleum have been accumulated in nature for a very long period of time and cannot be produced quickly when exhausted.

**18. Why are certain forests considered "biodiversity hot spots"? Suggest any two ways in which an individual can contribute effectively to the management of forests and wild life.** **[Foreign]**

**Ans. Forests are considered biodiversity hot spots because:**

(*a*) there are a number of species.

(*b*) there is also a range of different life forms

**Two ways for effective management forests and wild life:**

(*a*) Judicious use of forest products.

(*b*) Hunting of animals/overfishing.

READERS VENUE

## Short Answer Type [II] Questions [3 Marks]

**19. (*a*) Water is an elixir of life, a very important natural resource. Your Science teacher wants you to prepare a plan for a formative assessment activity, "How to save water, the vital natural resource." Write any two ways that you will suggest to bring awareness in your neighbourhood, on 'how to save water.'**

**(*b*) Name and explain any one way by which the underground water table does not go down further.** **[All India]**

**Ans.** (*a*) Two ways of creating awareness among neighbourhood are:

- Not using the shower, but to use a bucket to collect water and bathe with that water.
- Not to leave the tap open while brushing the teeth.
- Have a sprinkler to water the plants in the garden and not to flood the plots.

(*any two*)

(*b*) – Constructing rain water harvesting structure in every house.

– Pumping out water in quantities less than that is added.

## 2017 (Compartment)

### Long Answer Type Questions [5 Marks]

**20. (*a*) What is sustainable development? Why is it necessary?**

**(*b*) What is water harvesting? List its four benefits.** **[Delhi]**

**Ans.** (*a*) Refer to Ans. 6.

(*b*) Water harvesting refers to the capturing of the water that falls on the earth.

Benefits of water harvesting:

(*i*) It mitigates droughts and floods.

(*ii*) It increases the life of the downstream dams and reservoirs.

(*iii*) It increases the production and increase the income of the watershed community.

(*iv*) The groundwater is recharged.

**21. (*a*) In the context of conservation of natural resources, explain the terms reduce, recycle and reuse.**

**(*b*) Why is conservation of water necessary? State any four reasons.** **[All India]**

**Ans.** (*a*) – Reduce means to use the resources/materials less.

– Recycle means to collect items like paper, metal, plastic etc and process them to make required things instead of synthesising fresh paper, metal or plastic.

– Reuse means to simply use the things again and again, instead of throwing them away.

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(*b*) **Conservation of water**

(*i*) Rains are largely due to monsoons; so rainfall occurs during a few months of the year and water is needed throughout the year.

(*ii*) Water is the basic necessity for all terrestrial forms of life.

(*iii*) Water is necessary to generate electricity throughout the year.

(*iv*) Many other food items like fishes are obtained from water bodies.

## 2016

### Short Answer Type [I] Questions [2 Marks]

**22. List four advantages of properly managed watershed management.** **[Delhi]**

**Ans.** The main goal of watershed management is the sustainable management of natural resources to improve the quality of living. This can be done through:

1. Improving and restoring the soil quality and thus, raising productivity rates.
2. Supplying and securing of clean and sufficient drinking water for the population.

3. Improvement of infrastructure for storage, transport and agricultural marketing.
4. Managing the watershed for beneficial developmental activities like domestic water supply, irrigation, hydropower generation etc.
5. Minimizing the risks of floods, droughts and landslides.

**23. Explain giving example where active involvement of local people lead to efficient management of forest.** **[Delhi]**

**Ans.** In 1972, the forest department realized its mistake while reviving the degraded sal forests of Arabari forest range. Arabari forest lies in Midnapore district of West Bengal. The earlier methods of policing and surveillance were a total failure as they often led to frequent clashes with local people. It also led to alienation of people from the conservation programme. Then came a forest officer; named A K Banerjee; who was a real visionary. He involved the local people in the revival of 1,272 hectares of forest. In lieu of that the villagers were given employment in silviculture and harvest and were given 25% of the harvest. They were also allowed to gather firewood and fodder against a nominal payment. Due to active participation of the local community there was remarkable revival of the Arabari sal forest. By 1983, the value of the forest rose to ₹ 12.5 crores. By this, active involvement of the village people and forest officials brought about efficient forest management.

**24. "Reuse is better than recycling of materials." Give reason to justify this statement.** **[Delhi]**

**Ans.** Reusing is better than recycling because in the process of recycling certain energy is required and energy is a natural resource. We basically recycle or reuse things to conserve our resources and when energy is being consumed in the process of recycling it is using up a precious resource. This is the reason why simply reusing is better than recycling.

**25. What was "Chipko Andolan"? How did this Andolan ultimately benefit the local people and the environment?** **[All India]**

**Ans.** In the 1970s, an organized resistance to the destruction of forests spread throughout India and came to be known as the Chipko movement. The name of the movement comes from the word, as the villagers hugged the trees, and prevented the contractors from felling them.

- It forced the government to rethink their priorities in the use of forest produce and include the local people in forest management. The local people depend on the forests for meeting their basic needs. Thus, they were ultimately benefitted.

**Benefits to the environment:**

Reduction in cutting of trees leads to reduction in soil erosion, increase in the rainfall, increase in forest produce. Above of all, it reduce $CO_2$ level and increase $O_2$ level in the atmosphere.

**26. Forests are "biodiversity hot spots". Justify this statement.** **[All India]**

**Ans.** Refer to Ans. 18.

**27. What is water harvesting? How can this technique help in the conservation of water?** **[All India]**

**Ans.** Refer to Ans. 2.

**28. List four stakeholders which may be helpful in the conservation of forests.** **[All India]**

**Ans.** The conservation of forests depend on various stakeholders. These are as following:

(*i*) People who live in and around forests.
(*ii*) Forest department of the government.
(*iii*) Industrialist.
(*iv*) Wildlife and nature enthusiasts.

**29. The construction of large dams leads to social and environmental problems. List two problems of each category.** **[All India]**

**Ans.** (*i*) Social problems:
(*a*) adequate rehabilitation (*b*) compensation to the displaced
(*ii*) Environmental problems:
(*a*) afforestation (*b*) soil cover to prevent erosion.

**30. What is sustainable development? State its two main objectives.** **[Foreign]**

**Ans.** Refer to Ans. 6.

**31. How did 'Chipko Andolan' ultimately benefit the local people? Explain briefly.** **[Foreign]**

**Ans.** Refer to Ans. 25.

READERS VENUE

**32. List four causes of damage to forests.** **[Foreign]**

**Ans.** Four main causes of damage to forests are:

(*i*) Deforestation for various uses; indiscriminate cutting of trees.
(*ii*) Natural calamities like forest fires, floods, etc.
(*iii*) Felling of trees for fuel wood.
(*iv*) Overgrazing in forests.

## 2015

### Short Answer Type [I] Questions [2 Marks]

**33. Why are forests considered "biodiversity hot spots"? List two ways in which an individual can contribute effectively to the management of forests and wildlife.** **[Delhi]**

**Ans.** Refer to Ans. 18.

Two ways to manage forests and wildlife are as under:

1. Not to allow the destruction of forests for making roads, dams and hotels etc.
2. Planting more trees. The rate of afforestation must be more than that of deforestation.

**34. What is meant by "sustainable management"? Why is reuse considered better than recycling?** **[Delhi]**

**Ans.** Refer to Ans. 6.

**35.** (*i*) **Why do we need to manage our resources carefully?**
(*ii*) **Why management of natural resources requires a long-term perspective?** **[Delhi]**

**Ans.** (*i*) Our resources are not unlimited. With a tremendous increase in human population, the demand for resources is increasing at an exponential rate. So we need to manage these resource and use them wisely.
(*ii*) Long-term perspective is required to meet the needs of the present as well as the future generations.

**36. List two advantages associated with water harvesting at the community level.** **[Delhi]**

**Ans.** The advantages for water harvesting at the community level are:
(*i*) recharges groundwater and provides drinking water.
(*ii*) mitigates floods and droughts.
(*iii*) brings rivers and wells back to life and makes more water available.
(*iv*) Helps in irrigation and reduces floods and soil erosion. (*any two*)

**37. List four measures that can be taken to conserve forests.** **[Delhi]**

**Ans.** Four measures to conserve forest are:
(*i*) Reforestation of the deforested areas as soon as possible.
(*ii*) Ban on the indiscriminate cutting of trees
(*iii*) Felling of trees for fuel wood should be avoided.
(*iv*) Overgrazing in forests should be discouraged.

READERS VENUE

**38. Everyone of us can do something to reduce our personal consumption of various natural resources. List four such activities based on 3–R approach.** **[Delhi]**

**Ans.** Four activities based on 3-R approach are:
(*a*) Walk or cycle as much as possible. Use stairs instead of lifts.
(*b*) Use public transport or pool system of cars.
(*c*) Use cloth or jute bags instead of plastic or polythene bags.
(*d*) Recycle all paper or card-board cartons.

**39. What is biodiversity? What will happen if biodiversity of an area is not preserved? Mention one effect of it.** **[All India]**

**Ans.** **Biodiversity:** Variety of plant and animal life in a particular habitat.
**Effect:** Loss of biodiversity may lead to a loss of ecological stability.

**40. List any two advantages associated with water stored in the ground.** **[All India]**

**Ans.** Advantages of water stored in the ground as "groundwater":
(*i*) It does not evaporate.
(*ii*) It spreads out to recharge wells.
(*iii*) It provides moisture for vegetation over a large area.
(*iv*) It does not provide breeding ground for mosquitoes. (*any two*)

**41. What is meant by biodiversity? List two advantages of conserving forests and wildlife.** **[All India]**

**Ans.** Biodiversity: Refer to Ans. 39.

**Two advantages of conserving forests:**

(*i*) It helps in retaining the sub-soil water.

(*ii*) It also checks blood.

**Two advantages of conserving wildlife:**

(*i*) It maintains ecological equilibrium.

(*ii*) It protects the nature.

**42. Why is sustainable management of natural resources necessary? Out of the two–reuse and recycle–which, in your opinion, is better to practise? Give reason.** **[All India]**

**Ans.** Refer to Ans. 6.

**43. List two main causes of the pollution of water of the river Ganga. State how pollution and contamination of river water prove harmful for the health of the people of neighbouring areas.** **[All India]**

**Ans. Causes:**

(*i*) Disposal of industrial effluents. Human activities like bathing, washing, immersion of ashes, etc.

(*ii*) Disposal of untreated sewage.

Harmful effects on health – Spreads water – borne diseases, Consumptions of contaminated water can lead to health problems.

READERS VENUE

**44. Building of big dams gives rise to some problems. List three main problems that may arise. Suggest a solution to any one of these problems.** **[Foreign]**

**Ans.** Refer to Ans. 5.

**Solution:** (*i*) Adequate rehabilitation, (*ii*) compensation to the displaced persons, and (*iii*) afforestation.

**45. What is meant by three types of 'R' (3–R's) to save the environment? Explain with examples how would you follow the 3–R's in your school to save the environment.** **[Foreign]**

**Ans.** 3–R's: Reduce, Rcycle and Recise

We should switch off unnecessary light and fans to save electricity. Also, we should not waste papers and food. This will help to save the environment.

**46. Write two advantages of sustainable management of natural resources. Out of the two-reuese and recycle. Which is better and why?** **[Foreign]**

**Ans.** Refer to Ans. 6.

### Short Answer Type [II] Question [3 Marks]

**47. After the examinations Rakesh with his friends went on a picnic to a nearby park. All friends carried cooked food packed in plastic bags or plastic cans. After eating the food some friends collected the leftover food and plastic bags, etc. and planned to dispose them off by burning. Rakesh immediately checked them and suggested to segregate the leftover food and peels of fruits from the plastic materials and respectively dispose them off separately in the green and red dustbins placed in the corner of the park.** [Delhi]

**(*i*) In your opinion, is burning plastic an eco-friendly method of waste disposal? Why? State the advantage of method suggested by Rakesh.**

**(*ii*) How can we contribute in maintaining the parks and roads neat and clean?**

**Ans.** (*a*) Burning plastic is not an eco-friendly method of waste disposal because it causes air pollution by producing harmful gases. Rakesh's method of waste disposal is advantageous as the leftover food and peels of fruits are biodegradable material and can serve as manure, whereas plastic bags and cans should be disposed off in blue dustbins as they are non-biodegradable and can be recycled manually; thus, keeping the environment clean.

(*b*) We can keep the parks and roads clean by throwing the biodegradable waste in green dustbins and the non-biodegradable waste in blue dustbins stopping people from spitting on roads and parks.

## 2014

READERS VENUE

### Very Short Answer Type Questions [1 Mark]

**48. List two measures that you would suggest for the better management of water resources.** [Delhi]

**Ans.** Two measures for the better management of water resources are:

(*i*) Waste water treatment.

(*ii*) Drip irrigation.

**49. "We need to manage our resources." List two reasons to justify this statement.** [Delhi]

**Ans.** We need to manage our resources as

(*i*) natural resources like fossil fuels are limited and so we need to use them judiciously and

(*ii*) to save the environment by planting trees which in turn clean the air, reduce soil erosion, reduce floods and increase rainfall.

**50. Water is a valuable resource. List two ways that you would suggest every family member to save this resource.** [Delhi]

**Ans.** (*i*) Turning-off the taps when not in use, taking bath with a bucket of water rather than shower.

(*ii*) Instead of washing homes and cars with hose pipe, mop them clean with a wet cloth.

**51. Give one example each from your daily life where the domestic waste can be effectively reused and recycled.** **[All India]**

**Ans.** **Reuse:** Old newspapers can be recycled into envelopes, paper, cardboards or packing material.

**Recycle:** Empty bottles can be used for storage purpose.

**52. List two items which can be easily recycled, but we generally throw them in the dustbins.** **[All India]**

**Ans.** (*i*) Most plastic cups and plates can go in the recycle bin, and paper plates can be composted.

(*ii*) Cardboard boxes, including cereal boxes, pizza boxes, cracker boxes, and any other type of paper packaging can be recycled.

**53. Write one negative effect of affluent lifestyle of few persons on the environment.** **[All India]**

**Ans.** Our affluent lifestyle has resulted in the production of acid rain which degrade the monuments, plants and even human beings.

**54. List two advantages of building dams.** **[Foreign]**

**Ans.** 1. To provide a supply of water for towns, cities and mining sites.
2. To provide a supply of water for the irrigation of crops.
3. To generate electricity in hydro-electric power stations.
4. To help control or mitigate floods. (*any two*)

**55. List two causes of pollution of river Ganga.** **[Foreign]**

**Ans.** The pollution of river Ganga is caused due to:

(*i*) human waste,

(*ii*) industrial waste, and

(*iii*) religious events.

READERS VENUE

## Short Answer Type [I] Questions [2 Marks]

**56. List three problems which arise due to construction of big dams. Suggest a solution of these problems.** **[Delhi]**

**Ans.** Refer ro Ans. 5 and Ans. 44.

**57. What is meant by biodiversity? List two advantages of conserving forest and wildlife.** **[Delhi]**

**Ans.** Refer to Ans. 39 and 41.

**58. In some states of our country there is a ban on the use of polythene bags for shopping. Why? List three advantages of using jute or cloth bags over polythene bags.** **[Delhi]**

**Ans.** Plastic is non-biodegradable. It also increases the soil temperature and thereby affects agricultural production.

Advantages of jute and cloth bags are as follows:
(*i*) They are washable and reusable.
(*ii*) They are biodegradable.
(*iii*) They are stronger than polythene bags.

**59. Why is sustainable management of natural resources necessary? Out of the two methods – reuse and recycle – which one would you suggest to practise and why?** **[All India]**

**Ans.** Refer to Ans. 6.

**60. What is watershed management system? List two benefits derived by the communities that participate in this system.** **[All India]**

**Ans.** Watershed management is controlling conservation of soil and water so that plants and crop production increases. Maintenance of water quality, supply and rain water harvesting and its usage are the components of the project.
**Benefits:**
(*i*) Water quality and regular supply are maintained.
(*ii*) Continuous supply of water ensures better yield.

**61. What is water harvesting? How can this technique help in the conservation of water?** **[All India]**

**Ans.** Refer to Ans. 2.

**62. List four advantages of water stored in the ground.** **[Foreign]**

**Ans.** (*i*) Loss of water due to evaporation becomes minimal.
(*ii*) Water gets less polluted by surface pollutants, wastes.
(*iii*) It does not provide breeding ground for mosquitoes.
(*iv*) It provides moisture for crops.

TOPPERS VENUE

**63. What are fossil fuels? "Burning fossil fuels may lead to intense global warming." Justify this statement.** **[Foreign]**

**Ans.** Fossil fuels are the dead remains of plant and animal parts buried millions of years ago. So these fuels are composed of carbon, hydrogen, nitrogen and sulfur. When these components are burnt they combine with oxygen to produce their oxides—$CO_2$, $H_2O$, $SO_2$, and nitric oxide. All these gases are harmful for the environment specially $CO_2$ which is a green house gas and absorbs huge amount of heat and causes global warming.

## 2013

### Very Short Answer Type Questions [1 Mark]

**64. List any two measures that you suggest for better management of water resources.** **[Delhi]**

**Ans.** Two measures for better management of water resources are:
(*a*) Water harvesting plants should be set up generously.
(*b*) Sewage and industrial affluents should be treated before they enter any water source.

**65. Give one example each from your daily life where the household waste can be effectively reused and recycled respectively.** **[All India]**

**Ans.** **Reuse:** 1. The water from rinsing clothes is good for plants and can be used as toilet flush.
2. Yard debris can be used as composts.

**Recycle:** Plastic, polythene, glass, metal can be segregated and remade into different things for use again.

**66. Write the main objective of conservation of biodiversity.** **[All India]**

**Ans.** Biodiversity means the population of flora and the fauna of a place. The protection, preservation, management or restoration of natural resources are the main objectives.

**67. Write any two ways that you can suggest at home to save water which is a valuable resource.** **[Foreign]**

**Ans.** Refer to Ans. 50.

**68. State the environmental problem posed by construction of large dams.** **[Foreign]**

**Ans.** Deforestation or loss in biodiversity is the main environmental problem posed by construction of large dams.

**69. List any two strategies that you would suggest to your friends for maintaining balance between forest products and the environment.** **[Foreign]**

**Ans.** Two strategies for maintaining balance between forest products and the environment are:
(*i*) Forest products such as timber should be used wisely.
(*ii*) Medicinal plants should be planted and protected.

TOPPERS VENUE

## Short Answer Type [I] Questions [2 Marks]

**70. List and explain any two advantages associated with water harvesting at community level.** **[Delhi]**

**Ans.** Refer to Ans. 2.

**71. Every one of us can do something to reduce our consumption of various natural resources. List four such activities based on 3-R approach.** **[Delhi]**

**Ans.** Refer to Ans. 38.

**72. Why is sustainable management of natural resources necessary? Which one out of reuse and recycle would you suggest to practise and why?** **[All India]**

**Ans.** Refer to Ans. 6.

**73. Government of India is imposing ban on the use of polythene bags for shopping. List four advantages of using cloth or jute bags over polythene bags.** **[Foreign]**

**Ans.** Advantages of jute and cloth bags are:
(*i*) They are washable and reusable.
(*ii*) They are biodegradable.
(*iii*) They are stronger than polythene bags.
(*iv*) They last for a longer time.

**74. What is water harvesting? How can water harvesting help in conservation of water?** **[Foreign]**

**Ans.** Refer to Ans. 2.

**75. State the meaning of 'biodiversity". List two advantages of conserving forests and wildlife.** **[Foreign]**

**Ans.** Refer to Ans. 39 and 41.

## Short Answer Type [II] Questions [3 Marks]

**76. State in brief two ways in which non-biodegradable substances would affect the environment. List two methods of safe disposal of the non-biodegradable waste.** **[All India]**

**Ans.** (*i*) Biomagnification can be the result of using pesticides which are non-biodegradable chemicals.

(*ii*) Due to polythene bags accumulated in the soil water seepage would reduce and plant growth would get affected.

Two methods of disposal of non-biodegradable waste are:

(*i*) **Recycling:** Melting and making the products again for use.

(*ii*) **Incineration:** Medical and toxic wastes are burnt at high temperature in incinerators. Incinerators transform the waste into ashes.

**77. List three environment-friendly practices which you would like to form a part of your daily habit, giving justification for each.** **[Foreign]**

**Ans.** Four activities based on 3-R approach are:

(*i*) Walk or cycle as much as possible. Use stairs instead of lifts will reduce use of electricity and improve health.

(*ii*) Use public transport or car-pool system so that we can reduce use of fossil fuels.

(*iii*) Use cloth or jute bags instead of plastic or polythene bags because they are stronger, durable and biodegradable.

(*iv*) Recycle all paper or cardboard cartons so that less plants will be used for making them.

TOPPERS VENUE

# 2012

## Short Answer Type [I] Questions [2 Marks]

**78. List four advantages of water stored in the ground.** **[Delhi]**

**Ans.** Refer to Ans. 40.

**79. "Burning fossil fuels is a cause of global warming." Justify this statement.** **[Delhi]**

**Ans.** Refer to Ans. 63.

**80. List three problems which arise due to construction of big dams. Suggest a solution for these problems.** **[All India]**

**Ans.** Three problems of construction of large dams are:

1. In flat basins, large dams cause flooding of large tracts of land, destroying local animals and habitats.
2. People have to be displaced causing change in life style and customs, even causing emotional scarring. About 40 to 80 million people have been displaced physically by dams worldwide.
3. Large amounts of plant life are submerged and decay anaerobically (in the absence of oxygen) generating greenhouse gases like methane. It is estimated that a hydroelectric power plant produces 3.5 times the amount of greenhouse gases as a thermal power plant burning fossil fuels.

These problems can be sorted out by constructing smaller dams instead of a big dams.

**81. List the products of combustion of fossil fuels. What are their adverse effects on the environment?** **[All India]**

**Ans.** Burning of fossil fuels carbon dioxide, water, oxides of nitrogen and oxides of sulphur are formed. If the combustion takes place in insufficient air, then carbon monoxide is formed instead of carbon dioxide. Of these products, the oxides of sulphur and nitrogen and carbon monoxide are poisonous gases and carbon dioxide is a greenhouse gas. The layer of carbon dioxide around the earth prevents the heat rays to escape leading to global warming.

READERS VENUE

**82. State the meaning of "sustainable management". Reuse is better than recycling. How?** **[Foreign]**

**Ans.** Refer to Ans. 6.

**83. Why are forests considered "biodiversity hot spots"? List two ways in which an individual can effectively contribute to the management of forests and wildlife.** **[Foreign; All India 2010]**

**Ans.** Refer to Ans. 18.

**84. How did 'Chipko Andolan' ultimately benefit the local people? Describe briefly.** **[Foreign]**

**Ans.** Refer to Ans. 25.

**85. Which of the two is a better option, (*i*) to collect rainwater in ponds or artificial lakes, or (*ii*) to let it recharge groundwater by water harvesting? List two advantages of the option to justify your answer.** **[Foreign]**

**Ans.** To let rainwater to recharge groundwater by water harvesting is the better option. Its advantages are:

(*i*) It spreads out to recharge wells.
(*ii*) It provides moisture for vegetation over a large area.

## 2011

### Short Answer Type [I] Questions [2 Marks]

**86. List any four characteristics of a good fuel.** **[Delhi]**

**Ans.** (*a*) Ignite easily and give out a lot of heat.
(*b*) Have low smoke and ash content and do not produce any toxic substances during combustion.
(*c*) Should be inexpensive and easy to store and transport.
(*d*) Have high calorific value.
(*e*) Have low moisture content.

**87. What are non-renewable resources of energy? Give two examples of such resources.** **[Delhi]**

**Ans.** Resources which take a long time to be made and cannot be produced immediately are known as non-renewable resources. If these resources get exhausted we would not be able to produce them, e.g. coal and petroleum.

**88. List any four disadvantages of using fossil fuels for the production of energy.** **[All India]**

**Ans.** **Disadvantages**:
(*a*) Depletion of the resources already happening.
(*b*) Fossil fuels give off carbon dioxide causing the greenhouse effect, which contributes to the global warming.
(*c*) Sulfur dioxide and carbon dioxide that are emitted by burning of these fuels produce acid rain.
(*d*) Mining of coal always results in the destruction of wide areas, which also endangers human lives.
(*e*) The emissions from the burning of these fuels results in many health problems like breathing, etc.

**89. Give two examples each of the following:**
**(*i*) renewable sources of energy** **(*ii*) non-renewable sources of energy.** **[All India]**

**Ans.** (*i*) Solar energy, wind energy (*ii*) Coal, petroleum

**90. Define:**
**(*i*) Biomass** **(*ii*) Anaerobic degradation.** **[Foreign]**

**Ans.** (*i*) The organic matter contained in the bodies of plants and animals is called biomass.
(*ii*) Anaerobic degradation is the process which happens in the absence of oxygen the organic matter is broken down by the microorganisms.

**91. What is an equitable distribution of resources in a society and why is it necessary? State any two factors which work against an equitable distribution of resources.** **[Foreign]**

**Ans.** There should be equitable distribution of resources so that all people, all countries will be able to fulfill its needs and could grow properly using all resources equally. Each and every one gets his share of the resource and it would fulfill the fundamental right of equality. Forces working against equitable distribution of resources are:
Natural forces: (*a*) Land form, (*b*) climate, (*c*) rainfall, and (*d*) soil structure
Man-made forces: (*a*) Human greed, and (*b*) corruption

## 2010

### Very Short Answer Type Questions [1 Mark]

**92. List any two industries based on forest produces.** **[Delhi]**

**Ans.** Timber and food industry.

**93. A person lives near a forest. Make a list of four items which he can get from the forest to meet his daily needs.** **[Delhi]**

**Ans.** Food, fuel, fibre and fodder.

**94. With the help of an example showing that 'Reuse' strategy is better than recycle.** **[All India]**

**Ans.** Taking the example of books or clothes, we can give it to the person in need or organisation, so that it can be reused instead of discarding it.
While in Recycle, resources have to be used to make old products to new ones.

READERS VENUE

### Short Answer Type [I] Questions [2 Marks]

**95. List any four changes you would like to incorporate in your life style in a move towards a sustainable use of available resources in our country.** **[All India]**

**Ans.** (*i*) To use public transport instead of your own personal car.
(*ii*) Switching off electrical appliances when not in use.
(*iii*) Save water from leaking taps. Do not keep tap open while brushing teeth, etc.
(*iv*) Collect items that can be recycled.

**96. State any four personal choices you would like to make to reduce energy consumption without affecting the quality of life or work explaining how each one of them would help you to do so.** **[Foreign]**

**Ans.** (*i*) Biking or taking public transport and car-pooling to be used.
(*ii*) Learning how to cook with local, sustainable produce instead of using coal, and gas.
(*iii*) Shifting entertainment to low impact activities such as spending time in nature and reading downloaded or library books.

(*iv*) By switching off unnecessary lights and fans. This will reduce consumption of electricity.

(*v*) Save water – repair any leaking water taps,do not wash houses, cars etc. Mopping is the best method.

(*vi*) Reusing used paper, envelopes, etc.

**97. Name any four categories of people who depend on the forest resources, mentioning major needs of each category.** **[Foreign]**

**Ans.** (*i*) People who live inside forests, often living as hunter-gatherers or shifting cultivators: They use forests for grazing their cattle, collecting fruits, firewood, bamboo and thatch.

(*ii*) People who live near forests, usually involved in agriculture outside the forest, who regularly use forest products (timber, fuelwood, bush foods, medicinal plants, etc.) partly for their own subsistence purposes and partly for income generation.

(*iii*) People who use the raw materials like wood, timber from forests for their industries like construction, furniture, etc.

(*iv*) Medical sciences is dependent on many herbs and plant products to be added in to the formulations.

READERS VENUE