# CHAPTER NO . 1

# HEAT

## 1 Mark Questions

**I. 1. Define 'Heat' ? (As–1)**

**Ans. Heat :** Heat is a form of energy that flows from a hotter body to a colder body.

**2. Define 'Temeperature' ? (As–1)**

**Ans. Temperature :** The degree of hotness or coldness of a body is called 'Temperature'.

**3. Convert $20^0$C into kelvin scale ? (As–1)**

**Ans.** $20^0C = (20 + 273)\ K^0 = 293\ K^0$

**4. What is 'Evaporation' ? (As–1)**

**Ans. Evaporation :** "The process of escaping of molecules from the surface of a liquid at any temperature is called evaporation".

**5. What is humidity ? (As–1)**

**Ans. Humidity :** The amount of water vapour present in air is called 'humidity'.

**6. Why does ice floats on water ? (As–1)**

**Ans.** The density of ice is less than the density of water. So ice floats on water.

**7. If we put the glass bottle into the fridge for a few hours which is completely filled with water and fix the lid tightly will break. Why ? (As–1)**

**Ans.** If we put the glass bottle into the fridge for a few hours, the water in the bottle freezes to ice. The volume increases. So the bottle is broken.

**8. A samosa appears to be cool outside but it is hot when we eat it. Why ? (As–7)**

**Ans.** A samosa appears to be cool outside but it is hot when we eat it because the curry inside the samosa contains ingredients with higher specific heats.

**9. How much energy is released or obsorbed when 1 gm of water at $0^0$C freezes to ice at $0^0$C ? (As–1)**

**Ans.** 80 cal. of heat is released when 1 gm of water at $0^0$ C freezes to ice at $0^0$C.

**(Note :** Q = mL, m = 1 gm; L = 80 Cal/gm**)**

**10. How much energy is transferred when 1 gm of boiling water at $100^0$C condenses to water at $100^0$C ? (As–1)**

**Ans.** 540 cal of energy is transferred, when 1 gm if boiling water at $100^0$C condenses to water at $100^0$C.

**(Note :** Q = mL, m = 1 gm; L = 540 Cal/gm**)**

## 2 Mark Questions

**II.11. Write the differences between Heat and Temperature ? (As–1)**

**Ans.**

| Heat | Temperature |
|---|---|
| 1. Heat is a form of energy that flows from a hotter body to a colder body.<br>2. The SI unit of heat is Joule.<br>3. Heat is measured by calorimeter. | 1. The degree of hotness or coldness of a body is called 'Temperature'.<br>2. The SI unit of temperature is Kelvin.<br>3. Temperature is measured by thermometer. |

**12. Write the differences between evaporation and boiling ? (As–1)**

**Ans.**

| Evaporation | Boiling |
|---|---|
| 1. The process of escaping of molecules from the surface of a liquid at any temperature is called evaporation.<br>2. Evaporation takes place at any temperature.<br>3. Evaporation is a surface phenomenon. | 1. A process in which the liquid phase changes to gaseous phase at a constant temperature and costant pressure is called boiling.<br>2. Boiling takes place at boiling pint $\frac{3000}{100}$ only.<br>3. Boiling is a bulk phenomenon. |

**13. What would be the final temperature of a mixture of 50 gm of water at $20^0$C temperature and 50 gm of water at $40^0$C temperature ? (As–1)**

**Ans.** $m_1 = 50$ gm; $T_1 = 20^0$C; $m_2 = 50$ gm; $T_2 = 40^0$C

Final temperature (T) $= \frac{m_1T_1 + m_2T_2}{m_1 + m_2}$

$= \frac{(50 \times 20) + (50 \times 40)}{50 + 50}$

$= \frac{2000 + 1000}{100} =$

$\therefore$ Final temperature = $30^0$C

**14. Write the formula for the amount of heat absorbed (released) by a substance and explain the terms in it ? (As–1)**

**Ans.** $Q = mS\,\Delta T$ ..... (1)

Where Q = Amount of heat absorbed by a substance

m = Mass of the substance

s = Specific heat of the substance

and $\Delta T$ = Change in temperature.

**15. The temperatures of two substances A and B in different cases are given in the table.**

| Case Substance | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|
| A | $30^0$C | $50^0$C | $-273^0$C | $10^0$K | $40^0$K |
| B | $30^0$C | $30^0$C | $0^0$K | $10^0$C | $40^0$C |

**Write the answer for the following questions using the table : (As–1)**

**i) In which cases A and B are in thermal equilibrium ? Give reason ?**

**ii) In which cases heat transfers from A to B ?**

**Ans.** i) In 1st and 3rd cases A and B are in thermal equilibrium because they have equal temperatures.

ii) In 2nd case heat transfers from A to B.

**16. Explain why dogs pant during hot summer days using the concept of evaporation ?(As–1)**

**Ans.** 1) Dogs do not have sweat poress on their body.

2) Dogs pant during hot summer days to reduce their internal temperature.

3) When the dogs pant, the water molecules present on the tongue gets evaporated by absorbing some heat from their body.

4) As a result the interior of dog's body gets cooled.

**17. Equal amounts of water are kept in a cup and in a dish. Which will evaporate faster ? Why ? (As–3)**

**Ans.** 1) Rate of evaporation of a liquid increases with increase in surface area.

2) The surface area of water in a dish is more than the surface area of water in a cup.

**18. Why do we prefer to sip hot tea with a saucer rather than a cup ? (As–3)**

**Ans.** 1) The rate of evoporation of a liquid increases with increase in surface area.

2) The surface area of a saucer is more than the surface area of a cup.

3) So tea in a saucer evaporates faster.

4) As a result tea in a saucer becomes cool fastly than in a cup. Hence we prefer to sip hot tea with a saucer rather than a cup.

**19. Why do we sweat while doing work ? Why do we feel cooler after sweating ? (As–7)**

**Ans.** 1) When we do work, we spend our energy mostly in the form of heat from the body.

2) As a result the temperature of the skin becomes higher.

3) Then the water in the sweat glands comes out so we get sweat.

4) The sweat evaporates by absorbing the heat from our body. This make us to feel cool.

**20. What role does specific heat play in keeping a watermelon cool for a long time after removing it from a fridge on a hot day ? (As–7)**

**Ans.** 1) Watermelon contains large percentage of water.

2) Water has higher specific heat value.

Hence water melon takes a lot of time for cooling after removing it from a fridge on a hot day.

**21. If you are chilly outside the shower stall, why do you feel warm after the bath if you stay in the bathroom ? (As–7)**

**Ans.** 1) In the bathroom the number of vapour molecules per unit volume is greater than the number of vapuor molecules per unit volume outside the bathroom.

2) When we try to dry ourselves with a towel, the vapour molecules surrounding us condense on our skin.

3) Condensation is a warming process.

4) Hence we feel warm.

## 4 Mark Questions

**III.22. Your friend is asked to differentiate between evaporation and boiling. What questions could you ask him to know the differences between evaporation and boiling ? (As–2)**

**Ans.** I would ask the following questions :

i) If we heat water, at which temperature it convert into vapour ?

ii) What we call this process ?

iii) By which process wet clothes become dry ?

iv) Does evaporation take place at all temperatures or not ?

v) Is the temperature if liquid increases or decreases in boiling ?

vi) Is the temperature of liquid increases or decreases in evaporation ?

vii) Is boiling a surface phenomenon/bulk phenomenon ?

viii) Is evaporation a surface phenomenon / bulk phenomenon ?

**(Note :** Ask any question which is relevant to the above processes**)**

**23. Explain the procedure of finding specific heat of solid experimentally ? (As–1)**

**Ans. Aim :** To find the specific heat of given solid.

**Material required :** Calorimeter, thermometer, stirrer, water, lead shots and woodenbox.

**Procedure :**

1) Measure the mass of the calorimeter along with stirrer. Mass of the calorimeter = $m_1$ = .....

2) Now fill one third of the volume of calorimeter with water. Measure its mass and its temperature.

Mass of the calorimeter + Water = $m_2$ = .....

Mass of the water = $m_2 - m_1$ = .....

Temperature of water in calorimeter = $T_1$ = ..... $C^0$.

3) Take a few lead shots and place them in water. Heat them upto a temperature $100^0$C. Let this temperature be $T_2$. Transfer the hot lead shots quickly into the calorimeter. The mixture settles to a certain temperature after some time. Let this temperature be $T_3$.

Mass of calorimeter + Water + Lead shots

= $m_3$ = .....

Mass of lead shots = $m_3 - m_2$ = .....

4) Let the specific heats of the calorimeter, Lead shots and water be $S_C$, $S_L$ and $S_W$ respectively.

5) According to the method of mixtures, Heat lost by the solid = Heat gain by the calorimeter + Heat gain by the water.

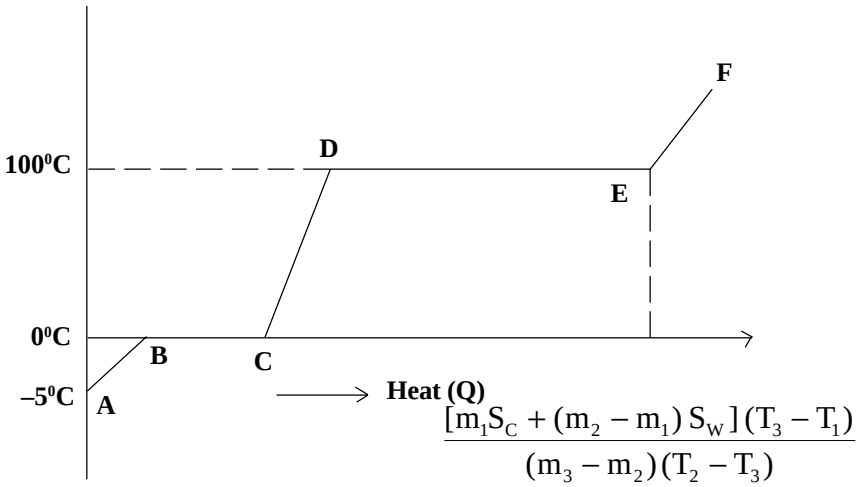
6) Hence

$$(m_3 - m_2)\, S_L\, (T_2 - T_3) = m_1 S_C\, (T_3 - T_1) + (m_2 - m_1)\, S_W\, (T_3 - T_1)$$
$$= [m_1 S_C + (m_2 - m_1)\, S_W]\, (T_3 - T_1)$$

$$S_L = \frac{[m_1 S_C + (m_2 - m_1)\, S_W]\, (T_3 - T_1)}{(m_3 - m_2)(T_2 - T_3)} \quad \text{..... (1)}$$

We can calculate the specific heat of a solid (lead shots) by using the above formula.

**24.**




**By observing the graph, answer the following** **(As–1)**

**i) Which part indicates conversion of ice into water ?**

**ii) What does the part DE represent ?**

**iii) At which point ice starts melting ?**

**iv) What does the point 'E' represent ?**

**Ans.** i) BC

ii) DE represents latent heat of vaporization i.e., the conversion of water into vapour at $100^0$C.

iii) At B

iv) Completely vapour at $100^0$C.

## BITS

**I. Multiple Choice questions :**

1. Which of the following is a warming process. ( )

A) Evaporation B) Condensation C) Boiling D) All the above

2. Three bodies A, B and C are in thermal equilibrium. The temperature of B is $45^0$C. Then the temperature of C is ..... ( )

A) $45^0$C B) $50^0$C C) $40^0$C D) any tempterature

3. The temperature of a steel rod is 330 $K^0$. Its temperature in $C^0$. is ..... ( )
   A) $55^0C$ B) $57^0C$ C) $59^0C$ D) $53^0C$
4. Specific heat S = ..... ( )
   A) $Q/\Delta T$ B) $Q\Delta T$ C) $Q/m\Delta T$ D) $m\Delta T/Q$
5. When ice melts, its temperature ( )
   A) remains constant B) increases C) decreases D) cannot say
6. Which of the following is a cooling process ( )
   A) Evaporation B) Condensation C) Boiling D) All the above

**II. Fill in the blanks.**

7. The SI unit of specific heat is .....
8. The latent heat of fusion of ice is .....
9. The latent heat of vaporization of water is .....
10. Temperature of a body is directly proportional to .....
11. According to the principle of method of mixtures, the net heat lost by the hot bodies is equal to ..... by the cold bodies.
12. The sultryness in summer days is due to .....
13. ..... is used as a coolant.
14. Ice floats on water because .....
15. $0^0C$ = ..... $^0K$.
16. 1 cal = ..... Joules.
17. The amount of water vapour present in air is called .....
18. The water droplets keep floating in the air and form a thick mist is called .....

**III. Matching.**

| | | | |
|---|---|---|---|
| 19. Melting | ( ) | A. Vapour to liquid |
| 20. Boiling | ( ) | B. Liquid to vapour |
| 21. Freezing | ( ) | C. Surface phenomenon |
| 22. Condensation | ( ) | D. Solid to liquid |
| 23. Evaporation | ( ) | E. Liquid to solid |
| | | F. Solid to vapour |

## Answer

**I.** 1) B 2) A 3) B 4) C 5) A 6) A

**II.** 7) J/Kg–K 8) 80 Cal/gm 9) 540 cal/gm
10) average kinetic energy of the molecules 11) heat gained 12) Humidity
13) water 14) the density of ice is less than the density of water
15) 273 16) 4.186 17) Humidity 18) fog

**III.** 19) D 20) B 21) E 22) A 23) C

❖ ❖ ❖ ❖❖

# 2. CHEMICAL REACTIONS AND EQUATIONS

## 1 Mark Questions

**I. 1. Write two reactions which proves that the substance act as base. (As–1)**

**Ans.** 1) Bases are soapy to touch and turn red litmus to blue.

2) The methyl orange indicator convert Base solution into yellow colour.

**2. Write balanced chemical reaction between Calcium Oxide and water. (As–1)**

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

**3. Write world equation of Zn + dil. $HCl_2 \longrightarrow ZnCl_2 + H_2$. (As–1)**

**Ans.** Zinc + dilute Hydro chloric acid ⟶ Zinc Chloride + Hydrogen

**4. Write the substances which undergoes chemical reaction. (As–1)**

**Ans.** The subtances which undergo chemical change in the reaction are called reactants.

**5. Write the substances which are present left side of the arrow mark in the chemical equation ? And also right of the arrow mark in the chemical equation. (As–1)**

**Ans.** The reactants are written on the left side of arrow and the final substances, or products are written on the right side of the arrow.

**6. A) $C(g) + O_2(g) \longrightarrow CO_2 + Q$**

**B) $N_2(g) + O_2(g) \longrightarrow 2NO(g) - Q$ State the type of chemical reaction. (As–1)**

**Ans.** A) Exothermic Reaction

B) Endothermic Reaction

**7. What is meant by Chemical reaction. (As–1)**

**Ans.** The making and breaking of chemical bonds are called Chemical reactions.

**8. X react with Y and forms $Ca(OH)_2$ and Heat. Name X and Y the substances paricipated in the reaction. (As–1)**

**Ans.** X : Cao Y : $H_2O$

**9. Write the reaction involved in the whitening of walls. (As–1)**

**Ans.** A solution of slaked lime produced in the reaction is used to white wash walls. Calcium hydroxide reacts slowly with the carbon dioxide in air to form a thin layer of calcium carbonate on the walls. It gives a shiny finish to the walls.

$$Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$$

**10. How to determine the realeased gas is $CO_2$ in the chemical reaciton. (As–1)**

**Ans.** In the chemical reaction the gas is put off burning match stick with "TUP" sound then is confirmed the released gas is $CO_2$.

**11. Which gas evolved with brown colour in the Heat reaction of Lead Nitrate. (As–1)**

**Ans.** On heating lead nitrate decomposes to lead oxide, oxygen and Nitrogen dioxide. You observe the brown fumes liberating in the boiling tube. These brown fumes are of Nitrogen dioxide ($NO_2$).

$$2Pb(NO_3)_2 \longrightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_2$$

**12. Why they add Dil HCl in electrolysis of water. (As–1)**

**Ans.** The Dil HCl is added to water in the electrolysis process for improve the Conductivity of Electricity.

**13. Write the chemical reaction of Lead Nitrate decomposition. (As–1)**

**Ans.** On heating lead nitrate decomposes to Head oxide, oxygen and Nitrogen dioxide. The brown fumes are liberated by the boiling tube. These brown fumes are due to liberation of Nitrogendioxide ($NO_2$).

$$2Pb(NO_3)_2 \longrightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_2$$

**14. When the reactions are said to be endothermic ? (As–1)**

**Ans.** The reactions require energy in the form of heat, light or electricity for converting the reactants to products. The reactions are Called endothermic Reactions.

**15. Which substance has undergone oxidation reaction in the following. (As–1)**

**Ans.** $H_2S + Br \longrightarrow 2\,HBr + S$

In the above reactions $H_2S$ lost its Hydrogen. So $H_2S$ is oxidized by Bromine.

**16. Write the role of Vitamin C & E in preservation of food. (As–1)**

**Ans.** Usually substances which prevent oxidation (Antioxidants) are added to food. The spoilage of food can be prevented by adding preservatives like Vitamin C and Vitamin E.

**17. What is the use of keeping food in air tight containers. (As–1)**

**Ans.** Chips manufacturers usually flush bags of chips with gas such as nitrogen to prevent the chips from getting oxidized.

**18. Write the chemical reaction, which the silver metal exposed to moisture. (As–1)**

**Ans.** The black coatings on silver

$$4Ag + 2H_2S + O_2 \longrightarrow 2Ag_2S + 2H_2O$$

**19. Define rancidity (As–1)**

**Ans.** When fats and oils in food material that were left for a long period are responsible for spoiling of food. The process is known as Rancidity. Rancidity is an oxidation reaction.

**20. Write the name of metal which is not undergone oxidation process. (As–1)**

**Ans.** Gold

**21. Write the substances are used for manufacturing of stainless steel. (As–1)**

**Ans.** Iron is mixed with carbon, nickel and chromium to get an alloy stainless steel.

## 2 Mark Questions

**II.22. Give examples for exothermic reactions. (As–1)**

**Ans.** i) Burning of Coal : When coal is burnt in oxygen, carbon dioxide is produced.

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} + Q$ (heat energy) ..... (1)

ii) Slaked lime is prepared by adding water to quick lime.

$Ca\ O_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2\ (aq)} + Q$ (heat energy) ..... (2)

Large amount of heat energy is released on reaction of water with $CaO_{(s)}$. If you touch the walls of the container you will feel the hotness. Such reactions are called exothermic reactions.

**23. Write a chemical change between Barium chloride and Sodium Sulphate ? Determine the colour of the end product for the above reaction. (As–1)**

**Ans.** Sodium sulphate reacts with barium chloride to give white precipitate, barium sulphate and sodium chloride.

$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + NaCl$

**24. What are the changes do you observed between the chemical reaction of Zinc and Dilute Hidro chloric acid in conical plask. (As–1)**

**Ans.** Zinc metal reacts with dilute HCl to yield $ZnCl_2$ and liberates Hydrogen gas.

$Zn + HCl \longrightarrow ZnCl_2 + H_2$

**25. What is meant by chemical equation ? Write chemical equation of the reaction between Barium chloride and Sodium Sulphate. (As–1)**

**Ans.** Describing a chemical reaction using least possible words or symbols is called a chemical equation.

Sodium sulphate reacts with barium chloride to give white precipitate, barium sulphate and sodium chloride.

$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + NaCl$

**26. Balance the following chemical equation**

**a)** $\mathbf{C_3H_8 + O_2 \longrightarrow CO_2 + H_2O}$

**b)** $\mathbf{Fe_2O_3 + Al \longrightarrow Fe + Al_2O_3}$

**c)** $\mathbf{CO_2 + H_2O \longrightarrow C_6H_{12}O_6 + O_2}$

**d)** $\mathbf{Pb(NO_3)_2 \longrightarrow PbO + NO_2 + O_2}$ **(As–1)**

**Ans.** a) $2C_3H_8 + O_2 \longrightarrow 6CO_2 + 8H_2O$

b) $Fe_2O_3 + 2Al \longrightarrow 2Fe + Al_2O_3$

c) $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

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

**27. Write the photolytic reaction by taking example as Silver bromide decomposition reaction. (As–1)**

**Ans.** Silver bromide decomposes to silver and bromine in sunlight. Light yellow coloured silver bromide turns to gray due to sunlight.

$2AgBr_{(s)} \longrightarrow 2\ Ag_{(s)} + Br_{2(g)}$

This decomposition reaction occurs in presence of sunlight and such reactioins are called photochemical reactions.

**28. When you dippled iron nails in Copper sulphate solution, becoming brown. Write causes for loss of colour of copper sulphate solution. (As–1)**

**Ans.** The Iron nail dipped in copper sulphate solutions compared before and after the experiment.

$Fe_{(S)} + CuSO_{4(s)} \longrightarrow FeSO_{4(aq)} + Cu_{(g)}$

Iron is more reactive than copper, so it displaces copper from copper sulphate.

**29. What do you observe in the chemical displacement reaction. How do you satisy the above exaplanation with suitable example. (As–1)**

**Ans.** In the displacement reaction the element in the one compound is displaced by another. Zinc pieces react with dilute hydrochloric acid and liberate hydrogen gas as shonw below.

$Zn_{(S)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_{2(g)}$

In reaction the element zinc has displaced hydrogen from Hydrochloric acid.

**30. What are precipitative reaction ? Give examples. (As–1)**

**Ans.** Lead nitrate solution with potassium iodide solution. A yellow colour substance which is insoluble in water, is formed. This insoluble substance in known as precipitate, and the reactions are called precpitative reactions.

$Pb(NO_3)_{2(aq)} + 3Kl_{(aq)} \longrightarrow PbI_{2(s)} + 2KNO_{3(aq)}$

**31. In the following chemical reaction name the compound which is oxidized and which is reduced. (As–1)**

**Ans.** $MnO_2 + HCl \longrightarrow MnCl_2 + 2H_2O + Cl_2$

In the above reaction $MnO_2$ loss it Oxygen. So $MnO_2$ is reduced. Hcl accept Oxygen, So it is Oxidized.

**32. What do you mean by corrosion ? Give precausationary measure for prevention of corrossion. (As–1)**

**Ans.** When some metals are exposed to moisture, acids etc., they tarnish due to the formation of respective metal oxide on their surface. This process is called corrosion.

Corrosion can be prevented or at least minimized by shielding the metal surface from oxygen and moisture. It can be prevented by painting, oiling, greasing, galvanizing, chrome plating or making alloys. Galvanizing is a method of protecting iron from rusting by coating them a thin layer of Zinc.

**33. Why the apple change their colour in to brown, when you cut with knife. (As–1)**

**Ans.** Apples produce an enzyme called polyphenol oxidase or tyrosinase, that reacts with oxygen. When the fruit is cut, it damages the cells in the fruit and allows the oxygen in the air to react with the enzyme and other chemicals of fruit. This reaction leads to browning of cut surface of fruit.

**34. What is galvonisation ? Write their uses. (As–1)**

**Ans.** Galvanizing is a method of coating a metal with a thin layer of Zinc. It is essential for protection of metals from rusting.

**35. Write the bleaching reaction of chlorine. (As–1)**

**Ans.** Bleaching of coloured objects using moist chlorine.

$Cl_2 + H_2O \longrightarrow HOCl + HCL$

$HOCL \longrightarrow HCl + (O)$

Coloured object + (O) Colourless object.

**36. Give two examples of reactions in w hich oxidation - reduction process has observe in the same reaction. (As–1)**

**Ans.** Oxidation and reduction occur in the samireaction. If one reactant gets oxidized, the other gets reduced. Such reactions are called oxidation-reduction reactions or redox reactions.

$CuO + H_2 \longrightarrow Cu + H_2O$

In the CuO, $H_2$ reaction CuO is reduced and $H_2$ is oxidized.

**37. Why the formers add Cao or $CaSO_4.2H_2O$ or $CaCO_3$ to the soil. Give me reasons. (As–1)**

**Ans.** The formers are used the Cao or $CaSO_4.2H_2O$ or $CaCO_3$ to the soil to increase the $P^H$ of soil and to reach the ideal soil pH for the growth of plants.

## 4 Mark Questions

**III.38. How to determine the substances undergone a chemical reaction ? (As–1)**

**Ans.** We can determine when the substance undergone a chemical reaction the following changes are observed.

1) A change that changes state and colour of substance.
2) A change that release heat energy.
3) A change which forms an insoluble substance as precipitate.
4) A change that liberate a gas.

**39. Write the steps involved in the balancing of chemical equation with suitable examples ? (As–1)**

**Ans.** The chemical equation is balanced by using a systematic method.

**Step 1 :** Write the unbalanced equation using the correct chemical formula for each reactant and products. In the reaction of hydrogen with oxygen to yield water, you can write unbalanced chemical equations as follows :

$H_2 + O_2 \longrightarrow H_2O$

**Step 2 :** Compare number atoms of each element on both sides. Find the suitable coefficients – the numbers placed before formula to indicate how many formula units of each substance are required to balance the equation. Only these coefficients can be changed when balancing an equation, the formulas themselves can't be changed. We take the reaction of hydrogen with oxygen as an example; we can balance the equation by adding a coefficient of 2 to both $H_2$ and $H_2O$. By so doing there are 4 hydrogen and 2 oxygen atoms on each side of the equation :

$$2H_2 + O_2 \longrightarrow 2H_2O$$

**Step 3 :** Reduce the coefficients to their smallest whole number values, if necessary by dividing them all by a common devisor.

**Step 4 :** Check the answer by making sure that the numbers and kinds of atoms are the same on both sides of the equation.

**Example 2 :** Propane, $C_3H_8$ is a colorless, odorless gas often used as a heating and cooking fuel. Write the chemical equation for the combustion reaction of propane with oxygen to yield carbon dioxide and water and balance it. Follow the four steps described in previous discussion.

**Step 1 :** Write the unbalanced equation using correct chemical formulas for all substances.

$$C_3H_8 + O_2 \longrightarrow CO_2 + H_2O$$

**Step 2 :** Compare number of atoms of each element on both sides. Find the coefficients to balance the equation. It is usually best to start with the most complex substance – in this case $C_3H_8$ – and to deal with one element at a time. Look at the unbalanced equation, and note that there are 3 carbon atoms on the left side of the equation but only 1 on the right side. If we add a coefficient of 3 to $CO_2$ on the right side the carbon atoms balance.

$$C_3H_8 + O_2 \longrightarrow 3CO_2 + H_2O$$

| **Element** | **No of atoms** | |
|---|---|---|
| | LHS | RHS |
| C | 3 | 1 |
| H | 8 | 2 |
| O | 2 | 3 |

Now, look at the number of hydrogen atoms. There are 8 hydrogens on the left but only 2 on the right side. By taking a coefficient of 4 to the $H_2O$ on the right, the hydrogens balance.

$$C_3H_8 + O_2 \longrightarrow 3CO_2 + H_2O$$

Finally, look at the number of oxygen atoms. There are 2 on the leftside but 10 on the right side, by taking a coefficient of 5 to the $O_2$ on the left, the oxygen balance.'

$$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + H_2O$$

**Step 3 :** Make sure the coefficients are reduced to their smallest wholenumber values. In fact, the equation – 11 we got is already coefficients in smallest whole number. There is no need to reduce its coefficients, but this might not be achieved in each chemical reaction. lLet us assume that you have got chemical equation as shown below :

$$2C_3H_8 + 10O_2 \longrightarrow 6CO_2 + 8H_2O$$

Though the equation – 12 is balanced, the coefficients are not the smallest whole numbers. If would be necessary to divide all coefficients by 2 to reach the final equation.

**Step 4 :** Check the answer. Count the numbers and kinds of atoms on both sides of the equationto make sure that are the same.

**40. What is meant by balanced equation ? Why the chemical equation must be balanced.** **(As–1)**

**Ans.** A chemical equation in which the numbers of atoms of different elements on the reactants side (left side) are same as those on product side (right side) is called a balanced reaction.

According to the law of conservation of mass, the total mass of the substances thatare taking part in chemical reaction must be the same before and after the reaction. You know an atom is the smallest particle of an element that take part in a chemical reaction as it is the atom which account for the mass of any substance. The number of atoms of each element before and after reaction must be the same. All the chemical equations must balance, because atoms are neither created nor destroyed in chemical reactions.

**41. What type of information acquired from Chemical equation.** **(As–1)**

**Ans. i) Expressing physical state :** To make the chemical equation more informative, the physical states have to be mentioned along with their chemical formulas. The different states i.e., gaseous, liquid, and solid states are represented by the notations (g), ($l$) and (s) respectively. If the substance is present as a solution in water the word aqueous is written as (aq). The balanced equation is written along with the physical states as :

$Fe_2O_{3(s)} + 2Al_{(s)} \longrightarrow 2\ Fe_{(l)} + Al_2O_{3(s)}$

In the above equation $Fe_{(l)}$ indicates that iron is produced in liquid state, remaining all the substances are in solid state.

**ii) Expressing the heat changes :** You know heat is liberated in an exothermic reactions and heat is absorbed in endothermic reactions. See the following examples.

1) $C_{(s)} + O_{2(g)} \longrightarrow CO_2 + Q$ (exothermic reaction)

2) $N_{2(g)} + O_{2(g)} \longrightarrow 2NO_{(g)} - Q$ (endothermic reaction)

**iii) Expressing the gas eolved :** If a gas is evolved in a reaction, it is denoted by an upward arrow.

**Example :** $Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

**iv) Expressing precipitate formed :** If a precipitate is formed in the reactions it is denoted by a downward arrow.

**Example :** $AgNO_3 + NaCl \longrightarrow AgCl + NaNO_3$

**42. Define Chemical combination ? Explain with Examples.** **(As–1)**

**Ans.** A reaction in which single product is formed from two or more reactants is known as chemical combination reaction.

1) Take a small piece (about 3 cm long) of Magnesium ribbon.
2) Rub the Magnesium ribbon with sand paper.
3) Hold it with a pair of tongs.
4) Burn it with a spirit lamp or burner.

Magnesium burns in oxygen by producing dazzling white flame and changes into white powder. The white powder is Magnesium oxide.

$2\ Mg_{(s)} + O_{2(g)} \longrightarrow 2MgO_{(g)}$

In this reaction Magnesium and oxygen combine to form a new substance magnesium oxide, such a reaction in which single product is formed from two or more reactants is known as chemical combination reaction.

**43. Define Chemical decomposition ? Explain with examples. (As–1)**

**Ans. Chemical decomposition :** In a decomposition reaction a single substance decomposes to give two or more Substances.

1) Take a pinch of Calcium Carbonate (lime stone) in a boiling tube.
2) Heat the boiling tube over the flame of spirit lamp or burner.
3) Now take a burning match stick near the mouth of boiling tube.

In the above activity, on heating calcium carbonate, it decomposes to calcium oxide and carbon dioxide.

$CaCO_{3\,(s)} \longrightarrow CaO_{(S)} + CO_{2(g)}$

It is a thermal decomposition reaction. When a decomposition reaction is carried out by heating, it is called thermal decomposition reaction.

**44. Explain the Electrolysis experiment to release of $H_2$ and $O_2$. (As–1)**

**Ans.** 1) Take a plastic mug. Drill two holes at its base.
2) Fit two rubber stoppers in these holes.
3) Insert two carbon electrodes in these rubber stoppers.
4) Connect the electrodes to 6V battery as shown in fig.
5) Fill the mug with water, so that the electrodes are immersed.
6) Add few drops of dilute sulphuric acid to water.
7) Take two test tubes filled with water and invert them over the two carbon electrodes.
8) Switch on the current and leave the apparatus undisturbed for sometime.

The liberation of gas bubbles at both the electrodes. These bubbles displace the water in the test tubes. Once the test tubes are filled with gases take them out carefully. Test both the gases separately by bringing a burning candle near the mouth of each test tube.

In the above activity on passing the electricity, water dissociates to Hydrogen and oxygen.

$2H_2O_{(l)} \longrightarrow 2\ H_{2(g)} + O_{2(g)}$

**45. Define displacement reaction ? Explain with Examples. (As–1)**

**Ans.** The element displaces another element from its compund, the reactions called displacement reaction.

Take a small quantity of zinc dust in a conical flask with nozzle. Add dilute Hydrochloric acid slowly. Now take a balloon and tie it to the mouth of the conical flask. Closely observe the changes in the conical flask and ballon. The gas bubbles coming out from the solution and the balloom bulges out. Zinc pieces react with dilute hydrochloric acid and liberate hydrogen gas as shown below.

$$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_{2(g)}$$

In reaction the element zinc has displaced hydrogen from Hydrochloric acid. This is displacement reaction.

**46. Define double displacement reaction ? Explain with Examples. (As–1)**

**Ans. Double displacement reaction :** Two different atoms or ions are Exchanged in double displacement reactions.

1) Take a pinch of lead nitrate and dissolve in 5.0 mL of distilled water in a test tube.
2) Take a pinch of potassium iodide in a test tube and dissolve in distilled water.
3) Mix lead nitrate solution with potassium iodide solution. A yellow colour substance which is insoluble in water, is formed. This insoluble substance in known as precipitate. The precipitate is Lead Iodide.

$$Pb(NO_3)_{2(aq)} + 3Kl_{(aq)} \longrightarrow PbI_{2(s)} + 2KNO_{3(aq)}$$

In the above reaction, lead ion and Potassium ion exchange their places each other. Lead ion combines with iodide ion and forms $PbI_2$ as precipitate and $KNO_3$.

**47. Define oxidation and reduction ? Give the example for oxidation and reduction reactions occus in the same reaction. (As–1)**

**Ans.** 'OXIDATION' is a reaction that involves the addition of oxygen or removal of hydrogen.

'REDUCTION' is a reaction that involves the addition of hydrogen or removal of oxygen.

On heating coper it reacts with oxygen present in the atmosphere to form coper oxide. The reaction is shown below.

$$Cu_{(2)} + O_{2(s)} \longrightarrow 2CuO_{(s)}$$

Here copper combines with oxygen to form coper oxide. Here oxygen is gained and the process is called oxidation.

Generally oxidation and reduction occur in the same reaction. If one reactant gets oxidized, the other gets reduced. Such reactions are called oxidation-reduction reactions or redox reactions.

$$CuO_{(2)} + H_{2(s)} \longrightarrow Cu_{(s)} + H_2O_{(g)}$$

In the CuO, $H_2$ reaction CuO is reduced and $H_2$ in oxidized.

**48. Write the balanced chemical equation for the following and identify the type of reaction in each case. (As–1)**

**A)** $\mathbf{Ca(OH)_2 + HNO_3 \longrightarrow H_2O + Ca(NO_3)_2}$

**B)** $\mathbf{Ma + I_2 \longrightarrow MgI_2}$

**C)** $\mathbf{Mg + HCl \longrightarrow MgCl_2 + H_2}$

**D)** $\mathbf{Zn + CaCl_2 \longrightarrow ZnCl_2 + Ca}$

**Ans.** A) $Ca(OH)_2 + 2HNO_3 \longrightarrow 2H_2O + Ca(NO_3)_2$

This is double displacement reaction.

B) $Ma + I_2 \longrightarrow MgI_2$

This is chemical combination reaction.

C) $Mg + 2HCl \longrightarrow MgCl_2 + H_2$

This is chemical displacement reaction

D) $Zn + CaCl_2 \longrightarrow ZnCl_2 + Ca$

This is Chemical Displacement reaction.

❖ ❖ ❖ ❖❖

# 3. REFLECTION OF LIGHT BY DIFFERENT SURFACES

## 1 Mark Questions

**1. State Fermat's principle.**

**Ans.** Fermat's principle states that the light selects the path which takes the least time to travel.

**2. State the laws of reflection of light.**

**Ans.** i) When light gets reflected from a surface, the angle of reflection is equal to the angle of incidence.

ii) The incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane.

**3. Why does an image of plane mirror suffer lateral (right-left) inversion ?**

**Ans.** The light rays which come from our right ear get reflected from the plane mirror and reach our eye. Our brain feels that the ray (reflected ray) is coming from the inside of the mirror. That is why our right ear looks like left ear in the image.

**4. Define magnification.**

**Ans.** The ratio of the height of the image to the height of the object is called magnification.

$$\text{Magnification (m)} = \frac{\text{Height of the image } (h_i)}{\text{Height of the object } (h_0)}$$

**5. The magnification produced by a plane mirror is +1. What does this mean ?**

**Ans.** Magnification +1 indicates that (i) the image is erect and (ii) the size of the image is equal to size of the object.

**6. Write the mirror formula and explain the terms.**

**Ans.** Mirror formula

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$$

Here f = focal length

u = object distance

v = image distance

## 2 Mark Questions

**II.1. State the differences between convex and convace mirror.**

**Ans.**

| Convex mirror | Convave mirror |
|---|---|
| 1. A spherical mirror whose reflecting surface is curved outward is called convex mirror. | 1. A speherical mirror whose reflecting surface is curved inward is called concave mirror. |
| 2. After reflection from the mirror the light rays diverge. | 2. After reflection from the mirror the light rays converge. |

| | |
|---|---|
| 3. The image formed due to convex mirror is always virtual. | 3. The image formed due to concave mirror is generally real. But when an object is placed between pole and focus, it is virtual. |
| 4. The image formed due to convex mirror is always diminished. | 4. The image formed due to concave mirror is either diminished, or magnified orin same size. |

**2. Distinguish between real and virtual image.**

**Ans.**

| Real image | Virtual image |
|---|---|
| 1. Real image formed due to converging of light rays. | 1. Virtual image formed due to diverging of light rays. |
| 2. Real image can be formed on screen. | 2. This image cannot be formed on screen. |
| 3. Real image is always inverted. | 3. Virtual image is always erected. |
| 4. Here the rays actually meet at the image point. | 4. Here the rays appears to diverge from the image point. |

**3. List out any four properties of the image formed by a plane mirror.**

**Ans.** 1) The image by a plane mirror is virtual and erect.

2) Size of the image is equal to the size of the object.

3) Image distance is equal to object distance. (i.e., the distance of the image in a plane mirror seems to be equal to the distance between the mirror and object).

4) The image suffers lateral inversion.

**4. Why does the size of the image seem to be decreased when you move the object towards your eye ?**

**Ans.** When we move the object from the mirror to our eye the image in the mirror seems to move back in the mirror. Then the distance from the image to our eye increases. The angle made by image at our eye is smaller than the angle made by the object. That is why the image looks smaller than the object.

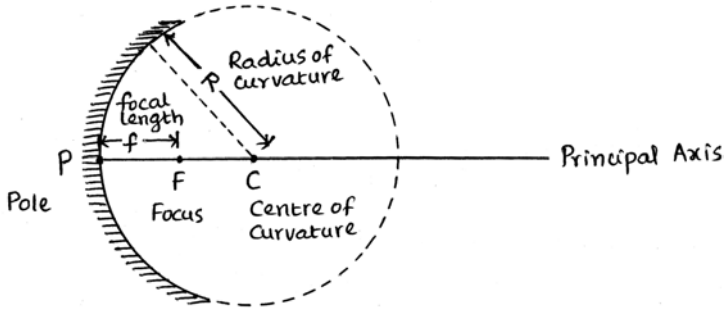
**5. Define the following terms in connection with spherical mirrors.**

**i) Pole** **ii) Centre of curvature**

**iii) Principal axis** **iv) Radius of curvature**

**v) Focal pint (focus)** **vi) Focal length**

**Ans.**




**i) Pole :** The geometrical centre of the spherical mirror is called 'pole' (P).

**ii) Centre of curvature :** It is the centre of the sphere of which the mirror forms a part.

**iii) Principal Axis :** The line passing through the centre of curvature and pole is called principal axis.

**iv) Radius of curvature :** The distance between pole and centre of curvature is called radius of curvature.

**v) Focus :** It is a point on the prinipal axis where a beam of light parallel to the principal axis either actually converges to or appears to diverge from, after reflection from a mirror.

**vi) Focal length :** The distance between the focus and the pole of the mirror is called focal length.

**6. Write the rules for sign convention.**

**Ans.** i) All distance should be measured from the pole.

ii) The distances measured in the direction of incident light to be taken positive and those measured in the direction opposite to incident light to be taken negative.

iii) Height of object and height of image are positive if measured upwards from the axis and negative if measured downwards.

**7. Imagine that spherical mirrors were not known to human beings. Guess the consequences.**

**Ans.** i) Without rear view mirrors safe driving in automobiles will not be possible.

ii) Dentists may not have proper diagnosis of teeth and also by ENT specialists not possible to see the inner parts of ear and nose without concave mirrors.

iii) Automobile head lights, torch light, search lights can not give bright lighting.

iv) Solar cookers are also made from concave mirrors. Construction of reflecting telescopes would not be possible.

Thus every where we are using spherical mirrors and without these life of human begings is miserable.

**8. How do you appreciate the role of spherical mirrors in daily life ?**

**Ans.** Spherical mirros are very useful to our life.

i) Concave mirrors are used by dentists to see the large images of the teeth of patient.

ii) Spherical mirrors are used in telescopes.

iii) Concave mirrors are used as reflectors in torches and vehicle head lights.

iv) Convese mirrors are used as rear view mirrors in vehicles.

v) Concave mirrors are used in solar furnaces.

vi) Concave mirrors are used by ENT specialists to see the affected part more visible.

So i can appreciate the role of spherical mirrors.

**9. Why do we prefer a convese mirror as a rear-view mirror in the vehicles ?**

**Ans.** i) Convex mirror always forms virtual, erect and diminished images irrespective of distance of the object.

ii) A convex mirror enables a driver to view large area of the traffic behind him.

iii) Convex mirror forms very small image than the object.

Due to these reasons convex mirrors are used as rear view mirrors in vehicles.

**10. By observing steel vessels and different images in them, Surya, a third class student asked some questions his elder sister Vidya. What may be those questions ?**

**Ans.** i) How these steel vessels form images like mirrors ?

ii) One side they form large image and other side they formed small images. Why ?

iii) Why is the image size changing when the vessel is moved away or towards the face ?

iv) Why the image is blurred not as clear as in mirror ?

## 4 Mark Questions

**III.1. What do you infer from the experiment which you did with concave mirrors and measure the distance of object and distance of image ?**

**Ans.**

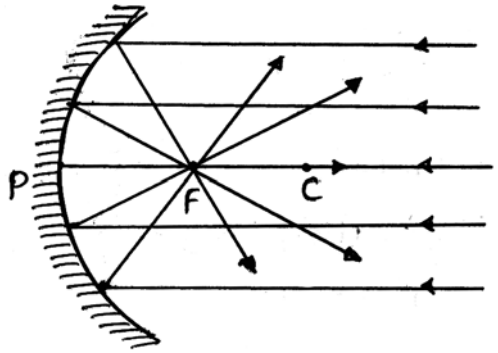
| Position of the object | Position of the image | Enlarged/ diminished | Inverted/ erected | Real/ virtual |
|---|---|---|---|---|
| Between mirror and F | beind mirror | Enlarged | Erect | Virtual |
| At focal point F | at infinity | – | – | – |
| Between F and C | beyond C | Enlarged | Inverted | Real |
| At centre of curvature C | at centre of curvature C | Same size | Inverted | Real |
| Beyond C | between F and C | Diminished | Inverted | Real |
| at infinity | at focus | Very diminished (Point sized) | Inverted | Real |

**2. How do you find the focal length of a concave mirror ?**

**Ans.** i) Hold a concave mirror perpendicular to the direction of sunlight.

ii) Take a small paper and slowly move it in front of the mirror and findout the point where you get smallest and brightest spot, which will be the image of the sun.

iii) The rays coming from sun parallel to concave mirror are converging at a point.




iv) This point is called focus or focal point of the concave mirror.

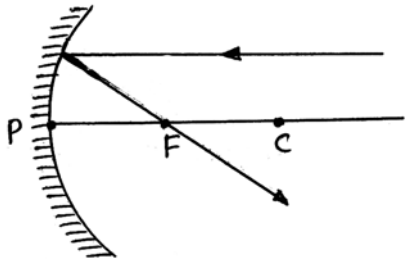
v) Measure the distance of this spot from the pole of the mirror.

vi) This distance is the focal length of the given concave mirror.

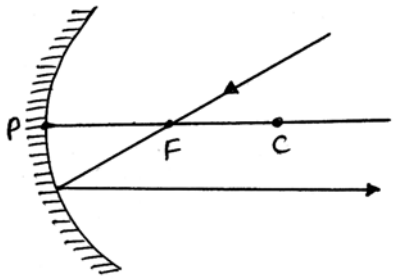
## 5 Mark Questions

**1. Draw suitable rays by which we can guess the position of the image formed by a concave mirror.**

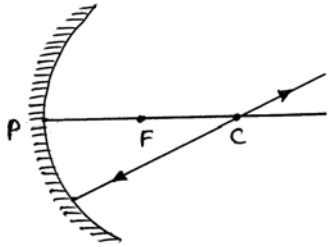
**Ans.** 1) A ray parallel to the principal axis passing through principal focus (F) after reflection from a concave mirror.




2) A ray passing through Focus (F) becomes parallel to principal axis after reflection from a concave mirror.

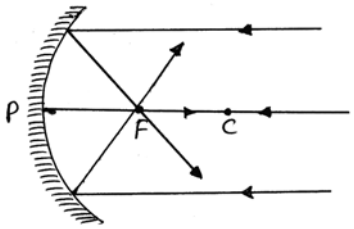



3) A ray passing through C is reflected back along the same path after reflection from a concave mirror.

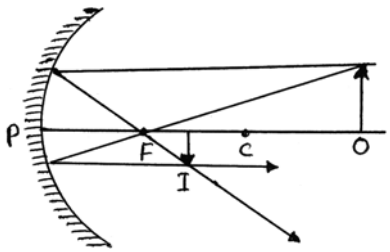


**2. Explain the nature of imges formed with the help of ray diagrams when an object is placed at different points between a concave mirror.**

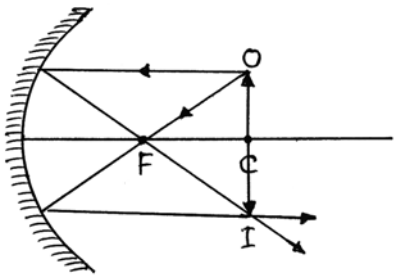
**Ans. 1) When object is at infinity :** When object is at infinity, the image is formed at focal point (F) of the mirror. The image is real and point sized.



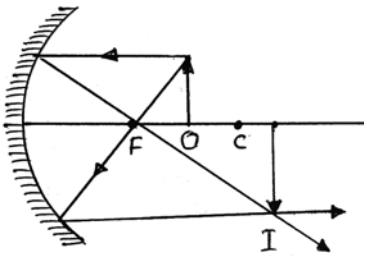

**2) When the object is (between infinity and centre of curvature) beyond C :** When the object is beyond C (centre of curvature), the image is formed between Focus (F) and C. This is real, inverted and diminished image.



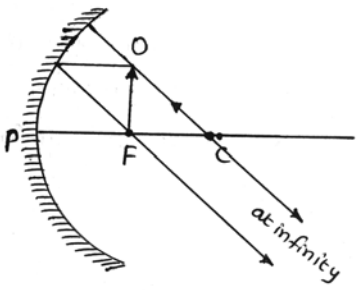

**3) When the object is at C :** When the object is at C, the image also forms at C. This is a real, inverted and same sized image.



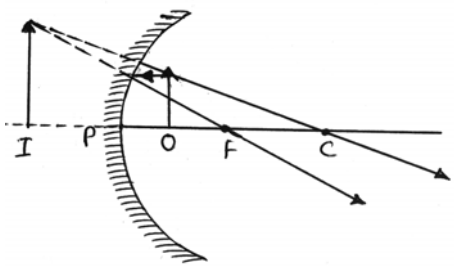

**4) When the object is between C and F :** When the object is between C and F, the image is formed beyond C. This is real, inverted and enlarged image.




**5) When the object is at F :** When the object is at F, the image is formed at infinity. This is real, inverted and highly enlarged.

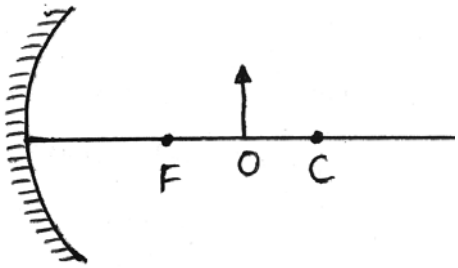



**6) When the object is between F and Pole :** When the object is between F and pole, the image forms behind the mirror. This is virtual, enlarged and erect image.

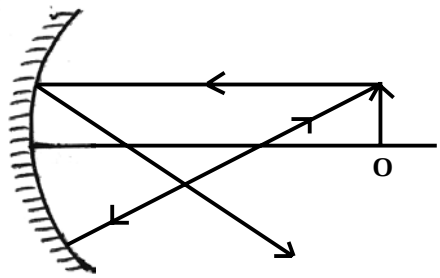


## Related questions :

1. Where will the image form when we place an object, on the principal axis of a concave mirror at a point between focus and centre of curvature ?
2. How do you get a virtual image using a concave mirror ?
3. Show the formation of image with a ray diagram when an object is placed on the principal axis of a concave mirror beyond the centre of curvature and explain the nature of the image.
4. Top form the image on the object itself, how should we place the object in front of a concave mirror ? Explain with a ray diagram.
5. Draw the formation of image with the help of suitable rays. And explain the nature of the image.




6. Indicate the pole, Focus, centre of curvature, position of the image in the following figure.

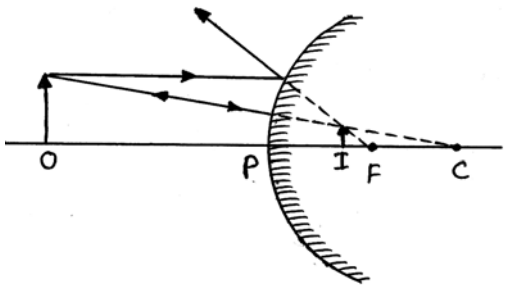



**3. With the help of ray diagrams, explain the formation images by a convese mirror when**

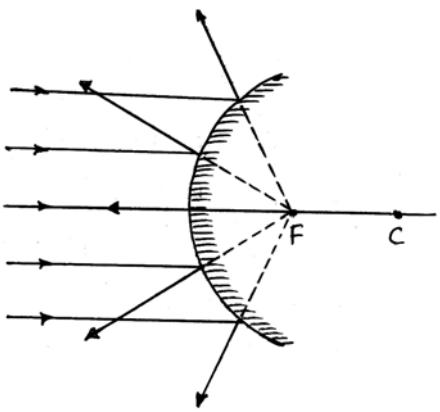
**i) Object between pole and infinity**

**ii) Object at infinity**

**Ans.**




**Object between pole and infinity**




**Object at infinity**

| Position of the object | Position of the image | Nature of the image | Size of the image |
|---|---|---|---|
| Between pole and object | Between P and F image | Virtual and image | Diminished image |
| At infinity | At the focus, behind the mirror | Virtual and erect | Highly diminished (point-sized) |

## Problems :

1. **If the radius of curvature of a spherical mirror is 20 cm what is its focal length ?**

**Ans.** Focal length f =

Given radius of curvature R = 20 cm

∴ f = = 10 cm

2. **Find the distance of the image when an object is placed on the principal axis at a distance of 10 cm in front of a concave mirror whose radius of curvature is 8 cm.**

**Ans.** Object distance u = 10 cm

Radius curvature R = 8 cm

∴ Focal length f = = 4 cm

Image distance V = ?

From mirror formula

(or)

= =

$\therefore v = \frac{20}{3} = 6.67$ cm

∴ Image distance v = 6.67 cm.

3. **An object is placed at a distance of 10 cm from a convese mirror of focal length 15 cm. Find the position and nature of the image.**

**Ans.** Object distance u = – 10 cm

Focal length f = 15 cm

Image distance v = ?

From mirror formula

(or)

=

$= \frac{1}{15} + \frac{1}{10} = \frac{2+3}{30}$

$\therefore$ v = = 6

$\therefore$ Image is formed behind 6 cm from the mirror. Image is virtual, erect and diminished.

**4. A convese mirror with a radius of curvature of 3 m is used as rear view in an automobile. If a bus is located at 5 m from this mirror, find the position and size of the image.**

**Ans.** Radius of curvaturer = 3

Focal length = = 1.5 m

Object distance u = –5 m

Image distance v = ?

$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{\text{Radius of curvature (R)}}$

$\frac{1}{1.5} = \frac{1}{v} + \frac{1}{(-5)} = \frac{2}{5}$

From mirror formula

(or)

=

=

=

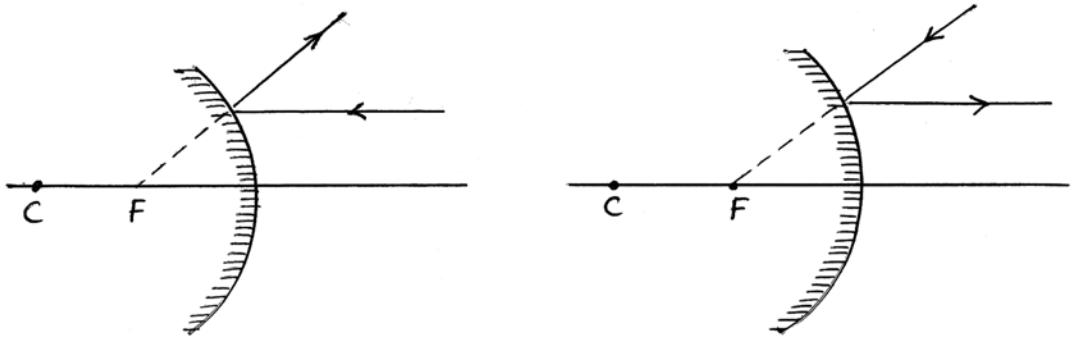
$\therefore$ v = = 1.15 m

$\therefore$ Image is formed behind 1.15 m of mirror.

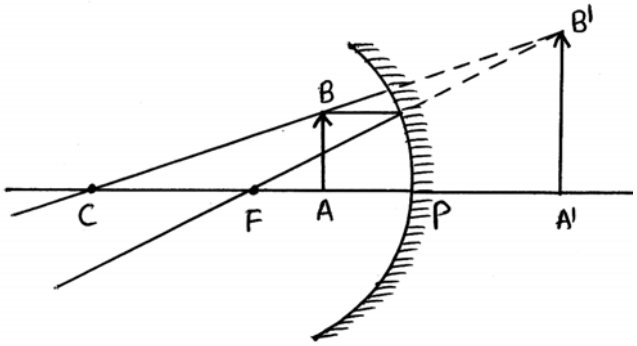
Image is virtual, erect and diminished.

## TRY THESE :

1. Comment on the following ray diagrams.




2. Explain the nature of the image in the following figure.




3. Raju saw his face in a mirror and observed that his face became smaller in size.
   i) Which type of mirror is that ?
   ii) What is the nature of the image ?

$$\frac{1}{u}+\frac{1}{v}=\frac{1}{f}$$

4) i) Which is type of mirror is used in head lights of vehicles like car ?
   ii) What is the position of the bulb with respect to the mirror ?
   iii) In a head light of the car, light rays coming from the bulb incident on mirror and reflects. Show this with a ray diagram.
5. What questions do you ask to confirm the factors shoud know to draw ray diagrams of a spherical mirror.
6. In olden days kings burned the ships and tents of enemies by using mirrors.
   i) What type of mirrors they used ?
   ii) How they burned the ships ?

## BITS

**I. Multiple Choice questions :**

1. The ratio of the focal length of spherical mirror to its radius of curvature is ( )
   A) 1 : 2 B) 2 : 1 C) 1 : 3 D) 1 : 4
2. The object distance u, image distance v and focal length f for a spherical mirror are related as
   A) B) C) v + u = f D) f = ( )

3. The image formed by a concave mirror ( )

   A) is always real B) is always virtual

   C) can be both real and virtual D) none of these

4. The image formed by a convese mirror is always ( )

   A) real and magnified B) real and diminished

   C) virtual and diminished D) virtual and magnified

5. The mirror which has a wide field of view must be ( )

   A) concave B) convex C) plane D) none of these

6. A real and inverted image of the same size is forme dby a concave miror when the o bject is placed ( )

   A) between the mirror and its focus B) between the focus and the centre of curvature

   C) at the centre of curvature D) beyond the centre of the curvature

7. A concave mirror always forms real and inverted image except when the object is placed( )

   A) at infinity B) between F and C

   C) at F D) between F and pole of the mirror

8. An object is placed at a distance of 30 cm from a concave mirror of focal length 15 cm. The image will be ( )

   A) real and same size B) real and magnified

   C) real and diminished D) virtual and magnified

9. If an object is placed at C on the principal axis in from of a concave mirror, the position of the image is ( )

   A) at infinity B) between F and C C) at C D) beyond C

10. A ray which seems to be traelling through the focus of a convese mirror passes ..... after reflection. ( )

    A) paralled to the principal axis B) along the same path in

    C) through F D) through C

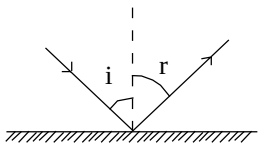
11. Magnification m = ( )

    A) B) C) D)

12. The driver's mirror used in automobiles is ( )

    A) convex B) concave C) plane D) none of these

**II. Fill in the blanks.**

1. Light selects the least time path to travel between two points. This principle was states by .....
2. The relation between focal length and radius of curvature is given by .....
3. 

In the adjacent figure, Lr indicates .....
4. The rays which are parallel to the principal axis of a concave mirror on reflection, meet at the .....
5. The distance between pole and centre of curvature is .....
6. The distance between pole and focus is .....
7. The equation of mirror formula is .....
8. The relation between the angle of incidence and angle of reflection is given by .....
9. If m > 1, the size of the image is ..... than the size of the object.
10. The dentists use ..... mirrors to see large image of the teeth of patients.
11. The geometric centre of the mirror is .....
12. The line which passes through the centre of curvature and pole is .....

**III. Matching.**

| | | | |
|---|---|---|---|
| 1. Beyond C | ( ) | A. Behind the mirror | $\frac{1}{f}=\frac{1}{v}+\frac{1}{u}$ |
| 2. On C | ( ) | B. At infinity | |
| 3. Between C and F | ( ) | C. Between F and C | |
| 4. On F | ( ) | D. On F | |
| 5. Between F and P | ( ) | E. Beyond C | |
| 6. At infinity | | F. At C | |

## Answer

**I.** 1) A 2) B 3) C 4) C 5) B 6) C
7) D 8) A 9) C 10) A 11) D 12) A

**II.** 1) Fermat 2) t f = (or) R = 2f 3) angle of reflection 4) Focus
5) Radius of curvature 6) Focal length 7)
8) 9) more (greater) 10) concave 11) pole 12) principal axis

**III.** 1) C 2) F 3) E 4) B 5) A 6) D

❖ ❖ ❖ ❖❖

# 4. ACIDS AND BASES

## 1 Mark Questions

**I. 1. Which substance involved in the chemical reaction for formation of Sodium Zinkate.**

**Ans.** Zinc metal react in a bottle and add sodium hydroxide (NaOH) solution and warm the contents. The reaction is written as follows.

$$2\,NaOH + Zn \longrightarrow \underset{\text{(Sodium zincate)}}{Na_2ZnO_2} + H_2$$

**2. What type of reaction in stomach when an antacid tablet is consumed.**

**Ans.** These antacids neutralize the excess acid in the stomach. Magnesium hydroxide (milk of magnesia), a mild base, is often used for this purpose. Being alkaline, it neutralizes excess acid in the stomach and provides relief.

**3. Write the reaction between bases with non-metal oxides with suitable examples.**

**Ans.** Calcium hydroxide, which is a base, reacts with carbon dioxide to produce a salt and water. This reason is similar to the reaction between a base and an acid. Thus we can conclude that carbon dioxide which is a non metallic oxide is acidic in nature.

$$Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow CaCO_3 + H_2O_{(l)}$$

**4. A calcium compound react with Dil.HCl and forms a gas with hiss sound. The released gas convert the lime water into milkly white. In this reaction the product formed is Calcium Chloride. Write balanced equation for the above reaction.**

**Ans.** $Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow CaCO_3 + H_2O_{(l)}$

**5. How to form hydronium ions.**

**Ans.** Hydrogen ions cannot exist as bare ions. They associate with water molecules and exist as hydronium ions ($H_3O^+$).

$$H_+ + H_2O \longrightarrow H_3O^+$$

**6. What is meant by dilution of acids.**

**Ans.** Mixing an acid or base with water result in decrease in the concentration of ions ($H_3O/OH$) per unit volume. Such a process is called dilution of acids.

**7. How to reduce the pain when stung by the honey-bee**

**Ans.** Honey-Bee sting leaves an acid which causes pain and irritation. Use of a mild base like baking soda on the stung area gives relief.

**8. Define salts**

**Ans.** Salts are the ionic compounds which are produced by the neutralization of acid with base.

**9. Write the salts produced from common salt.**

**Ans.** The common salt is an important raw material for various materials of daily use, such as sodium hydroxide, baking soda, washing soda, bleaching powder and many more.

**10. How to prepared brine solution.**

**Ans.** An aqueous solution of sodium chloride is called brine, it is prepared by dissolving of NaCl in Distilled water.

**11. Which substance are you added for making of the cake soft and spongy.**

**Ans.** Baking powder is a mixture of baking soda and a mild edible acid such as tartaric acid. When baking powder is heated or mixed in water, the following reaction takes place.

$NaHCO_3 + H \longrightarrow CO_2 + H_2O$ + Sodium Salt of acid.

Carbon dioxide produced during the reaction causes bread or cake to rise making them soft and spongy.

**12. Why the plaster of pairs is called Calcium Sulphatre Hemi Hydrate.**

**Ans.** The two formula units of $CaSO_4$ share one molecule of water. So 1/2 molecule of water present in each Plaster of paris unit. So Plaster of paris is called Calcium Sulphatre Hemi Hydrate.

## 2 Mark Questions

**1. Write the tests to identify the nature of substances which acts as acid and bases.**

**Ans.** 1) Blue litmus, red litmus, methyl orange, phenolphthalein indicators are used to identy the acidic and basic nature substances in solution.

2) A blue litmus paper turn the colour to red indicates the presence of acidic nature solution in a substance.

3) A red litmus paper turn the colour to blue indicates the presence of basic nature solution in a substance.

4) The acidic solution change the colour methyl orange into red.

5) The basic solution change the colour of methyl orange in to yellow.

6) The Acidic solution is not change the colour of Phenolphthalein.

7) The basic solution change the colour of Phenolphthalein in to pink.

**2. Write the reaction between the acids and metallic carbonatates and bi carbonates.**

**Ans.** Take two test tubes; label them as A and B. Take about 0.5 gm of sodium carbonate ($Na_2CO_3$) in test tube A and about 0.5 gm of sodium hydrogen carbonate ($NaHCO_3$) in test tube B. Add about 2 ml of dilute HCl to both test tubes. Pass the gass produced in each cash through lime water (calcium hydroxide solution).

The reactions occurring in the above activity are as follows :

$Na_2CO_{3(s)} + 2\ HCl_{(aq)} \longrightarrow 2\ NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

$NaHCO_{3(s)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$

Pass the gas evolved through lime water.

$Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow CaCO_3 + H_2O_{(l)}$

**3. Which substance are formed due to reaction between acids with metal oxides ? Give an example.**

**Ans.** The general reaction between a metal oxide and an acid can be written as :

Metal oxide + acid ⟶ salt + water

The copper oxide present in the beaker dissolves in dilute HCl and the colour of the solution becomes blueish-green. The reason for this change is the formation of Copper (II) Chloride in the reaction.

$CuO + HCl \longrightarrow CuCl_2 + H_2O$

**4. Explain the activity the acids conduct the electricity. Repeat this activity with glucose and alcohol and write the causes for non conductivity property.**

**Ans.** Prepare solutions of glucose, alcohol, hydrochloric acid, sulphuric acid etc. Drill two holes on a rubber cork and introduce two nails into it. Connect two different coloured electrical wires and keep it in a 100 ml beaker. Connect free ends of the wire to 6 volts DC battery and complete the circuit. Now pour some dilute HCl in the beaker and switch on the current. Repeat activity with dilute sulphuric acid and glucose and alcohol solutions separately. It confirms that the bulb glows only in acid solutions but not in glucose and alcohol solutions. Glowing ofbulb indicates that there is flow of electric current through the solution. Acid solutions have ions and the moment of these ions in solution helps for flow of electric current through the solution. The positive ion (cation) present in HCl solution is H. This suggests that acids produce hydrogen ions $H^+$ in the solutiion, which are responsible for their acidic properties. Inglucose and alcohol solution the bulb did not glow. This indicates the absence of ions in these solutions.

**5. Explain the activity the HCl released Hydrogen ion in the presence of water only.**

**Ans.** The HCl gas evolved at delivery tube dissociates in presence of water to produce hydrogen ions. In the absence of water dissociation of HCl molecules do not occur.

**6. What do you observe when the water is mixed with acid or bases.**

**Ans.** The process of dissolving an acid or a base in water is an exothermic process. Care must be taken while mixing concentrated nitric acid or sulphuric acid with water. The acid must always be added slowly to water with constant stirring. If water is added to a concentrated acid, the heat generated may cause the mixture of splash out and cause burns. The glass container may also break due to excessive local heating.

**7. What are the uses of acid – base universal indicators.**

**Ans.** The universal indicator can be used to know the strength of acid or base. Universal indicator is a mixture of several indicators. The universal indicator shows different colours at different concentrations of hydrogen ions in a solution.

**8. What is PH ? Note the points of Acids, Bases and Neutral solutions in the PH Scale.**

**Ans.** A Scale for measuring hydrogen ion concentration in a solution is called PH scale.

The pH of neutral solutions is 7, values less than 7 on the pH scale represent an acidic solution. As the pH value increases from 7 to 14, it represents a decrease in $H_3O^+$ ion concentration or an increases in $OH^-$ ion concentration in the solution. i.e., if pH value of a solution above is '7' then it represents a basic solution.

**9. Write the PH value and nature of the each solution on the basis of the following table.**


**Ans.**

| | | | |
|---|---|---|---|
| 1) | Battery acid | – 0.2 | – Strong acid |
| 2) | Vinegar | – 3 | – 11 |
| 3) | Milk | – 6.4 | – Weak acid |
| 4) | Blood | – 7.4 | – Weak Base |
| 5) | Ammonia solution | – 11.4 | – Strong base |
| 6) | Sodium Hydroxide solution | – 13.8 | – Strong base |

**10. What effect of lowers the PH values of river water on aquatic life.**

**Ans.** Living organisms can survive only in a narrow range of ph change between 7.0 to 7.8. When pH of rain water is less than 5.6, it is called acid rain. When acid rain flows in to the rivers, it lowers the pH of the river water, the survival of aquatic life in such riversbecomes difficult.

**11. Write the chemical the following**

**a) Sodium Sulphate b) Potassium Chloride c) Magnesium Sulphate d) Sodium Carbonate**

**Ans.** a) $Na_2SO_4$ b) KCl c) $MgSO_4.7H_2O$ d) $Na_2SO_4$

**12. What are the factors influence on PH of salts.**

**Ans.** Salt of a strong acid and a strong base are neutral and the pH value is 7. The salts of a strong acid and weak base are acidic and the pH value is less than 7. The salts of a strong base and weak acid are basic in nature and the pH value is more than 7.

**13. How is bleaching powder produced ? Write some uses of it.**

**Ans.** The chlorine gas is used for the manufacture of bleaching power. Bleaching power is produced by the action of chlorine on dry slaked lime [$Ca(OH)_2$]. Bleaching powder is represented by formula $CaOCl_2$, through the actual composition is quite complex.

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

**User of Bleaching Power :**

1) It is used for bleaching cotton and linen in the textile industry for bleaching wood pulp in paper industry and for bleaching washed clothes in laundry.
2) Used as an oxidizing agent in many chemical industries.
3) Used for disinfecting drinking water to make it free of germs.
4) Used as a reagent in the preparation of chloroform.

**14. A milkman adds a very small amount of banking soda to fresh milk. Why does this milk take a long time to set a curd ?**

**Ans.** Fresh milk has a pH of 6. A milkman adds a very small amount of baking soda to fresh milk. They shift the pH of the fresh milk from 6 to slightly alkaline. In this condition the milk stored for long time but it cannot set a curd because inconvenient environment for the curd formation causing bacteria.

**15. How is baking soda produced ? Write some uses of it.**

**Ans.** This is commonly used in the kitchen for making tasty crispy pakodas is baking soda. Sometimes it is added for faster cooking. The chemical name of the compound is sodium hydrogen carbonate ($NaHCO_3$). It is produced using sodium chloride as one of the raw materials.

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

**Uses of sodium hydrogen carbonate :**

i) Backing powder is a mixture of baking soda and a mild edible acid such as tartaric acid. When baking powder is heated or mixed in water, the following reaction takes place.

$NaHCO_3 + H^+ \longrightarrow CO_2 + H_2O$ + Sodium Salt of acid.

Carbon dioxide produced during the reaction causes bread or cake to rise making them soft and spongy.

ii) Sodium hydrogen carbonate is also an igredient in antacids. Being alkaline, it neutralizes excess acid in the stomach and provides relief.

iii) It is also used in soda-acid fire extinguishers.

iv) It acts as mild antiseptic.

**16. Write the general name of the Sodium Carbonate ? Give the importance of Sodium Carbonate.**

**Ans.** Another Name sodium carbonate is washing soda. It is o btained by heating baking soda.

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

Sodium carbonate and sodium hydrogen carbonate are useful chemicals for many industrial processes.

**Uses of Washing Soda :**

1) Sodium carbonate (washing soda) is used in glass, soap and paper industries.
2) It is used in the manufacture of sodium compounds such as borax.
3) Sodium carbonate can be used as a cleaning agent for domestic purposes.
4) It is used for removing permanent hardness of water.

**17. Write the procedure for manufacturing of Plaster of Paris ? Why they the material in air locked plastic bags.**

**Ans.** On careful heating of gypsum ($CaSO_4\ 2\ H_2O$) at 373 K it loses water molecule partially to become calcium sulphate hemihydrate ($CaSO_4.\ 1/2\ H_2O$). This is called plaster of paris, the substance which doctors use as plaster for supporting fractured bones in the right position. Plaster of paris is a white powder and on mixing with water, it sets into hard solid mass due to the formation of gypsum.

$CaSO_4.\ 1/2\ H_2O + 11/2\ H_2O \longrightarrow CaSO_4\ 2\ H_2O$

It is stored in airlock plastic bags for prevention of formation of hard solid mass.

**18. What is meant by water Crystallization ? Describe an activity to show the water crystallization. The presence of water molecules in the salts is called Crystallisation.**

**Ans.** Copper sulphate crystals which seem to be dry contain the water of crystallization, when these crystals are heated, water present in crystals is evaporated and the salt turns white. When the crystals are moistened with water, the blue colour reapears. Water of crystallization is the fixed number of water molecules present in one formula unit of a salt. Five water molecules are present in one formula unit of copper sulphate. Chemical formula for hydrated copper sulphate is $CuSO_4.5H_2O$.

**19. A white powder has used for supporting of fractured bones**

**a) State the name of white powder**

**b) Write the chemical name of it**

**c) Write the reaction between white powder and water**

**Ans.** A) Plaster of paris

B) $CaSO_4.1/2H_2O$

C) $CaSO_4.1/2\ H_2O + 11/2\ H_2O \longrightarrow CaSO_4.2H_2O$

## 4 Mark Questions

**1. Note down the responses of various test soluntions with the following indicators.**

**Ans.**

| S.No. | Test solution | Blue litmus | Red litmus | Methyl orange | Phynolphthalin |
|---|---|---|---|---|---|
| 1. | Acetic acid | Red | No change | Red | No change |
| 2. | Nitric acid | Red | No change | Red | No change |
| 3. | Sodium hydroxide | No change | Blue | Yellow | Pink |
| 4. | Ammonium hydroxide | No change | Blue | Yellow | Pink |
| 5. | Sulfuric acid | Red | No change | Red | No change |
| 6. | Potasium hydroxide | No change | Blue | Yellow | Pink |

**2. Write the activity in the chemical reaction between metals with acids to release $H_2$ gas.**

**Ans.** Take 10 ml of dilute HCl in one of the bottles. Add few pieces of Zinc granules to it. Insert one end of the plastic tube in to the bottle through its rubber cork. Fill the other bottle with water and invert it. The gas coming out from the mouth of the bottle burns with a pop sound indicating $H_2$. The chemical reaction of the above activity is

Acid + metal $\longrightarrow$ Salt + Hydrogen

$2\ HCl_{(aq)} + Zn_{(s)} \longrightarrow Zn\ Cl_2 + H_{2(g)}$

**3. Define Neutralisation reaction ? Write the activity for this reaction.**

**Ans.** The reaction of an acid with a base to give a salt and water is known as a neutralization reaction. In general, a neutralization reaction can be written as :

Base + Acid $\longrightarrow$ Salt + Water

Take about 2 ml of dilute NaOH solution in a test tube and add two drops of phenolphthalein indicator. Observe the colour of the solution after adding phenolphthalein. Now add one or two drops of NaOH to the above mixture.

In the above activity, when HCl is added to the solution you observe that the pink colour of the Phenolphthalein indicator disappears because of NaOH present in the solution reacts with HCl. i.e., the effect of base is nullified by an acid and vice-versa. The reaction that is taking place between acid and base in above activity can be written as :

$NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

**4. How to find whether the acid is strong or weak.**

**Ans.** A test to know whether the Acid is trong or weak. Take two beakers A and B. Fill the beaker A with dil. $CH_3COOH$ (Acetic acid) and beaker B with dil.HCl (Hydrochloric Acid). Arrange the apparatus and pass electric current. When we will notice that the bulb glows brightly in HCl solution while the glowing intensity of the bulb is low in acetic acid solution. This indicates that there are more ions in HCl solution and fewer ions in acetic acid solution. More ions in HCl solution mean more $H_3O^+$ ions. Therefore it is a strong acid. Whereas acetic acid has fewer $H_3O^+$ ions and hence it is weak acid.

**5. Explain the effect of PH Changes on dental and digestive systems.**

**Ans.** **PH Change cause of teeth decay :** Tooth decay starts when the pH of the mouth is lower than 5.5. Tooth enamel, made of calcium phosphate is the hardest substance in the body. It does not dissolve in water, but is corroded when the pH in the mouth is below 5.5. Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth. The best way to prevent this is to clean the mouth after eating food. Using tooth pastes, which are generally basic neutralize the excess acid and prevent tooth decay.

**pH in our digestive system :** It is very interesting to note that our stomach produces hydrochloric acid. It helps in the digestion of food without harming the stomach. During indigestion the stomach produces too much acid and this causes pain and irritation. To get rid of this pain, people use bases called antacids; These antacids neutralize the excess acid in the stomach. Magnesium hydroxide (milk of magnesia), a mild base, is often used for this purpose.

## BITS

**I. Multiple Choice questions :**

1. When red litmus paper is dippled in X solution then the litmus paper changes to blue colour. The nature solution X is ( )

   A) Salt B) Acid C) Base D) All of the above

2. The reaction between sodium sulphate and barium chloride gives barium sulphate. The colour of the product is ( )

   A) Yellow B) White C) Brown D) Black

3. $N_2 + O_2$ 2Na–Q in this reaction the negation indicates ( )

   A) Exothermic reaction B) Endothermic reaction

   C) Electro chemical reaction D) All of the above

4. 2 Grams of $H_2$ Occupies how much volume at STP condition ( )

   A) 112 lit B) 22.4 lit C) 24.2 lit D) 211 lit

5. What is reason for whitening of wall when wet lime is applied ( )

   A) $Ca(OH)_2$ B) CaO C) $CO_2$ D) $CaCO_3$

6. Take X substance and heat it with a Bunsen burner. In this reaction they give brown colour gas. State the gas realeased from the following ( )

   A) Nitrous oxide B) Nitric Oxide C) Nitrogen dioxide D) Nitrogen

7. Take yellow coloured Silver bromide in a watch glass and keep it in sunlight. Then the colour changes to ash colour. State the type of reaction occurred ( )

   A) Chemical combination B) Decompositon

   C) Displacement D) Double displacement

8. The colour of Precipitate formed when potassium lodide is reacted with Lead Nitrate. ( )
   A) Yellow B) White C) Brown D) Black
9. In a chemical reaction the reactants changes their positive and negative radicals mutually. The reaction is called ( )
   A) Chemical combination B) Decompositon
   C) Displacement D) Double displacement
10. Which type of reaction occurred in crakers ( )
    A) Neutralization B) Oxidation C) Reduction D) Mixed reaction
11. Sravanthi anklets changes its colour to black after some days. What is reason for the formation of the .....
    A) AgO B) $Ag(OH)_2$ C) Ag2S D) AgCl ( )
12. An Apple slice changes it colour to brown immediately after cutting. What is reason for this.
    A) Oxidation B) Reduction ( )
    C) Double displacement D) Decomposition
13. Wet yello wflowers are placed in chlorine gas. Then they losses their colour. State the reason
    A) $Cl_2$ B) O C) $H_2O$ D) HCl ( )
14. Stainless steel is mixture off ( )
    A) Iron mixed with Carbon, Nickel and Chromium
    B) Silver mixed with Carbon, Iron, NIckel
    C) Copper mixed with Carbon, Chromium and Iron
    D) Iron mixed with Copper, Carbon and Chromium
15. Which gas is filled in the pocket for long time storage of chips. ( )
    A) Oxygen B) Nitrogen C) Carbon Dioxide D) Air

**II. Matching.**

| **Group – A** | | **Group – B** |
|---|---|---|
| 16. Chemical combination | ( ) | A. $2\,AgCl \longrightarrow 2Ag + Cl$ |
| 17. Decomposition | ( ) | B. $Pb + CuCl_2 \longrightarrow PbCl_2 + Cu$ |
| 18. Chemical displacement | ( ) | C. $C + O_2 \longrightarrow CO_2$ |
| 19. Double displacement | ( ) | D. Precipitation |
| 20. Down arrow mark | ( ) | E. $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$ |
| 6. At infinity | | F. Air |

## Answer

| | | | | | | |
|---|---|---|---|---|---|---|
| **I.** | 1) C | 2) B | 3) B | 4) B | 5) D | 6) C |
| | 7) B | 8) D | 9) D | 10) B | 11) C | 12) A |
| | 13) B | 14) A | 15) B | | | |
| **II.** | 1) C | 2) A | 3) B | 4) E | 5) D | |

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# 5. REFRACTION OF LIGHT AT PLANE SURFACES

## 1 Mark Questions

**I. 1. Write the formula for refractive index ? (As–1)**

**Ans.** Refractive index n =

Here c = speed of light in vacuum
v = speed of light in medium

**2. The speed of light in a diamond is 1,24,000 km/s. Find the refreactive index of diamond if the speed of light in air is 3,00,000 km/s. (As–1)**

**Ans.** c = 3,00,000 km/s;
v = 1,24,000 km/s

Refractive index of diamond, n =

Refractive index of diamond, n =

Refractive index of diamond, n = 2.42

**3. Write the formula for relative refractive index ?**

**Ans.** Relative refractive index ($n_{21}$) = .... (1)

Where $n_2$ = Refractive index of second medium
$n_1$ = Refractive index of first medium

Relative refractive index ($n_{21}$) = .... (2)

Where $v_1$ = Speed of light in first medium
$v_2$ = Speed of light in second medium

**4. Refractive index of glass relative to water is . What is the refractive index of water relative to glass ?**

**Ans.** Refractive index of glass relative to water $n_{gw}$ =

$\therefore n_{gw}$ =

Refraftive index of water relative to glass $n_{gw}$ =

**5.**

| Media (Material) | Ice | Water | Benzene | Carbon disulphide |
|---|---|---|---|---|
| Refractive index | 1.31 | 1.33 | 1.5 | 1.63 |

**By observing the above table, answer the following ?** **(As–1)**

**i) In which material, speed of light is high ?**

**ii) In which material, speed of light is low ?**

**Ans.** i) In Ice speed of light is high.

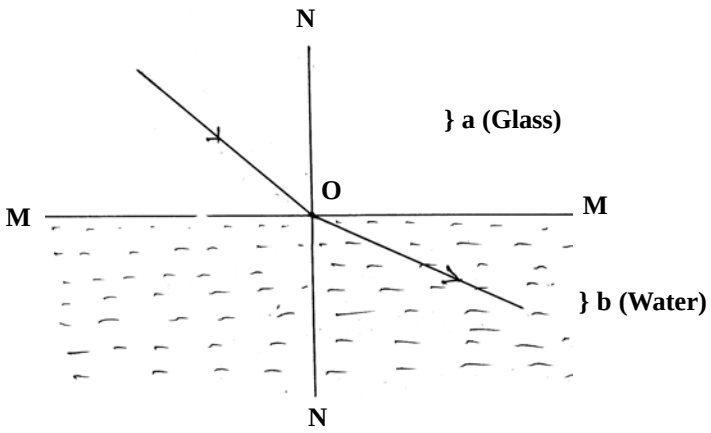
ii) In carbon-di-sulphide speed of light is low.

**6. What is snell's law ?** **(As–1)**

**Ans. Snell's law :**

(or) $n_1 \sin i = n_2 \sin r$

**7.**




**In the above figure,**

**MM is the plane separating two media 'a' and 'b'.**

**NN is the normal drawn at '0' to the plane MM.**

**1) Then, In a and b which is the denser medium ?**

**2) Which is the rarer medium ?** **(As–1)**

**Ans.** 1) 'a' is the denser medium and b is the rarer medium.

**8. Observe the following table.** **(As–1)**

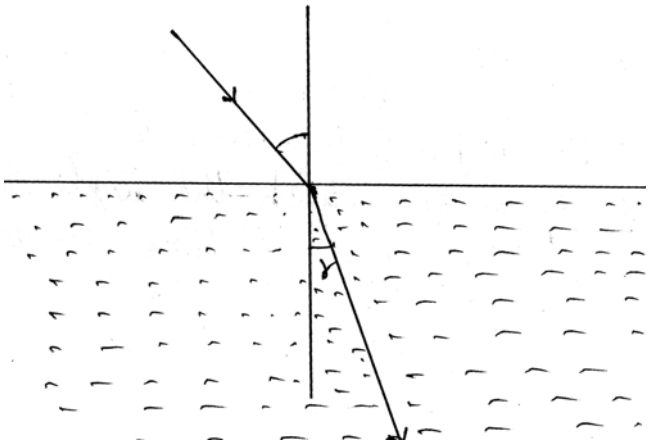
| Medium | Water | Crown glass |
|---|---|---|
| Refreactive Index | 1.33 | 1.52 |

**i) Which is the deuser medium in water and crown glass ?**

**Ans.** Crown glass is the denser medium.

**(Note :** d & n**)**

**9.**



**By observing the above figure, write the answer for the following questions. (As–1)**

**i) What is the relation between i and r ?**

**ii) In first and second media, which is douser ?**

**Ans.** i) $i > r$ (or $r < i$

ii) Second medium is denser.

**10. In what cases does a light ray not deviate at the interface of two media ? (As–7)**

**Ans.** 1) When the incident ray strikes normally at the interface of two media, it does not deviate from its path. ($\because \angle i = \angle r = 0$)

2) If the refractive indices of two media are equal, the light ray passes without any deviation at the boundary.

**11. Define critical angle ? (As–1)**

**Ans. Critical angle :** The angle of incidence at which the light ray travelling from denser to rarer medium grazes the interface is called 'Critical angle' for denser medium.

(Or)

The angle of incidence in the denser medium for which the angle of refraction in the rarer medium is $90^0$ is called 'Critical angle'.

**12. Define total internal reflection ? (As–1)**

**Ans. Total internal reflection :** When the angle of incidence is greater than the critical angle, the light ray is reflected into denser medium at interface. This phenomenon is called 'Total internal reflection'.

**13. The absolute refractive index of water is . What is the critical angle ? (As–1)**

**Ans.** c = ?

Absolute refractive index of water $n_{12}$ =

sin c =

sin c =

c = $\sin^{-1}$ = $\sin^{-1}$ (0.75)

$\therefore$ c = 48.5

**14. What is the reason behind the shining of diamonds ? (As–1)**

**Ans.** Total internal reflection is the main reason for brilliance of diamonds.

## 2 Mark Questions

**II. 15. Why is it difficult to shoot a fish swimming in watern? (As–1)**

**Ans.** 1) Due to refraction of light, it is difficult to shoot a fish swimming in water.

2) The fish and observer are in two different media.

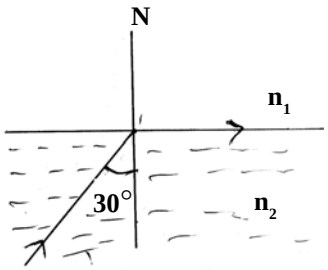
3) When the fish is in water (denser medium) and observer is in air (rarer medium) due to refraction at water-air interface, the fish appears to be raised and seems to be close to surface which is called 'Apparent position'.

4) The shooter aims the gum to apparent position of the fish instead of real position. Hence it is difficult to shoot a fish swimming in water.

**16. Look at the picture. (As–1)**

**a) What is the**

**b) Find the refractive index of denser medium with respect rarer medium ?**




**Ans.** a) Critical angle c = 30°

b) Refractive index of denser medium w.r.t rarer medium = $n_{21}$

= ( i = c, r = 90°)

= ( c = 30°)

=

$\therefore$ $n_{21}$ = 2

**17. What is the reason behind the spining of diamonds and how do you appreciate it ?(As–6)**

**Ans.** 1) The reason behind the shining of diamonds is total internal reflection.

2) The critical angle of a diamond is very low ($24.4^0$).

3) So if a high ray enters a diamond it undergo total internal reflection which makes the diamond shine.

**18. Why does a diamond shine more than a glass piece cut to the same shape ?**

**Ans.** 1) The critical angle of a diamond is very low ($24.4^0$).

2) Hence all the light rays enter the diamond, undergo total internal reflection and make the diamond shines more.

3) The critical angle of a glass ($42^0$) is more than diamond.

4) Hence most of the incident rays reflects and less number of rays get total internal reflection. So glass shines less than diamond.

**19. Why do stars appears twinkling ?**

**Ans.** 1) Due to refraction of light stars appears twinkling.

2) The light coming from stars when entering our atmosphere undergo multiple refractions continuously.

Hence stars appears twinkling.

## 4 Mark Questions

**III. 20. Explain the refraction of light through a glass slab with a neat ray diagram ? Identify lateral shift ?**

**Ans.** **Aim :** Determination of position and nature of image formed by a glass slab.

**Material required :** Plank, chart paper, Clamps, Scale, Pencil, Thin glass slab and pins.

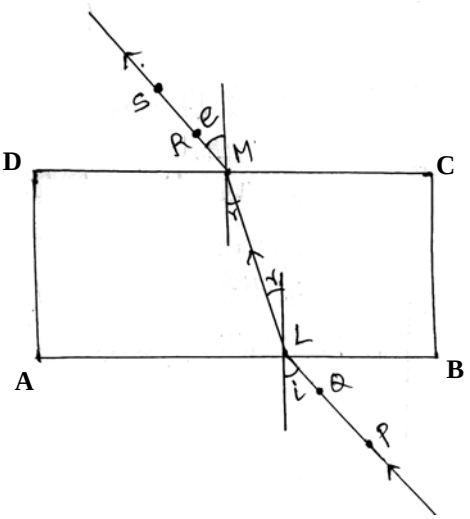
**Procedure :**

1) Place a piece of chart (paper) on a plank clamp it.

2) Place of glass slab in the middle of the paper. Draw border line along the edges of the slab by using a pencil. Remove the glass slab. We will get a figure of a rectangle. Name the vertices of the rectangle as A, B, C and D.

3) Draw a perpendicular at a point 'L' on the longer side 'AB' of the rectangle.

4) Now draw a line from 'L' in such a way that it makes $30^0$ angle with normal. Mark two points P, Q on this line.



5) The line PQ represents the incident ray. The angle it makes with normal represents the angle of incidence ($i = 30^0$)
6) Now place the glass slab in the rectangle ABCD. Fix two identical pins at 'P' and 'Q' such that theystand vertically with equal height.
7) By looking at the two pins from other side (CD) of the slab, fix two more pins at R, S in such a way that all pins appear to be along a straight line.
8) Remove glass slab and the pins. Draw a straight line by joining R, S upto the edge CD of the rectangle. This line (RS) represents emergent ray of the light.
9) Draw a perdicular to the line CD at 'M' where the line 'RS' meets the line 'CD'.
10) Measure the angle between emergent ray (RS) and normal. This is called 'angle of emergence (x)'.
11) The angles of incidence and emergence are equal ($\angle i = \angle e$)
12) The incident and emergent rays (PQ, RS) are parallel.
13) Measure the distance between the parallel rays (PQ, RS). This distance is called 'Lateral shift'.

**21. Explain the woring of optical fibres. Prepare a report about various uses of optical fibres in our daily life ? (AS–4)**

**Ans. Optical fibre :**

**Principle :** Total internal reflection is the basis principle behind working of optical fibre.

**Description :** An optical fibre is very thin fibre made of glass (or) plastic having radius about a micrometer ($10^{-6}$m). A bunch of such thin fibres form a light pipe.

**Working :** The light going into pipe makes a nearly glancing incidence on the wall. The angle of incidence is greater than the critical angle and hence total internal reflection takes place. In this way light is transmitted along the fibre.

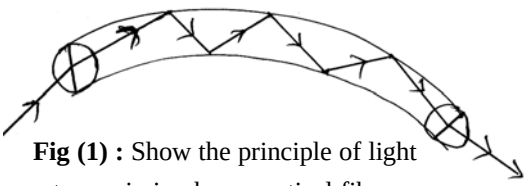


**Fig (1) :** Show the principle of light transmission by an optical fibre.

**Uses of optical fibres in our daily life :**

**1) Communication :** Different telephone signals by superposing on the optical beam can be transmitted through fibres without any interference.

**2) Medical investigation :** Optical fibres are used in endoscope, Laproscope for visual examination of inaccessible regions in the human body.

**3) Photometric sensors :** Measuring the blood flow in the heart.

**4) Sensors :** To measure temperature and Pressure.

**5) Refractometers :** To determine the refractive indices of liquids.

## BITS

**I. Multiple Choice questions :**

1. Which of the following is snell's law ( )

   A) $n_1 \sin i = \sin r / n_2$ B) $n_1/n_2 = \sin r / \sin i$

   C) $n_2/n_1 = \sin r / \sin i$ D) $n_2 \sin i$ = constant

2. The refractive index of glass with respect to air is 2. Then the critical angle of glass-air interface is ..... ( )

   A) $0^0$ B) $45^0$ C) $30^0$ D) $60^0$

   **(Note :** $\sin C = \frac{1}{2}$ ; $C = \angle 30^0$**)**

3. Total internal reflection takes place when the high ray travels from ..... ( )

   A) rarer to denser medium B) rarer to rarer medium

   C) denser to rarer medium D) denser to denser medium

4. The angle of deviation produced by the glass slab is ..... ( )

   A) $0^0$ B) $20^0$ C) $90^0$

   D) depends on the angle formed by the light ray and normal to the slab (**Note :** $\angle i = \angle e$)

5. 1 micrometer = ..... metres ( )

   A) $10^{-8}$ B) $10^{-9}$ C) $10^{-4}$ D) $10^{-6}$

6. At critical angle of incidence, the angle of refraction is ..... ( )

   A) $60^0$ B) $90^0$ C) $120^0$ D) $45^0$

7. The unit of refractive index is ( )

   A) m/s B) $m/s^2$ C) $kg/m^3$ D) No units

8. ..... is used for visual examination of in accessible regions in the human body ( )

   A) Vacuum B) Water C) Light pipe D) None

**II. Fill in the blanks**

9. Speed of light in vacuum is .....

10. The refractive index of a transparent material is . The speed of the light in that medium is .....

11. Mirage is an example of .....

12. The reason behind the shining of diamond is .....

13. ..... is the basic principle of optical fibre.

14. The reason for a coin placed in the water appears to be raised is .....

15. Twinking of starts is due to .....

**III. Matching.**

| Group – A | | Group – B |
|---|---|---|
| 16. Water | ( ) | A. 1.50 |
| 17. Kerosene | ( ) | B. 2.42 |
| 18. Flint glass | ( ) | C. 1.52 |
| 19. Benzene | ( ) | D. 1.65 |
| 20. Diamond | ( ) | E. 1.33 |
| | | F. 1.71 |
| | | G. 1.44 |

## Answer

**I.** 1) B 2) C 3) C 4) A 5) D 6) B
7) D 8) C

**II.** 9) $3 \times 10^8$ m/s 10) $2 \times 10^8$ m/s 11) Total internal reflection
12) Total internal reflection 13) Total internal reflection
14) Refraction of light 15) Refraction of light

**II.** 16) E 17) G 18) D 19) A 20) B

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