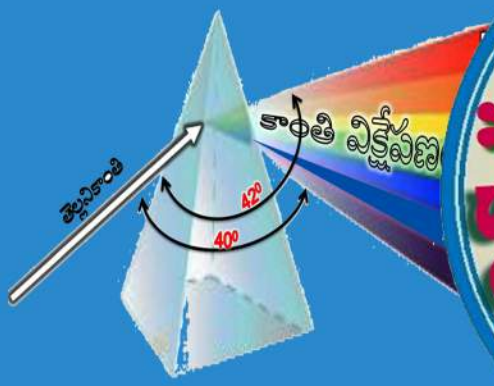
X CLASS - STUDY MATERIAL

PHYSICAL SCIENCE (E.M).



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Chapter -1

Heat

1 Mark Questions

1. Define temperature?

Temperature:- 1. The degree of hotness or coldness is called temperature.
2. The SI unit of temperature is Kelvin (K). It can also be expressed as degree Celsius (^{0}C).

2. What is thermal equilibrium?

Thermal equilibrium:- The state of a thermal equilibrium denotes a state of body where it neither receives nor gives out heat energy.

3. What is "Heat"? Write their units?

Heat:- Heat is a form of energy which flows from hot body to cold body.
Units :- 1. Joule (J) (in S.I system)
2. Calorie(cal) (in C.G.S system)

4. Define "Calorie"?

Calorie:- 1.The amount of heat required to raise the temperature of 1 gram of water by 1^{0}C is called calorie.
2. It is the C.G.S. unit of "Heat".

5. Write the definition of "Specific Heat" (S).

Specific Heat(S):- 1. The specific heat of a substance is the amount of heat required to raise the temperature of unit mass of the substance by one unit.

Units :- 1. J/Kg-K (in S.I System).
2. Cal/gm -^{0}C (in C.G.S Unit).

6. How much heat energy is required to raise the temperature of 1g mass of water to 14.5^{0}C to 15.5^{0}C?

One calorie

7. What is evaporation?

Evaporation:- 1. The process of escaping of molecules from the surface of a liquid at any temperature is called evaporation.
2. Evaporation is a cooling process.

(OR)

The change of phase from liquid to gas that occurs at the surface of the liquid is called evaporation.

8. What is condensation?

Condensation:- 1. The phase change from gas to liquid is called condensation.
2. It is a warming process.

9. What is meant by melting?

Melting :- 1. This process of converting solid into a liquid is called "**Melting**".
2. Melting point of a water is at 0^{0}C or 273K.

10. What is meant by freezing?

Freezing :- 1. The process in which a substance in liquid phase changes to solid phase by losing some of its energy is called freezing.
2. Freezing of water takes place at 0°C temperature and at one atmospheric pressure.

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11. What is "dew"?

Dew: The water droplets condensed on window panes, flower, grass etc during the winter nights is dew.

12. What is "Fog"?

Fog: 1. During the low temperature, the water molecules presents in vapour condense on the dust particles in air and form small droplets of water.

2. These droplets keep floating in the air and form a thick mist. This thick mist is called fog.

13. Define Boiling?

Boiling:- 1. Boiling is a process in which the liquid phase changes to gaseous phase at a constant temperature at a given pressure.

2. Boiling point of a water is 100^0C or 373K.

14. What is humidity ?

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

15. Covert 20^0C into Kelvin scale. (AS1) (TQ)

Temperature in Kelvin =273 + Temperature in Celsius degrees.

20^0C =273+20 =293 K

16. What happens to the water when wet clothes dry? (AS3) (TQ)

When wet clothes are dried, the water in them is escaped as water vapor due to evaporation and mixes with the air.

17. Equal amounts of water are kept in a cap and in a dish. Which will evaporate faster? Why? (TQ)

1. The evaporation is a surface phenomenon and the rate of evaporation increases with increase in surface area.
2. So the water kept in dish will evaporate faster than the cap because dish has more surface area than cap.

18. Why does ice floats on water ?

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

19. If we keep the glass bottle into the fridge for a few hours which is completely filled with water and fix the lid tightly will break. Why ?

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

20. A samosa appears to be cool outside but it is hot when we eat it. Why ?

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.

21. Write the formula for the amount of heat absorbed (released) by a substance and explain the terms in it ?

The amount of heat, $Q = m S \Delta T$

Where Q = Amount of heat absorbed by a substance

m = Mass of the substance

S = Specific heat of the substance

ΔT = Change in temperature.

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22. On which factors the rate of evaporation depends?

The rate of evaporation depends on its surface area, temperature and amount of water, vapour already present in the surrounding air.

23. What is meant by a absolute temperature?

Absolute temperature:- Temperature measured on Kelvin scale is called absolute temperature.

24. How would you convert degree Celsius to Kelvin?

Temperature in Kelvin = 273+ Temperature in degree Celsius

Add 273 to the value of temperature in degree Celsius to get the temperature on the Kelvin scale.

25. What are the principles of methods of mixtures?

Net heat lost= Net heat gain

This is known as principle of method of mixtures.

26. What is the difference between heat and temperature?

1. Heat is the energy that flows from a hotter to a colder body.
2. Temperature is a quantity that denotes which body is hotter and which is colder.
3. So temperature determines direction of heat (energy) flow, whereas heat is the energy that flows.

27. What is meant by a internal energy?

Internal energy:- 1. The molecules of the system have different forms of energies such as linear kinetic energy, rotational kinetic energy, vibrational energy and potential energy between molecules.
2. The total energy of the system is called internal energy of the system.

2 Marks Questions

1. What would be the final temperature of a mixture of 50g of water at 20^0C temperature and50g of water at 40^0C temperature? (AS1) (TQ)

Solution: - Given $m_1 = 50g$ $T_1 = 20^0C$

$m_2 = 50\ g$ $T_2 = 40^0C$

Final temperature, T= ?

Formula :- $$T = \frac{m_1T_1 + m_2T_2}{m_1 + m_2} = \frac{50\ X\ 20 + 50\ X\ 40}{50+50} = \frac{1000+2000}{100}$$

$$= \frac{3000}{100}$$

$$= 30^0C$$

∴ The final temperature of a mixture is 30^0C.

2. Why do we get dew on the surface of a cold soft drink bottle kept in open air? (AS1) (TQ)

1. We know that air contain a large number of water molecules in the form of vapour.
2. This vapour may come from evaporation of water from the surface of rivers, lakes, ponds and from the drying of wet cloths, sweat and so on.
3. When a cold soft drink bottle is kept in open air the water vapour present in the surrounding air condenses on the bottle.
4. These water molecules are slow down and stick to surface of the bottle as its surface is cold.
5. These water droplets are appeared as dew on the surface of the bottle.
6. This is a condensation process.

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3. Does the surrounding air become warm or cool when vapors phase of H_2O condenses? Explain? (AS1) (TQ)

The surrounds air becomes warm when vapor phase of H_2O condenses.

Explanation: - 1. When vapour phase of H_2O condenses it losses energy.
2. The energy losses by vapour phase of H_2O is gained by the surrounding air.
3. Thus the surrounding temperature increases.
4. So the surrounding air becomes warm.

4. Answer these. (AS1) (TQ)

a) How much energy is transferred when 1gm of boiling water at 100^0C condenses to water at 100^0C?

Given Mass of water, m = 1gm.
Latent heat of vaporization, L = 540 cal/gm
$Q = m \times L_v$
$Q = 1g \times 540$ cal/gm = 540 cal.

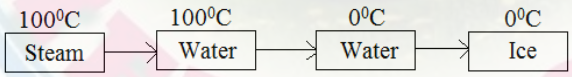
b) How much energy is transferred when 1gm of boiling water at 100^oC cools to water at 0^oC?

Mass of water, m= 1gm
Initial Temperature, $T_1 = 0^0$C
Final temperature, $T_2 = 100^0$C
Specific heat of water, S = 1 cal/gm-^{o}C
$Q = m \times S (T_2 - T_1) = 1 \times 1 \times (100-0) = 100$ Cal

c) How much energy is released or observed when 1gm of water at 0^0C freezes to ice at 0^0C?

Given Latent heat of ice = 80 cal/gm.
Mass of ice = 1 gm.
Heat energy released or observed, Q = m L = 1 x 80 = 80 cal

d) How much energy is released or observed when 1gm of steam at 100^0C turns to ice 0^0C?



Steam → water, Q_1 = 540 cal/gm.
Water at 100^{o}C → Water at 0^{o}C , Q_2 = 100 cal (From point (b))
Water at 0^{o}C → Ice at 0^{o}C, Q_3 = 80 cal (From point (c))

∴ Total energy released, $Q = Q_1 + Q_2 + Q_3 = 540+100+80 = 720$ cal.

5. What role does specific heat capacity play in a watermelon to keep it cool for long time after removing it from a fridge on a hot day? (AS7) (TQ)

1. Water melon contains large percentage of water.
2. Water has higher specific heat value.
3. greater specific heat means to increase the temperature of 1gm of water by 1^0C.
4. It requires 1 calorie of heat to reach 1^0C, its takes place for a long time.
5. Hence watermelon cools for a long time after removing it from a fridge on a hot day.

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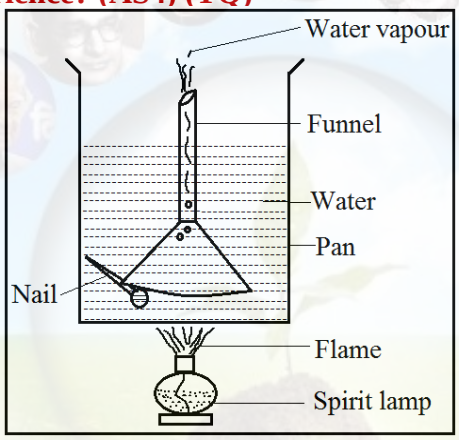
6. Write the differences between evaporation and boiling? (AS1) (TQ)

Evaporation	Boiling
1. The process of escaping of molecules from the surface of a liquid at any temperature is called evaporation.	1. The process in which the liquid phase changes to gaseous phase at a constant temperature is called boiling.
2. Evaporation takes place at any temperature.	2. Boiling takes place at constant temperature.
3. It is a cooling process.	2. It is a heating process.
4. Temperature of the system falls during evaporation.	4. Temperature of the system remains constant during this process.
5. When the evaporation process starts, the temperature of the system decreases.	5. When the boiling process starts, the temperature of the liquid cannot be raised.

7. Place a Pyrex funnel with its mouth-down in a sauce pan with full of water, in such a way that the stem tube of the funnel is above the water or pointing upward into air. Rest the edge of the bottom portion of the funnel on a nail or on a coin so that water can get under it. Place the pan on a stove and heat it till it begins to boil. Where do the bubbles form first? Why? Can you explain how a Geyser works using above experience? (AS4) (TQ)



1. The boiling point of the water increases with increasing the pressure.
2. So the bubbles first form at the top of the funnel.

Working of Geyser: - 1. The Geyser works on the principle of electrical energy converted into heat energy.
2. When heat energy increases, the pressure inside of the Geyser is also increases.
3. So, the bubbles of water will come out from the top portion of the Geyser.
4. This is the laboratory demonstration of working of Geyser.

8. Suppose that to 1 litre of water is heated for a certain time to rise and its temperature by 2^0C. If 2 liter of water for the same time, by how much will its temperature rises? (AS7) (TQ)

Solution:- Given $m_1 = 1Kg$ $\Delta T_1 = 2^0C$
$m_2 = 2Kg$ $\Delta T_2 = ?$

Formula:- $\frac{m_1}{m_2} = \frac{\Delta T_1}{\Delta T_2}$

$\Rightarrow \frac{1}{2} = \frac{\Delta T_2}{2}$

$\Rightarrow \Delta T_2 = 1^oC$

$\therefore$ Rise in temperature is 1^oC.

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9. If you are chilly outside the shower stall, why do you feel warm after the bath if you stay in bathroom? (AS7) (TQ)

1. We fell warm after finish our bath under the shower on a hot day.
2. In the bathroom the number of vapour molecules per unit volume is greater than the number of Vapour molecules per unit volume outside the bathroom.
3. When we try to dry ourselves with a towel, the vapour molecules surrounding us condense on our skin.
4. Condensation is a warming process.
5. Hence we feel warm.

10. What is Latent Heat of Vaporization? Write their units?

Latent Heat of Vaporization:- 1. This heat energy is used to change the state of water from liquid to vapour (gas). This is called latent heat of vapourization.

2. Latent heat of vaporization, L = $\frac{Q}{m}$.
3. Latent heat of vaporization is 540 cal/gm.

Units :- 1. SI unit is J/kg.
2. CGS unit of is cal/gm.

11. What is Latent Heat of Fusion? Write their units?

Latent Heat of Fusion:- 1. The heat energy required to converted 1g of solid completely into liquid at a constant temperature is called Latent Heat of fusion.

2. Latent heat of fusion, L = $\frac{Q}{m}$
3. Latent heat of fusion is 80 cal/gm.

Units :- 1. SI unit is J/kg.
2. CGS unit of is cal/gm.

12. Derive the equation for specific heat of a substance?

1. The amount of heat (Q) absorbed by a substance is directly proportional to its mass (m).

$$\text{i.e } Q \propto m \text{ -------(1)}$$

2. For the same mass (m) of water the change in temperature is proportional to amount of heat (Q) absorbed by it.

$$\text{i.e } Q \propto \Delta T \text{ --------(2)}$$

3. From equation (1) and (2), we get $Q \propto m\,\Delta T$

$$\Rightarrow Q = mS\,\Delta T$$

4. Where 's' is a constant for a given substance. This constant is called "specific heat" of the substance.

4 Marks Questions

1. Explain why dogs pant during hot summer days using the concept of evaporation? (AS1) (TQ)

1. During hot summer days the temperature of the skin becomes higher and water in the sweat glands starts evaporating.
2. The process of evaporation cools our body.
3. That's why we sweat to regulate our temperature since we have unobstructed pores all over the body.
4. Dogs do not have sweat pores on their skin and they do not have this facility.
5. When dogs pant, the water molecules present on the tongue and in the mouth starts to evaporate.
6. Evaporation is the cooling phenomenon.
7. This helps to cool the interior parts of the dogs body.
8. So, dog pant regulate their body temperature.

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2. Your friend is not able to differentiate between evaporation and boiling. What questions do you? Ask to make him know the differences between evaporation and boiling? (AS2) (TQ)

1. What is meant by evaporation?
2. What is meant by boiling?
3. At what temperature evaporation takes place?
4. At what temperature boiling point takes places?
5. Why evaporation takes place at any temperature?
6. Why boiling takes place at constant temperature?
7. Which one is the cooling process?
8. Which one is the warming process?
9. In which process energy of the system increases?
10. In which process the energy of the system decreases?

3. Suggest an experiment to prove that rate of evaporation of liquid depends on its surface area and vapour already present in surrounding air? (AS3) (TQ)

1. Rate of evaporation depends on surface area.

Aim: -To prove that rate of evaporation of liquid depends on its surface area.

Apparatus: -Two dishes of different surface area and water.

Procedure: - 1. Take a small amount of water in a china dish and a cap.
2. Keep the dishes and cap under the fan and switch on the fan.
3. After some time observe the quantity of water in both dishes.
4. It is proved that the dishes contain larger surface area of water is fastly evaporated.
5. From this observation we concluded that rate of evaporation depends on its surface area.

2. Rate of evaporation depends on vapour already present in it.

Aim :- To show the rate of evaporation depends on vapour present in it.

Apparatus:- Two China dishes, spirit.

Procedure:- Take a few drops of spirit in two dishes.
2. One of the dish is placed in the AC room and another one is at normal room.
3. After some time we noticed that the spirit in the normal room disappears quickly.
4. This means that the rate of evaporation depends upon the vapour already present in surrounding area.

4. Explain the procedure of finding specific heat of solid experimentally? (AS1) (TQ)

Aim: -To find the specific heat of given solid experimentally.
Apparatus: -Calorimeter, thermometer, stirrer, water, steam heater, wooden box and lead shots.
Procedure: -1. The mass of the calorimeter along with stirrer is determined by using the physical balance and noted as ' m_1' gm.
2. One third of the volume of the calorimeter is filled with water and its mass is ' m_2' gm.
3. The mass of the water = m_2-m_1 gm
4. The calorimeter is placed in a wooden box and the temperature is measured by using the thermometer and noted as $T_1{}^0$C.
5. Take a few lead shots and place them in hot water or steam heater.
6. Heat them up to a temperature 100^oC. Let this temperature be T2.
7. Transfer the hot lead shots quickly into the calorimeter with minimum loss of heat.
8. Determine the mass of calorimeter, water and lead shots are noted as m_3 gm.
9. The mass of the lead shots = m_3-m_2 gm.
10. Contents in the calorimeter are stirred and then resultant temperature is noted as $T_3{}^0$C.
11. Let the specific heats of the calorimeter, led shots and water are S_c, S_l and S_w respectively.

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12. According to the principles of methods of mixtures,

Heat lost by the solid = Heat gain by the calorimeter + Heat gain by the water.

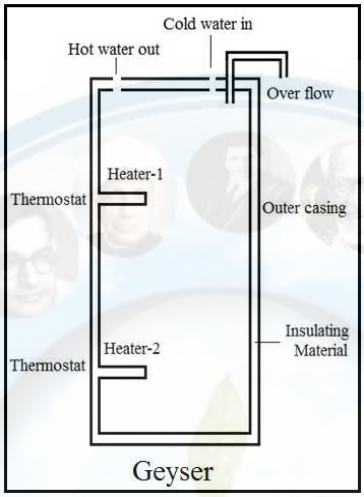
$$(m_3 - m_2)S_l (T_2-T_3) = m_1 S_c (T_3-T_1)+(m_2-m_1) S_w (T_3-T_1)$$

$$(m_3 - m_2)S_l (T_2-T_3) = [m_1 S_c+(m_2-m_1)S_w](T_3-T_1)$$

$$S_l = \frac{[m_1 S_c+(m_2-m_1)\, S_w]\,(T_3-T_1)}{(m_3-m_2)\,(T_2-T_3)}$$

By using the above formula we calculate the specific heat of the solids (lead shots) experimentally.

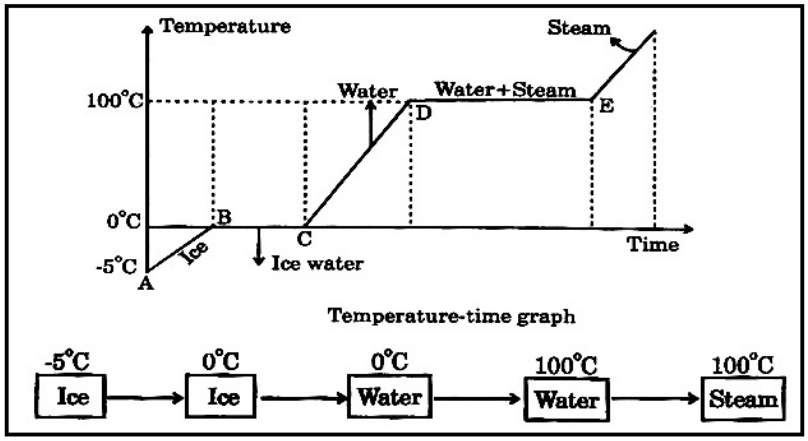
5. Collect the information about working of geyser and prepare a report. (AS4) (TQ)



Working of Geyser: - 1. Geyser is an electrical device which converts the electrical energy into heat energy.

2. It has two way of water pipes. Cool water enter into one pipe and hot water is out in another pipe.
3. A geyser has inner heating element made up of Nichrome.
4. The water in the geyser observes the heat energy from the heating element.
5. Thermostat unit was attached to heating element to control the temperature by switching off the element, once the desired temperature has been reached.
6. The water reaches to certain temperature the heating element does not transfer the heat energy.
7. To prevent the loss of heat energy from geyser to surrounds it is enclosed by an insulating material.
8. All this arrangement is kept in a metallic cylinder and has a facility to fix on the wall.

6. Assume that heat is being supplied continuously to the ice at -5^{0}C. You know that ice melts at 0^{0}C and boils at 100^{0}C. Continue the heating till it starts boiling. Note the temperature for every minute. Draw a graph between temperature and heat using the values you get. What do you understand from the graph? Write the conclusions. (AS5) (TQ)



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Given that Ice is at -5^0C.

1. Ice gains heat energy from A to B until the temperature becomes 0^oC, the melting point of ice and so temperature increases from -5^0C to 0^oC.
2. At 0^0C (from B to C), the temperature of the ice remains constant.
3. After the temperature increases, up to 100^0C and remains constant for some time(from C to D).
4. At 100^0C water is converted into water vapour nothing but boiling point of water(from D to E).
5. Then after temperature increases (after E).

Conclusions: - From the graph we concluded that,

1. The temperature remains constant at 0^0C, till all the ice is converted in to water.
2. The temperature remains constant at 100^0C, until all the water is converted in to water.
3. The amount of heat energy required to change the liquid to gas is more than the solid to liquid.
4. Time taken to convert the liquid to gas is more than the solid to liquid.

7. How do you appreciate the role higher specific capacity value of water in stabilizing atmospheric temperature during winter and summer seasons? (AS6) (TQ)

The specific heat of a water is 4.2 J/gm-^{o}C. So, every 1 gm of water will absorb 4.2 Joules of heat energy, when its temperature rises by 1^oC only. This property of water has a profound effect on our day to day life.

1. The sun delivers a large amount of energy to the Earth daily.
2. The water sources on Earth, particularly the oceans, absorb this energy for maintaining a relatively constant temperature.
3. The oceans behave like heat “store houses” for the earth.
4. They can absorb large amounts of heat at the equator without appreciable rise in temperature due to high specific heat of water.
5. Therefore, oceans moderate the surrounding temperature near the equator.
6. Ocean water transports the heat away from the equator to areas closer to the north and south poles.
7. This transported heat helps moderate the climates in parts of the Earth that are far from the equator.
8. So, appreciate the role higher specific capacity value of water in stabilizing atmospheric temperature.

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Chapter 2

Chemical Reactions and Equations

1 Mark Questions

1. What is meant by Chemical reaction?

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

2. What is meant by a antioxidants?

Antioxidants:- The substances which prevents the oxidation are called antioxidants.

Ex:- Vitamin C and vitamin E etc.

3. $MnO_2 + 4\ HCl \rightarrow MnCl_2 + 2\ H_2O + Cl_2$ In the above equation, name the compound which is oxidized and which is reduced? (AS1)(TQ)

1. Removal of oxygen is reduced. Oxygen id removed from MnO_2. So, reduced compound is MnO_2.
2. Removal of hydrogen is oxidation. Hydrogen is removed from HCl. So, oxidized compound is HCl.

4. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write the reaction involved? (AS1)(TQ)

When copper metal is placed in a silver nitrate solution, copper is more reactive than silver, so it displace silver from silver nitrate.

Ex: $2AgNO_3 + Cu \rightarrow Cu(NO_3)_2 + 2Ag$

5. What is the use of keeping food in air tight containers? (AS7) (TQ)

1. Keeping food in air tight containers helps to slow down oxidation process.
2. So that we can avoid the spoiling of food(rancidity).

6. Write the substances which undergoes chemical reaction?

The substances which undergo chemical change in the reaction are called reactants.

7. Write a chemical change between Barium chloride and Sodium Sulphate? Determine the colour of the end product for the above reaction?

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

$$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + NaCl$$

8. What are the changes do you observed between the chemical reaction of Zinc and dilute hydro chloric acid in conical flask?

Zinc metal reacts with dilute HCl to form Zinc chloride ($ZnCl_2$) and liberates Hydrogen gas.

$$Zn + HCl \rightarrow ZnCl_2 + H_2\uparrow$$

9. What is meant by chemical equation ? Write chemical equation of the reaction between Barium chloride and Sodium Sulphate?

Chemical Equation:- 1. Describing a chemical reaction using least possible words or symbols is called a chemical equation.

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

$$Na_2SO_4 + BaCl_2 \rightarrow BaSO_4\downarrow + NaCl$$

10. State one basic difference between a physical change and a chemical change?

1. In a physical change, no new substance is formed.
2. In a chemical change a new substance is formed and sometimes heat energy is observed or liberated.

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11. State the type of chemical reaction?

A) $C_{(g)} + O_{2\ (g)} \rightarrow CO_2 + Q$

B) $N_{2(g)} + O_{2\ (g)} \rightarrow 2NO(g) - Q$

A) Exothermic Reaction.

B) Endothermic Reaction.

12. Define Oxidation? Give an example?

Oxidation:- 'Oxidation' is a reaction that involves the addition of oxygen or removal of hydrogen.

Ex:- $Cu(s) + O_{2(g)} \xrightarrow{Heat} 2\ CuO_{(S)}$

13. Define reduction? Give an example?

Reduction:- 'Reduction' is a reaction that involves the addition of hydrogen or removal of oxygen.

Ex:- $CuO_{\ (s)} + H_{2(g)} \xrightarrow{Heat} Cu_{\ (s)} + H_2O$

14. Write balanced chemical reaction between Calcium Oxide and water?

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

15. Why photosynthesis is considered an endothermic reaction?

Photosynthesis is an endothermic reaction as it takes energy from the sun.

16. Which type of reaction involved when silver chloride is exposed to sunlight?

Photo chemical reaction.

17. Write the substances which are present left side and right side of the arrow mark in the chemical equation ?

The reactants are written on the left side of arrow and the products are written on the right side of the arrow.

Ex:- $Zn + HCl \rightarrow ZnCl_2 + H_2\uparrow$

(Reactants) (Products)

18. Why should a magnesium ribbon cleaned before burning in air?

1. Magnesium ribbon should be cleaned before burning in air, because it forms magnesium oxide by reacting with oxygen present in the air.
2. This oxide layer should be removed and we burn only pure magnesium metal.

19. Why does the chemical decomposition reactions are considered as endothermic?

1. A chemical decomposition requires a energy in the form of heat, light and electricity.
2. So, Chemical decomposition reactions are endothermic.

20. Write word equation of $Zn + dil.\ HCl \rightarrow ZnCl_2 + H_2$?

Zinc + dil. Hydro chloric acid → Zinc Chloride + Hydrogen

21. Which two gases are evolved on heating Ferrous sulphate?

Sulphur dioxide(SO_2) and Sulphur tri oxide(SO_3).

22. Why are certain reagents like silver bromide stored in dark bottles?

1. Reagents or chemicals like silver bromide decompose when exposed to light.
2. Hence, these are stored in dark bottles.

23. Why do we apply paint on iron articles?(AS7)(TQ)

1. When iron articles are exposed to moisture, acids etc, they undergo rusting.
2. We apply paint on iron articles to shield their surfaces from oxygen and moisture to prevent them from rusting.

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24. Why potato chips manufacturers fill the packet of chips with nitrogen gas?

To prevent potato chips from oxidation, fill the packet of chips with nitrogen gas.

25. A student has mixed the solutions of lead nitrate and potassium iodide. State the colour of the precipitate formed?

Yellow coloured precipitate.

26. Why the surface of some metals lose their brightness when kept in air for a long time?

Metals get corroded due to exposure to air and moisture and a rough oxide film is formed on the surface.

27. X react with Y and forms $Ca(OH)_2$ and Heat. Name X and Y the substances in the reaction?

X : Cao Y : H_2O

28. What are anti oxidants? Give examples?

Anti oxidants:- The substances which prevent oxidation are called anti oxidants.

Ex:- Vitamin C and Vitamin E.

30. When does the reactions are said to be endothermic chemical reactions?

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

31. Why they add dil. HCl in electrolysis of water?

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

32. How to you determine the realeased gas is CO_2 in the chemical reaction?

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

33. Which substance has undergone oxidation reaction in the following? $H_2S + Br \rightarrow 2\ HBr + S$

In the above reactions H_2S lost its Hydrogen. So H2S is oxidized by Bromine.

34. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write the reaction involved?

1. Copper displaces silver from silver nitrate solution.

$$2Ag\ NO_3 + Cu \rightarrow Cu\ (No_3)_2 + Ag$$

2. Copper is more reactive than silver. So, copper displaces the silver.

35. Write the role of Vitamin C & E in preservation of food?

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

36. What is meant by alloy? Give some examples?

Alloy:- The metallic substance mixing or fusing two or more metals and non metal , to obtain desirable qualities such as hardness, lightness and strength is known as alloy.

Ex:- Brass, bronze, and steel**.**

37. Write the chemical reaction, which colour the silver metal exposed to moisture?

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

In this chemical reaction the colour of the silver when exposed to moisture is block.

38. Write the name of metal which is not undergone oxidation process?

Gold and Platinum.

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39. 1. $AgNO_{3(aq)} + Nacl_{(aq)} \rightarrow AgCl_{(s)} \downarrow + NaNO_{3\,(aq)}$

2. $FeS + H_2SO_4 \rightarrow FeSO_4 + H_2S\uparrow$

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

'↓' Indicates silver chloride is precipitated.
'↑' Indicates that H_2S is formed in gaseous form.

40. Write the substances are used for manufacturing of stainless steel?

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

41. Name any four metals which can not displace hydrogen from dilute acids?

Copper, Plattinum, Silver and Gold.

42. What is galvanizing? Write their uses?

Galvanizing:- 1. Galvanizing is a method of coating a metal with a thin layer of Zinc.
2. It is essential for protection of metals from rusting.

43. Define combustion? What are the products in the combustion of hydrocarbons?

Combustion:- The process of burning of a substance in the presence of oxygen is called combustion.
Ex:- $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$.

44. Why does freshly cut fruits and vegetables such as apples, pears , bananas and potatoes turns brown after some time?

Apples, pears, bananas and potatoes etc., contain enzyme called polyphenol oxidise or tyrosinane, which reacts with oxygen and change the colour on the cut surface of the fruit.

2 Marks Questions

1. What is a balanced chemical equation? Why should chemical equations be balanced? (AS1) (TQ)

Balanced chemical equation: 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.

A chemical equation should be balanced because,

1. According to the law of conservation of mass, the total mass of the products formed in chemical reaction must be equal to the mass of reactants consumed.
2. The number of atoms of each element before and after reaction must be the same.
3. Atoms are neither created nor destroyed in chemical reactions.

Ex:- $C_3H_8 + 5O_2 \rightarrow 3\,CO_2 + 4H_2O$

2. What is a chemical equation? Illustrate with an example?

Chemical equation:- 1. A chemical reaction using least possible words or symbols is called a chemical equation.
2. For emxaple, the reaction of zinc with dilute sulphuric acid to produce zinc sulphate and hydrogen is given by the following chemical equation.

Ex:- $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2\uparrow$

3. Why does respiration considered as an exothermic reaction? Explain (AS1)(TQ)

1.The reactions which involves with the evolution of heat energy is called exothermic reactions.
2. In respiration, glucose combine with oxygen in the cells of our body and releases the energy.
3. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + Q$ (Energy).
4. So respiration is considered as an exothermic reaction.

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4. What is the difference between displacement and double displacement reactions? Write equations for these reactions?(AS1)(TQ)

Displacement Reaction	Double displacement Reactions
1. In a displacement reaction one element displace another element from its compound.	1. In a double displacement reaction two reactants exchange their constituents chemically and form two new compounds.
2. **Ex:-** $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$	2. **Ex:-** $BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 + 2NaCl$
3. In this reaction one of the reactant must be an element.	3. In this reqction both the reactants must be the Ionic compounds.
4. In this reactions generally change of colour takes place.	4. In this reactions generally precipitated are formed.

5. Give two examples of oxidation – Reduction(redox reactions) reaction?(AS1)(TQ)

Redox Reactions:- 1. A chemical reaction in which one substance is oxidized and the other is reduced is called redox reaction.

2. Tedox reactions are also called as oxidation-reduction reactions.

Ex:- 1. Carbon combines with oxygen to form carbon dioxide. Hence carbon is oxidized. Iron loses oxygen to form iron, hence iron is reduced.

$$2Fe_2O_{3\,(s)} + 3C_{(s)} \rightarrow 4Fe_{(s)} + 3CO_{2\,(g)}$$

In this reaction Carbon is oxidized and Fe_2O_3 is reduced.

2. Carbon combines with oxygen to form carbon dioxide. Hence carbon is oxidized. Lead loses oxygen to form lead, hence lead is reduced.

$$2Pbo_{(s)} + C_{(s)} \rightarrow 2pb_{(s)} + CO_{2\,(g)}$$

In this reaction Carbon is oxidized and Pbo is reduced.

6. What do mean by corrosion? How can you prevent it?(AS1) (TQ)

Corrosion:- 1. When some metals are exposed to moisture, acids etc, they tarnish due to the formation of respective metal oxide on their surface.

2. This process is called corrosion.

$$Fe + O_2 + H_2O \rightarrow Fe_2O_3.\ x\ H_2O$$

(Rust)

Prevention:- 1. Corrosion can be prevented or at least minimized by shielding the metal surface from oxygen and moisture.

2. It can be prevented by painting, oiling, greasing.
3. It can be prevented by galvanizing, chrome plating or making alloys.
4. Galvanizing is a method of protecting iron from rusting by coating them a thin layer of Zinc.

7. How chemical displacement reactions differ chemical decomposition reaction? Explain with an example for each? (AS1) (TQ)

1. Chemical displacement reaction:- In a displacement reaction one element replaces another element from its compound.

Ex:- Zn + CuSO4 →ZnSO4 + Cu.

Zinc is more reactive than copper, it can displace copper from copper sulphate solution.

2. Chemical decomposition reaction:- In a decomposition reaction one substance (reactant) decomposes into two or more new compounds.

Ex:- $CaCO_3 \xrightarrow{Heat} CaO + CO_2$

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8. A shiny brown coloured element 'X' on heating in air becomes black in colour. Can you predict the Element 'X' and the black coloured substance formed? How do you support your predictions? (AS2)(TQ)

The shiny brown coloured element 'X' may be Cu.

Explanation:- 1. Copper(shiny brown colour metal) reacts with oxygen present in the atmosphere to form copper oxide(black coloured substance).

$$2Cu + O_2 \rightarrow 2CuO$$

(Brown) (Block)

2. Therefore shiny brown coloured element 'X' is nothing but copper.

9. Which gas evolved with brown colour in the Heat reaction of Lead Nitrate?

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

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

10. Explain rancidity? How can you prevent it? (AS1)(TQ)

Rancidity:- 1. When the fat/oil containing food maternal left for a long time, they are oxidized and change their smell and taste.

2. The oxidation of fats or oils in the food material is called Rancidity.
3. Rancidity is an oxidation process.

Prevention:- Rancidity can be prevented by,

1. Storing food material in air tight container.
2. Adding preservatives such as vitamin C and E to the food materials.
3. Antioxidents are added to food containing fats and oils to prevent spoilage of food.
4. Flushing nitrogen gas into the bags containing food material to prevent the oxidation.

11. What do you mean by precipitation reaction? (AS1)(TQ)

Precipitation reaction:- 1. Sometimes the products in the chemical reactions are in soluble in water is called precipitate.

2. Such type of chemical reactions are called precipation reactions.

Ex:- 1. Lead nitrate solution react with potassium iodide solution,a yellow colour substance which is insoluble in water, is formed.

2. This insoluble substance in known as precipitate, and the reactions are called precpitative reactions.

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

12. Write the reaction involved in the whitening of walls?

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

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

13. When you dippled iron nails in Copper sulphate solution, becoming brown. Write causes for loss of colour of copper sulphate solution?

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

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

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

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14. What is meant by a skeletal chemical equation? Give one example?

Skeletal chemical equation:- 1. If the number of atoms of any element in a chemical equation is not equal on both sides, then it is a skeletal equation.

Ex:- $Mg + HCl \rightarrow MgCl_2 + H_2$

3. Here, the number of chlorine and hydrogen atoms are not equal on both sides.

15. Write the bleaching reaction of chlorine?

Bleaching of coloured objects using moist chlorine.

$$Cl_2 + H_2O \rightarrow HOCl + HCl$$

$$HOCl \rightarrow HCl + (O)$$

Coloured object + (O) $\rightarrow$ Colourless object.

16. List out four observations that help us to determine whether a chemical reaction has taken place?

When a chemical reaction occurs, one or more of the following changes take place. They are,

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.

17. Write the skeletal equation for the following reactions.

(a) Hydrogen sulphide reacts with sulphur dioxide to form sulphur and water.

(b) Methane on burning combines with oxygen to produce carbon dioxide and water.

(a) $H_2S + SO_2 \rightarrow S + H_2O$

(b) $CH_4 + O_2 \rightarrow CO_2 + H_2O$

18. Define Chemical combination ? Explain with Examples?

Chemical combination:- If two or more reactants combine to form a single product is called chemical combination reactions.

Ex:- Magnesium and oxygen combine to form a new substance magnesium oxide.

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

19. Define Chemical decomposition ? Explain with examples?

Chemical decomposition:- In a decomposition reaction a single substance decomposes to give two or more products.

Ex:- $CaCO3_{(s)} \rightarrow CaO_{(S)} + CO_{2(g)}$

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

20. Define displacement reaction ? Explain with Examples?

Displacement reaction:- In a displacement reaction one element displaces another element from its compound.

Ex:- $Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_{2(aq)} + H_{2(g)}$

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

21. Define double displacement reaction ? Explain with Examples?

Double displacement reaction:- If two reactants exchange their constituents chemically and form two products, then the reaction is called as double displacement reaction.

Ex:- $Pb(NO_3)_{2(aq)} + 3Kl_{(aq)} \rightarrow PbI_{2(s)} + 2KNO_{3(aq)}$

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.

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4 Marks Questions

1. Name the reactions taking place in the presence of sunlight? (AS1)(TQ)

Photo chemical reactions:- 1. The reactions which takes place in the presence of sunlight is called photo chemical reactions.

2. There are two types of photochemical reactions. They are,
   i. Photo synthesis.
   ii. Photochemical reactions.

i. Photo synthesis:- 1. Photosynthesis is a chemical reaction in which green pigment of the plants called chlorophyll preparing the food starch material in the presence of sun light.

2. It is also called as Photochemical reaction.

$$6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Sunlight}} C_6H_{12}O_6 + 6O_2.$$

ii. Decomposition of Silver bromide:- 1. Silver bromide decomposes to silver and bromine in sunlight.

2. Light yellow coloured silver bromide turns to gray due to sunlight.

$$\underset{\textbf{(Yellow)}}{2AgBr_{(S)}} \xrightarrow{\text{Sunlight}} \underset{\textbf{(Gray colour)}}{2Ag_{(S)}} + Br_{2(g)}$$

2. Balance the following chemical equations.(AS1)(TQ)

a) $NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
b) $Hg(NO_3)_2 + KI \rightarrow Hg I_2 + KNO_3$
c) $H_2 + O_2 \rightarrow H_2O$
d) $KClO_3 \rightarrow KCl + O_2$
e) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

Balanced chemical equations:-

a) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
b) $Hg(NO_3)_2 + 2KI \rightarrow Hg I_2 + 2KNO_3$
c) $2H_2 + O_2 \rightarrow 2H_2O$
d) $2KClO_3 \rightarrow 2KCl + 3O_2$
e) $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

3.Write the balanced chemical equations for the following reactions. (AS1).(TQ)

a) Zinc + Silver nitrate → Zinc nitrate + Silver.
b) Aluminum + copper chloride → Aluminum chloride + Copper.
c) Hydrogen + Chlorine. → Hydrogen chloride.
d) Ammonium nitrate → Nitrogen + Carbon dioxide + water.
e) Ammonium nitrate → Nitrous Oxide + water.

Balanced chemical equations:-

a) Zinc + Silver nitrate → Zinc nitrate + Silver.
$Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag.$

b) Aluminum + copper chloride → Aluminum chloride + Copper.
$2Al + 3CuCl_2 \rightarrow 2AlCl_3 + 3Cu$

c) Hydrogen + Chlorine→ Hydrogen chloride.
$H_2 + Cl_2 \rightarrow 2HCl$

d) Ammonium nitrate → Nitrogen + Oxygen + water.
$2NH_4NO_3 \rightarrow 2N_2 + O_2 + 4H_2O$

e) Ammonium nitrate → Nitrous Oxide + water.
$NH_4NO_3 \rightarrow N_2O + 2H_2O$

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4. Write the balanced chemical equation for the following and indentify the type of reaction in each Case? (AS1) (TQ)

a) Calcium hydroxide (aq) + Nitric acid (aq) → Water (l) + Calcium nitrate (aq)

$Ca(OH)_2$ (aq) + $2HNO_3$ (aq) → H_2O (liquid) + $Ca(No_3)_2$ (aq)

This is a chemical double displacement reaction.

b) Magnesium (s) + Iodine (g) → Magnesium Iodide. (s)

Mg (s) + I_2 (g) → $Mg I_2$ (s)

This is a chemical combination reaction.

c) Magnesium(s) + Hydrochloric acid (aq) → Magnesium chloride (aq) + Hydrogen (g)

Mg (S) + 2Hcl (aq) → $Mg Cl_2$ (aq) + $H_2\uparrow$ (g)

This is a chemical displacement reaction.

d) Zinc(s) + Calcium chloride (aq) → Zinc Chloride (aq) + Ca(s)

Zn (s) + $Ca Cl_2$ (aq) → $Zn cl_2$ (aq) + Ca (s)

This is a chemical displacement reaction.

3. Write an equation for decomposition reaction where energy is supplied in the form of heat/light/electricity? (AS1)(TQ)

Heat:- On heating calcium carbonate ($CaCO_3$) decomposes to calcium oxide (CaO) and carbon dioxide (CO_2)

$$CaCO_3 \xrightarrow{\text{Heat}} CaO + CO_2$$

(Lime stone) (quick lime)

Light (photo chemical reaction):- 1. Silver bromide decomposes to form silver and bromine in the presence of sun light.

2. Such reactions are called photo chemical reactions.

3. The light yellow coloured silver bromide turns to gray due to sunlight.

$$2AgBr \xrightarrow{\text{Sunlight}} 2Ag + Br_2$$

(Yellow) **(Gray colour)**

Electricity (electrolysis):- When electricity is passes through acidified water, it dissociates to hydrogen and oxygen.

$$2H_2O\ (\ell) \xrightarrow{\text{electricity}} 2H_2\uparrow(g) + O_2\uparrow\ (g)$$

4. Balance the following chemical equations including the physical states. (AS1)(TQ)

a) $C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$

b) $Fe + O_2 \rightarrow Fe_2O_3$

c) $NH_3 + Cl_2 \rightarrow N_2H_4 + NH_4Cl$

d) $Na + H_2O \rightarrow NaOH + H_2$

Balanced chemical equations:-

a) $C_6H_{12}O_6\ (s) \rightarrow 2C_2H_5OH_{(\ell)} + 2CO_{2(g)}$

b) $4Fe(s) + 3O_2\ (g) \rightarrow 2Fe_2O_3(s)$

c) $4NH_{3(\ell)} + Cl2_{(g)} \rightarrow N_2H_{4(\ell)} + 2NH_4Cl(g)$

d) $2Na(s) + 2H_2O_{(\ell)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

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17. Balance the chemical equation by including the physical state of the substances for the following reactions. (AS1)(TQ)

a) Barium chloride and Sodium sulphate aqueous solutions react to give insoluble Barium sulphate and aqueous solution of solution of sodium chloride.

b) Sodium hydroxide reacts with Hydrochloric acid to produce Sodium chloride and water.

c) Zinc pieces react with dilute hydrochloric acid to liberate hydrogen gas and forms Zinc chloride.

Balanced chemical equations:-

a) $BaCl_{2(aq)} + Na_2SO_{4(aq)} \rightarrow BaSO_4(\downarrow) + 2NaCl_{(aq)}$

b) $NaOH_{(aq)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(\ell)}$

c) $Zn_{(s)} + 2HCl_{(aq)} \rightarrow ZnCl_2(\downarrow) + H_{2(g)}$

2. Balance the following chemical equation?(AS1) (TQ)

a) $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$

b) $Fe_2O_3 + Al \rightarrow Fe + Al_2O_3$

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

d) $Pb(NO_3)_2 \rightarrow PbO + NO_2 + O_2$

Balanced chemical equations:-

a) $2C_3H_8 + O_2 \rightarrow 6CO_2 + 8H_2O$

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

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

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

16. Balance the following chemical equations including the physical states?

a) $C_6H_{12}O_6 \rightarrow C_2H_5OH + CO_2$

b) $Fe + O_2 \rightarrow Fe_2O_3$

c) $NH_3 + Cl_2 \rightarrow N_2H_4 + NH_4Cl$

d) $Na + H_2O \rightarrow NaOH + H_2$

Balanced chemical equations:-

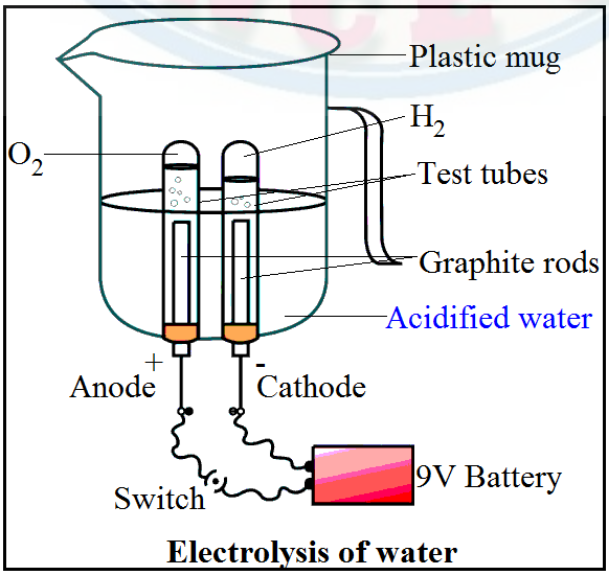
a) $C_6H_{12}O_6\,(s) \rightarrow 2C_2H_5OH_{(\ell)} + 2CO_{2(g)}$

b) $4Fe(s) + 3O_2\,(g) \rightarrow 2Fe_2O_3(s)$

c) $4NH_{3(\ell)} + Cl2_{(g)} \rightarrow N_2H_{4(\ell)} + 2NH_4Cl_{(g)}$

d) $2Na(s) + 2H_2O_{(\ell)} \rightarrow 2NaOH_{(aq)} + H_{2(g)}$

12. Explain the Electrolysis experiment to release of H_2 and O_2 ?



Electrolysis of water

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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 figure.
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 some time.
9. The liberation of gas bubbles at both the electrodes.
10. These bubbles displace the water in the test tubes.
11. Once the test tubes are filled with gases take them out carefully.
12. Test both the gases separately by bringing a burning candle near the mouth of each test tube.
13. In the above activity on passing the electricity, water dissociates to Hydrogen and oxygen.

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

14. Hence it is a example of electrolysis of water.

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Chapter -3

Reflection of light on different surfaces

1 Mark Questions

1. State Fermat's principle? (AS1)

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

2. It is also applicable to to reflection of light.

2. Why concave and convex mirrors are called spherical mirrors? (AS1)(TQ)

1. The reflecting surface of concave and convex mirrors can be considered to form a part of the surface of a sphere.
2. Such mirrors, whose reflecting surfaces are spherical are called spherical mirrors.

3. Define the following terms in connection with spherical mirrors.(AS1) (TQ)

a) Pole b) Principal axis c) Focal point (focus) d) Centre of curvature e) Object distance f) Image distance g) Focal length h) Radius of curvature i) Magnification

a) Pole(P):- The geometrical centre of the spherical mirror is called a pole.

b) Principal Axis:- The horizontal line passes through the centre of curvature and pole is called principle axis or central axis.

c) Focus(F):- It is a point on the principle 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.

d) Centre of curvature(C):- It is the centre of the sphere of which the mirror forms a part.

e) Object distance (u):- The distance between the pole of the mirror and object is known as object distance(u).

f) Image distance (v):- The distance between the pole of the mirror and image is known as image distance(v).

g)Focal length(f):-The distance between the focus and the pole of the mirror is called focal length.

h) Radius of curvature(R):- The distance between pole and centre of curvature is called radius of curvature(R).

i) Magnification(m):- The ratio of the height of the image to the height of the object is called magnification.

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

(or) The ratio of image distance to object distance is called magnification(m).

$$\text{Magnification (m)} = \frac{-\text{ Image distance (v)}}{\text{Object distance(u)}}$$

$$\therefore \text{Magnification (m)} = \frac{\text{Height of the image}(h_i)}{\text{Height of the object }(h_o)} = \frac{-\text{ Image distance (v)}}{\text{Object distance(u)}}$$

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4. The magnification produced by a plane mirror is +1. What does this mean? (AS1) (TQ)

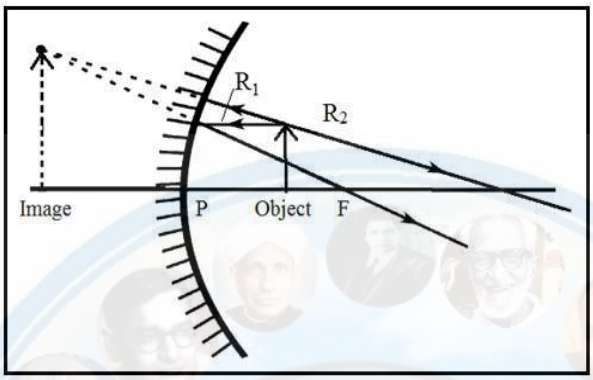
Magnification (m) = $\frac{\text{Height of the image}(h_i)}{\text{Height of the object }(h_o)}$ = +1

Magnification +1 indicates that,

1. The size of the image is equal to size of the object.
2. The '+'sign of magnification indicates that the image is erect.

5. How do you get a virtual image using a concave mirror?(AS1) (TQ)

When an object is placed between pole and focus of a concave mirror, virtual, erect and enlarged image is formed behind the mirror.



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

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

7. What is a plane of reflection?

Plane of reflection:- The plane in which the incident ray, refracted ray and normal will lie is the plane of reflection.

8. Which rays are called paraxial rays?

Paraxial Rays:- 1. The rays which are very nearer to the principle axis are called paraxial rays.
2. Paraxial rays are inclined at the angle less than 10^0 to the principle axis and the other rays away from the principle axis are called marginal rays.

+Ve magnification:- The image is erect and virtual.
- Ve Magnification:- The image is inverted and real.

9. Write the mirror formula and explain the terms.

Mirror formula, $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$.

Here f = focal length
u = object distance
v = image distance.

10. When does a concave mirror form virtual image?

A concave mirror forms virtual image when the object is placed between pole and focal point.

11. What are the values of radius of curvature and focal length of a plane mirror?

The focal length and the radius of curvature of a plane mirror is infinite.

12. What happens to image when an object is moved towards a concave mirror from infinity?

The image moves away from mirror staring from focal point to infinity.

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13. What is the relation between radius of curvature and focal length of a concave mirror?

1. The focal point is the midpoint of centre of curvature and pole.
2. So, focal length is half of radius of curvature.

$$\text{i.e } 2f = R \text{ (or) } f = \frac{R}{2}$$

14. How do you find magnification produced by a spherical mirror?

There are two ways of finding the magnification. They are,

1. The ratio of size of the image to object distance (m) = $\frac{\text{Height of the image}(h_i)}{\text{Height of the object }(h_o)}$

2. The ratio of image distance to object distance (m) = $\frac{-\text{ Image distance (v)}}{\text{Object distance (u)}}$

15. Can a convex mirror burn a paper? If not? Why?

We cannot burn a paper by using a convex mirror, because the rays coming parallel to principal axis after reflection diverge from the mirror.

16. Which mirror has wider field view?

A convex mirror has wider field view.

17. Why does our image appear thin or bulged?

Due to converging or diverging of height rays from the mirror.

18. Can we focus sunlight at a point using a mirror instead of magnifying glass?

Yes, by using concave mirror we can focus sun light at a point.

19. Why is angle of incidence is equal to angle of reflection when a light ray reflected from a surface?

The angle of incident is equeal to angle of reflection because light selects the path which takes the least time to travel.

20. Are angle of reflection and angle of incidence equal for curved surface?

Yes, they are equal for curved surfaces like spherical mirrors.

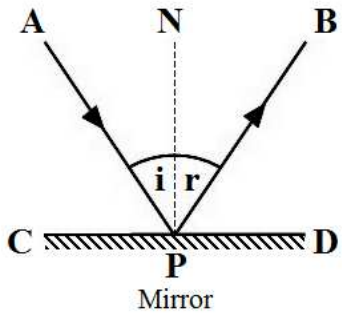
2 Mark Questions

1. State the laws of reflection of light? (AS1)(TQ)

First Law:- 1. When light gets reflected from a surface, the angle of reflection is equal to the angle of incidence.

Second law:- 2. The incident ray, the normal at the point of incidence and the reflected ray all lie in the same plane.

CD = Plane mirror.
AP = Incident ray.
PB = Reflected ray.
PN = Normal to reflecting surface.
P = Point of incidence.
i = Angle of incident.
r = Angle of reflection.



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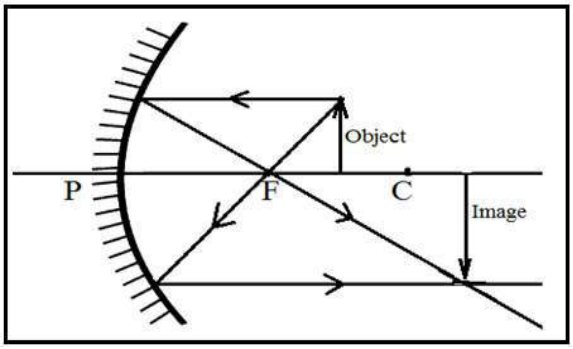
2. Where will the image form when we place an object, on the principal axis of a concave mirror at a point between focus and centre of curvature (AS1) (TQ)



When an object is placed between focus and centre of curvature on the principal axis of a concave mirror, a real inverted and enlarged image is formed beyond the centre of curvature.

3. Distinguish between real and virtual image? (AS1) (TQ)

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 the screen.	2. This image cannot be formed on the screen.
3. Real image is always inverted.	3. Virtual image is always erected.
4. Real image is formed infront of the mirror.	4. Virtual images are formed behind the mirror.
5. Real images can be diminished, magnified or same size of the object depending on the object distance.	5. Virtual images are always diminished irrespective of position of the object.
6. **Ex:-** The image formed on a cinema screen.	6. **Ex:-** The image of our face in a plane mirror.

4. State the differences between convex and concave mirrors. (AS1) (TQ)

Convex mirror	Concave 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. The shape of a convex mirror is, 	2. The shape of a concave mirror is, 
2. It is also known as diverging mirror.	2. It is also known as converging mirror.
3. After reflection from the mirror the light rays diverge.	3. After reflection from the mirror the light rays converge.
4. Center of curvature and principle focus lie behind the mirror on the principle axis.	4. Center of curvature and principle focus lie infront of the mirror on the principle axis.
5. It always forms virtual, erect and diminished image of a real object.	5. It can forms different types of image of a real object.
6. It is used as rear view mirrors of motor vehicles to see the Traffic behind them.	6. ENT doctors use these mirrors to examine the eyes, ears, nose and throat.

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5. Write the rules of sign convention?(AS1) (TQ)

Rules of sign convention:-

1.All distances should be measured from the pole.

2. The distances measured in the direction or incident light, to be taken positive and those measured in the direction opposite to incident light to be taken negative.

3. Height of object (h_0) and height of image (h_i) are positive if measured upwards from the axis and negative if measured downwards.

6. Imagine that spherical mirrors were not known to human beings. Guess the consequences? (AS2) (TQ)

1. A driver cannot see the traffic behind him in rare-view mirror. So safe driving in automobile will not be possible.
2. Automobile head lights, torch light, search lights cannot give bright lighting.
3. Constructions of reflecting telescopes would not be possible.
4. Constructions of solar cookers would not be possible.
5. ENT specialists may not have proper diagnosis of ear, nose and throat.
6. Dentists may not have proper diagnosis of teeth.

7. 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?(AS2) (TQ)

1. Why the image is not clearly visible?
2. Why the image is blurred?
3. Why the image is not as clear as in mirror?
4. Why the image seems to be small sometimes?
5. How steel vessels form images like mirrors ?
6. Why the image is small when we look outside of the vessel(Convex surface)?
7. Why the image is bigger than the objects when we look inside of the vessel(Concave surface)?
8. Why the image size is changing when the vessel is moved away or towards the face?

8. How do you appreciate the role of spherical mirrors in daily life ?(AS6) (TQ)

Spherical mirros are very useful to our life.

1. Concave mirrors are used as reflectors in torches and vehicle head lights.
2. Spherical mirrors are used in telescopes.
3. Convex mirrors are used as rear view mirrors in vehicles.
4. Concave mirrors are used in solar furnaces.
5. Concave mirrors are used by ENT specialists to see the affected part more visible.
6. Concave mirrors are used by dentists to see the large images of the teeth of patient.
7. So, I appreciate the role of spherical mirrors in daily life.

9. How do you appreciate the use of reflection of light by a concave mirror in making of antenna dishes?(AS6) (TQ)

1. TV antenna dishes contains the concave surface to receive the signals from the distinct communication satellites.
2. The concave (parabolic) shape of a dish antenna helps to reflect the signal to the focal point of the dish.
3. A device known as feed horn is mounted at the focal point which gathers the signals and sends them to a LNB(Low Noise Block down converter).
4. The LNB converts these electromagnetic waves into electrical signals and shifts to the receiver(T.V Set).
5. This is all possible only with the help of concave shape of dish antennas.
7. So, I appreciate the use of reflection of light by a concave mirror in making of antenna dishes.

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10. Have you ever observed the image of the sky in rain water pools on earth? Explain the reflection of light in this context?(AS6) (TQ)

1. Sky form an image in the rain water pool on the earth.
2. The surface of rain water pool acts as a plane mirror.
3. So, we can observe a virtual image of the sky due to reflection of light from surface of rain water pool.

11. Why do we prefer a convex mirror as a rear-view mirror in the vehicles ?(AS7)(TQ)

We use convex mirror as a rear view mirror in the vehicles because,

1. Convex mirror always forms virtual, erect and diminished images irrespective of distance of the object.
2. A convex mirror enables a driver to view large area of the traffic behind him.
3. Convex mirror forms very small image than the object.
4. Due to these reasons convex mirrors are used as rear view mirrors in vehicles.

12. Write any two useas of each of concave and convex mirrors in our daily life? (AS7) (TQ)

Useas of convex mirror:- 1. It is used as a rear view mirror in automobiles.
2. It is used as a reflector for street lights.
3. It is used as a security mirror.

Useas of concave mirror:- 1. It is used as a shaving mirror.
2. Concave mirrors are used in solar furnaces.
3. Concave mirrors are used by ENT specialists to see the affected part more visible.
4. Concave mirrors are used by dentists to see the large images of the teeth of patient.

13. Write the characteristics of an image formed by a plane mirror?

Characteristics of a plane mirror:-

1. The image formed by a plane mirror is virtual and erect.
2. The image formed by a plane mirror suffers lateral invertion(left-right invertion).
3. The image is formed as far behind the mirror as the object is infront of it.
4. The size of image formed by a plane mirror is equeal to that of the object.

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

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

15. How will our image be in concave and convex mirror?

Concave mirror:-

1. In concave mirrors our image is thin and enlarged.
2. As we move away from the mirror, the image will be diminished.

Convex mirror:

1. In convex mirror, our image is bulged and size of image is diminished.
2. As we move away from the mirror, the image is further diminished.

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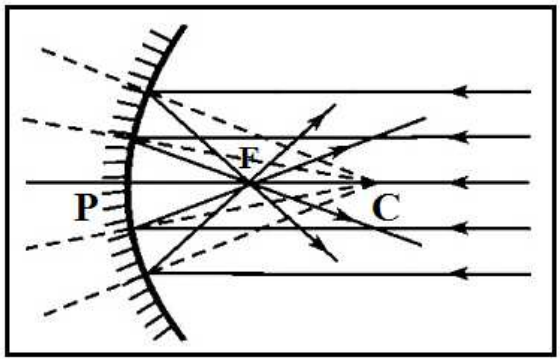
4 Mark Questions

1. How do you find the focal length of a concave mirror?(AS1)(TQ)

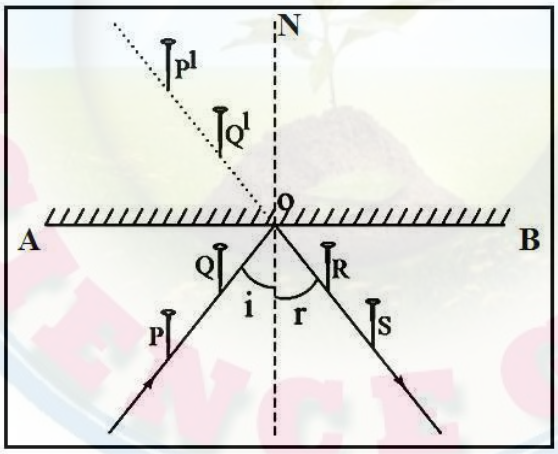


1. Hold a concave mirror perpendicular to the direction of sunlight.
2. Take a small paper and slowly move it in front of the mirror and find out the point where you get smallest and brightest spot, which will be the image of the sun.
3. The rays coming from sun parallel to concave mirror are converging at a point.
4. This point is called focus or focal point of the concave mirror.
5. Measure the distance of this spot from the pole of the mirror.
6. This distance is the focal length(f) of the given concave mirror.
7. The radius of curvature(R) will be twice of this distance.(R =2f)

2. How do you verify the 1st law of reflection of light with an experiment?(AS3) (TQ)

Aim: To verify the 1st law of reflection of light.

Required material: Mirror strip, drawing board, white paper, plane mirror, pins, clamps etc.



Procedure:- 1. Take a drawing board and fix a white paper on it with the help of clamps.
2. Draw a straight line AB at the centre of the paper and also a normal (ON) to AB at the point 'O'.
3. Draw a straight line PQ making certain angle (angle i) with ON as shown in figure.
4. Fix two pins at the points P and Q on the paper vertically.
5. Observe the image P^{I} of the pin P and Q^{I} of the pin Q, in the mirror kept along the line AB.
6. Fix two more pins R and S such that they are in the same line as that of P^{I} and Q^{I}.
7. Join R, S and O as shown in figure. Measure the angle between RS and ON (angle of reflection).

Observations:- 1. You will find that angle of incidence(i) = angle of reflection(r).
2. Repeat the experiment for different angles of incidence(i) and measure the corresponding angles of reflection (r).

Conclusion:- 1. In all the cases the angle of incidence is equal to the angle of reflection.
2. Hence 1st law of reflection of light is verified.

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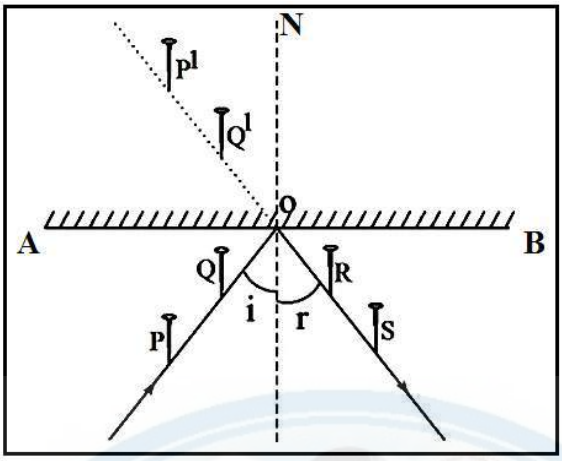
3. How do you verify the 2nd Law of reflection of light with an experiment?(AS3)

Aim:- To verify the 2nd law of reflection.

Required material:- Mirror strip, white paper, drawing board, plane mirror, clamps etc.



Procedure:- 1. Take a drawing board and fix a white paper on it with the help of clamps.
2. Draw a straight line AB at the centre of the paper and also a normal (ON) to AB at the point 'O'.
3. Draw a straight line PQ making certain angle (angle i) with ON as shown in figure.
4. Fix two pins at the points P and Q on the paper vertically.
5. Observe the image P' of the pin P and Q' of the pin Q, in the mirror kept along the line AB.
6. Fix two more pins R and S such that they are in the same line as that of P' and Q'.
7. Join R, S and O as shown in figure.
8. The incident ray is the ray which is passing through the points 'P' and 'Q' touching the paper.
9. The reflected ray is the ray which is passing through the points 'R' and 'S' touch the same paper and 'ON' is the normal to the mirror point 'O' .

Observation:- 1. The incident ray and reflected ray are in the plane parallel to the plane of the paper.
2. Repeat the experiment with different angles of incidence.

Conclusion:- 1. In all observations incident ray and reflected ray are present in the same plane.
2. Hence 2nd law of reflections of light is verified.

4. Think about the objects which act as concave or convex mirrors in your surroundings. Make a table and display in your class room?(AS4) (TQ)

Convex mirror	Concave mirror
1. Rear view mirrors.	1. Head light of motorcycle.
2. Globe	2. Inner surface of glasses
3. Calling Bell	3. Shaving mirror.
4. Outer surface of the steel flask.	4. Inner surface of glasses.
5. Outer surface the pens.	5. Inner surface of cooking vessel.
6. Spoon bulged out wards.	**6.** Spoon bulged inwards.
7. Water glass surface.	7. Lunch plates.
8. Surface of steel flask.	8. Inner surfaces of glasses.

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5. What do you infer from the experiment which you did with concave mirrors and measure the distance of object and distance of image?(AS3) (TQ)

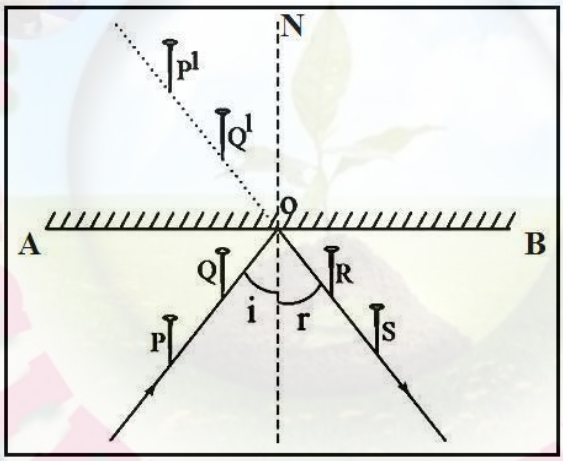
S.No	Position of the object	Position o the image	Enlarged/ Diminshed	Inverted/ Erected	Real/ Virtual
1	Between mirror and F	Beind the mirror	Enlarged	Erect	Virtual
2	At focal point(F)	At infinity	-------	-------	-------
3	Between F and C	beyond C	Enlarged	Inverted	Real
4	At centre of of curvature(C)	At centre of curvature C	Same size	Inverted	Real
5	Beyond C	Between F and C	Diminished	Inverted	Real
6	at infinity Very	At focus	Diminished	Inverted	Real

6. Find the plane of the reflection experimentally for the incident ray which passes through the heads of the pins pierced in front of the mirror? (AS3) (TQ)

Aim:- To find the plane of reflection experimentally for the incident ray which passes through the heads of the pins pierced in front of the mirror.

Required material:- Mirror strip, white paper, drawing board, plane mirror, clamps etc.

Plane of reflection:- The plane in which the incident ray, reflected ray and normal will lie is the plane of reflection.



Procedure:- 1. Take a drawing board and fix a white paper on it with the help of clamps.
2. Draw a straight line AB at the centre of the paper and also a normal (ON) to AB at the point 'O'.
3. Draw a straight line PQ making certain angle with ON.
4. Fix two pins at the points P and Q on the paper vertically.
5. Observe the image p' of the pin P and Q' of the pin Q, in the mirror kept along the line AB.
6. Fix two more pins R and S such that they are in the same line as that of P' and Q'.Join R, S and O.
7. Assume that the heads of all pins observed at the points P, Q, R and S are in the same height.
8. If the incident ray is the ray which is passing through the heads of pins those are localized at P and Q and reflected rays is the ray which is passing through the heads of pins those are located at points R and S, then the normal lies along the plane of PQRS.
9. Then the plane along PQRS is known as plane of reflection.

7. Collect information about the history of spherical mirrors in human civilization. Display it in your class room?(AS4)(TQ)

1. The idea of mirror came into existence long back when people saw their images in water on polluted surfaces etc.
2. The earliest manufactured mirrors were pieces of polished stone such as obsidian a naturally occurring volcanic glass.

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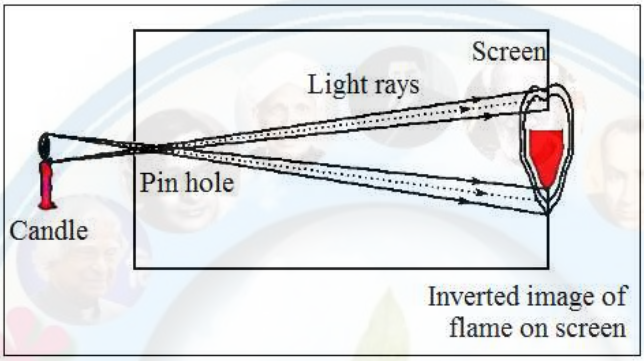
3. The Romans also developed a technique for creating crude mirrors by coating blown glass with molten lead.
4. In China, people began making mirrors with the use of silver-mercury amalgams as early as 500 AD.
5. The first modern silver-glass mirror was created by Justus von Liebig, a German chemist in 1835.
6. The invention of glass blowing method during the 14th century led to the discovery of spherical mirrors, which increased the popularity of glass mirrors.
7. By the end of 18th century, decorative mirrors were widely used.
8. New cheaper techniques of mirror production in the 19th century led to a great proliferation of their use.

8. Draw and explain the process of formation of image with a pin hole camera? (AS5) (TQ)

Process of formation of image with a pin hole camera:-



1. The light from candle travels straight in all directions from each point of the flame of the candle.
2. But only the light coming in some particular directions can enter into the camera through its pin hole.
3. Light which comes from the point at the top of the flame goes straight towards the bottom of the screen.
4. Light which comes from the point at the bottom of the flame goes straight towards the top of the screen as shown in the figure.
5. The other rays are blocked by the black sheet.
6. This leads to the formation of an inverted image.

9. Make a solar heater/cooker and explain in process of making?(AS5)(TQ)

Making a solar cooker:- 1. A concave mirror focus the parallel sun rays at focal point of the mirror.
2. So with a small concave mirror we can heat up and burn a paper.
3. In the same way a big concave mirror can be used to heat up a vessel.
4. Make a wooden /iron frame in the shape of TV dish.
5. Cut acrylic mirror sheets into 8 or 12 pieces in the shape of isosceles triangles with a height equal to the radius of your dish antenna.
6. The bases of the 8 or 12 triangles together make the circumference of the dish.
7. Stick the triangle mirrors to the dish.
8. Arrange it so that concave part faces sun. Find its focal point and place a vessel at that point.
9. It will get heated. One can even cook rice in that vessel.

10. How do you appreciate the role of spherical mirrors in our daily life? (AS6)(TQ)

Spherical mirrors (concave and convex mirrors) are very useful to our life. They are,

1. Concave mirrors are used by dentists to see the large images of the teeth of patient.
2. ENT doctors uses the Spherical mirrors to examine the ear, nose and throat.
3. Spherical mirrors are used in telescopes.
4. Concave mirrors are used as reflectors in torches and vehicle head lights.

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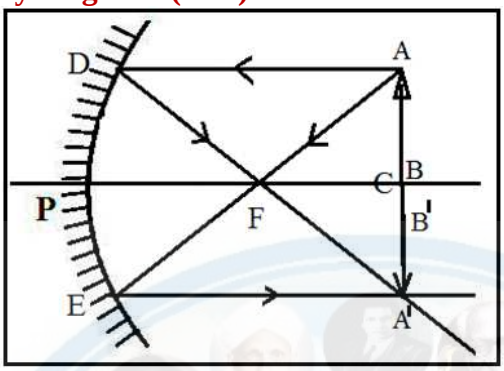
5. Concave mirrors are used in solar furnaces.
6. Convex mirrors are used as rear view mirrors in vehicles.
7. Concave mirrors are used as a shaving mirror.
8. Convex mirrors are used as reflectors in street lights.
8. So, we appreciate the role of spherical mirrors in our daily life.

11. To form the image on the object itself, how should we plane the object in front of a concave mirror? Explain with a ray diagram?(AS5)



To form the image on the object itself, the object should be kept at centre of curvature a concave mirror.

Explanation:- 1. Let the object 'AB' placed at the centre of curvature C on the concave mirror.
2. A ray of light AD which is parallel to the principal axis passes through the focus 'F' after reflection.
3. The second ray of light passing through the focus, after reflection its passes parallel to principle axis.
4. The reflected ray DA^I and EA^I meet at a point A^I.
5. So a real inverted and same size of the object is formed at A^1.
6. This A^1B^1 is the real image of the object AB.

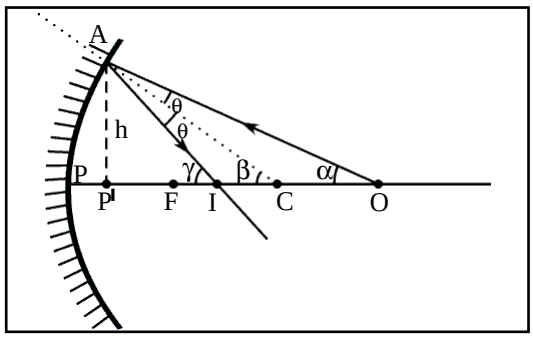
12. Discuss the merits and demerits of using mirrors in building elevation? (AS7) (TQ)

Merits:- 1. Mirrors can be cut into different shapes or sizes.
2. Mirrors provide safety and make the building attractive.
3. Some mirrors they cools inside the building .
4. The mirrors used in elevating buildings are rain forced, tough and laminated glasses.
5. Mirrors do not rust.

Demerits:- 1. Elevation with mirrors is very expansive.
2. Mirrors are broken very easily.
3. Birds like sparrows; crow will get confusion while flying on roads.
4. They are also not safe enough to the buildings, which causes easy access thieves.
5. Glass elevation is not environmental friendly, becomes natural air does not enter into the building.

13. Derive the formula for curved mirrors? (or) Derive the formula $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$?

Derivation of formula for curved mirrors:-



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1. A ray coming from the point O falls on the mirror at point A which is at height 'h' from the axis and after reflection, passes through point I.
2. Here AC is the normal. The angle of incidence (angle OAC) and the angle of reflection (angle CAI) are equal and they are denoted by θ in the figure.
3. Line segment AP^I is the perpendicular drawn to the axis from the point A.
4. Let the angles at the vertices O, C and I of three triangles be α, β and γ respectively as shown in figure.
5. In a triangle, sum of the interior angles is equal to the exterior angle.
6. From the triangle AOC; $\beta = \alpha + \theta$

$$\Rightarrow \theta = \beta - \alpha \quad \text{-------(1)}$$

7. From the triangle ACI; $\gamma = \beta + \theta$

$$\gamma = \beta + \beta - \alpha \quad (\text{Since } \theta = \beta - \alpha)$$

$$2\beta = \alpha + \gamma \quad \text{-------(2)}$$

8. When 'h' becomes very small, P^I may coincide with point P, which is pole of the mirror. Then we can say $P^IO = PO$, $P^IC = PC$ and $P^II = PI$.

9. $\text{Tan } \alpha = \frac{P^1A}{P^1O} = \frac{h}{P^1O} = \frac{h}{Po}$

$$\text{Tan } \beta = \frac{P^1A}{P^1C} = \frac{h}{P^1C} = \frac{h}{Pc}$$

$$\text{Tan } \gamma = \frac{P^1A}{P^1I} = \frac{h}{P^1I} = \frac{h}{PI}$$

10. When an angle θ becomes very small, then the value of Tan θ is taken as θ. That is Tan θ ≈ θ.

Similarly here, $\text{Tan } \alpha = \alpha = \frac{h}{PO}$, $\text{Tan } \beta = \beta = \frac{h}{PC}$ and $\text{Tan } \gamma = \gamma = \frac{h}{PI}$

11. By substituting the values of α, β and γ in the equation-(1).

We get, $\frac{2h}{PC} = \frac{h}{PO} + \frac{h}{PI}$

$$\Rightarrow \frac{2}{PC} = \frac{1}{PO} + \frac{1}{PI} \quad \text{..... (3)}$$

12. According to the rules for sign convenction, Radius of curvature PC = –R
Object distance PO = –u
Image distance PI = –v

$$\frac{2}{-R} = \frac{1}{-u} + \frac{1}{-v}$$

$$\Rightarrow \frac{2}{R} = \frac{1}{u} + \frac{1}{v}$$

$$\Rightarrow \frac{2}{2f} = \frac{1}{u} + \frac{1}{v} \quad (\text{Since } R = 2f)$$

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

This mirror formula should be used according to the sign convention in every situation.

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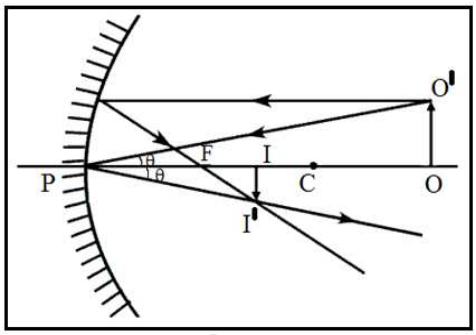
14. Derive the formula for magnification?



Magnification(m):- 1. A ray coming from O^I is incident at pole with an angle of incidence θ, and get reflected with same angle θ.

2. From the triangle POO^I , Tan $\theta = \frac{OO^1}{PO}$ ------ (1)

3. From the triangle PIII, Tan $\theta = \frac{II^I}{PI}$ ------ (2)

4. From (1) & (2) $\frac{OO^1}{PO} = \frac{II^I}{PI} \Rightarrow \frac{II^I}{OO^1} = \frac{PI}{PO}$ ------ (3)

5. According to sign convention PO = –u; PI = –v; $OO^I = h_0$; $II^I = -h_i$

6. Substituting the above values in equation (3). We have $\frac{h_i}{h_o} = \frac{-v}{u}$

$\therefore$ Magnification $m = \frac{h_i}{h_o} = \frac{-v}{u}$.

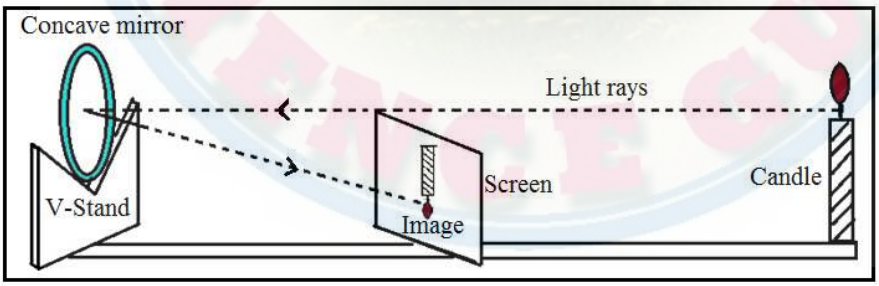
7. We define the magnification, $m = \frac{\text{Height of the image}(h_i)}{\text{Height of the object }(h_o)}$

8. In all cases it can be shown that, $m = \frac{-\text{ Image distance (v)}}{\text{Object distance(u)}}$

15. How do you find the focal length of a concave mirror experimentally?

Aim:- To find the focal length of a concave mirror experimentally.

Material required:- A candle, paper, concave mirror (known focal length), V-stand, meter scale.



Procedure:- 1. Place the concave mirror on V-stand, a candle and meter scale as shown in figure.
2. light the candle and keep the candle at 80 cm(object distance) distances from the mirror.
3. Adjust the distance of the screen such that you get the sharp image of candle on screen.
4. Measure the distance between the screen and mirror and noted as image distance(v).
5. The same experiment is repeated with various distances of candle from the mirror and in each case noted the image distance.

S.No	Object distance, ucm	Image distance, vcm	$f = \frac{uv}{u+v}$
1	80		
2	70		
3	60		
4	50		

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Practice the following problems

1. If the radius of curvature of a spherical mirror is 20 cm what is its focal length ? Ans:- 10 cm.

Given:- Radius of curvature of a spherical mirror, R = 20Cm
Focal length, f = ?

Formula:- $f = \frac{R}{2} = \frac{20}{2} = 10$ cm.

∴ The focal length of a spherical mirror is 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. 6.67 cm.

Given:- Radius of curvature of the concave mirror R = - 8 cm.
Focal length of the concave mirror $f = \frac{R}{2} = \frac{-8}{2} = -4$cm
Object distance (u) = - 10cm
Image distance (v) =?

Formula:- $\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \quad \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{-4} - \frac{1}{-10} = \frac{-5+2}{20} = \frac{-3}{20}$.

$\Rightarrow v = \frac{-20}{3} = -6.67$ cm.

∴ The image is real, inverted and formed at a distance of 6.66 cm from the mirror.

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 :- 6 Cm

Given:- Radius of curvature R = 3m
Focal length $f = \frac{R}{2} = \frac{3}{2} = 1.5$ m
Object distance (u) = - 5m
Image distance (v) =?

Formula:- $\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \quad \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{1.5} - \frac{1}{-5} = \frac{10}{15} + \frac{1}{5} = \frac{10+3}{15} = \frac{13}{15}$.

$\Rightarrow v = \frac{15}{13} = 1.15$ cm

∴ Virtual, erect and diminished image is formed at a distance of 1.15cm behind the mirror.

4. A convex 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 :- 1.15m

Given:- Radius of curvature of the convex mirror, R = 3 m.
Focal length of the concave mirror $f = \frac{R}{2} = \frac{3}{2} = 1.5$ cm.
Object distance (u) = - 5 m.
Image distance (v) =?

Formula:- $\frac{1}{f} = \frac{1}{u} + \frac{1}{v} \quad \Rightarrow \frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \frac{1}{1.5} - \frac{1}{-5} = \frac{10}{15} + \frac{1}{5} = \frac{10+3}{15} = \frac{13}{15}$.

$\Rightarrow v = \frac{15}{13} = 1.15$ m.

∴ Virtual, erect and diminished image is formed at a distance of 1.15 m behind the mirror.

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5. An object 4 cm in size is placed at 25 cm in front of a concave mirror of focal length 15cm. At what distance from the mirror would a screen be placed in order to obtain a sharp image? Find the nature and size of the image? Ans:- -37.5 cm, -6 cm.

Given:- Focal length, f = -15cm
Object distance (u) = - 25cm
Object height (h_0) = +4cm
Image distance (v) =?
Image height h_i =?

Formula:- $\frac{1}{f}=\frac{1}{u}+\frac{1}{v} \Rightarrow \frac{1}{v}=\frac{1}{f}-\frac{1}{u}=\frac{1}{-15}-\frac{1}{-25}=\frac{-1}{15}+\frac{1}{25}=\frac{-5+3}{75}=\frac{-2}{75}$

$$\Rightarrow v=\frac{-75}{2}=-37.5 \text{ cm.}$$

∴ The image is real, inverted and formed at a distance of 37.5 cm from the mirror.

$$\text{Magnification (m)} = \frac{\text{Height of the image}(h_i)}{\text{Height of the object }(h_o)} = \frac{-\text{ Image distance (v)}}{\text{Object distance(u)}}$$

$$\Rightarrow \frac{h_i}{4}=\frac{-37.5}{25} \Rightarrow h_i = -4\times\frac{37.5}{25}=\frac{-150}{25}=-6 \text{ cm.}$$

∴ So, the image is real, inverted and enlarged.

6. An object is placed at a distance of 10cm from a convex mirror of focal length 15cm find the position and nature of the image. Ans:- 6cm, 0.6cm

Given:- Object distance (u) = - 10cm
Focal length (f) =15cm
Image distance (v) =?

Formula:- $\frac{1}{f}=\frac{1}{u}+\frac{1}{v} \Rightarrow \frac{1}{v}=\frac{1}{15}-\frac{1}{-10}=\frac{1}{15}+\frac{1}{10}=\frac{2+3}{30}=\frac{5}{30}=\frac{1}{6}.$

$$\Rightarrow v = 6 \text{ cm.}$$

Magnification m= $\frac{-v}{u}=\frac{-6}{-10}=0.6$

∴ Virtual, erect and diminished image is formed at a distance of 6 cm behind the mirror.

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Chapter-4
ACIDS, BASES AND SALTS
1 Mark Questions

1. What is the source of common Salt?

Sea water and Rock salts.

2. What are antacids?

Antacids:- 1. Antacids are mild alkalis.
2. These are used for getting relief from acidity and indigestion.
Ex:- Milk of magnesia[$Mg(OH)_2$].

3. What type of reaction takes place in stomach when an antacid tablet is consumed?

Neutralization reaction takes place in stomach when an antacid tablet is consumed.

4. Give some examples of natural weak acids or bases?

Litmus, extract of red cabbage, turmeric solution and extracts of coloured petals of some flowers contain dye molecules which are weak acids or bases.

5. What are olfactory indicators? Give an example?

Olfactory indicators:- Olfactory indicators are substances which have different odour in acid and base solutions.
Ex:- Onion, vanilla essence and clove oil etc.

6. Which gas is usually liberated when an acid reacts with a metal?

Hydrogen (H_2) gas.

7. Write the suitable chemical reaction between acids with metals?

When acids react with metals to form salt and liberate hydrogen gas.

Acid + Metal $\rightarrow$ Salt + Hydrogen

Ex:- $2\,HCl_{(aq)} + Zn_{(s)} \rightarrow Zn\,Cl_{2\,(aq)} + H2_{(g)}$

8. Which substance involved in the chemical reaction for formation of Sodium Zinkate.

When zinc metal is react with sodium hydroxide (NaOH) solution , forms a sodium zincate.

$$2\,NaOH + Zn \rightarrow Na_2ZnO_2 + H_2\uparrow$$
(Sodium zincate)

9. Write the reaction of carbonates with Acids?

Acids react with carbonates to form salt, water and liberate carbon dioxide.

Metal carbonate + acid $\rightarrow$ salt + carbon dioxide + water.

Ex:- $Na_2\,CO_{3\,(S)} + 2\,HCl_{(aq)} \rightarrow 2\,NaCl_{(aq)} + H_2O_{(l)} + CO_{2\,(g)}$

10. Write the reaction of metal hydrogen carbonates with Acids?

Acids react with metal hydrogen carbonates to form salt, water and liberate carbon dioxide.

Metal hydrogen carbonate + acid $\rightarrow$ salt + carbon dioxide + water

Ex:- $NaHCO_{3\,(S)} + HCl_{(aq)} \rightarrow NaCl_{(aq)} + H_2O_{(l)} + CO_{2\,(g)}$

11. Write the reaction between bases with non-metal oxides with suitable examples?

Calcium hydroxide is a base, reacts with carbon dioxide to produce a salt and water.

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

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12. 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?

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

13. Write the reaction of metal oxides with Acids?

When metal oxides are react with acids to form salt and water.

Metal oxide + Acid → Salt + Water

Ex:- $CuO + 2HCl \rightarrow CuCl_2 + H_2O$.

14. Write the reactions of non-metal oxides with base?

When non-metal oxides are react with base to form salt and water.

Non-metal oxide + Base → Salt + Water.

Ex:- $Ca(OH)_{2(aq)} + CO_{2(g)} \rightarrow CaCO_3 + H_2O_{(l)}$

15. How does the hydronium ions are formed?

1. Hydrogen ions cannot exist as bare ions.
2. They associate with water molecules and exist as hydronium ions (H_3O^+).

$$H^+ + H_2O \rightarrow H_3O^+$$

16. What happened when water is added to acids or base? (AS7)(TQ)
(or) What is meant by a dilution of acids/bases?

1. Mixing an acid or base with water result in decrease in the concentration of ions (H_3O^+/OH^-) per unit volume.
2. Such a process is called dilution of acids.

17. How do you reduce the pain when someone stung by the honey-bee?

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

18. Define salts?

Salts:- Salts are the ionic compounds which are produced by the neutralization of acid with base.

Ex:- KNO_2, NaCl, KCl

19. What are the salts obtained from common salt?

The various salts obtained from common salt are sodium hydroxide, baking soda, washing soda, bleaching powder and many more.

20. Write the chemical names of two salts belongs to sodium family?

Na_2SO_4, NaCl, $NaNO_3$, Na_2CO_3.

21. How to prepared brine solution.

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

22. Which substance are you added for making of the cake soft and spongy?

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

$$NaHCO_3 + H^+ \rightarrow CO_2 + H_2O + \text{Sodium Salt of acid.}$$

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

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23. Why the plaster of pairs is called Calcium Sulphatre Hemi Hydrate?

1. The two formula units of CaSO4 share one molecule of water.
2. So $\frac{1}{2}$ molecule of water present in each Plaster of paris unit.
3. So Plaster of paris is called Calcium Sulphatre Hemi Hydrate.

24. Why the formers add Cao or CaSO4.2H2O or CaCO3 to the soil. Give the reasons?

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 p^H for the growth of plants.

25. Write the common name of Sodium hydrogen carbonate?

Baking soda ($NaHCO_3$).

26. What are alkalis?

Bases which are soluble in water are called alkalis.

27. What are the difference between metals and non- metals with respect to the nature of their oxides?

Metals give basic oxides and non metals give acidic oxides.

28. Name the acids present in (i) Nettle sting (ii) Curd?

(i) Methanoic acid (Formic acid) (ii) Lactic acid.

29. Why Tartaric acidis used as an ingredient in a baking powder?

Tartaric acid($C_6H_4O_6$) acts as preservation and also reacts with baking soda to give carbon dioxide.

30. What is P^H scale?

P^H is defined as the negative logarithm of hydrogen ions[H^+] concentration.

(or) A scale for measuring hydrogen ion concentration in a solution is called p^H scale.

$$P^H = - \log H^+$$

31. Who introduced the PH scale?

Sorenson

32. Give the chemical names of acids present in. (a) ants (b) lemon (c) milk (d) tomato.

1. Ants	Formic acid.
2. Lemon	Citric acid.
3. Milk	Lactic acid.
4.Tomato	Oxalic acid.
5. Tamarind	Tartaric acid
6. Vinegar	Acetic acid.

33. What is neutralization reaction?

Neutralization reaction:- The reaction of an acid with a base to give a salt and water is known as a neutralization reaction.

$$\text{Base} + \text{Acid} \rightarrow \text{Salt} + \text{Water.}$$

Ex:- $HCl + NaOH \rightarrow NaCl + H_2O$

34. What is the range of pH scale?

The range of PH scale is from 0 to 14.

35. What is water of crystallization?

Water of crystallization is the fixed number of water molecules present in one formula unit of salt.

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36. Write the reaction of copper oxide with hydrochloric acid?

$$Cuo_{(s)} + 2HCl_{(aq)} \rightarrow CuCl_{2(aq)} + H_2O_{(l)}$$

37. Where acid is added to water, what type of reaction is it?

When acid is added to water, it is an exothermic reaction.

38. How do you decide the strength of acid or base?

The strength of acid or base can be decided on the basis of no of H_3O^+ ions or OH^- ions produced in solution.

39. What is bleaching powder? Write its formula?

1. Beaching powder is produced by the action of chlorine on dry slaked lime.

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

2. Chemical formula of bleaching powder is $CaOCl_2$.

40. Write the balanced chemical equation for preparation of baking soda?

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

40. What happened when we add a baking soda during cooking? Write the balanced equation?

Baking soda(is mild non-corrosive base).

$$2\,NaHCO_3 \xrightarrow{Heat} Na_2CO_3 + H_2O + CO_2$$

2 Marks Questions

1. What are antacids? Give an example?

Antacids:- 1. Antacids are mild alkaloids(Bases).
2. These are used for getting relief from acidity and indigestion and some times even head ache.
3. When it take orally, it react with hydrochloric acid present in the stomach and reduces its strength by consuming some of it.

Ex:- Milk of Magnesia[$Mg(OH)_2$] is an antacid.

2. Why does tooth decay start when the pH of mouth is lower than 5.5 ? (AS1)(TQ)

1. The pH value of saliva is 6.4 to 6.9. It is almost neutral in nature.
2. Tooth enamel, made of calcium phosphate.
3. It is the hardest substance in the body.
4. It does not dissolve in water, but is corroded by an acids.
5. Bacteria present in the mouth produce acids by the degradation of sugars and food particles remaining in the mouth.
6. Due to the formation of acids, the pH of the mouth is shifted to acidic.
7. Hence, tooth decay starts when the pH of the mouth is lower than 5.5.

3. Dry hydrogen chloride gas does not turn blue litmus to red. Whereas hydrochloric acid does. Why? (AS1)(TQ)

1. Hydrochloric acid disassociated in the presence of water to produce H^+ ions.
2. The dissociation will be as follows.

$$HCl \xrightarrow{Aquous} H^+ + Cl^-$$

3. So, aqueous HCl solution is an acid and change the colour of blue litmus to red.
4. But dry HCl will not considered as acid because in the absence of water HCl will not produce H^+ ions.
5. Hence, dry HCl can't change the colour of blue litmus to red.

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4. Why does not distilled water conduct electricity? (AS2)(TQ)

1. Liquids conduct electricity only due to their ions.
2. Distilled water is prepared by the distillation of tap water.
3. In distilled water, the concentration of both H_3O^+ and OH^- is same.
4. Hence they do not form ions.
5. As there is no formation of ions in electrolysis, distilled water do not conduct electricity.
6. On the other hand while rain water falling to earth through the atmosphere dissolve some acidic gaseous like CO_2, SO_2 and N_2O and forms acids such as H_2CO_3, H_2SO_3 and HNO_3.
7. These acids produce ions. Due to the presence of ions rain water conducts electricity.

5. Why pure acetic acid does not turn blue litmus to red? (AS2)(TQ)

1. Disassociation of acids takes place in the presence of water to produce H^+ ions.
2. The formation of these ions change the colour of the litmus paper.
3. Pure acetic acid will not show acidic character in the absence of water.
4. Because dissociation of molecule will not occur and do not form the ions.
5. So, pure acetic acid does not turn blue litmus to red.

6. A milkman adds a very small amount of baking soda to fresh milk.

a) Why does he shift pH of the fresh milk from 6 to slightly alkaline?

b) Why does this milk take a long time to set as curd? (AS1)(TQ)

a) 1. The chemical name of the compound is sodium hydrogen carbonate (Na HCO3) and its p^H value is 8.1.
2. When milk man adds a little baking soda to fresh milk to make it slightly alkaline.
3. So the pH of the fresh milk shift to 6 and make it slightly alkaline.
4. Thus the spoilage of milk can slow down.

b) 1. Lactic acid which was formed initially reduces the basic nature of the baking soda.
2. Then more lactic acid is needed to convert milk into curd.
3. That is why it takes time to produce more lactic acid and hence the milk takes a long time to become curd.

7. Plaster of Paris should be stored in moisture-proof container. Explain? (AS2)(TQ)

1. Plaster of Paris chemical name is calcium sulphate hemihydrates ($CaSO_4.\frac{1}{2}H_2O$).
2. It is a white powder and on mixing with water, it sets into hard solid mass due to the formation of gypsum($CaSO_4.2H_2O$).

$$CaSO_4.\frac{1}{2}H_2O + 1\frac{1}{2}H_2O \rightarrow CaSO_4.2H_2O$$

(plaster of Paris) (Gypsum)

3. Because of the above reason plaster of Paris should be stored in moisture proof container.

8. Fresh milk has a pH of 6. Explain why the pH changes as it turns into curd? (AS3)(TQ)

1. Fresh milk has a p^H of 6. Hence it is an acid.
2. The p^H of the milk decreases as milk turns to curd.
3. We have to achieve this, add a small quantity of buttermilk to milk.
4. Fermentation takes place and lacto bascillus bacteria turns milk to curd by releasing lactic acid.
5. During this process, the pH of the milk changes and sets as curd.
6. Thus, the pH of the milk decreases from 6 to acidic(5.5-4.5) as it turns to curd.

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9. Equal lengths of magnesium ribbons are taken in test tubes A and B. Hydrochloric acid is added to tube A, while acetic acid is added to test tube B. Amount and concentration of the both the acids is same. In which test tube the fizzing occurs more vigorously and why?(AS4) (TQ)

1. Magnesium is a metal.
2. Strong acids vigorously reacts with metals and liberates the Hydrogen(H_2) gas.
3. Test tube 'A' contains hydrochloric acid which is a strong acid than acetic acid present in test tube 'B'.
4. Even though the concentration of the Hydrochloric acid and acetic acid are same.
5. But the number of H^+ ions produced by the two aids are different.
6. Hydrochloric acid can produce a large number of H+ ions then acetic acid.
7. So in test tube 'A' the reaction occurs vigourously as it contains strong acid(Hydrochloric acid).

10. How does the flow of acid rain into a river make the survival of aquatic life in a river difficult? (AS7)(TQ)

1. Living organisms can survive only in a narrow range of pH change.
2. Acid rains have some acids like carbonic acid(H_2CO_3), sulphuric acid (H_2SO_4) and nitric acid (HNO_3).
3. If the pH of rain water is less than 5.6, it is called acid rain.
4. When acid rain flows into rivers, it lower the pH of river water.
5. Due to less pH, the river water becomes acidic and hence the aquatic life in a river difficult.
6. The high acidity of river water can even kill the aquatic animals like fish.

11. What is backing powder? How does it make the cake soft and spongy? (AS7)(TQ)

1. Baking powder is a mixture of baking soda and a mild edible acid such as tartaric acid.
2. When baking powder is heated or mixed in water, then $NaHCO_3$ reacts with tartaric acid to evolve carbon dioxide gas.

$$NaHCO_3 + H^+ \rightarrow CO_2 + H_2O + \text{sodium salt of acid.}$$

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

12. Give two important uses of washing soda and baking soda? (AS7) (TQ)

Uses of washing soda(Na_2CO_3):- 1. It is used in glass, soap and paper industries.
2. It is used in the manufacture of sodium compound such as borax.
3. Sodium carbonate can be used as a cleaning agent for domestic purpose.
4. It is used for removing permanent hardness of water.

Uses of baking soda($NaHCO_3$):- 1. It is used to prepare baking powder. (Sodium bicarbonate + tartaric acid)
2. It is used as an antacid to neutralise the acidity in the stomach.
3. It is used in soda-acid fire extinguishers.
4. It is used as mild antiseptic.

13. What will happen if the PH value in your body increases?

1. Our body works well with in a narrow PH range of 7.0 to 7.8.
2. If due to some reason this PH range gets disturbed in the body of a person, then many ailments can occur.

14. Classify the following examples as acid, base(or)salt?

$Mg(OH)_2$, H_3PO_4, KNO_2, $Ba(OH)_2$, KCl, HBr, NaCl, HFO_4, HCl, $Al(OH)_3$

Acid	H_3PO_4, HBr, HFO_4, Hcl
Basis	$Mg(OH)_2$, $Ba(OH)_2$, $Al(OH)_3$
Salts	KNO_2, NaCl, KCl.

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15. While diluting an acid, why is it recommended that the acid should be added to water and not water to the acid?

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

16. What are the uses of acid – base universal indicators?

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

17. Write the PH value and nature of the each solution on the basis of the following table?

S.No	Solution	p^H	Nature
1	Battery acid	0.2	Strong acid
2	Vinegar	3	Weak acid
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

18. What are the factors influence on PH of salts?

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

19. How is bleaching powder manufactured? Write their useas?

1. Chlorine gas is used for the manufacture of bleaching power.
2. Bleaching power is manufactured by the action of chlorine on dry slaked lime [$Ca(OH)_2$].

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

Uses of Bleaching Powder:- 1. It is used textile industry and laundry shops.
2. It is used as an oxidizing agent in many chemical industries.
3. It is used for disinfecting drinking water to make it free of germs.
4. It is used as a reagent in the preparation of chloroform.

20. What is plaster of paris? How it is prepared?

Plaster of paris:- 1. $CaSO_4.\frac{1}{2}H_2O$(Calcium sulphate hami-hydrate) is a plaster of paris.

2. This is prepared by heating gypsum at 120-130^{0}C.

$$2\ CaSO_4\ 2\ H_2O \rightarrow 2\ CaSO_4.\frac{1}{2}H_2O + 3\ H_2O$$

21. 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?

A) Plaster of paris.

B) $CaSO_4.\frac{1}{2}H_2O$.

C) $2\ CaSO_4.\frac{1}{2}H_2O + 3\ H_2O \rightarrow 2\ CaSO_4\ .\ 2\ H_2O$.

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22. What is meant by strong acids and weak acids? Give some examples?

Strong acids:- An acid which is completely ionized in water and thus produces a large amount of hydrogen ions is called strong acid.

Ex:- HCl, H_2SO_4, HNO_3 etc.

Weak acids:- An acid which is partially ionized in water and thus produces a small amount of hydrogen ions is called a weak acid.

Ex:- CH_3COOH, H_2CO_3, H_2SO_3

23. what is meant by strong bases and weak bases?

Strong base:- A base which completely ionizes in water and thus produces a large amount of hydroxide ions (OH^-) is called strong base.

Ex:- NaOH, KOH etc.

Weak base:- A base which is partially ionized in water and thus produces a small amount of hydroxide ions is called a weak base.

Ex:- NH_4OH, $Ca(OH)_2$, $Mg(OH)_2$

4 Marks Questions

1. Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9 respectively, Which solution is,
a) neutral b) strongly alkaline c) strongly acidic d) weakly acidic e) Weakly alkaline.
Arrange the PH in increasing order of hydrogen ion concentration (AS1)(TQ)

a) Solution 'D' is neutral.
b) Solution 'C' is strongly alkaline.
c) Solution 'B' is strongly acidic.
d) Solution 'A' is weakly acid.
e) Solution 'E' is weakly alkaline.

S.No	Solution	P^H
1	A	4
2	B	1
3	C	11
4	D	7
5	E	9

We know, $pH = -\log [H^+]$

A) $4 = -\log [H^+] \Rightarrow [H^+] = 10^{-4}$
B) $1 = -\log [H^+] \Rightarrow [H^+] = 10^{-1}$
C) $11 = -\log [H^+] \Rightarrow [H^+] = 10^{-11}$
D) $7 = -\log [H^+] \Rightarrow [H^+] = 10^{-7}$
E) $9 = -\log [H^+] \Rightarrow [H^+] = 10^{-9}$

Increasing order of hydrogen ion concentration is $10^{-11}, 10^{-9}, 10^{-7}, 10^{-4}, 10^{-1} \Rightarrow 11<9<7<4<1$
i.e C, E, D, A, B.

2. Compounds such as alcohols and glucose contain hydrogen but are not categorized as acids. Describe an activity to prove it? (AS3) (TQ)

1. Prepare solutions of glucose and alcohol.
2. Fix two iron nails on a rubber cork and place the cork in a beaker as shown in the figure.
3. Connect the iron nails to the two terminals of a battery through a switch and a bulb.
4. Now pour some solution of glucose ($C_6H_{12}O_6$) and switch on the current.
5. We will notice that bulb does not glow.
6. This shows that glucose solution does not conduct electricity.
7. Repeat this experiment with alcohol solution in the beaker.
8. The bulb does not glow again, that means alcohol solution does not conduct electricity.
9. This indicates the absence of ions(H+ ions) in the glucose and alcohol solutions.

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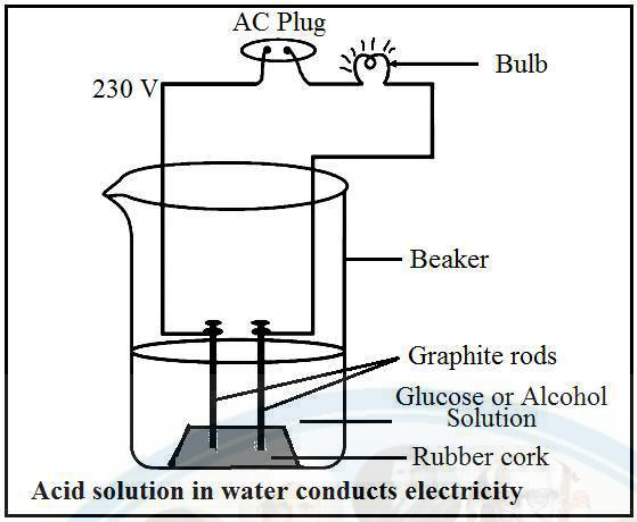
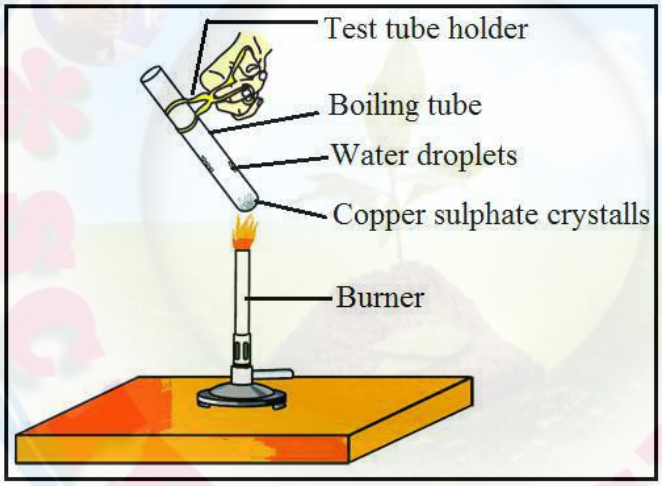
10. Glucose and alcohol do not disassociate in water to produce H^+ ions even though they contain hydrogen.
11. Hence glucose and alcohol are not categorised as acids because they do not produce H^+ ions in water.



3. What is meant by "Water of Crystallization" of a substance? Describe an activity to show the water of crystallization?(AS3)(TQ)



Water of Crystallization:- 1. Water of crystallizations is the fixed number of water molecules present in one formula unit of salt.
2. The salts which contain water of crystallization are called hydrated salts.
Ex:- $CusO_4.5H_2O$.
3. It means that five water molecules are present in one formula unit of copper sulphate.

Activity:- 1. Take a few crystals of copper sulphate in dry test tube.
2. Heat the dry crystals strongly over the flame of a burner for some time.
3. The water present in the crystals are evaporated and the blue colour of salt turns to white.
4. We also see tiny water droplets on the walls of the test tube.

$$CuSO_4.\ 5H_2O \rightarrow CuSO_4 + 5H_2O$$

Hydrated copper sulphate (Blue colour) — Anhydrous copper sulphate (White colour)

5. Now cool the test tube and add 2 – 3 drops of water to the sample of anhydrous copper sulphate.
6. We observe the blue colour of copper sulphate crystals is restored.
7. From this activity we conclude that some water molecules are fixed in the blue coloured copper sulphate crystals.

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4. How do you prepare your own indicator using beetroot? Explain (AS5)(TQ)

1. Take a beetroot and cut it into small pieces.
2. Add little water and boil for half an hour in a beaker.
3. After allowing the beaker to cool for 15 minutes, collect the filtrate.
4. Dip a filtrate paper into the beetroot juice. The filtrate paper change into red colour.
5. Now add a few drops of acidic solution on the piece of beetroot paper.
6. Observe the colour of the beetroot paper. There is no change in colour.
7. Add a few drops of basic solution on the piece of beetroot paper.
8. The beetroot paper colour turns to yellow.
9. From this observation we concluded that beetroot paper acts as a natural indicator.
10. It does not change the colour in acidic medium and change the yellow colour in basic medium.

5. Write the tests to identify the nature of substances which acts as acids and bases?

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

S.No	Substance	Test	Colour
1	Acidic Solution	Blue Litmus	Red
2	Basic Solution	Red Litmus	Blue
3	Acidic Solution	Methyl orange	Red
4	Basic Solution	Methyl orange	Yellow
5	Acidic Solution	Phenolphthalein	No colour
6	Basic Solution	Phenolphthalein	Pink

6. Give reasons :-

(a) Tap water conducts electricity where as distilled water does not.

(b) Solution of Sulphuric acid conducts electricity where as alcohol does not.

(c) Dry ammonia gas has no action on litmus paper but a solution of ammonia in water turns red litmus paper blue.

a). 1. Tap water contains some impurities in the form of salts.
2. Due to the presence of salts, it conducts electricity.
3. Distilled water is free from all kinds of salts and hence does not conduct electricity.

b). Solution of Sulphuric acid has charged ions H+ ions which helps in conducting electricity where as alcohol does not give any ions in water.

c). Dry ammonia has no H+ or OH- ions where as ammonia in water gives OH- ions which turns red litmus to blue.

7. Give the important uses of the following substances?

1. Bleaching powder 2. Washing soda 3. Baking soda 4. Plaster of Paris

1. Bleaching powder ($CaOCl_2$):- 1. It is used for bleaching purpose.
2. It is used as an oxidising agent.
3. It is esed for disinfection of drinking water to make it free of germs.
4. It is used as reagent in the preparation of chloroform.

2. Washing soda (Na_2CO_3):- 1. Sodium carbonate is used in glass, soap and paper industries.
2. It is used in the manufacture of Borax.
3. It can be used as a cleaning agent for domestic purposes.
4. It is used for permanent hardness of water.

3. Baking soda($NaHCO_3$):-1. Baking soda causes bread or cake to rise, making them soft and spongy.
2. It is also used in soda acid fire extinguishers.
3. It acts as mild anti septic.

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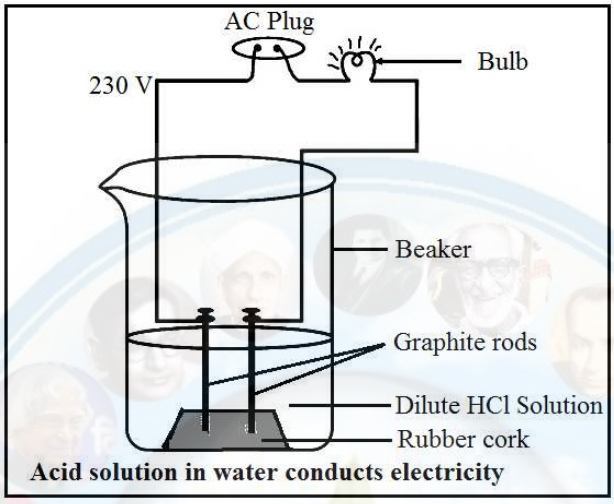
4. It is an ingredient in antacids. Being alkaline it neutralizes excess acid in the stomach and provides relief.

4. Plaster of Paris ($CaSO_4$. ½ H_2O):- 1. It is used in making chalks and fire proof materials.
2. Doctors use as plaster for supporting fractured bones in the right position.
3. It is used as a cement in ornamental casting and for making moulds in pottery work.
4. It is used for making toys, materials for decoration.

8. Draw a neat diagram showing acid solution in water conducts electricity? (AS5) (TQ)



Acid solution in water conducts electricity

Written by:- Gali Sreekar M.Sc, B.Ed Chirala Mandal, Prakasam District. 9440234404, 9700842884

Chapter-5
REFRACTION OF LIGHT AT PLANE SURFACES

1 Mark Questions

1. What is refraction of light?

Refraction of light:- The process of changing speed at an interface when light travels from one medium to another medium, resulting in changes in direction is called refraction of light.

2. Define rarer medium?

Rarer Medium:- A medium in which the speed of light is more is known as optically rarer medium.

3. Define denser medium?

Denser medium:- A medium in which the speed of light is less is known as optically denser medium.

4. What is the reason for refraction? (or) Why light rays deviate at the interface of two media?

The incident light ray changes its direction (deviate) at the interface separating the two media due to change its speed.

5. What is the speed of light in vacuum?

Speed of light in vacuum, $c = 3 \times 10^8$ m/s.

6. Define refractive index (n)? Write the formula for refractive index?

Refractive index (n):- 1. The ratio of the speed of light in vacuum to the speed of light in that medium is defined as refraction index (n).

2. It is also called as absolute refractive index.

$$\text{Refractive index, } n = \frac{\text{Speed of light in vaccum}(c)}{\text{Speed of light in medium}(v)}$$

8. Write the formula for relative refractive index?

$$\text{Relative refractive index, } n_{21} = \frac{\text{Refractive index of second medium}(n_2)}{\text{Refractive index of first medium}(n_1)}$$

$$\text{(or) Relative refractive index, } n_{21} = \frac{\text{Speed of light in first medium}(v_1)}{\text{Speed of light in second medium}(v_2)}$$

9. What is the use of refractive index of a light?

Refractive index gives the idea of how fast or how slow the light travels in a medium.

10. For which medium refractive index is minimum and maximum?

1. The Refractive index is minimum for vacuum (n = 1).
2. The Refractive index is maximum for diamond (n = 2.42).

11. Which factor decides the speed of light in the medium?

Refraction index (n) decides the speed of light in the medium.

12. On what factors does the refractive index of a medium depend?

Refractive index of the material depends on the following factors.

1. Nature of the material.
2. Wavelength of light used.

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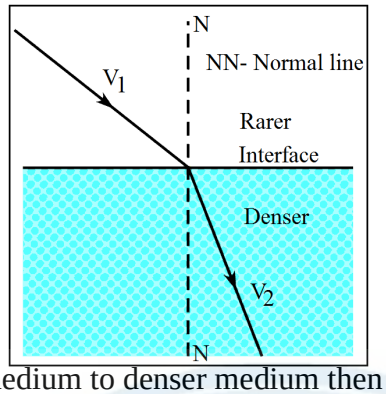
13. What is the reason behind the shining of diamonds?

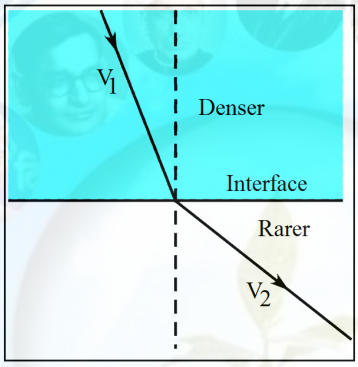
Total internal reflection is the main reason for brilliance of diamonds.

14. How light ray moves when it enters from rarer medium to denser medium?



If light ray enters from rarer medium to denser medium then refracted ray moves towards the normal.

15. How light ray moves when it enters from denser medium to rarer medium?



If light ray enters from denser medium to rarer medium then refracted ray moves away from the normal.

16. Define critical angle?

Critical angle(c):- At what angle of incidence do you notice that the refracted ray grazes the interface separating the two media (air and glass). This angle of incidence is known as critical angle(c).

(or)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'.

17. What is the critical angle of a diamond?

Critical angle of a diamond is 24.4^0.

18. What is mirage?

Mirage:- Mirage is an optical illusion where it appears that water has collected on the road at a distant place but when we get there we don't find any water.

19. How do you appreciate the role of Fermat principle in drawing ray diagrams? (AS6) (TQ)

1. Fermat's principle says that light selects a shortest path to travel.
2. This is the basic reason for the straight line propagation of light.
3. Using this principle, we can draw ray diagram to trace the image formed by mirrors to understand reflection and refraction.

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20. Observe the following table.

Medium	Water	Crown glass
Refreactive Index	1.33	1.52

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

Crown glass is the denser medium.

21. By observing the following table, answer the following questions?

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

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

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

1. In Ice speed of light is high.
2. In carbon disulphide speed of light is low.

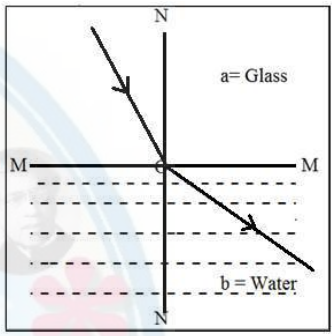
22. What is Snell's law?

Snell's law:- $n_1 \sin i = n_2 \sin r$ (or) $\frac{Sin\ i}{Sin\ r}$ = Constant.

23. In the following 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?



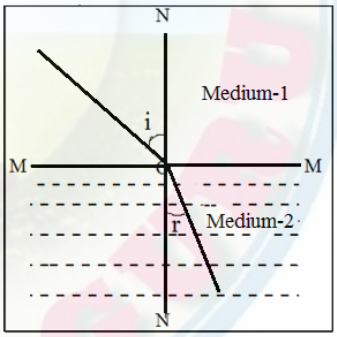
'a' is the denser medium and b is the rarer medium.

24. By observing the following figure, write the answer for the following questions?

1. What is the relation between i and r?

2. In first and second media, which is denser?

1. i > r (or) r < i
2. Second medium is denser.



2 Mark Questions

1. Write the laws of refraction of light?

First law:- The incident ray, the refracted ray and the normal to interface of two transparent media at the point of incidence all lie in the same place.

Second law:- During the refraction light follows Snell's law is constant.

$$n_1 \sin i = n_2 \sin r \text{ (or) } \frac{\text{Sin i}}{\text{Sin r}} = \text{Constant.}$$

2. Why is it difficult to shoot a fish swimming in water? (AS-1)(TQ)

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 gun to apparent position of the fish instead of real position.
5. Hence it is difficult to shoot a fish swimming in water.

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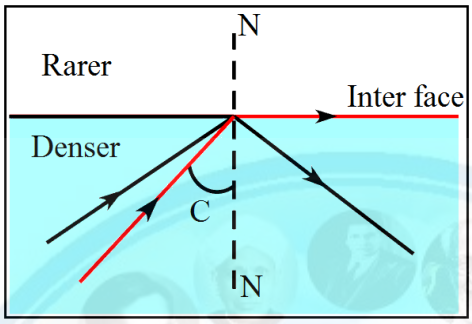
3. What is the reason behind the shining of diamond and how do you appreciate it? (AS6) (TQ)

1. Total internal reflection is the main cause for brilliance of diamonds.
2. The critical angle of diamonds is very low (24.4^0).
3. Diamond sparkles due to repeated internal reflections.
4. The faces of diamond are cut in such a way; the angle of incidence is greater than the critical angle(c).
5. So that total internal reflection takes place again and again.
6. Due to the total internal reflection we appreciate the shining of a diamond.

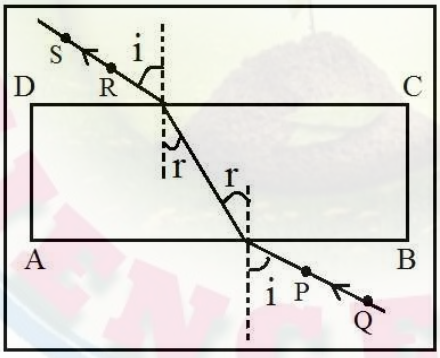
4. Define Total internal reflection? Given two examples?



Total internal Reflection:- 1. When the angle of incidence is greater than critical angle, the light ray gets reflected into the denser medium at the interface i.e. light never enter the rarer medium.
2. This phenomenon is called internal reflection.

Ex:- 1. Formation of mirages.
2. Brilliance of diamonds.
3. Working of an optical fibre.

5. What is the angle of deviation produced by a glass slab? Explain with ray diagram (AS7)? (TQ)

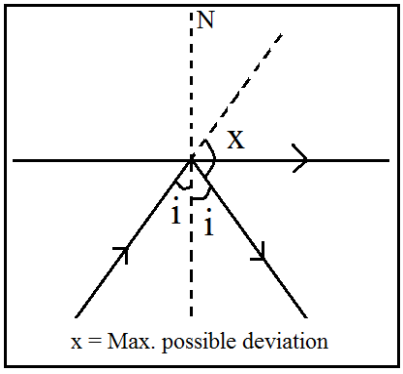


Angle of Deviation:- 1. The angle between incident ray and emergent ray is known as angle of deviation.
2. The angle of deviation produced by a glass slab is 0^0.
3. Because the incident ray and emergent rays are parallel to each other.

6. A ray of light travels from an optically denser to rarer medium. The critical angle of two media is 'c'. What is the maximum possible deviation of the ray? (AS7)(TQ)

1. If the light incident at an angle $i \geq c$ as shown in the figure the angle of deviation is given by, $x = \pi - 2i$ (Since $i + x + i = \pi$)
2. The maximum value of δ occurs when $i = c$ and is equal to,

$$x_{max} = \pi - 2c.$$



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7. When we sit at a camp fire, objects beyond the fire is seen swaying. Give the reason for it? (AS7)(TQ)

1. From the campfire, heat is carried into surrounding air by the process of convection.
2. During this process the density of surrounding air changes continuously, thus changes its refractive index slightly.
3. This continuous change in refraction index gives rise to continuous change in angle of refraction .
4. Due to this result the object beyond the camp fire is seen swaying.

8. Why do stars appear twinkling? (AS7) (TQ)

1. The twinkling of a star is due to atmospheric multiple refraction of star light.
2. Star light reaches to the surface of the earth through many layers of atmosphere.
3. These layers have different optical densities and they offer different refractive index values to the incoming light.
4. The star light on entering the earth's atmosphere, under goes refraction continuously before it reaches the earth.
5. So, the light bends many times giving different apparent positions of the star.
6. Due to this fluctuations of refractive index of layers, stars appear twinkling.

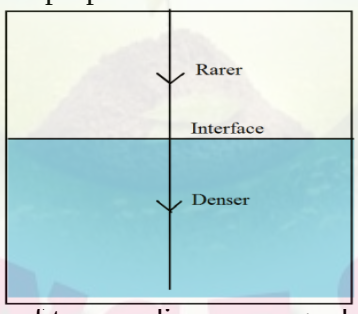
9. Why does a diamond shine more than a glass piece cut to the same shape? (AS7) (TQ)

1. The critical angle of a diamond is very low (24.4^0).
2. When light falls on a face of diamond, it suffers total internal reflection and make the diamond shines more.
3. The critical angle of a glass (42^0) is more than the diamond.
4. Hence most of the incident rays reflect and less number of rays gets total internal reflection.
5. So, diamond shine more than a glass piece cut to the same shape.

10. In what cases does a light ray not deviate at interface of two media? (AS7) (TQ)
(or) Write the cases at which angle of incidence in equation in angle of refraction?

Case (1):- When a light ray is incident in perpendicular to the interface of surface of two media.

Here $\angle i = 0$
$\angle r = 0$



Case (2):- When the refractive indexes of two mediums are equal.

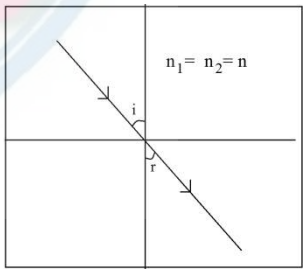
Here n1 = n2 = n.

From Snell's law, $n_1 \sin i = n_2 \sin r$

$n \sin I = n \sin r$

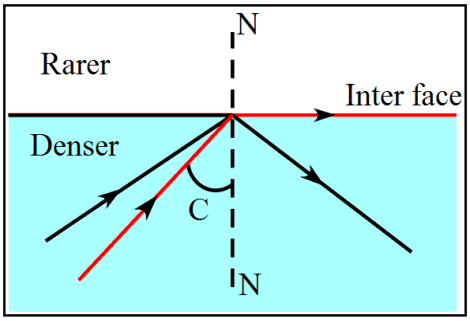
$\sin i = \sin r$

$\angle i = \angle r$



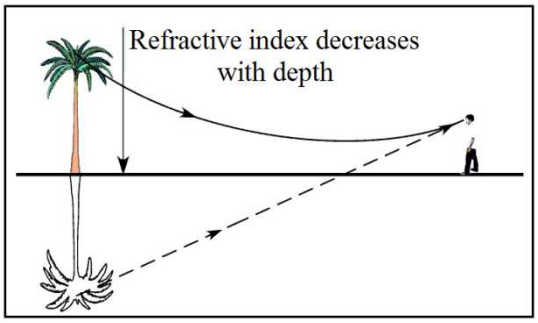
Hence the ray passes without any deviation at the boundary.

Case (3):- When a light ray incident is more than critical angle, it does not undergo deviation but it reflects into the same medium. Such phenomenon is called total internal reflection.



4 Mark Questions

1. Explain the formation of mirage? (AS1) (TQ)



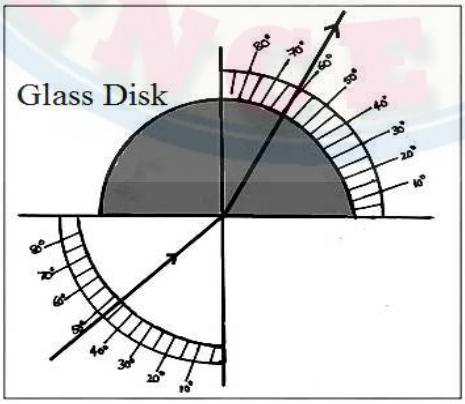
Mirage:- Mirage is an optical illusion where it appears that water has collected on the road at a distant place but when we get there, we don't find any water.

Explanation:- 1. During a hot summer day, air just above the road surface is very hot and the air at higher altitudes is cool.
2. It means that the temperature decreases with height.
3. As a result density of air increases with height.
4. We know that refractive index of air increases with density.
5. Thus the refractive index of air increases with height.
6. So, the cooler air at the top has greater refractive index than hotter air just above the road.
7. Light travels faster through the thinner hot air than through the denser cool air above it.
8. When the light from a tall object such as tree or from the sky passes through a medium just above the road, whose refractive index decreases towards the ground.
9. When light from tall object, it suffers refraction and takes a curved path because of total internal reflection.
10. This appears to the observer as if the ray is reflected from the ground.
11. Hence we feel the illusion of water being present on road which is the virtual image of the sky (mirage) and an inverted image of tree on the road.

2. How do you verify experimentally that $\frac{\text{Sin i}}{\text{Sin r}}$ is a constant? (AS1) (TQ)

Aim:- Obtaining a relation between angle of incidence and angle of refraction.

Materials required:- A plank, white chart, protractor, scale, small black painted plank, a semi circular glass disc of thickness nearly 2cm, pencil and laser light.



Procedure:- 1. Take a wooden plank which is covered with white chart.
2. Draw two perpendicular lines, passing through the middle of the paper as shown in the figure.
3. Let the point of intersection be o. Mark one line as NN which is normal to another line marked as MM.
4. Here MM represents the line drawn along the interface of two media and NN represents the normal drawn to this line at 'o'.

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5. Take a protractor and place it along NN in such way that it centre coincides with 'O' as shown in figure.
6. Then mark the angles from 0^0 to 90^0 on both sides of the line NN as shown in the figure.
7. Repeat the same on the other side of line NN.
8. The angles should be indicated on the curved line.
9. Now place a semi-circular glass disc so that its diameter coincides with the inter face line (MM) and its centre coincides with the point 'o'.
10. Send laser light along a line which makes 15^0 with NN.
11. Measure its corresponding angle of refraction.
12. Repeat the experiment for 20^0, 30^0, 40^0, 50^0 and 60^0 and noted the corresponding angles of refraction and noted down in the table.

S.No	i	r	Sin i	Sin r	$\frac{\text{Sin i}}{\text{Sin r}}$
1	15^0				
2	20^0				
3	30^0				
4	40^0				
5	50^0				
6	60^0				

13. Find the values of every i and r and evaluate $\frac{\text{Sin i}}{\text{Sin r}}$ for every incident angle i.

Observation:- Finally we will get the ratio $\frac{\text{Sin i}}{\text{Sin r}}$ is a constant.

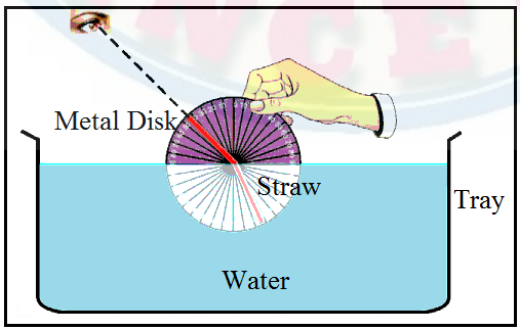
Conclusion:- 1. This ratio of $\frac{\text{Sin i}}{\text{Sin r}}$ gives the value of refractive index of glass.

2. In the above experiment we might have noticed that 'r' is less than 'i' in all cases and the refracted ray bends towards the normal in each case.

3. Explain the phenomenon of total internal reflection with one or two activities? (AS1)(TQ)

Activity:-1. Take a transparent glass tumbler and coin.
2. Place the coin on a table and place glass tumbler on the coin.
3. Observe the coin from the side of the glass.
4. Now fill the glass tumbler with water and observe the coin from the side of the glass tumbler.
5. Now the coin is disappears from our view because of total internal reflection.

4. How do you verify experimentally that the angle of refraction is more than angle of incidence when light ray travel from the denser to rarer medium? (AS1)(TQ)



When light ray travel from the denser to rarer the angle of refraction is more than the angle of incidence. This can be verified by the below experiment.

Procedure:- 1. Take a metal disc and mark angles along its edge using protractor.
2. Arrange two straws at the centre of disk.
3. Adjust one of the straws to make an angle 10^0.
4. Immerse the half of disc in transparent vessel containing water vertically.
5. The straw should be at an angle 10^0 inside the water.

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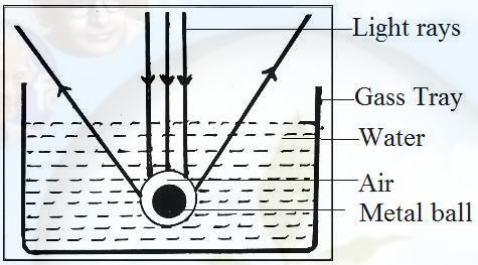
6. Adjust the other straw which is outside the water until both straws appear to be in a single straight line.
7. Take the disc out of the water and observe the two straws on it.
8. We will find that the two straws are not in straight line.
9. Measure the angle between the normal and second straw and noted down in the below table.
10. Do the same for various angles of incidence (i) and note down corresponding angles of refraction (r) in the given table.

S.No	Angle of incidence (i)	Angle of refraction (r)
1		
2		
3		
4		

Observation:- We will find the angle of refraction is more than angle of incidence.

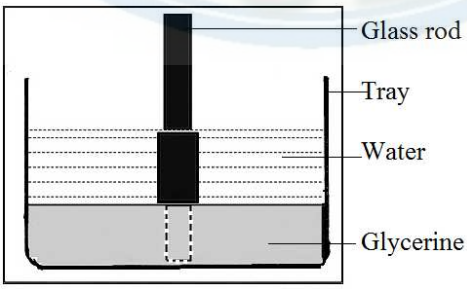
Conclusion:- When light travels from douser (water) to rarer (air) it bends away from the normal.

5. Take a bright metal ball and make it black with soot in a candle flame immerses it in water. How does it appear and why? (Make hypothesis and do the above experiment) (AS2)(TQ)



1. If a metal ball coated with soot of candle flame is immersed in water, then it appears shining.
2. Soot is non-stick to water. A thin air film is formed in between water and soot as shown in the figure.
3. The light ray is travelling from water(denser medium) to air(Rarer medium).
4. The angle of incidence is greater than the critical angle, total internal reflection takes place.
5. As the ray reflects at water air interface, the metal ball appears shining.
6. It is similar to shining of air bubble in water.

6. Take a bright glass vessel and pour some glycerine into it and then pour water up to the brim. Take a Quartz glass rod. Keep it in the vessel. Observe glass rod from the sides of the glass vessel. What change of you notice? What could be the reasons for these changes? (AS2)(TQ)



1. When this arrangement is viewed from side, the size of the glass rod appears increased in water and glass rod disappeared in glycerine.

Reason:-

2. As shown in the figure, the vessel contains glycerine (n = 1.47) and water (n = 1.33) when glass rod immersed into the liquid the part in the glycerine disappears.
3. This is due to the fact that both glass rod (n = 1.5) and glycerine (1.47) have same refractive index.

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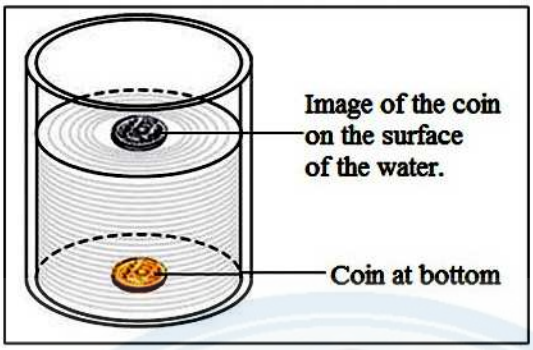
4. When refractive Indies are same the speed of light is same in both media.
5. So no bending is takes place and hence no refraction takes place.
6. The part of the glass rod in water appears as larger than the original size of the rod. This is due to refraction.

7. Do activity-7 again. How can you find critical angle of water? Explain your steps briefly. (AS3)(TQ)



Activity:- 1. Take a cylindrical transparent vessel (you may use 1 L beaker).
2. Place a coin at the bottom of the vessel.
3. Now pour water until you get the image of the coin on the water surface (look at the surface of water from a side).
4. The image of the coin is formed at the surface of the water because total internal reflection.

Calculate the critical angle of water:-

1. You might have observed a coin kept at the bottom of a vessel filled with water appears to be raised.
2. The refractive index of water is 1.33
3. So critical angle of water, $\text{Sin C} = \frac{1}{Refractive index\ (n)} = \frac{1}{1.33}$

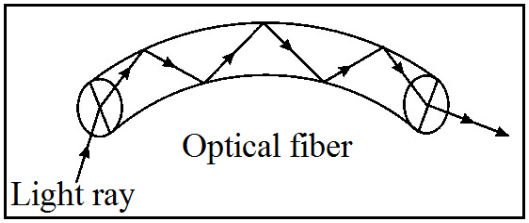
   $\text{Sin C} = 0.7518$

   $\text{Sin C} = \text{Sin } 48.7^0 \Longrightarrow \text{C} = 48.7^0$
4. The critical angle of water = 48.7^o

8. Collect the values of refractive index of following media? (AS4) (TQ)

S.No	Material Medium	Refractive index
1	Water	1.33
2	Coconut oil	1.44
3	Flint glass	1.65
4	Crown glass	1.52
5	Diamond	2.42
6	Benzene	1.50
7	Hydrogen gas	1.000132

9. Collect the information on working of optical fibres. Prepare a report about various uses of optical fibres our daily life. (AS4) (TQ)
(or)
While doing heart operation Sreekar observed that a thin pipe is passed to observe internal parts on a computer screen. He comes to know that it was an optical fibre. How does the optical fibre works?

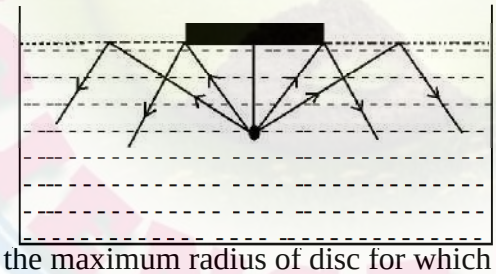


Optical Fibres:- 1. Total internal reflection is the basic principle behind working of optical fibre.
2. An optical fibre is very thin fibre made of glass or plastic having radius about a 10^{-6} meter.
3. A bunch of such thin fibres form a light pipe.

Working:- 1. Because of small radius of the fibre, light goes into it makes a nearly glancing incidence on the wall.
2. The angle of incidence is greater than the critical angle and hence total internal reflection takes place.
3. The light is thus transmitted along the fibre.

Uses:- 1. Optical fibres are used in endoscopy to see the internal organs of our body.
2. Optical fibres are used in transmitting communication signals through light pipes.
3. Optical fibres are used in international telephone cables laid under the sea, in large computer network etc.
4. Optical fibres are used in photometric sensors to measuring blood flow in the heart.

10. Take a thin thermocol sheet. Cut it in circular discs of different radii like 2cm, 3cm, 4cm, 4.5cm, 5cm etc and mark canters with nearly 6 cm. pin a needle to each disc at its centre vertically. Take water in a large opaque tray and place the disc with 2 cm radius in such a way that the needle is inside the water as shown in figure.
Now try to view the tree end (head) of the needle from surface of water.
a) Are you able to see the head of the needle? Now do the same with other discs of different radii. Try to see the head of the needle, each time.
Note:- The position of your eye and the position of the disc on water surface should not be changed while repeating the activity with other discs.
b) At what maximum radius of disc, were you not able to see the free end of the needle?
c) Why were you not able to view the head of the hail for certain radii of the discs?
d) Does this activity help you to find the critical angle of the medium (water)?
e) Draw a diagram to show the passage of light ray from the head of the nail in different situations.



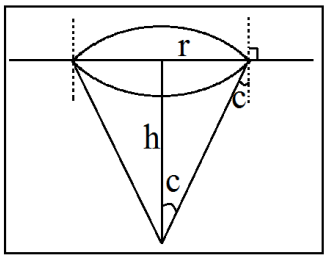
First we have to calculate the maximum radius of disc for which we can able to see the free end of the needle.

Here, c = critical angle of water.
r = radius of circular disc
h = height of the needle = 6 cm.

From Snell's law, $n_{water} \times \sin c = n_{air} \times \sin r$

$$\sin c = \frac{1 \times \text{Sin } 90^0}{n_{Water}}$$

$$\sin c = \frac{1}{\frac{4}{3}} = \frac{3}{4} \quad (\text{Since } n_{water} = \frac{4}{3})$$



From right angle triangle, $\text{Tan } c = \frac{r}{h}$ (Since $\text{Tan } c = \frac{\text{Sin C}}{\text{Cos C}}$)

$$\text{Cos } c = \sqrt{1 - \sin^2 C} = \sqrt{1 - (\tfrac{3}{4})^2} = \sqrt{1 - \frac{9}{16}} = \sqrt{\frac{16-9}{16}} = \sqrt{\frac{7}{16}} = \frac{\sqrt{7}}{4}$$

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Now Tan c = $\frac{r}{h}$

$\Rightarrow \frac{\text{Sin C}}{\text{Cos C}} = \frac{r}{h} \Rightarrow \frac{\frac{3}{4}}{\frac{\sqrt{7}}{4}} = \frac{r}{6} \Rightarrow \frac{r}{6} = \frac{3}{4} \times \frac{4}{\sqrt{7}} \Rightarrow \frac{r}{6} = \frac{3}{\sqrt{7}} \Rightarrow r = \frac{6 \times 3}{\sqrt{7}} = \frac{18}{\sqrt{7}} = 6.8$ cm.

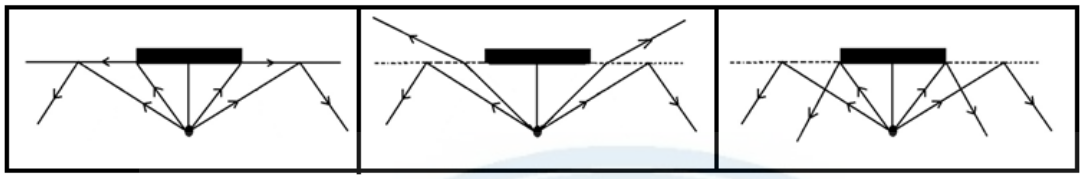
a) Yes, we can see head of the needle.

b) At radius 6.8 cm, we cannot see the free end of the needle.

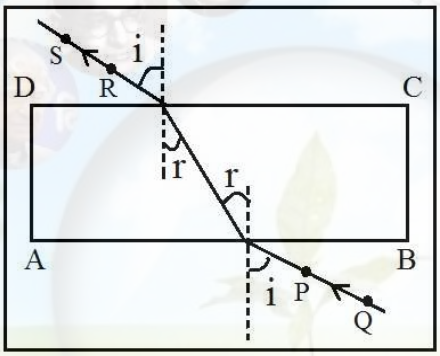
c) As the angle of incidence on water surface is greater than critical angle total internal reflection takes place no light ray incident on eye. Hence needle head cannot be seen.

d) Yes, applying Snell's law to water – air interface. sin c = $\frac{3}{4} \Rightarrow c = 48.7^0$

e) r < 6.8 cm r = 6.8 cm r > 6.8 cm



11. Explain the refraction of light through a glass slab with a neat ray diagram? Identify lateral shift? (or) How do you conduct an experiment to determine the position and nature of image formed by a glass slab? (TQ)



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.
3. Remove the glass slab. We will get a figure of a rectangle. Name the vertices of the rectangle as A, B, C and D.
4. Draw a perpendicular at a point 'L' on the longer side 'AB' of the rectangle.
5. 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.
6. The line PQ represents the incident ray. The angle it makes with normal represents the angle of incidence ($i = 30^0$)
7. Now place the glass slab in the rectangle ABCD. Fix two identical pins at 'P' and 'Q' such that they stand vertically with equal height.
8. 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.
9. Remove glass slab and the pins. Draw a straight line by joining R, S up to the edge CD of the rectangle. This line (RS) represents emergent ray of the light.
10. Draw a perpendicular to the line CD at 'M' where the line 'RS' meets the line 'CD'.
11. Measure the angle between emergent ray (RS) and normal. This is called 'angle of emergence.

Observation:- The angles of incidence and emergence are equal ($\angle i = \angle e$).

Conclusion:- 1. The incident and emergent rays (PQ, RS) are parallel.

2. Measure the distance between the parallel rays (PQ, RS). This distance is called 'Lateral shift'.

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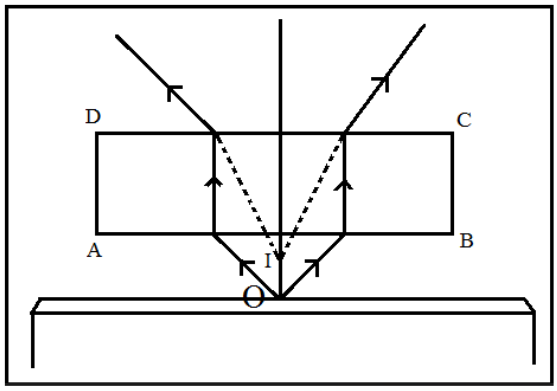
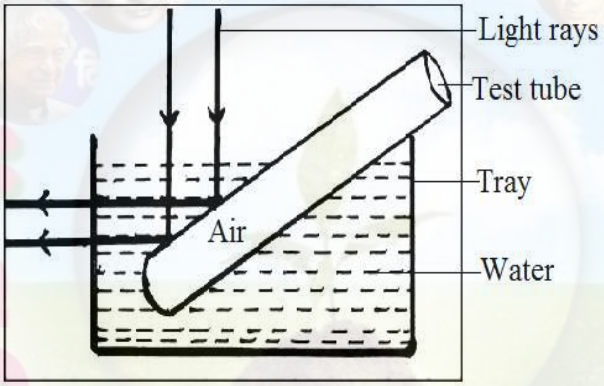
12. Place an object on the table. Look at the object through the transparent glass slab. You will observe that it will appear closer to you. Draw a ray diagram to show the passage of light in this situation? (AS5) (TQ)



ABCD = Glass Slab
O = Object
I = Virtual image of the object seen by you.

If a glass slab is placed in the path of a converging or diverging beam of light them point of convergence or point of divergence appears to be shifted as shown in the figure.

13. Explain why a test tube immersed at a certain angle in a tumbler of water appears to have a mirror surface for a certain viewing position. (AS7)(TQ)



When a test tube is immersed at a certain angle in a tumbler of water appears to have a mirror surface for a certain viewing position.

Explanation:- 1. The critical angle of glass si 42^0.
2. The glass acts as a denser medium and air in the test tube acts as a rarer medium.
3. As light tries to enter air in the test tube it under goes total internal reflection bouncing back into water from the surface of the test tube.
4. When these reflected rays reaches the eye, they appear to come from the surface of test tube itself.
5. Due to this reason the test tube acts as a mirror.

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Problems

1. The absolute refractive index of water is 4/3. What is the critical angle of it? (AS1) (Ans: 48.5^0)(TQ)

Given :- The absolute refractive index of water = 4/3

$$\frac{1}{\sin c} = \frac{4}{3} \Longrightarrow \text{Sin C} = \frac{3}{4}$$
$$\Longrightarrow \text{Sin C} = 0.75$$
$$\Longrightarrow \text{Sin C} = \sin 48.5^o$$
$$\Longrightarrow \text{C} = 48.5^0$$

∴ The critical angle of water is 48.5^0.

2. Determine the refractive index of benzene if the critical angle of it is 42^0. (AS1) (Ans: 1.51)(TQ)

Given:- The critical angle of Benzene = 42^0.

Refractive index of Benzene, $= \frac{1}{\text{Sin c}}$

$$= \frac{1}{Sin\ 42^0}$$
$$= \frac{1}{0.6691}$$
$$= \frac{10000}{6691}$$
$$= 1.51$$

∴ The refractive index of a benzene is 1.51.

3. Refractive index of glass relative to water is $\frac{9}{8}$. What is the refractive index of water relative to glass? (AS1) (TQ)

Given:- Refractive index of glass relative to water is $= \frac{9}{8} = \frac{\text{Speed of light in water}}{\text{Speed of light in air}}$

Refractive index of water relative to glass $= \frac{\text{Speed of light in air}}{\text{Speed of light in water}} = \frac{8}{9}$.

4. The speed of light in a diamond is 1, 24,000 km/s. Find the refractive index of diamond if the speed of light in air is 3, 00,000 km/s. (AS–1) (TQ)

Given that, Speed of light in air, c = 3, 00,000 km/s;
Speed of light in a diamond, v = 1, 24,000 km/s

Refractive index of diamond, $n = \frac{\text{Speed of light in air(c)}}{\text{Speed of light in a diamond (v)}}$

$$= \frac{3,00,000}{1,24,000}$$
$$= 2.42$$

∴ Refractive index of diamond, n = 2.42.

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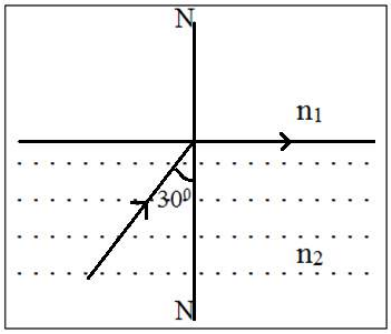
5. Look at the picture.
a) What is the value of critical angle?
b) Find the refractive index of denser medium with respect rarer medium?



a) Critical angle c = 30^0
b) Refractive index of denser medium w.r.t rarer medium = n_{21}

$n_{21} = \frac{1}{\text{Sin c}} = \frac{1}{\text{Sin } 30^0} = \frac{1}{\frac{1}{2}} = 2.$

6. A light ray is incident on air-liquid interface at $45^0$and is refracted at 30^0. What is the refractive index of the liquid? For what angle of incidence will the angle between reflected ray and refracted ray is 90^0? (AS7) (Ans: 1.414, 54.7^0)(TQ)

Given: - The angle of incidence, i = 45^0
The angle of refraction, r = 30^0

Refractive index of a liquid (n) = $\frac{\sin i}{Sin\ r} = \frac{Sin\ 45}{Sin\ 30} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = \frac{1}{\sqrt{2}} \text{ x } \frac{2}{1} = \sqrt{2} = 1.414$

The refractive index of a liquid is 1.414

We know angle of refraction, r = 90- Angle of incident = 90-i

Refractive index (n) = $\frac{\sin i}{Sin\ r}$

$\Rightarrow 1.414 = \frac{\sin i}{Sin\ (90-i)}$

$\Rightarrow \frac{Sin\ i}{Cos\ i} = 1.414$

$\Rightarrow$ tan i = 1.414

$\Rightarrow$ tan i = tan 54.7^0

$\Rightarrow \angle i = 54.7^0$

$\therefore$ Critical angle, c = 54.7^0

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Chapter-6

REFRACTION OF LIGHT AT CURVED SURFACES

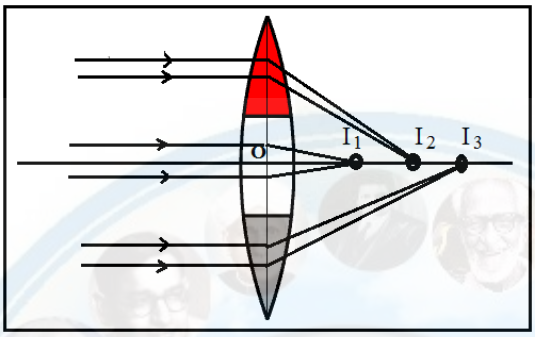
1 Mark Questions

1. Can a virtual image be photographed by a camera? (AS2)(TQ)

Yes, a virtual image can be photographed by a camera.

Examples:- 1. We are able to photograph the virtual images formed by plane mirrors.
2. Our eye works on the principle of camera with this we are able to see virtual images.

2. A convex lens is made up of three different materials as shown in the figure. How many images does it forms? (AS–2)(TQ)



1. Given convex lens is made up to three different materials have different refractive indexes.
2. So the given lens has three different focal lengths. Hence it forms three images.

3. Suppose you are inside the water in a swimming part near an edge. A friend standing on the edge. Do you find your friend taller or shorter than his usual height? Why? (AS7)(TQ)

My friend appears to be taller than his usual height.

Reason:- 1. The light rays of my friend travelling from rarer (air) to denser (water) medium.
2. These rays bends towards normal line.
3. So, apparent image of my friend which appears to be taller due to refraction.

4. How does a light ray behave when it is passing through the focus of a lens?

When a light ray passing through the focus will take a path parallel to principal axis after refraction.

5. Define one dioptre of a power of a lens?

One dioptre is the power of a lens of focal length 1m.

6. When does Snell's law fail?

Snell's law fail when light is incident normally on the surface of a refracting medium.

7. Write the lens formula and explain the terms in it?

Lens formula:- $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

Where, f = the focal length of the lens.
u = object distance.
v = image distance.

8. Write the formula for formation of image by curved surfaces?

Image formula:- $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$

Where, n_1 = refractive index of the first medium.
n_2 = refractive index of the second medium.
u = image distance.
v= Object distance.
R = Radius of curvature.

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9. What happens to the image formed by a convex lens if its lower part is blackend?

1. Every part of a lens forms a complete image.
2. If the lower part of the lens is blackend the complete image will be formed but its intensity will decreases.

10. What type of lens behaviour will an air bubble inside the water show?

It will act as a diverging lens.

11. Is it possible for a lens to act as a convergent lens in one medium and a divergent lens in another medium?

1. The convex lens behaves as a converging lens, if it is kept in a medium with refractive index less than the refractive index of the lens.
2. It behaves like a diverging lens when it is kept in a transparent medium with greater refractive index than that of the lens.

2 Mark Questions

1. A man wants to get a picture of a zebra. He photographed a white donkey after fitting a glass, with black stripes, on to the lens of his camera. What photo will he get? Explain? (AS1)(TQ)

Photographer will get a picture of white donkey only.

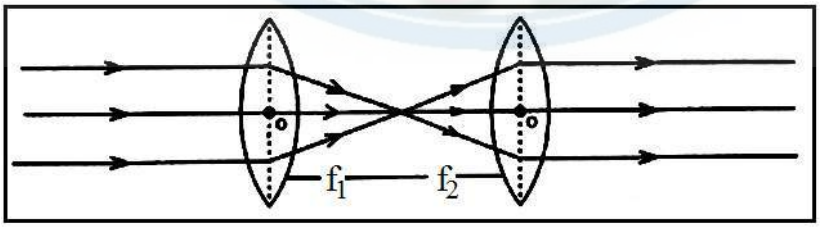
Explanation:- 1. A glass with block strips is fitted on the lens on a camera.
2. This camera is used to take photograph of a white donkey.
3. The photographer will not get the photograph of zebra.
4. Instead of he will obtain a photograph of the white donkey with reduced brightness.
5. This happens because the block stripes on the glass block light from the object reducing intensity of the image.

2. Write the lens makers formula and explain the terms in it? (AS1)(TQ)

Lens makers formula is, $\frac{1}{f} = (n-1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

Where, f = focal length of lens.
n = refractive index of lens.
R_1 = Radius of curvature of first surface.
R_2 = Radius of curvature of second surface.

3. Two converging lenses are to be placed in the path of parallel rays so that the rays remain parallel after passing through both lenses. How should the lenses be arranged? Explain with a neat ray diagram. (AS–1)(TQ)



1. A parallel beam of light rays will converge on focal point of the lens.
2. Light rays passes through the focal point will parallel to principal axis after refraction.
3. So the two lenses are arranged on a common principal axis such that their focal points coincide with each other.
4. Hence the two lenses should be kept at a distance equal to $f_1 + f_2$.

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4. Harsha tells Siddhu that the double convex lens behaves like a convergent lens. But Siddhu knows that Harsha's assertion is wrong and corrected Harsha by asking some questions. What are the questions asked by Siddhu? (AS2)(TQ)

1. What is meant by convergent lens?
2. What is meant by a double convex lens?
3. How does the lens behaves if it is kept in water?
4. How does the air bubble in water behave?
5. Does the convex lens behaves like a converging lens, if it is placed in a liquid of refractive index greater than the refractive index of the material of the prism?
6. Is it possible for a lens to act as a convergent lens in one medium and a divergent lens in another medium?

5. How will you decide whether a given piece of glass is a convex lens, concave lens or a plane glass?

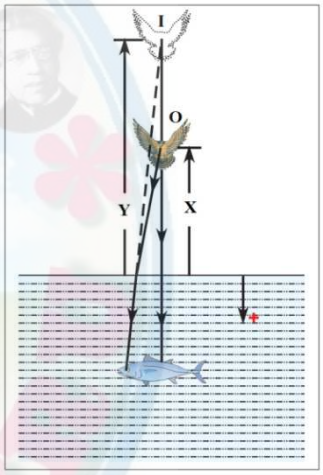
1. Hold the given piece of glass over some printed material.
2. If the letters appeared magnified, the given lens is a convex lens.
3. If the letters appeared diminished, the given lens is a concave lens.
4. If the letters appear to be of the same size, then it is a plane glass.

6. Assertion (A): A person standing on the land appears taller than his actual height to a fish inside a pond. (AS2)(TQ)

Reason (R):- Light bends away from the normal as it enters air from water.

Which of the following is correct? Explain?

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true and R is not the correct explanation of A.
c) A is true but R is false.
d) Both A and R are false.
e) A is false but R is true.



Both A and R are true and R is the correct explanation of A.

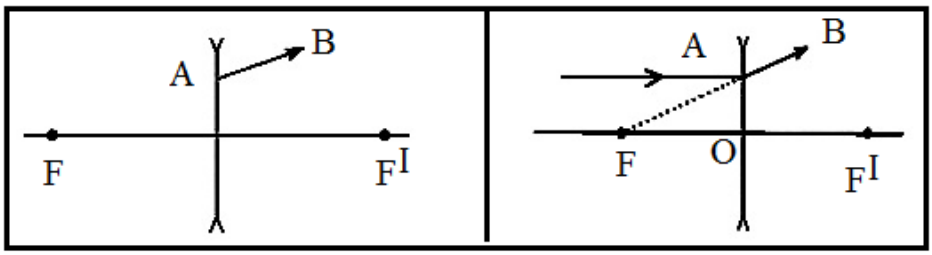
Explanation:- 1. Let the actual height of the person be 'x' feet.

2. $\frac{\text{Refractive index of air}}{\text{refractive index of water}} = \frac{\text{Actual height of the man}}{\text{Apparent height of the man}}$

3. $\frac{1}{1.33} = \frac{x}{\text{Apparent height of the man}}$

4. Apparent height of the man = $1.33 \times x$
   = $1.33 \times$ times of the actual height of the person.
5. Hence the standing on the land appears taller than his actual height to a fish inside a pond.

7. Figure shows ray AB that has passed through a divergent lens. Construct the path of the ray up to the lens if the position of focal is known? (AS5) (TQ)



A light passing parallel to principal axis, after refraction appears to be diverging from the focus of the lens.

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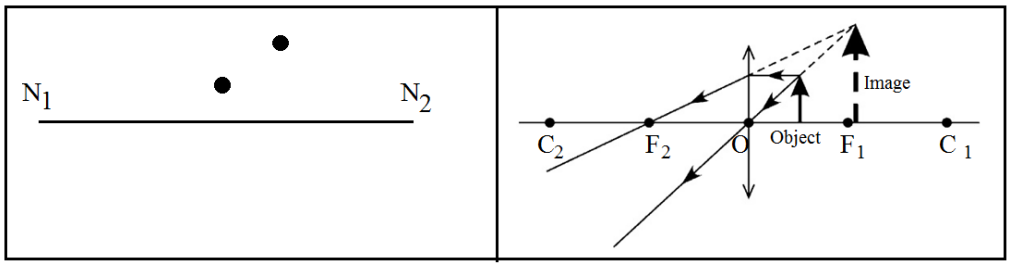
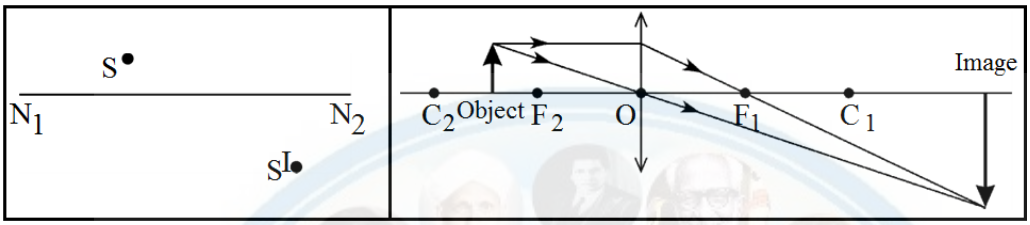
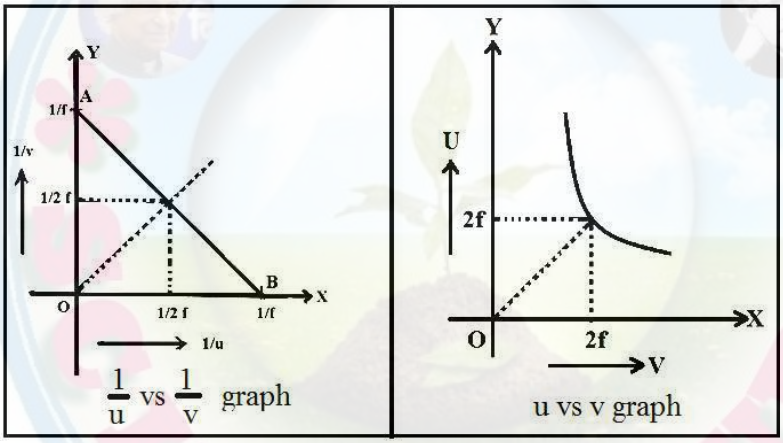
8. Figure shows a point light source and its image produced by a lens with an optical axis N_1N_2. Find the position of the lens and its focal using a ray diagram? (AS5) (TQ)



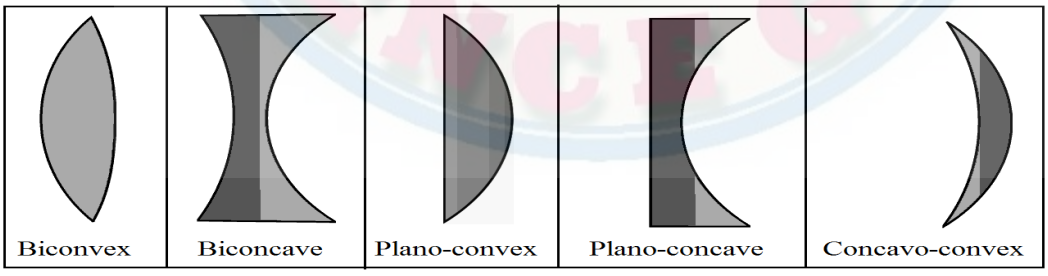
9. Find the focus by drawing a ray diagram using the position of source 'S' and image 'S^1' given in figure? (AS5) (TQ)



10. Draw the graphs of u *vs.* v and $\frac{1}{u}$ *vs.* $\frac{1}{v}$. ? (AS5) (TQ)



11. Write the names of different types of lenses. Draw their diagrams?



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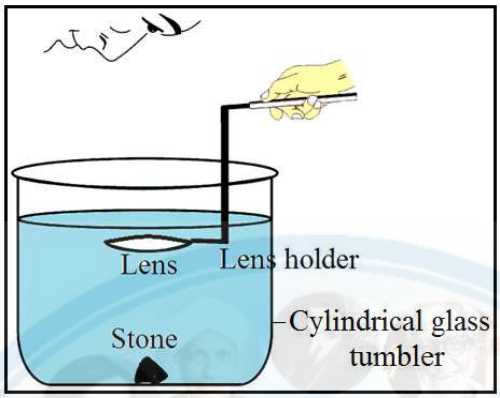
4 Mark Questions

1. How do you verify experimentally that the focal length of a convex lens is increased when it is kept in water? (AS1)(TQ)

Aim:- To verify the focal length of a convex lens is increased when it is kept in water.

Apparatus:- Convex lens of known focal length, circular lens holder, tall cylindrical glass tumbler, block stone and water.



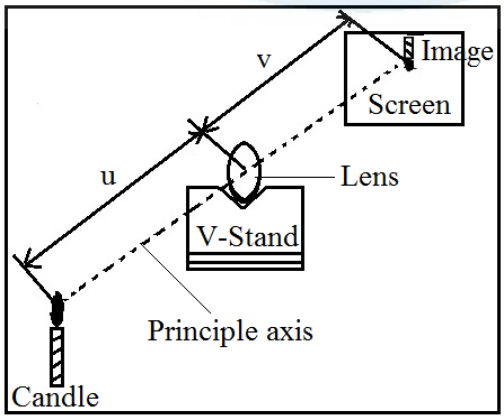
Procedure:- 1.Take a cylindrical glass tumbler, whose height is greater than the focal length of the lens and filled it with water.
2. Keep a black stone at the bottom of the vessel.
3. Now dip the lens horizontally using a circular lens holder.
4. Set the distance between stone and the lens that is equal to or less than focal length of lens.
5. Now look at the stone through lens.
6. We can see the image of the stone if the distance between lens and stone is less than the focal length of lens.
7. Now increase the distance between lens and stone until you can't see the image of stone.
8. When the lens is dipped to a height which is greater than the focal length of lens in air but we can see the image.
9. This shows that the focal length of lens has increased in water.

Conclusion:- The focal length of the lens depends upon surrounding medium.

2. How do you find the focal length of a lens experimentally? (AS1)(TQ)
(or) You have a lens suggest an experiment to find out the focal length of the lens? (AS3)(TQ)

Aim:- To determine the focal length of a convex lens.

Apparatus:- Convex lens, meter scale, V-stand, screen, candle (object).



Procedure:- 1. Take a v – stand and place it on a long table at the middle.
2. Place a convex lens on the v – stand.

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3. Light the candle and place it at a distance of 60cm from the lens on the principal axis.
4. Adjust the screen which is on the other side of lens to get an image on it.
5. Measure the distance between the candle and the stand of the lens, this value is noted as object distance(u).
6. Measure the distance of the image from the stand of the lens, this value is noted as image distance (v).
7. Repeat the experiment for various object distances (u) like, 50cm, 40cm, 30cm and measure the distance of image (υ) in all cases and noted in the following table.

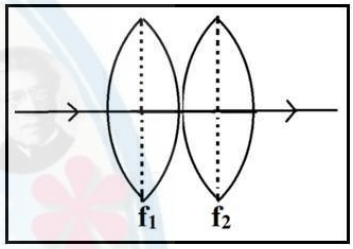
S.No.	Object distance (u)	Image distance(v)	Focal length, f = $\frac{uv}{u+v}$
1	60 cm		
2	50 cm		
3	40 cm		
4	30 cm		

8. From the above table f = $\frac{uv}{u+v}$ value is constant.
9. This constant value gives the focal length of the given lens.

3. Let us assume a system that consists of two lenses with focal length f1 and f2 respectively. How do you find the focal length of system experimentally. When,

i. Two lenses are touching each other.

ii. They are separated by distance 'd' common principal axis (AS3) (TQ)



i. The focal length of two lenses having f_1 and f_2 respectively, if they touch each other then the focal length of the system is,

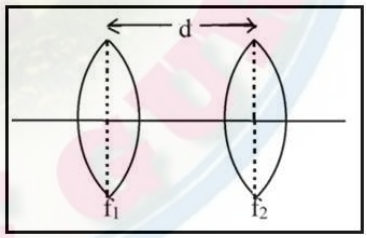
$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2}$$

$$\frac{1}{F} = \frac{f_1 + f_2}{f_1 f_2} \Rightarrow F = \frac{f_1 f_2}{f_1 + f_2}.$$

ii. If the lenses are separately by a distance 'd' with common optical axis then their focal length of the system is,

$$\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}.$$

$$\frac{1}{F} = \frac{f_2 + f_1 - d}{f_1 f_2} \Rightarrow F = \frac{f_1 f_2}{f_1 + f_2 - d}$$



4. Collect the information about the lenses available in an optical shop. Find out how the focal length of lens may be determined by given 'power' in lens. (AS4)(TQ)

Lenses available in an optical shop are,

1. Plano convex lens
2. Double convex lens
3. Plano concave lens
4. Double concave lens
5. Cylindrical lens
6. IR lens
7. UV lens

Power of lens (p):- 1. The reciprocal of focal length of the lens is called power of lens.

2. It is denoted by the letter 'p'.

Power of lens, p = $\frac{1}{f(\text{in m})}$ (or) P = $\frac{100}{f(\text{in cm})}$.

3. The S.I unit of optical power of the lens is dioptre.

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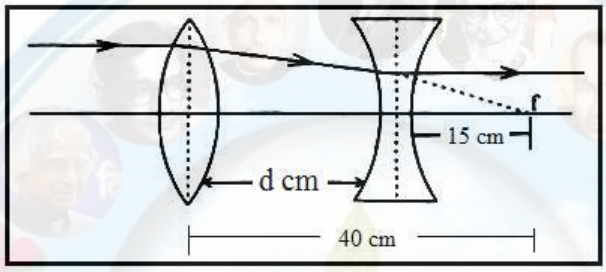
4. The focal length of a converging lens is positive therefore its power is positive.
5. Similarly the power of a diverging lens is negative.

5. Collect the information about lenses used by Galileo in his telescope? (AS5)(TQ)

Galileo telescope:- 1. It consists of two lenses.
2. Objective lens (close to the object or towards the object).
3. It is a convex lens of large focal length.
4. Eye piece (close to eye or towards the eye)
5. It is a diverging (concave) lens of short focal length.
6. The image of the object is formed at focal point of the objective lens.
7. This image acts as virtual object for eyepiece.
8. The eyepiece forms the final erect and magnified image.

6. A parallel beam of rays is incident on a convergent lens with a focal length of 40 cm. where should a divergent lens with a focal length of 15cm be placed for the beam of rays to remain parallel after passing through two lenses? Draw a ray diagram? (AS5)(TQ)



1. The focal length of conversing lens is 40 cm.
2. The focal length of diverging lens is 15 cm.
3. The separation between them (d) = 40-15=25 Cm.

(Or)
Let focal length of convergent lens = f_1 = 40cm
Focal length of divergent lens = f_2 = –15 cm
Let the 'd' is the distance between two lenses. Then $\frac{1}{F} = \frac{1}{f_1} + \frac{1}{f_2} - \frac{d}{f_1 f_2}$

$\Rightarrow \frac{1}{\alpha} = \frac{1}{40} + \frac{1}{-15} - \frac{d}{40 \times (-15)}$ (For emergent parallel beam, F = α)

$\Rightarrow 0 = \frac{1}{40} - \frac{1}{15} + \frac{d}{600} \Rightarrow \frac{d}{600} = \frac{1}{15} - \frac{1}{40} \Rightarrow \frac{d}{600} = \frac{40-15}{600} \Rightarrow$ d = 25 cm

∴ Distance between two lens = 25cm.

7. How do you appreciate the coincidence of the experimental facts with the results obtained by a ray diagram in terms of behaviour of images formed by lenses? (AS7)(TQ)

We are getting exactly same type of image as prescribed in ray diagrams by lenses.

The following conclusions may be obtained for a convex lens:-
1. A convex lens will form a real image for a real object when the object is placed beyond focus.
2. When the object is placed between focus and optical pole then virtual images are formed.
3. The formation of the real image is always inverted and virtual image is always erect.

The following conclusions may be obtained for a concave lens:-
1. A concave lens always forms a virtual image for a real object.
2. The image formed by a concave lens is always erect and diminished in size.

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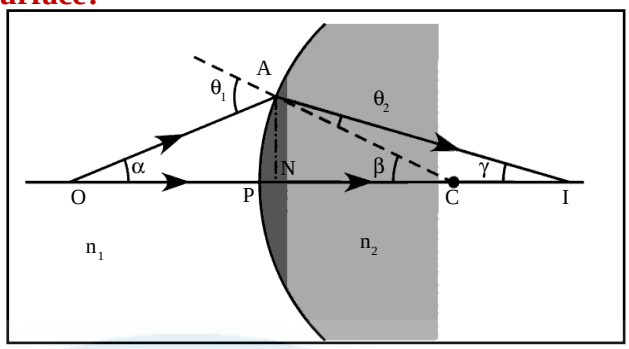
3. A concave lens can form a real image if the object is virtual.

So, I appreciate the coincidence of the experimental facts with the results obtained by a ray diagram in terms of behaviour of images formed by lenses.

8. Derive the image formula for a curved surface?

Image formula ($\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$):-



1. Consider a curved surface separating two media of refractive indexes n_1 and n_2.
2. A point size object is placed on the principal axis at point O.
3. The ray, which forms an angle 'α' with principal axis, meets the interface (surface) at A.
4. The refracted ray meet at I and the image is formed there.
5. Let the angle made by the refracted ray with principal axis be γ and the angle between the normal and principal axis be β.
6. From the figure the angle of incident is θ_1 and the angle of refraction is θ_2.
7. In the triangle ACO, $\theta_1 = \alpha + \beta$ and in the triangle ACI, $\beta = \theta_2 + \gamma \Rightarrow \theta_2 = \beta - \gamma$
8. According to Snell's law, we know $n_1 \sin\theta_1 = n_2 \sin\theta_2$.
9. Substituting the values of θ_1 and θ_2 we get, $n_1 \sin(\alpha + \beta) = n_2 \sin(\beta - \gamma)$--------(1)
10. If the rays move very close to the principal axis, then $\sin(\alpha + \beta) = \alpha + \beta$ and $\sin(\beta - \gamma) = \beta - \gamma$.
11. Substituting in equation (1). We have,

$$n_1(\alpha + \beta) = n_2(\beta - \gamma) \Rightarrow n_1\alpha + n_1\beta = n_2\beta - n_2\gamma \text{ .....(2)}$$

12. Since all angles are small, we can write

$$\text{Tan}\,\alpha = \frac{AN}{NO} \Rightarrow \alpha = \frac{AP}{PO}$$

$$\text{Tan}\,\beta = \frac{AN}{NC} \Rightarrow \beta = \frac{AP}{PC}$$

$$\text{Tan}\,\gamma = \frac{AN}{NI} \Rightarrow \gamma = \frac{AP}{PI}$$

13. Substitute α, β and γ values in equation (2), We have, $n_1 \frac{AP}{PO} + n_1 \frac{AP}{PC} = n_2 \frac{AP}{PC} - n_2 \frac{AP}{PI}$.

$$\Rightarrow n_1 \frac{AP}{PO} + n_2 \frac{AP}{PI} = n_2 \frac{AP}{PC} - n_1 \frac{AP}{PC} \Rightarrow AP\left(\frac{n_1}{PO} + \frac{n_2}{PI}\right) = (n_2 - n_1)\left(\frac{AP}{PC}\right)$$

$$\Rightarrow \frac{n_1}{PO} + \frac{n_2}{PI} = \frac{n_2 - n_1}{PC} \text{ ---------- (3)}$$

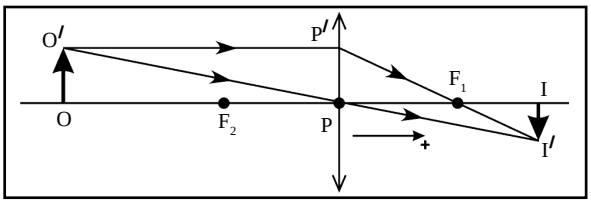
14. According to sign convention, PO = -u ; PI = v ; PC = R.

15. Substituting these values in equation (3) we get, $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R}$.

This is called an image formula of a curved surface.

9. Derive the equation for lens formula?

Lens formula ($\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$):-



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1. Let OO^I is the object, II^I is the formation of the image.
2. Po, PI and PF_1 are the Object distance (u), image distance (v) and focal length (f) respectively.
3. From the figure, triangle PP^IF1 and triangle $F1II^I$ are similar triangles,

$$\Rightarrow \frac{PP^I}{II^I} = \frac{PF_1}{f_1 I} \Rightarrow \frac{PP^I}{II^I} = \frac{PF_1}{PI - PF_1} \text{ ---------- (1)} \quad (\text{Since } f_1 I = PI - PF_1)$$

4. We have another set of similar triangles OO^IP and PII^I.

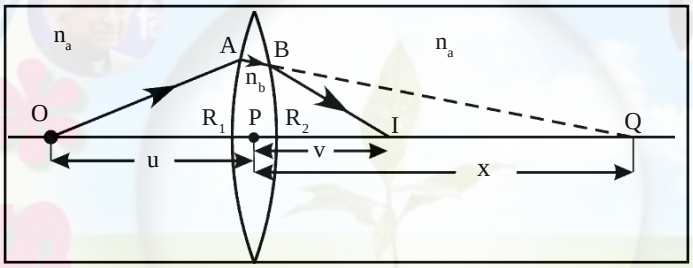
$$\text{From these triangles we get, } \frac{OO^I}{II^I} = \frac{PO}{PI} \Rightarrow \frac{PP^I}{II^I} = \frac{PO}{PI} \text{ ---------- (2) (Since } OO^I = PP^I)$$

5. From equation (1) and (2), $\frac{PO}{PI} = \frac{PF_1}{PI - PF_1} \Rightarrow \frac{PI}{PO} = \frac{PI - PF_1}{PF_1} \Rightarrow \frac{PI}{PO} = \frac{PI}{PF_1} - 1$
6. On dividing the equation by PI, we get $\frac{1}{PO} = \frac{1}{PF_1} - \frac{1}{PI} \Rightarrow \frac{1}{PO} + \frac{1}{PI} = \frac{1}{PF_1}$ -------- (3)
7. According to the sign convention, PO = -u; PI = v; PF_1 = f.
8. Substituting these values in equation (3), we get $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$.

This is called a lens formula.

10. Derive the equation for Len's maker's formula?

Len's maker's formula $\left[\frac{1}{f} = (n-1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)\right]$:-



1. Let us imagine a point object 'O' placed on the principal axis of the thin lens as shown in figure.
2. Let this lens be placed in a medium of refractive index n_a and let refractive index of lens medium be n_b.
3. Let us assume that, it forms image at Q, if there were no concave surface.
4. From the figure,
   Object distance PO = –u;
   Image distance v = PQ = x
   Radius of curvature R = R_1
   $n_1 = n_a$ and $n_2 = n_b$
4. Substitute the above values in the equation, $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R} \Rightarrow \frac{n_b}{x} + \frac{n_a}{u} = \frac{n_b - n_a}{R}$.-------(1)
5. The image Q of the object due to the convex surface is taken as object for the concave surface.
6. So, we can say that I is the image of Q for concave surface.
7. From the figure,
   Object distance u = PQ = + x
   Image distance PI = v
   Radius of curvature R = $-R_2$
   $n_1 = n_b$ and $n_2 = n_a$
8. Substituting the above values in equation $\frac{n_2}{v} - \frac{n_1}{u} = \frac{n_2 - n_1}{R} \Rightarrow \frac{n_a}{v} - \frac{n_b}{x} = \frac{n_a - n_b}{-R_2}$ -------- (2)
9. By adding (1) and (2) we get, $\frac{n_a}{v} + \frac{n_a}{u} = (n_b - n_a)\left(\frac{1}{R_1 - R_2}\right)$
10. Dividing both sides by n_a, we get $\frac{1}{v} + \frac{1}{u} = \left(\frac{n_b}{n_a} - 1\right)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$

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11. We know $\frac{n_b}{n_a}$ = n_{ba} called refractive index of lens with respect to surrounding medium.

$$\frac{1}{v} + \frac{1}{u} = (n_{ba} - 1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$$

12. According to rules for sign conversion, $\frac{1}{v} - \frac{1}{u} = (n_{ba} - 1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right)$.

$$\Rightarrow \frac{1}{f} = (n_{ba} - 1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right). \text{ (Since } \frac{1}{v} - \frac{1}{u} = \frac{1}{f})$$

13. If the surrounding medium is air, then the relative refractive index could be absolute refractive index of the lens.

$$\Rightarrow \frac{1}{f} = (n - 1)\left(\frac{1}{R_1} + \frac{1}{R_2}\right).$$

14. This formula can be used only when the lens is kept in air. Where n is absolute refractive index and this equation is called lens maker's formula.

Problems

1. The focal length of a converging lens is 20cm. An object is 60cm from the lens. Where will the images be formed and what kind of image is it? (AS1) (TQ)

Given: - Focal length, f = 20 Cm
Object distance, u = - 60 Cm (In front of lens take 'u' as – ve sign)
Image distance, v =?

Formula:- $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{f} + \frac{1}{u} \Rightarrow \frac{1}{v} = \frac{1}{20} + \frac{1}{-60} \Rightarrow \frac{1}{v} = \frac{1}{20} - \frac{1}{60} \Rightarrow \frac{1}{v} = \frac{3-1}{60} \Rightarrow \frac{1}{v} = \frac{2}{60}$

$\Rightarrow$ v = 30 cm

∴ Hence image is real, inverted and formed other side of the lens.

2. A double convex lens has two surfaces of equal radii 'R' and refractive index n = 1.5. Find the focal length 'f'. (AS1) (TQ)

Given:- Refractive index = 1.5
Let R_1 =R and R_2 = -R (With respect to sign convention)
Lens makers formula is $\frac{1}{f} = (n-1)\left[\frac{1}{R_1} - \frac{1}{R_2}\right]$

$$= (1.5-1)\left(\frac{1}{R} - \frac{1}{-R}\right)$$

$$= (1.5-1)\left(\frac{1}{R} + \frac{1}{R}\right)$$

$$= 0.5\left(\frac{1+1}{R}\right)$$

$$= 0.5 \times \frac{2}{R}$$

$$\frac{1}{f} = \frac{1}{R}$$

$$\therefore f = R$$

∴ The focal length is equal to radii of curvature.

3. Find the refractive index of the glass which is a symmetrical convergent lens if its focal length is equal to the radius of curvature of its surface. (AS7) (Ans: 1.5) (TQ)

1. The given lens is a symmetrical convergent lens. i.e. R_1=R_2=R and f=R.
2. Let n be the refractive index of the lens.

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3. $\frac{1}{f}$ = (n-1) [$\frac{1}{R1}$ - $\frac{1}{R2}$] $\Rightarrow \frac{1}{R}$ = (n-1) [$\frac{1}{R}$ - $\frac{1}{(-R)}$] (Since R_1=R , R_2= -R w.r.to sign convention)

$\Rightarrow \frac{1}{R}$ = (n-1) [$\frac{1}{R}$ + $\frac{1}{(R)}$]

$\Rightarrow \frac{1}{R}$ = (n-1) [$\frac{2}{R}$]

$\Rightarrow$ 2(n-1) =1

$\Rightarrow$ n-1 = $\frac{1}{2}$

$\Rightarrow$ n = 1+ $\frac{1}{3}$

$\Rightarrow$ n = $\frac{3}{2}$

$\Rightarrow$ n = 1.5

∴ The refractive index of the glass is 1.5.

4. Find the radii of curvature of a convexo –concave convergent lens made of glass with refractive index n=1.5 having focal length of 24cm. One of the radii of curvature is double the other? (AS7)

Given: - Refractive index of the glass, n=1.5 **(TQ)**
Focal length, f= 24 cm
Let the radius of curvature of convex surface = R_1
Let the radius of curvature of concave surface = $R_2 = 2R_1$
(For convexo-concave convergent lens R_1 and R_2 are positive)

Formula: - $\frac{1}{f}$ = (n-1) [$\frac{1}{R_1}$ - $\frac{1}{R_2}$] $\Rightarrow \frac{1}{24}$ = (1.5-1) [$\frac{1}{R_1}$ - $\frac{1}{2R_1}$]

$\Rightarrow \frac{1}{24}$ = (0.5) [$\frac{2-1}{2R_1}$]

$\Rightarrow \frac{1}{24}$ = (0.5) [$\frac{1}{2R1}$]

$\Rightarrow$ $\frac{1}{2R1}$ = $\frac{1}{24x0.5}$

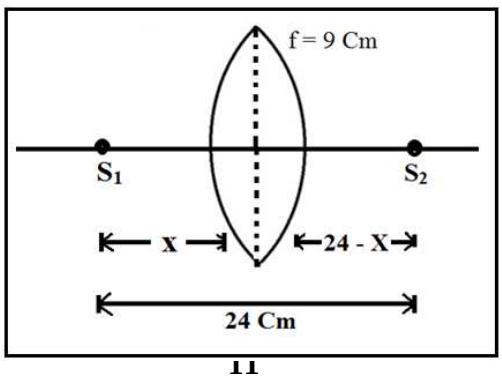
$\Rightarrow 2R_1 = 24 \times 0.5$

$\Rightarrow R_1 = \frac{24 \times 0.5}{2}$ =6 Cm

$R_2 = 2R_1 = 2 \times 6 = 12$ Cm

∴ R_1 = 6cm and R_2 = 12 cm

5. The distance between two point sources of light is 24cm .Where should a convergent lens with a focal length of f=9cm be placed between them to obtain the images of both sources at the same point? (AS7) (TQ)



11

Given :- Focal length, f = 9 Cm

1. For first Source, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{9} = \frac{1}{v} - \frac{1}{-x} \Rightarrow \frac{1}{9} = \frac{1}{v} + \frac{1}{x}$ -------(1) (w.r.t sign convention v=v, u = -x)

2. For second Source, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Rightarrow \frac{1}{9} = \frac{1}{-v} - \frac{1}{-(24-x)}$

$\Rightarrow \frac{1}{9} = -\frac{1}{v} + \frac{1}{24-x}$ ----(2) (w.r.t sign convention, v = -v, u = -(24-x))

3. (1) + (2) $\Rightarrow \frac{1}{9} + \frac{1}{9} = \frac{1}{v} + \frac{1}{x} - \frac{1}{v} + \frac{1}{24-x}$

$\Rightarrow \frac{2}{9} = \frac{1}{x} + \frac{1}{24-x}$

$\Rightarrow \frac{2}{9} = \frac{24-x+x}{x(24-X)}$

$\Rightarrow \frac{2}{9} = \frac{24}{24x - x^2}$

$\Rightarrow 2(24x - X^2) = 216$

$\Rightarrow x^2 - 24x + 108 = 0$

$\Rightarrow x^2 - 24x + 108 = 0$

$\Rightarrow x^2 - 18x - 6x + 108 = 0$

$\Rightarrow (x - 6)(x - 18) = 0$

$\Rightarrow x = 6, 18$

∴ Lens should be placed 18 cm and 6 cm to the right side of the first object.

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Chapter – 7

Human eye and Colourful world

1 Mark Questions

1. What is least distance of distinct vision? What is its value for a human being?

1. The minimum distance at which an object is to be placed so that it can be viewed distinctly and comfortably is known as least distance of distinct vision.
2. The value of least distance of distinct vision is 25 cm.

2. What is angle of vision? What is its value for healthy human being?

1. The maximum angle at which we are able to see the whole object is called angle of vision.
2. The angle of vision of human being is 60^0.

3. What is accommodation of eye lens?

The ability of eye lens to change its focal length is called accommodation of lens.

4. Which type of images forms by eye lens?

The eye-lens forms a real and inverted image of an object on the retina.

5. Name the receptors are there in the human eye?

1. Cones 2. Rods

6. What is the role of rods and cones in human eye?

Rods – identify the colour.
Cones – Identify the intensity of light.

7. How many number of receptors are there in the human eye?

125 Millions.

8. How many number of optic-nerve fibres are there in the human eye?

1 Million.

9. What is the function of optical nerve in the eyes?

The optical nerve transmits visual information from retina to the brain.

10. What are the maximum and minimum focal lengths of eye lens?

Maximum focal length of eye lens = 2.5 cm
Minimum focal length of eye lens = 2.27 cm.

11. How many types of eye defects? What are they?

There are mainly three common defects of vision. They are 1. Myopia 2. Hypermetropia 3. Presbyopia.

12. What is the meant by a far point?

Far point:- The point of maximum distance at which the eye lens can form an image on the retina is called 'far point'.

13. What is the meant by a near point?

Near point:- The point of minimum distance at which the eye lens can form an image on the retina is called near point.

14. What is meant by angle of deviation?

Angle of deviation:- The angle between incident ray and emergent ray is called angle of deviation.

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15. If you correct the eye defect Myopia then mention the focal length of bi-concave lens?

To correct the Myopia,

The focal length of bi-concave lens is f = – D.

Here D = Distance to far point from eye.

16. If you correct the eye defect Hypermetropia then mention the focal lengths of bi-convex lens?

To correct the Hypermetropia,

The foal length of bi–convex lens is $f = \frac{25\,d}{d-25}$

Here d = Distance to near point from eye.

17. What is meant by a Presbyopia?

Presbyopia:- Presbyopia is a vision defect when the ability of accommodation of the eye usually decreases with ageing.

18. How can you correct the eye defect presbyopia?

Presbyopia was corrected by using bi-focal lens which are formed using both concave and convex lenses.

19. Define power of lens? What are its units?

Power of lens(P):-

1. The reciprocal of focal length is called power of lens.
2. Let 'f ' be the focal length of lens,
3. Power of lens, $P = \frac{1}{f\,(\text{in m})}$ (or) $P = \frac{100}{f\,(\text{in cm})}$
4. The unit of power of lens is 'Dioptre' (D)

20. What is meant by a prism?

Prism:- A prism is a transparent medium separated from the surrounding medium by at least two plane surfaces which are inclined at a certain angle in such a way that, light incident on one of the plane surfaces emerges from the other plane surface.

21. What is meant by a 'angle of minimum deviation'?

Angle of minimum deviation:- 1. When the angle of incidence is equal to angle of emergence the angle of deviation attains least value.

2. This is known as 'angle of minimum deviation'.

22. Write a formula to find the refractive index of the material of the prism and explain the terms?

Refractive index of the material of a prism, $n = \frac{\sin\frac{A+D}{2}}{\sin\frac{A}{2}}$

Where, A = Angle of the prism.

D = Angle of minimum deviation.

23. What is Dispersion of light? Give an example?

Dispersion of light:- The splitting of white light into different colours (VIBGYOR) is called dispersion.

Ex:- Rainbow is formed due to the dispersion of sun light.

24. Name the component of white light that deviates the least and the most while passing through a prism?

Least deviation:- Red.

Most deviation:- Violet.

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25. What is meant by a scattering of light? Give an example?

Scattering of light:- The process of re-emission of absorbed light in all directions with different intensities by atoms or molecules is called scattering of light.

Ex:- The blue colour of the sky is due to scattering of light.

26. What is meant by an intensity of light?

Intensity of light:- The intensity of light is the energy of light passing through unit area of plane, taken normal to the direction of propagation of light, in one second.

27. What is meant by an angle of scattering?

Angle of scattering:- The angle between the incident light and a direction in which the intensity of scattered light is called angle of scattering.

28. If a white sheet of paper is stained with oil the paper turns transparent. Why? (AS7)(TQ)

The refractive index of oil and refractive index of paper is same then light passes from oil to paper without scattering hence the paper becomes transparent.

29. Can you guess the reason, why sun does not appear red during noon hours?

1. During noon hours, sun light travels less distance through the atmosphere then the morning and evening times.
2. Therefore all the colours reaches without much scattering, thus the sun appear white at noon.

30. A rainbow viewed from an airplane may form a complete circle. Where will the shadow of airplane appear?

A rainbow viewed from an airplane may form a complete circle.

31. Avantika can read a book but she does not able to read the letters on backboard clearly.

i) What is the eye defect of Avantika?

ii) Which type of lens she has to use to correct her eye defect?

i) Avantika has eye defect 'Myopia'.

ii) She has to use 'Biconcave lens' to correct her eye defect.

32. Sreekar can see the name boards of buses cearly from long distance. But he can't read the news paper clearly.

i) What type of eye defect has Sreekar?

ii) What kind of lens does Sreekar use to correct his eye defect?

i) Sreekar has eye defect – 'Hypermetropia'

ii) 'Hypermetropia' can be corrected by using 'biconvex lens'.

2 Mark Questions

1. Explain briefly the reason for the blue of the sky? (AS1)(TQ)

1. The blue colour of the sky is due to scattering of sun light.
2. We know that our atmosphere contains different types of molecules and atoms.
3. The reason to blue of the sky is due to the molecules N_2 and O_2.
4. The sizes of these molecules are comparable to the wavelength of the blue light.
5. These molecules act as a scattering centre for scattering of blue light.
6. So, sky appears to be blue in colour.

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2. Assertion (A):- The refractive index of a prism depends only on the kind of glass of which it is made of and the colour of light.
Reason(R):- The refractive index of a prism depends on the refracting angle of the prism and on the angle of minimum direction (AS2) (TQ)

Both A and R are true and R is not the correct explanation of A

Explanation:- 1. It is found that as the angle of deviation decreases refractive index of material decreases.
2. This means, the angle of deviation depends on the refractive index of the material of the prism.

3. Assertion (A):- Blue colour of sky appears due to scattering of light.
Reason(R):- Blue colour has shortest wavelength among all the colours of white light. (AS2)(TQ)

(A) is true and (R) is false.

Explanation:- 1. Sky appears blue due to scattering of light.
2. Violet colour has the shortest wavelength among all the colours of white light.

4. Light wave length (λ_1) enters a medium with refractive index n2 from medium with refractive index n_1. Then what is the wave length of light to second medium? (AS1)(TQ)

Wave length in first medium $=\lambda_1$
Wave length in second medium $=\lambda_2$
Refractive index of first medium $=n_1$
Refractive index of second medium$=n_2$

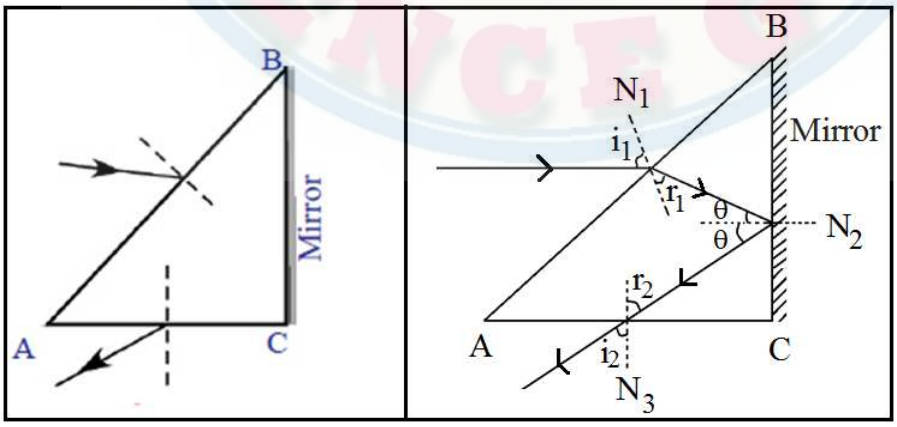
The relation among velocity (v), wavelength (λ) and frequency (ν) is $v = \nu\lambda$.

$$\frac{v_1}{v_2} = \frac{\lambda_1}{\lambda_2} \text{ ------- (1)}$$

We know $n = \frac{c}{v} \Rightarrow n\ \alpha\ \frac{1}{v} \Rightarrow n_1v_1 = n_2\ v_2 \Rightarrow \frac{v_1}{v_2} = \frac{n_2}{n_1}$ ------- (2)

From (1) and (2), we have $\frac{\lambda_1}{\lambda_2} = \frac{n_2}{n_1} \Longrightarrow \lambda_2 = \frac{\lambda_1\, n_1}{n_2}$

5. Incident ray in one of the face (AB) of a prism and emergent ray from the face are given in figure. Complete the ray diagram. (AS5) (TQ)



1. From the figure; AB, AC are refracting surface and BC is reflecting surface.
2. Incident ray enters into prism (denser medium) from air (rarer medium) so it bends towards normal.
3. Emergent ray comes into (rarer medium) air from prism (denser medium)
4. So, it bends away from normal

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For mirror:- **1.** angle of incidence(θ) = angle of reflection(θ).
2. N_1, N_2, N_3 are normal's i_1- angle of incidence, i_2- angle of emergence
3. r_1, r_2- angle of refraction -angle of incidence, reflection for the mirror.

6. How do you appreciate the role of molecules in the atmosphere for the blue colour of the sky? (AS6)(TQ)

1. The blue colour of the sky is due to scattering of light.
2. We know that our atmosphere contains different types of molecules and atoms.
3. The reason to blue sky is due to the molecules N2 and O2.
4. The sizes of these molecules are comparable to the wavelength of blue light.
5. These molecules act as a scattering centre for scattering of blue light.
6. So, we should appreciate the role of molecules N2 and O_2, which are scattering centre of blue colour.

7. Eye is the only organ to visualize the colourful world around as this is possible due to accommodation of eye lens. Prepare a six line stanza explaining your wonderful feelings?(AS6)(TQ)

Oh! Wonderful eyes,
Eyes are very helpful.
Which makes our world colourful.
Eyes make you beautiful.
If you take the eyes careful.
Our life is always Wonderful.
Finally we live peaceful.

8. Glass is known to be a transparent material. But ground glass is opaque and white in colour. Why? (AS7)(TQ)

1. Glass is general a transparent material because it transmits most of the light incident on it.
2. When glass is ground, its surface becomes rough due to microscopic unevenness.
3. When light is incident on such a rough surface, it is reflected in many different directions.
4. This type of reflection is known as diffuse reflection.
5. Due to this reason ground glass is opaque and white in colour.

9. A person is viewing an extended object. If a converging lens is placed in front of his eye, will he feel that the size of the object has increased? Why? (AS7)

1. The person feels that the size of the object has increased.
2. He used the converging lens, i.e, convex lens and the image is an extended object.
3. The image formed by convex lens depends on the position of the object.
4. Here the nature of the object is extended object.
5. If extended object is viewed through a conversing lens he feels that the size of the object has increased.
6. It acts like a magnifying glass (or) simple microscope.

10. What is the reason for appearance the white colour during noon hours?

1. During noon hours, the distance to be travelled by the sun rays in the atmosphere is less than that compared to morning and evening hours.
2. Therefore all colours reach your eye without much scattering. Hence the Sun appears white during noon hours.

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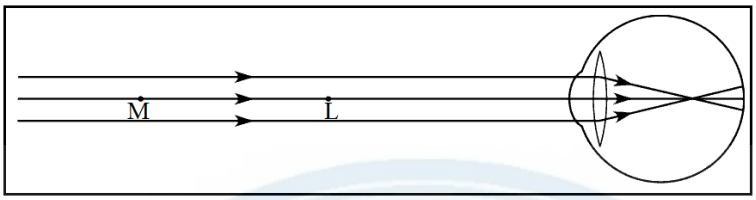
4 Mark Questions

1. How do you correct the eye defects myopia? (AS1) (TQ)

Myopia:- 1. Some people cannot see object at long distances but can see nearby objects clearly.
2. This type of vision defect is called myopia (near sightedness).

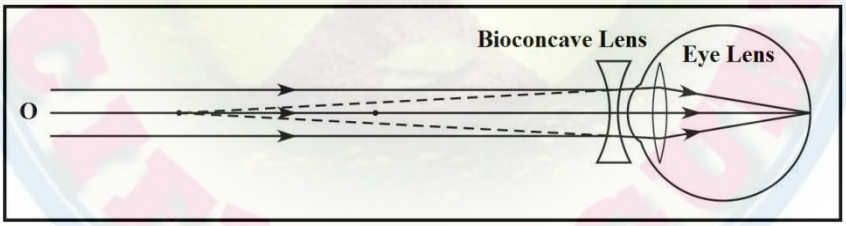
Cause of myopia:- 1. For the people of myopia, maximum focal length is less than 2.5 cm so that the rays coming from distant object after refraction through the eye lens form an image before the retina as shown in the figure.



2. The point of maximum distance at which the eye lens can form an image on the retina is called far point (M).
3. The eye lens can form clear image on the retina when an object is placed between far point (M) and point of least distance of distinct vision (L).

4. If we are able to bring the image of the object kept beyond far point, between far point and the point of least distance of distinct vision using a lens.
5. This image acts as an object for the eye lens. This can be possible only when a bi-concave lens is used.

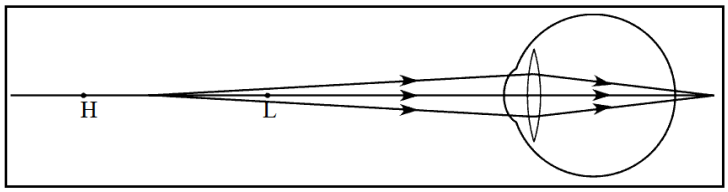
Correction of myopia:- 1. To correct one's myopia, we need to select a lens which forms an image at the far point for an object at infinity.
2. We need to select bi-concave lens to achieve this.



2. Explain the correction of the eye defect hypermetropia? (AS1) (TQ)

Hypermetropia:- 1. Some people can see the distant objects clearly but cannot see objects at near distances.
2. This type of vision defect is called hypermetropia (far sightedness).

Cause of hypermetropia:- 1. The minimum focal length of eye for the person of hypermetropia is greater than 2.27 cm.
2. In such cases the rays coming from a nearby object, after refraction at eye lens, forms an image beyond the retina as shown in figure.



3. The point of minimum distance at which the eye lens can form an image on the retina is called near point.

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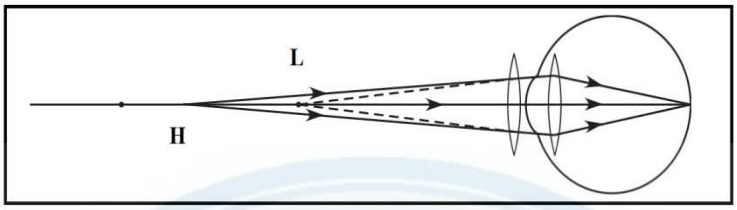
4. The people with defect of hypermetropia cannot see objects placed between near point (H) and point of least distance of distinct vision (L).
5. Eye lens can form a clear image on the retina when any object is placed beyond near point.

Correction of hypermetropia:-1. To correct the vision defect hypermetropia, we need to use a lens which forms an image of an object beyond near point (H), when the object is between near point (H) and least distance of distinct vision (L).

2. This is possible only when a double convex lens is used.

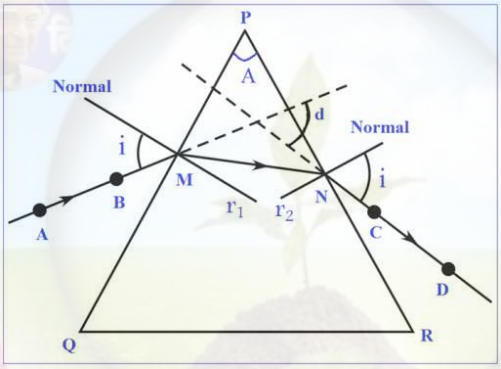


3. How do you find experimentally the refractive index of material of a prism (AS1)? (TQ)

Aim:- To find the refractive index of the prism.

Material required:- Prism, Piece of white chart, pencil, pens, scale and protractor.

Procedure: -



1. Take a prism and place it on the white chart and draw the boundary lines by using a pencil.
2. Remove the prism and name the vertices as P, Q and R.
3. Calculate the angle of the prism ($A=60^0$) and noted in your book.
4. Draw a normal to PQ at M and draw a line with 30^0 to the normal.
5. This is incident ray AB. Fix two ball pins on this ray at A and B.
5. Place the prism in its exact position and fix another two pins at C and D such that all four pins appear to lie along the same line by seeing the images of pins through the prism from the other side PR.
6. Draw line joining C and D and extend it to meet PR at N this is emerging ray.
7. Draw normal at PR at N and measure the angle between normal at N and emergent ray.
8. If we extent the incident ray AB and emergent ray CD, they meet at O.
9. Measure angle between these two rays and note as angle of deviation (d).
10. The same experiment repeated for different angles of incidence and measure corresponding angle of deviation and noted down in the following table.

S.No	Angle of incidence (i_1)	Angle of emergence (i_2)	Angle of deviation (d)
1	30^0		
2	40^0		
3	50^0		
4	60^0		
5	70^0		

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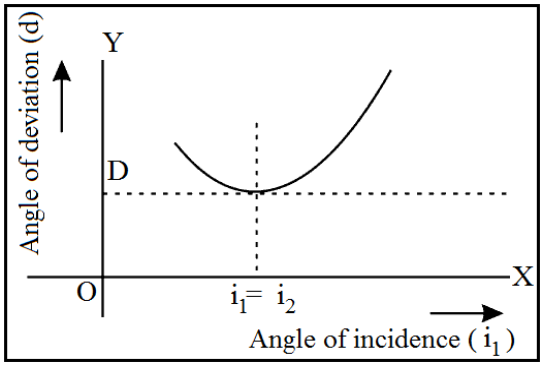
11. We draw a graph by taking angles of incident on X-axis and angles of deviation (d) on y-axis.
12. The graph is a curved line as shown in the figure. Find angle of minimum deviation (D).



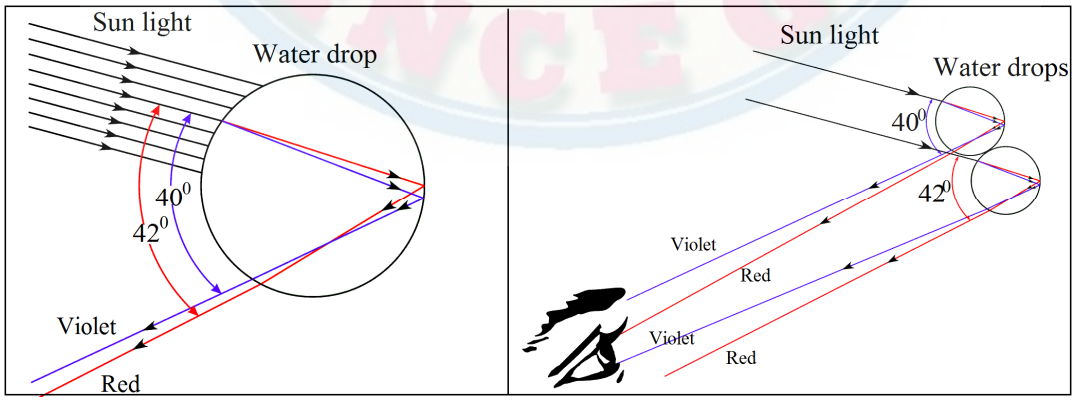
13. Now we can calculate the refractive index of the material of the prism by using the formula,

$$n = \frac{Sin(\frac{A+D}{2})}{Sin(\frac{A}{2})}$$

4. Explain the formation of rainbow? (AS1)(TQ)

Formation of rainbow:- 1. The beautiful colours of the rainbow are due to dispersion of the sunlight by millions of tiny water droplets.

2. The rays of sunlight enter the drop near its top surface.
3. At this first refraction, the white light is dispersed into its spectrum of colours, violet being deviated the most and red the least.
4. Reaching the opposite side of the drop, each colour is reflected back into the drop because of total internal reflection.
5. At the second refraction the angle between red and violet rays further increases when compared to the angle between those at first refraction.
6. The angle between the incoming and outgoing rays can be anything between 0^0 and about 42^0.
7. We observe rain bow when the angle between incoming and outgoing rays is near the maximum angle of 42^0.
8. The colour red will be seen when the angle between a beam of sunlight and light sent back by a drop is 42^0.
9. The colour violet is seen when the angle between a sun beam and light sent back by a drop is 40^0.
10. If we look at an angle between 40^0 and 42^0 we can observe the remaining colours of VIBGYOR.



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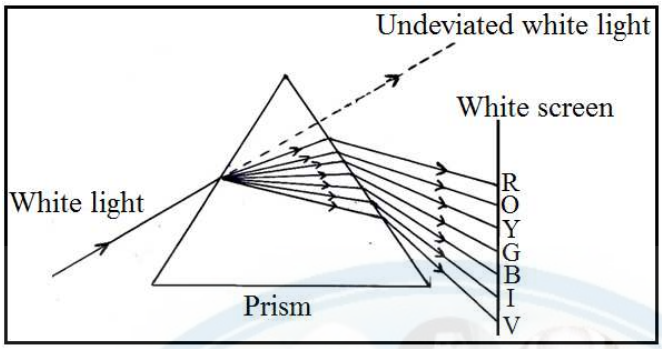
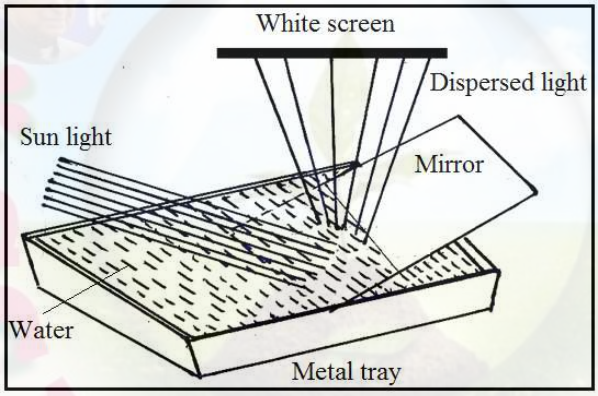
5. Explain Two activities for the formation of artificial rainbow? (AS1)(TQ)

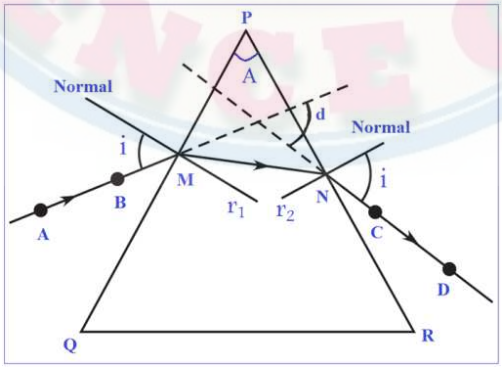
Activity-1: - 1. Take a prism and place it in between the light source and white wall.
2. Sent a light source such that the rays are falls on the prism through the narrow slit of a wooden plank.
3. Switch on the light. Adjust the height of the prism such that the light falls on one of the lateral surfaces.
4. We observed that the emergent light forms an artificial rainbow on the white wall.



Activity-2: - 1. Take a tray and fill it with water.
2. Place a mirror in the water such that it makes an angle to the water surface.
3. Now focus white light on the mirror through the water as shown in figure.
4. Try to obtain colour on a white card board sheet kept above the water surface.
5. We can observe the seven colours of VIBGYOR on the cardboard sheet.



6. Derive the refractive index of the material in the case of prism? (AS1) (TQ)



PQR –Glass triangular shaped prism
PQ, PR- refracting surfaces of prism
QR- Base of prism
A- Angle of prism
AB – incident ray
CD- emergent ray
MN- refracted ray
d- Angle of deviation.

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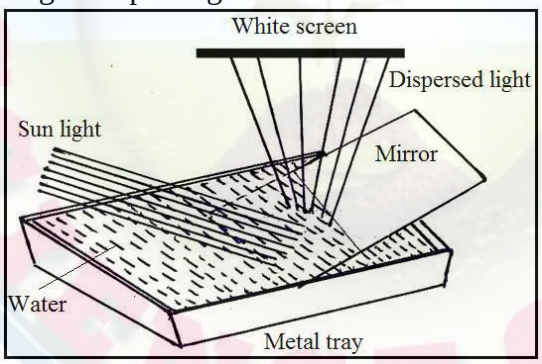
1. Consider the following ray diagram, from triangle OMN, we get $d = (i_1 + i_2)-(r_1 + r_2)$ ----- (1)
2. From triangle PMN, $A = r_1 + r_2$----- (2)
3. From (1) and (2), we have $A+d = r_1 + r_2 + (i_1 + i_2)-(r_1 + r_2)$
$= r_1 + r_2 + i_1 + i_2 - r_1 - r_2$
$A+d = i_1 + i_2$----- (3)
4. Using Snell's law at M, $n_1 = 1$, $I = i_1$, $n_2 = n$ and $r = r_1$ gives, $\text{Sin } i_1 = n \text{ Sin } r_1$----- (4)
5. At N with $n_1 = n$, $I = r_2$, $n_2 = 1$ and $r = i_2$ gives $n \text{ Sin } r_2 = \text{Sin } i_2$----- (5)
6. When $i_1 = i_2$, angle of deviation (d) becomes angle of minimum deviation (D).
7. Then equation (3) becomes $A+D = i_1+i_1 = 2i_1 \Longrightarrow i_1 = \frac{(A+D)}{2}$
8. If $i_1 = i_2$, then $r_1=r_2$. So from equation (2), we get $2r_1=A$ (or) $r_1 = \frac{A}{2}$.
9. Substitute i_1 and r_1 in equation (4), we get $\text{Sin}\left(\frac{A+D}{2}\right) = n.\ \text{Sin}\left(\frac{A}{2}\right)$
$$\therefore n = \frac{\text{Sin}\left(\frac{A+D}{2}\right)}{\text{Sin}\left(\frac{A}{2}\right)}$$
10. This is the refractive index of the prism.

7. Suggest an experiment to produce a rainbow in your classroom and explain the procedure?

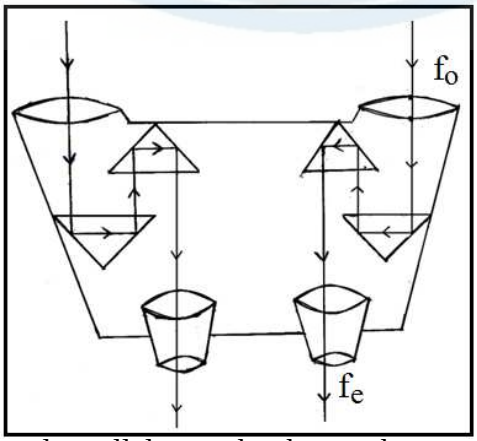
Aim:- To produce rainbow a classroom. **(AS3)(TQ)**

Apparatus:- Light source, mirror, plastic tray, water etc.

Procedure:- 1. Take a tray and fill it with water.
2. Place a mirror in the water such that it makes an angle to the water surface.
3. Now focus white light on the mirror through the water as shown in figure.
4. Try to obtain colour on a white card board sheet kept above the water surface.
5. We observe that a white ray of light splits into certain different colours called VIBGYOR.
6. We know that the white light is splitting into certain different colour as rainbow.



8. Prism used in binoculars. Collects information why prisms are used in binoculars? (AS4) (TQ)



1. If two telescopes are mounted parallel to each other so that an object can be seen by both the eyes simultaneously the arrangement is called binocular.
2. The length of each tube is reduced by using a set of totally reflecting prisms.

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3. They provide intense, erect image free from lateral inversion.
   f_0-focal length of objective lens.
   f_e- focal length eyepiece.
4. Through a binocular we get two images of the same object from different angles at same time.
5. Their super position gives the perception of depth also with length and breadth.
6. Binocular vision gives proper 3D image.
7. By using total reflecting prisms there is no loss of intensity.

9. How do you appreciate the working of ciliary muscle in the eye? (AS6) (TQ)

1. The Ciliary muscle is helpful to change its focal length by changing radii of curvature of eye lens.
2. When the eye is focused on a distant object, the ciliary muscles are relaxed so that the focal length of eye lens has its maximum value.
3. So, we see the distant object clearly.
3. When the eye is focused on a closer object the ciliary muscles are strained and focal length of eye-lens decreases.
4. Hence we see the closer objects clearly.
5. This process of adjusting focal length is called “accommodation”.
6. Due to this accommodation ability of the ciliary muscles we see the objects clearly.
7. Hence the role of ciliary muscles is highly appreciable.

10. Why does the sky sometimes appear white? (AS7)(TQ)

1. Our atmosphere contains atoms and molecules of different sizes.
2. According to their sizes, they are able to scatter different wavelengths of light.
3. For example, the size of the water molecule is greater than the size of the N_2 or O_2.
4. It acts as a scattering centre for other frequencies which are lower than the frequency of blue light.
5. On a hot day, due to rise in the temperature, water vapour enters into atmosphere which leads to abundant presence of water molecules in the atmosphere.
6. These water molecules scatter the colours of other frequencies other than blue.
7. All such colours of other frequencies reach your eye and the sky appears white.

11. Why the reasons for appearance the red colour of sun during sunrise and at sunset?

1. The atmosphere contains free molecules and atoms with different sizes.
2. These molecules and atoms scatter light of different wavelengths which are comparable to their size.
3. Molecules having a size that is comparable to the wavelength of red light are less in the atmosphere.
4. Hence scattering of red light is less when compared to the other colours of light.
5. The light from the sun needs to travel more distance in atmosphere during sunrise and sunset to reach our eye.
6. In morning and evening times, during sunrise and sunset except red light all colours scatter more and vanish before they reach us.
7. Since scattering of red light is very small, it reaches 4s. As a result sun appears red in colour during sunrise and sun set.

12. How do you demonstrate the scattering of light with an activity?

1. Take a solution of sodium-thio-sulphate (hypo) and sulphuric acid in a glass beaker.
2. Place the beaker in the presence of sunlight. We noticed that sulphur precipitates are starts to form.
3. At the beginning, the grains of sulphur appear blue in colour at the beginning and slowly their colour becomes white as their size increases.
4. At the beginning, the size of grains is small and almost comparable to the wave length of blue light.
5. Hence they appear blue in the beginning.

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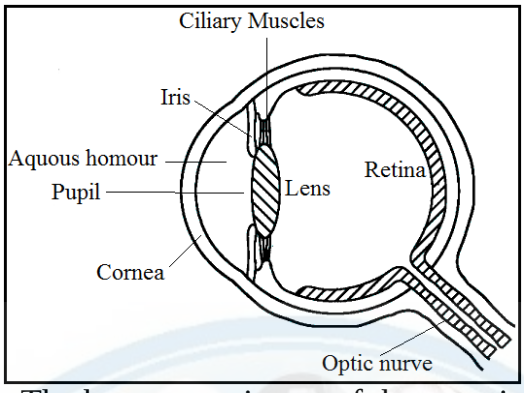
6. As the size of grains increases, their size becomes comparable to wave lengths of other colours.
7. As a result of this, they act as scattering centres for other colours.
8. The combination of all these colours appears as white.

13. Explain the structure of Human eye?



Structure of Human Eye:- 1. The human eye is one of the most important sense organs. It enables us to see the object and colours around us.
2. The eye ball is nearly spherical in shape.
3. The front portion is more sharply curved and is covered by a transparent protective membrane called the 'cornea'.
4. Behind the cornea, there is place filled with a liquid called aqueous humour.
5. Behind the aqueous humour a crystalline lens which is responsible for the image formation.
6. Between the aqueous humour and the lens, we have a muscular diaphragm called 'iris'.
7. Iris has a small hole in it called pupil. Iris is the coloured part that we see in an eye.
8. The pupil appears black because any light falling on it goes into the eye and there is almost no chance of light coming back to the outside.
9. Iris helps in controlling the amount of light entering the eye through 'pupil'.
10. The light that enters the eye forms an image on the retina.
11. The distance between the lens and retina is about 2.5 cm.

Problems

1. A light ray falls on one of the faces of prism at an angle 40^0 so that it suffers angle of minimum deviation of 30^0. Find the angle of prism and angle of refraction at the given surface? (AS7) (TQ)

Given:- Angle of incident $i_1 = 40^0$
Angle of minimum deviation, $D = 30^0$

We know $A+D = 2i \Longrightarrow A= 2i-D= 2x40^0-30^0 =80^0-30^0 = 50^0 \Longrightarrow A = 50^0$

Angle of refraction $= \frac{A}{2} = \frac{50}{2} = 25^0$

2. The focal length of a lens suggested to a person with Hypermetropia is 100cm. Find the distance of near point and power of the lens? (AS7) (TQ)

Given:- The focal length of the lens, f= 100cm
Image distance (V) = Distance of near point = -d
Object distance, u = -25 cm

Lens formula, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \Longrightarrow \frac{1}{100} = \frac{1}{d} - \frac{1}{(-25)} \Longrightarrow \frac{1}{d} = \frac{1}{25} - \frac{1}{100} \Longrightarrow \frac{1}{d} = \frac{4-1}{100} \Longrightarrow \frac{1}{d} = \frac{3}{100} \Longrightarrow d = \frac{100}{3} = 33.33cm.$

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Power of lens, p= $\frac{100}{f} = \frac{100}{100}$ =1 Diopter.

3. Doctor advised to use 2D lens. What is its focal length?

Given:- Power of the lens P = 2D.

Formula:- P = $\frac{100}{f\ (Cm)} \Rightarrow$ f = $\frac{100}{p} \Rightarrow$ f = $\frac{100}{2}$ = 50cm.

∴ The focal length of the lens is 50cm.

4. A prism with an angle A = 60^0 produces an angle of minimum deviation of 30^0. Find the refractive index of material of the prism?

Given:- Angle of prism A = 60^0
Angle of minimum deviation D = 30^0
Refractive index of the material of the prism = ?

Formula:- Refractive index, n= $\frac{\text{Sin}\left(\frac{A+D}{2}\right)}{\text{Sin}\left(\frac{A}{2}\right)} = \frac{\text{Sin}\left(\frac{60^0+30^0}{2}\right)}{\text{Sin}\left(\frac{60^0}{2}\right)} = \frac{\text{Sin}\left(\frac{90^0}{2}\right)}{\text{Sin}\left(\frac{60^0}{2}\right)} = \frac{Sin\ 45^0}{Sin\ 30^0} = \frac{\frac{1}{\sqrt{2}}}{\frac{1}{2}} = \sqrt{2}$ = 1.414

∴ Refractive index of the material of the prism is 1.414

5. A person is unable to see the objects nearer than 50 cm. He wants to read a book placed at distance of 25 cm.

i) Name the defect of the vision he is suffering from
ii) How can it be corrected?
iii) What is the power of such lens?

i) Since the person is not able to see the objects nearer than 50 cm.
ii) This defect of vision 'hypermetropia' can be corrected by using 'bi–convex lens'.
iii) Given that distance of near point d = 50 cm

If f be the focal length of the bi convex lens we have, f = $\frac{25\ d}{d-25} = \frac{25 \times 50}{50-25} = \frac{25 \times 50}{25}$ = 50 cm

Now power of lens p = $\frac{100}{f(in\ cm)} = \frac{100}{50}$ = 2D

By using convex lens of power 2D, we can correct given defect of vision.

6. A person cannot see objects beyond a distance of 2 m. Then find

i) What type of eye defect he has ?
ii) What kind of lens he has to use to overcome his eye defect?
iii) What is focal length of the lens?
iv) What is power of the lens he has to use?

i) Since the person is not able to see the objects beyond 2m, he is suffering from 'Myopia' or short sightedness.
ii) This defect of vision – myopia can be corrected by using 'bi–concave lens'.
iii) Given that distance of far point D = 2m

We know that focal length of lens using to correct myopia is f = –D
Where D is distance of far point.

∴ Focal length of f = – 2m = – 200 cm

iv) Now power of lens p = $\frac{100}{f(in\ cm)} = \frac{100}{-200} = \frac{-1}{2}$ = –0.5 Dioptre.

Here – sign indicates that it is a concave lens.

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Chapter-8

Structure of Atom

1 Mark Questions

1. What is meant by an atom?

Atom:- The smallest unit of a substance is called an atom.

2. What is electronic configuration?

Electronic configuration:- The arrangement of electrons in shells, sub-shells and orbital's of an atom is called electronic configuration.

3. Name the sub-atomic particles of an atom?

The sub atomic particles are Electron, proton and neutron.

4. How many colours are there in a rainbow?

There are seven colours namely violet, indigo, blue, green, yellow, orange and red (VIBGYOR) in a rainbow.

5. What is the value of speed of light in vacuum?

Speed of light in vacuum, $c = 3 \times 10^8$ m s^{-1}.

6. What is the relation between wavelength and frequency?

The relation between these quantities is given by, $\lambda \alpha \frac{1}{\nu}$ (or) $c = \nu\lambda$.

7. What is meant by an electromagnetic spectrum?

Electromagnetic spectrum:- The entire range of electromagnetic wave frequencies is known as the electromagnetic spectrum.

8. What is meant by a visible spectrum?

Visible spectrum:- The range of wavelengths covering red colour to violet colour is called the visible spectrum.

9. What is a spectrum? How many types of spectrums are there?

Spectrum:- 1. A group of wave lengths or frequencies is called a spectrum.

2. Spectrums are of two types. They are i). Emission spectrum ii) Absorption spectrum.

10. What is an Absorption Spectrum? (AS1) (TQ)

Absorption spectrum:- 1. Absorption spectrum is spectrum obtained when the substances absorb energy.

2. It contains dark lines on bright background.

11. What is Emission Spectrum? (AS1) (TQ)

Emission Spectrum:- The spectrum of radiation emitted by a substance from its excited state is an emission spectrum.

12. When do we get Atomic line spectra?

Atomic line spectra arise because of absorption or emission of certain frequencies of light energy.

13. Write the Plank's equation?

$E = h\nu$. Where E = Energy of radiation.

ν = frequency of the radiation absorbed / emitted.

h = Planck's constant.

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14. What is the value of Planks constant?

Plank's constant, h = 6.626 X 10^{-34} Js (or) h = 6.626 X 10^{-27} erg.sec

15. Who introduced the elliptical orbits?

Sommerfeld.

16. Who developed the quantum mechanical model of an atom?

Erwin Schrodinger.

17. What is meant by an orbit?

Orbit:- The path of the electron around the nucleus is called an orbit.

18. What is an orbital?

Orbital:- The region of space around the nucleus where the probability of finding the electron is maximum is called an orbital.

19. What are degenerate orbitals?

Degenerate orbital's:- Orbital's which have same energy are called degenerate orbitals.

20. How many spin orientations are possible for an electron in an orbital?

Two spin orientations are possible for an electron in an orbital i.e., clockwise and anti clock wise.

21. Which electronic shell is at a higher energy level K or L? (AS2) (TQ)

L shell is at higher energy shell. Since, it is for away from nucleus than K-shell.

22. The wave length of a radio wave is 1.0m. Find its frequency? (AS7) (TQ)

Given :- Wavelength of radio wave ($\lambda\nu$) = 1 m

Speed of light in vacuum, c = 3×10^8 m s^{-1}

Frequency, ν = ?

Formula:- $c = \lambda\nu \Rightarrow 3 \times 10^8 = 1 \times \nu$.

$\therefore \nu = 3 \times 10^8$ Hz.

23. State Heisenberg principle of uncertainty?

Heisenberg's uncertainty principle:- "It is not possible to find the exact position and velocity of electron simultaneously".

24. Which type of spectrum is rainbow?

Continuous spectrum.

25. The electron configuration of Helium is $1S^2$. Write the information conveyed by it?

He (Z=2) = $1s^2$

Where '1' denotes principal quantum number

'S' denotes angular momentum quantum number

'2' denotes the number of electrons present in that orbital.

26. Write the values of magnetic quantum number for the sub shell d.

1. The angular momentum quantum number (l) for sub shell d is '2'.
2. So magnetic quantum number m = $2l + 1 = 2 \times 2 + 1 = 5$.
3. The 'm_s' values are –1, – 1, 0, + 1, + 2.

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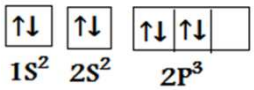
27. What is the maximum value of 'l' for n = 4?

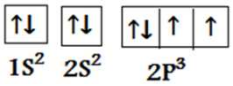
1. Given, n = 4.
2. So *l* = n – 1 = 4 – 1 = 3 i.e., 'f' orbital

28. Write the electronic configuration of calcium atomic number 20?

Ca (Z = 20) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$

29. Following orbital diagram shows the electron configuration of oxygen atom. Which rule does not support this?

O(Z=8) = 

Hund's rule. Because degenerate orbital's are filled by one electron after pairing takes place.
So the currect electronic configuration of Oxygen is 

30. 1. An electron in an atom has the following set of four quantum numbers to which orbital it belongs to and name that element? (AS1) (TQ)

n	l	m	m_s
2	0	0	$+\frac{1}{2}$

2. Write the four quantum numbers for $1s^1$ electron?

1. It belongs to $2s^1$.

2.

n	l	m_l	m_s
1	0	0	$+\frac{1}{2}$

31. Why are Bohr's orbits called stationary orbits?

As long as the electron is revolving in an orbit its energy is same. Hence these orbits are called stationary orbits.

32. Among Red and blue colours which is having high energy? Give reason?

1. Blue colour having high energy.
2. This is because the wavelength of blue colour is less than red colour.
3. The colour with lower wave length has higher frequency.

33. How many m_l values are possible for l = 3?

1. The possible m_l values for l = 3 are, 2l + 1 = 2(3) + 1 = 6+1= 7.
2. They are -3, -2, -1, 0, +1, +2, +3.

34. We observe yellow light in street lamps. Which will produce yellow light?

Sodium vapours produce yellow light in street lamps.

35. Which quantum does not follow from the solutions of Schrodinger wave equation?

Spin quantum number.

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2 Mark Questions

1. What information does the electronic configuration of an atom provide? (AS1) (TQ)

Electronic configuration:- The arrangement of electrons in shells, sub-shells and orbital's of an atom is called electronic configuration.

The electronic configuration of an element gives,

1. Valency of the element.
2. Which block does the element belongs to.
3. Which period does the element belongs to.
4. Which group does the element belongs to.
5. Reactivity of element.
6. Comparative size of the atom.
7. Metallic character of the element.

2. What is nl^x method? How it is useful? (AS1) (TQ)

1. The short hand notation of electronic configuration is nl^x.
2. It gives the information as shown below,
3. In nl^x method, n= Principle quantum number.
   x= number of electrons in in orbital.
   l = Azimuthal quantum number or angular momentum quantum number.

3. a. How many maximum number of electrons can be accommodated in a principal energy shell?
b. How many maximum number of electrons can be accommodated in a sub shell?
c. How many maximum number of electrons can be accommodated in an orbital?
d. How many sub shells will be present in a principal energy shell?
e. How many spin orientations are possible for an electron in an orbital? (AS1) (TQ)

a. '$2n^2$' ,Where n is the principle quantum number.
b. 2(2l +1), Where l = 0,1,2,3….
c. 2.
d. (2l +1), Where l = 0, 1, 2, 3….
e. 2.

Note:- The spin orientation of the electron is clockwise (↑) and anticlockwise (↓) direction. They are represented by $+\frac{1}{2}$ and $-\frac{1}{2}$.

4. In an atom the number of electrons in M shell is equal to the number of electrons in the K and L shell. Answer the following questions? (AS1)(TQ)

a. Which is the outer most shell?
b. How many electrons are there in its outermost shell?
c. What is the atomic number of an element?
d. Write the electronic configuration of the element?

a. M-Shell.
b. 10 electrons.
c. Atomic number = 20.
d. The atomic number of the element is 22.
e. $1S^2\ 2S^2\ 2P^6\ 3S^2\ 3P^6\ 4S^2$ (or) 2, 8, 10.

Note:- No. of electrons in 'M' shell = No. of electrons in K shell + No. of electrons in,L shell = 2+8= 10.

Total no.of electrons = No.of electrons in 'M' shell +No. of electrons in K shell + No.of electrons in L shell.

= 10+2+8=20

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5. Rainbow is an example for continuous spectrum-Explain? (AS1)(TQ)

1. A group of wavelengths is called a spectrum.
2. When white light is falls on a transparent material the white light split into sequence of colours.
3. The colours are Violet, Indigo, Blue, Green, Yellow, Orange, and Red (VIBGYOR).
4. A similar spectrum is produced when a rainbow forms in the sky after a rain shower.
5. It is caused by dispersion of sunlight by ting water droplets present in the atmosphere.
6. Such a spectrum in which there are no sharp boundaries in between colours is known as continuous spectrum.
7. So, rainbow is also a continuous Spectrum.

6. How may elliptical Orbits are added by Somerfield in third Bohr's Orbit? What was the purpose of adding these elliptical Orbits? (AS1)(TQ)

1. Sommerfeld modified Bohr's atomic model by adding elliptical orbits.
2. He added two elliptical orbits to Bohr's third orbit.

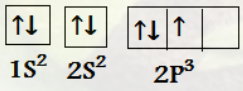
Purpose of adding elliptical Orbit:- 1. Bohr's model failed to account for splitting of line spectra.
2. In an attempt to account for the structure of line spectrum, Sommerfeld modified Bohr's atomic model by adding elliptical orbits.

7. Write the four quantum numbers for the differentiating electron of sodium (Na) atom? (AS1)

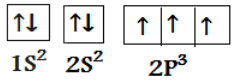
1. The atomic number of Sodium (Na) is 11.
2. Electronic configuration is $1S^2\ 2S^2\ 2P^6\ 3S^1$.
3. The differentiating electron is 3s orbital.
4. The four quantum numbers of Na are,

Orbital	n	l	m_l	m_s
3s	3	0	0	$+\frac{1}{2}$

8. Following orbital diagram shows the electron configuration of nitrogen atom. Which rule does not support this? (AS1) N (z=7) =



1. Hund's rule is violated in the above electronic configuration.
2. According to Hund's rule, electron pairing takes place all the available degenerate orbitals are completely filled by one electron in each.
3. In the above electronic configuration pairing takes place, but degenerate orbitals can not filled by one electron in each.
3. So, the correct electron configuration of Nitrogen is, $1S^2\ 2S^2\ 2P_x^1\ 2P_y^1\ 2P_z^1$ (or)



9. Collect the wave lengths and corresponding frequencies of three primary colours red, blue and green? (AS4) (TQ)

Red, Blue and green are the primary colours.

Colour	Wavelength	frequency
Red	700 nm	4.0×10^{14} Hz
Blue	470 nm	6.4×10^{14} Hz
Green	530 nm	5.7×10^{14} Hz

10. Which rule is violated in the electronic configuration? $1S^0\ 2S^2\ 2P^4$? (AS2) (TQ)

1. Aufbau principle is violated in this electronic configuration.
2. According to Aufbau principle, Electron enters into orbital of lower energy.

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3. The powest energy of the orbital is calculated by the formula (n+ℓ).Where,
   n = Principle quantum number.
   ℓ = Angular momentum quantum number.
4. Among 1s, 2s, 2p; 1s has least energy.
5. So 1s orbital must be filled before the electron should enter into 2s.

11. Write the differences between Orbit and Orbital?

Orbit	Orbital
1. The path of the electrons which revolves around the nucleus is called orbit.	1. The region in space around the nucleus where the probability of finding the electron is maximum is called orbital.
2. Orbits are circular and non-directional.	2. Orbital's have definite shape. Except 's' orbital other orbitals are directional.
3. These are denoted by the letters K, L, M, and N etc.	3. These are denoted by the letters s, p, d, and f etc.

12. Sreekanth said that, "The velocity of an electron and its exact position cannot be determined at a time". Do you agree with this statement – explain?

1. Yes, I agree with the statement of Krishna. Because electrons are very small.
2. To know its position light of very short wave length is required.
3. This short wave length light interacts with the electron and disturbs the motion of the electron.
4. Hence it is not possible to determine its position and velocity accurately.

13. Write the four quantum numbers for the differencing electron of potassium atomic number 19?

1. K (Z = 19) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1$.
2. The last electron enters into 4s orbital. So the four quantum numbers for $4s^1$ is as follows.

n	l	m	s
4	0	0	$+\frac{1}{2}$ (or) $-\frac{1}{2}$

14. The Electronic configuration of an element 'X' is given as below, observe it and Answer the questions? **$X = 1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2\ 3d^1$**

A) Name the element 'X'

B) Which is the outer most shell?

A) Name of the element 'X' is Scandium.

B) Outer most shell is '4'.

15. Write the electronic configuration of copper atomic number 29. Which rule is deviated?

1. Cu (Z=29) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$
2. Aufbau principle is deviated here.
3. Lower energy orbital '4s' is not completely filled.
4. Because half filled and completely filled orbitals are more stable.

16. What information does principle quantum number give?

1. The principle quantum number is related to the size and energy of the main shell.
2. By increasing the principle quantum, number the size and energy of the main shell also increases.

17. Explain why electrons enter into 4s orbital but not 3d after filling the 3p orbital?

1. The (n+l) value of 4s = 4 + 0 = 4
2. The (n+l) value of 3d = 3 + 2 = 5
3. The (n+l) value of 3d orbital has more than 4s orbital.
4. According to Aufbau principle electrons are enter into 4s orbital after filling the 3p orbital.

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18. How many elliptical orbits are added by Somerfield in third Behr's orbit what was the purpose of adding those elliptical orbits?

1. Two elliptical orbits are added to Bohr's third orbit.
2. To explain the complete model of atomic spectrum Somerfield added the elliptical orbits.

19. Why are chromium and copper exceptions to electronics configuration?

1. The half filled or fulfilled orbital's are in the outer most orbit is more stable.
2. So, the electronic configuration of Cr (z=24) is [Ar] $4s^1\ 3d^5$ instead of Cr (24) – [Ar] $4s^2\ 3d^4$.
3. In the same way the electronic configuration of CU (z-29) is [Ar] $4s^1 3d^{10}$ instead of cu (29) $4s^2 3d^9$.
4. Chromium and Copper redistribute one 4s electron to 3d they get half filled and fulfilled orbital's respectively both of them gets more stability.

20. What is ground state and excited state? Does the electron remains in the excited state forever?

1. Lowest energy state of the electron is known as ground state.
2. By gaining energy it moves to a high energy level called excited state.
3. The electron does not remain in the excited state forever.
4. By loosing energy the electron come back to its ground state.

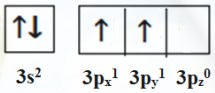
21. What is ground state and excited state?

Ground state:- The lowest energy of the electron is known as ground state.

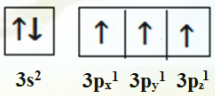
Excited state:- The electron moves to a higher energy level than that state is called excited state.

Examle:- Si (Z=4)

Si (ground state) = [Ne] $3s^2\ 3p_x^1\ 3p_y^1\ 3p_z^0$ (or) [Ne]



Si (excited state) = [Ne] $3s^1\ 3p_x^1\ 3p_y^1\ 3p_z^1$ (or) [Ne]



22. Write the electronic configuration of 'Cr' and 'Cu'?

Cr (Z=24) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^5$ (or) [Ar] $4s^1\ 3d^5$

Cu (Z=29) = $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^1\ 3d^{10}$ (or) [Ar] $4s^1\ 3d^{10}$

23. Define wavelength and frequency?

Wavelength (λ):- The wavelength (λ) of the wave is the distance from one wave peak to the next.

Frequency (ν):- The frequency (ν) of a wave is simply the number of wave peaks that pass by a given point per unit time, expressed in units of reciprocal seconds ($\frac{1}{S}$ or s^{-1}).

24. Write the limitations of Bohr's theory?

1. Bohr's theory does not explain the spectra of multi electrons.
2. Bohr,s theory does not explain the fine spectrum of hydrogen atom.
3. It does not explain the Zeeman effect and stark effect.
4. bohr's theory is not in agreement with heisenberg's uncertainity principle.

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4 – Mark Questions

1. What is an orbital? How is it different from Bohr's orbit? (AS1)(TQ)

1. The region or space around the nucleus where the probability of finding the electron is maximum is called orbital.
2. Bohr's orbit has a definite boundary and fixed energy at different distances from the nucleus.
3. They are circular in shape.
4. Orbital's has no definite boundary.
5. It is a region where we find maximum probability of electron.
6. The shape of each orbital is different.
7. For example, the shape of s-orbital is spherical and p-orbital is dumbbell and d-orbital is double dumbell.
8. Bohr's orbit can accommodate maximum of $2n^2$ electrons in it.
9. But orbital can accommodate only two (2) electrons.

2. Explain the significance of three Quantum numbers in predicting the positions of an electron in an atom? (AS1)(TQ)

Each electron in an atom is described by a set of three quantum numbers n, *l*, m. These numbers indicate the probability of finding the electron in the space around nucleus.

1. Principal Quantum Number (n):- 1. It was introduced by Niel's Bohr.
2. It is denoted by the letter 'n'.
3. The number of electrons in a shell is limited to $2n^2$. Where n = 1, 2, 3, ….etc.
4. The shells are denoted by the letters K, L, M, N, …etc.
5. Principal quantum number gives the size and energy of the main shell.

Shells	K	L	M	N	O
n	1	2	3	4	5

2. Angular-momentum Quantum Number (*l*):- 1. It was introduced by Sommerfeld.
2. It is denoted by the letter 'ℓ'.
3. It is also called as Angular momentum Quantum number.
4. '*l*' has integer values from 0 to (n+1) for each value of n. Where l = 0, 1, 2, 3, ….etc.
5. Azimuthal quantum number gives the shape of the sub-shell.
6. The sub shells are denote by the letters s, p, d, f, …etc.

ℓ	0	1	2	3	4
Sub shell	s	p	d	f	g

3. Magnetic Quantum Number(m_l):- 1. It was introduced by Lande.
2. It is denoted by the letter 'm_l'.
3. Magnetic Quantum number (ml) has integer values between $-l$ to $+l$ including zero.
4. For a given 'l'value the magnetic quantum number has $(2l + 1)$ integer values of m*l*
5. It gives the information about the orientation of orbital's in the presence of magnetic field.
6. For example the orientation of the p orbitals are p_x, p_y, p_z.

4. Spin Quantum Number (m_s):- 1. It was introduced by Uhlenbeck and Goudsmith.
2. It is denoted by the letter 'm_s'.
3. This quantum number refers to the two possible orientation of the spin of an electron, one clockwise (↑) and the other anticlockwise (↓) spin.
4. The spin motion of the electrons are represented by $+\frac{1}{2}$ and $-\frac{1}{2}$.

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3. State and explain with one example of Aufbau principle (Building up principle)?

Aufbau principle:- 1. According to this principle, the electron occupies the orbital having the lowest energy.

2. The energy of the orbital was calculated by the formula (n+l).

Where n= principle quantum number.

l= Angular momentum quantum number.

Example:- **Case-1:-** 1. Consider the Hydrogen atom. It has only one electron.

2. The electron enters the '1s'orbital which has the lowest energy.

3. In terms of the quantum number, the incoming electrons go to an orbital whose (n+l) is minimum.

Case-2:- 1. If two orbital's have the same (n+l) value, the orbital having lower, n, values will be occupied first.

2. For example the atomic number of the Scandium is 21.

3. Twenty electrons can be accommodated in 1s, 2s, 2p, 3s, 3p and 4s orbital's.

4. The last electron can enter into either 3d or 4p orbital.

5. The (n+l) value for these orbital's are,

Orbital	(n+l) value
3d	3+2=5
4p	4+1=5

6. Bothe two orbital's have same (n+l) value. But for '3d' orbital the 'n' value is less (n=3) compare to the 'n'value of '4p' (n=4).

7. Therefore the electron occupies the 3d orbital.

8. Thus the electronic configuration of the Sc is [Ar] $4s^2$ $3d^1$.

4. State and explain with one example of Hund's rule?

Hund's Rule:- Hund's rule states that electron pairing takes place only after all the available degenerate orbitals are occupied by one electron each.

Example:- 1. Consider a carbon atom (Z=6). It has six electrons.

2. The first electron goes into the '1s'orbital of the K-shell.

3. The second electron will be paired up with the first in the same '1s'orbital.

4. Similarly the third and fourth electrons occupy the '2s'orbital of the L-shell.

5. The fifth electron goes into one of the three '2p'orbitals of the L-shell. Let it be $2p_x$.

6. Since the three p-orbital's are degenerate (viz. $2p_x$, $2p_y$, $2p_z$), the sixth electron goes into $2p_y$ or $2p_z$ but not $2p_x$.

7. Thus the electronic configuration of carbon can be written as, $1s^2$ $2s^2$ $2p_x^1$ $2p_y^1$. (or)

5. State and explain Pauli's exclusion principle?

Pauli's exclusion principle:- Pauli's exclusion principle states that no two electrons will have all the four quantum numbers same.

Example:- 1. Consider a Helium atom (Z=2). It has two electrons.

2. The electronic configuration of Helium atom is $1s^2$.

3. If *n*, *l*, and *ml* are same for two electrons then *ms* must be different.

4. In the helium atom the spins must be paired.

5. Electrons with paired spins are denoted by '↑↓'.

6. One electron has $m_s = +\frac{1}{2}$, the other has $m_s = -\frac{1}{2}$. They have anti-parallel spins.

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8. Write the values of Angular momentum Quantum number, Magnetic quantum number, number of electrons present in the orbitals of principal quantum number '2'?

Principal quantum number	Orbital notation	Angular momentum qunatum number	Magnetic qunatum number(l) 2l + 1	Number of electrons present in the orbital
2	2s	0	0	2
	2p	1	-1, 0, +1	6

9. Write 'm'and 'l'values, for n = 1, 2, 3, 4.

n	l	m
1	0(s)	0
2	0(s)	0
	1(p)	-1, 0, +1
3	0(s)	0
	1(p)	-1, 0, +1
	2(d)	-2, -1, 0, +1, +2
4	0(s)	0
	1(p)	-1, 0, +1
	2(d)	-2, -1, 0, +1, +2
	3(f)	-3, -2, -1, 0, +1, +2, +3

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Chapter-9

Classification of Elements - The Periodic Table

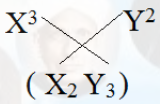
1 Mark Questions

1. How does metallic character change when we move? i. Down a group ii. Across a period. (AS1) (TQ)

i. As we move down a group from top to bottom, the metallic character of elements increases.
ii. As we move across a period, from left to right, metallic character decreases.

2. using the periodic table, predict the formula of compound formed between and element X of group 13 and another element Y of group 16. (AS2) (TQ)

1. Element X of group 13 Element Y of group 16
Valency of X = 13 Valency of Y = 18 – 16 = 2
2.Formula of the compound formed between X and Y is,



3.Define element according to Robert Boyle(1661)?

Robert Boyle defined an element as any substance that cannot be decomposed into further simple substance by a physical or chemical change.

4. What is meant by a Dobereiner's law of triads?

1. A group of three elements in which atomic weight of middle element is the average of first and third elements.
2. This statement is called the Dobereiner's law of triads.

Ex:- Li, Na, K and Ca, Sr, Ba

5. Why lanthanides and actinides are placed separately at the bottom of the periodic table?

1. The properties of these elements does not coincide with other elements because the valance electron enters in to 4f and 5f orbitals respectively.
2. So they are placed separately at the bottom of the periodic table.

6. Define modern periodic law ? How many periods and groups are present in the periodic table?

Modern Periodic Law:- "The physical and chemical properties of elements are the periodic function of the electronic configurations of their atoms".

2. The modern periodic table has eighteen vertical columns known as groups and seven horizontal rows known as periods.

7. What is meant by a Newlands' law of Octaves?

Newlands' law of Octaves:- 1. When the elements are arranged in the ascending order of their atomic weights, every eighth element starting from a given element resembles the same properties.
2. This hypothesis is called Newland's law of octaves.

8. What is the meaning of éka'?

Eka is a Sanskrit word for numeral one.

9. State Mendeleeff's periodic law?

Mendeleev's periodic law:- The properties of elements are the periodic functions of their atomic weights.

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10. Name the elements prediction of eka-boron, eka-aluminium and eka-silicon by Mendeleeff's?

1. Mendeleeff's eka-boron is Scandium(Sc).
2. Mendeleeff's eka-aluminium is Gallium(Ga).
3. Mendeleeff's eka-silicon is Germanium(Ge).

11. Mendeleev's said that "If I hold an element in my hand, it will melt". Name that element?

Gallium(Ga). Because the melting point of 'Ga' is 30.2^{o}C and our body temprature 37^{o}C.

12. What is the relation between atomic weight, equivalent weight and valence?

Atomic weight = equivalent weight × valence.

13. Name the element whose atomic number is 10 in the periodic table?

Mendelevium.

14. What is mean by a atomic number?

The number of positive charges (protons) in the atom of an element is called the atomic number of the element.

15. Sate Modern Periodic Law or Mosley's law?

The Physical and chemical Properties of the elements are the periodic functions of their atomic number or Electronic Configurations of the atoms.

16. What is a chemical family?

Chemical family:- Group of elements is called a chemical family or element family.

17. Define the word valence?

Valency:- Valency of an element was defined as the combining power of an element with another element.

18. What is meant by a groups in a periodic table?

Groups:- 1. The vertical columns in the periodic table are known as groups.
2. There are eighteen groups in long form of periodic table.
3. They are represented by using Roman numeral I through VIII with letters A and B in traditional notation.

19. What is meant by a periods in a periodic table?

Periods:- 1. The horizontal rows in the periodic table are called periods.
2. There are seven periods in the modern periodic table.
3. periods are represented by Arabic numerals 1 through 7.

20. Do you know how the name of Alkali metal family of periodic table derived?

Alkali metal family:- 1. The word alkali means plant ashes.
2. Na, K etc.... were obtained from plant ash.
3. So, group IA elements are called alkali metals family.

21. Do you know how the name of Chalcogen family of periodic table derived?

Chalcogen family:- 1. The word chalcogenous means ore product.
2. As the elements in group 16(VIA) form ores with metals.
3. They are called as chalcogenous family.

22. Do you know how the name of Halogen family(salt family) of periodic table derived?

Halogen family:- 1. Halos means sea salt and genus means produced.
2. As most of the elements in group 17(VIIA) are obtained from nature as sea salt.
3. They are called as halogen family or salt family.

23. Do you know how the name of Noble gases of periodic table derived?

Noble gases:- 1. As the elements of group 18(VIIIA) are chemically least active.
2. They are called as noble gases.
3. Their outer shell electronic configurations are basis for octet rule.

24. Which elements are called as Lanthanoids and Actinoids?

Lanthanoids:- 1. 4f elements from $_{58}$Ce to $_{11}$Lu posses almost the same properties as $_{57}$La.
2. So they were called as Lanthanoids or lanthanides.

Actinoids:- 1. 5f elements from $_{90}$Th to $_{103}$Lr posses almost the same properties as $_{89}$Ac.
2. So they were called as Actinoids or actinides.

25. What is meant by a metals and non-metals?

Metals:- The elements with three or less electrons in the outer shell are considered to be metals.
Non-Metals:- The elements with five or more electrons in the outer shell are considered to be non-metals.

26. What are transition elements?

Transition elements:- All the d- block elements (except Zn group) are known as transition elements.

27. What are inner-transition elements?

Inner- transition elements:- All the f-block elements (both Lanthanides, Actinides) are known as inner transition elements.

28. What is meant by a metalloids or semi-metals ?

Metalloids or semi-metals:- 1. Metalloids or semi-metals are elements which have properties that are intermediate between the properties of metals and non metals.
2. They possess properties like metals but brittle like non metals.
3. They are generally semi-conductors.
Eg:- B, Si, Ge etc.

29. Define atomic radius?

Atomic radius:- 1. The distance between the nucleus and outermost shell is known as atomic radius.
2. Atomic radius is measured in 'pm' (pico meter) units.

$$1 \text{ pm} = 10^{-12} \text{ m}$$

30. Define covalent radius?

Covalent radius:- half of the distance between the two atoms in covalent molecules is known as covalent radius.

31. Define ionization energy?

Ionization Energy:- 1. The energy required to remove an electron from the outer most orbit or shell of a neutral gaseous atom is called ionization energy.
2. Ionization energy is expressed in kJ/mol (or) k.cal/mol
3. Ionization energy is also called the ionization potential but when we use the term the ionization potential, it is better to write the unit ev .

32. Define electron affinity?

Electron affinity:- 1. Electron affinity of an element is defined as energy liberated when an electron is added to its neutral gaseous atom.
2. Its units are ev (or) kJ/mol (or) k.cal/mol.

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33. Define electro negativity?

Electro negativity:- The electro negativity of an element is defined as the tendency of atoms to attract electrons towards itself when it is bonded to the atom of another element.

$$\text{Electronegativity} = \frac{\text{ionization energy + electron affinity}}{2}$$

34. Name the elements which has most and least electronegativity?

The most electronegative element is 'F' and the least electronegative stable element is 'Cs'.

35. Write the names of Alkaline earth metals?

Beryllium (Be), Magnesium (Mg), Calcium (ca), Strontium (Sr), Barium (Ba) and Radium (Ra).

36. Why Zero group elements are inert towards any chemical reactions?

Because of fully filled outer most orbital's zero group elements are inert towards chemical reactions.

37. Which group elements has electronic configuration of ns^2 or ns^2 np^6 ?

VIII A group elements(Nobel gases) have the configuration of ns^2 or ns^2 np^6.

38. How does the metallic character changes in periods and groups?

1. The metallic character increases as we move along a group.

2. The metallic character decreases as we move along a period (from left to right).

39. The Element X Belongs to 4^{th} period and 5^{th} group. Write the no of valence electrons, Valence and state whether it is metal or non-metal?

X element belongs to 4th period and 5th group = Arsenic

Valence = 03

Metallic character = metalloids.

2 Mark Questions

1. Given below is the electronic configuration of elements A, B, C, D (AS1)(TQ)

A.$1S^2$ $2S^2$ B.$1S^2$ $2S^2$ $2P^6$ $3S^2$ C.$1S^2$ $2S^2$ $2P^6$ $3S^2$ $3P^3$ D.$1S^2$ $2S^2$ $2P^6$

1. Which are the elements coming within the same period?

2. Which are the ones coming within the same group?

3. Which are the noble gas elements?

4. To which group and period does the element 'C 'belong?

1. A and D elements belongs to same period because their valency shell is same(2).

   B and C elements belongs to same period because their valency shell is same (3).

2. A and B belongs to same group because they have same valency shell configuration.

3. D is the noble gas because it has octet configuration(ns^2 np^6).

4. C belongs to third period(valency shell is 3) and VA group (number of valency electron is 5).

2. Write down the characteristics of the elements having atomic number 17. (AS1) (TQ)

1. Electronic configuration. 2. Period number. 3. Group number. 4. Element family. 5. No. of valence electrons. 6. Valence. 7. Metal or nonmetal.

1. Electronic configuration = $1s^2$ $2s^2$ $2p^6$ $3s^2$ $3p^5$
2. Period number = 3
3. Group number = VII A (or) 17^{th} .
4. Element family = Halogen family.
5. No. of valence electrons = 7
6. Valence = 8-7 = 1
7. Metal or nonmetal = Non-metal.

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3. a. State the number of valence electrons, the group number and the period number of each element given in the following table? (AS1) (TQ)

Element	Valence electron	Group Number	Period Number
Sulphur			
Oxygen			
Magnesium			
Hydrogen			
Fluorine			
Aluminum			

Element	Valence electron	Group Number	Period Number
Sulphur	6	16 (or) (VIA)	3
Oxygen	6	16 (or) (VIA)	2
Magnesium	2	2 (or) (IIA)	3
Hydrogen	1	I (or) (IA)	1
Fluorine	7	17 (or) (VIIA)	2
Aluminum	3	13 (or) (IIIA)	3

b. state whether the following elements belong to a group (G), period (P) or neither group nor period (N) (AS1)

Elements	G/P/N
Li, C, O	
Mg, Ca, Ba	
BR, Cl, F	
C, S, Br	
Al, Si, Cl	
LI, NA, K	
C, N, O	
K, Ca, Br	

Elements	G/P/N
Li, C, O	period(P)
Mg, Ca, Ba	Group(G)
BR, Cl, F	Group(G)
C, S, Br	Neither group nor period(N)
Al, Si, Cl	period(P)
LI, NA, K	Group(G)
C, N, O	period(P)
K, Ca, Br	period(P)

4. Elements in a group generally possess similar properties, but elements along a period have different properties. How do you explain this statement?(AS1) (TQ)

1. According to modern periodic law, the physical and chemical properties of elements are the periodic function of their atomic number or electronic configuration.
2. That means, the elements having the similar valence electronic configuration have similar properties.
3. In a group the elements have same valence. So they posses similar chemical properties.
4. But, the valence of the elements in the same period is different.
5. So, the properties of different elements in a period is different.

5. s - block and p - block elements except 18^{th} group elements are sometimes called as 'Representative elements' based on their abundant availability in the nature. Is it justified? Why? (AS1) (TQ)

1. s - block and p - block elements except 18^{th} group elements are called 'Representative elements'.
2. All these elements have incompletely filled outer most shells.
3. So they are chemically reactive to obtain stable electronic configuration of noble gases $ns^2\ np^6$.
4. Thus, they are abundant in nature in the form of compounds.
5. So, s - block and p - block elements except 18^{th} group elements are sometimes called as 'Representative elements'.

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6. The electronic configuration of the elements X, Y and Z are given below? (AS1) (TQ)

a) X = 2 b) Y = 2, 6 c) Z = 2, 8, 2

i) Which element belongs to second period?

ii) Which element belongs to second group?

iii) Which element belongs to 18^{th} group?

i) Y belongs to second period, since, differentiating electron enter into the second shell.

ii) 'Z' belongs to second group. Because, its valence is 2.

iii) 'X' belongs to 18^{th} (or) VIIIA group because its first shell completely filled with electrons.

7. On the basis of atomic number predict to which block the elements with atomic number 9, 37, 46 and 64 belongs to? (AS2) (TQ)

1. The element with atomic number 9, belongs to Group 17(VIIA). So it belongs to P-block.
2. The element with atomic number 37, belongs to Group 1 (1A). So it belongs to S-block.
3. The element with atomic number 46, belongs to Group 19(VIIIB). So it belongs to d-block.
4. The element with atomic number 64, belongs to lanthanoids. So it belongs to f-block.

8. Name two elements you would expect to chemical reactions similar to Mg. What is the basis for your choice? (AS2)(TQ)

1. The elements which have chemical properties similar to Mg are Beryllium(Be), Calcium(Ca), Strontium(Sr), Barium(Ba) and Radium(Ra).
2. Because they belong to same group(IIA).
3. The outer most shell of these elements consists of 2 electrons.
4. We know the physical and chemical properties of the elements are depends on the number of electrons in the outer most shell.
5. All the elements which are in the same group have same electronic configuration and same chemical properties.
6. Hence we expect that Be, Ca, Sr, Ba and Ra have similar properties with Mg.

9. An element X belongs to 3rd period and group 2 of the periodic table. State (AS2) (TQ)

a) The no. of valence electrons.

b) The valency.

c) Whether it is metal or a non-metal.

An element X belongs to 3^{rd} period and group 2 is Mg.

a) The no. of valence electrons = 2

b) The valency of atom = 2

c) It is a metal.

Explanations:- 1. The element belongs to IIA group element and has two valency electrons.

2. It always try to loss two valency electrons to get octet configuration.
3. More over is present in the left side of the periodic table.
4. So, it is a metal.

10. An element has atomic number 19. Where would you expect this element in the periodic table and why? (AS2) (TQ)

1. Atomic number of the element =19
2. Arrangement of these 19 electrons is 2, 8, 8, 1.
3. So, the differentiating electron enters into 4^{th} shell.
4. So, the element belongs to 4^{th} period.
5. The no. of valence electrons = 1.
6. So it belongs to 1^{st} group
7. Hence the element with atomic number 19 belongs to 4^{th} period and IA group.

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11. How do you appreciate the role of electronic configuration of the atoms of elements in periodic classification? (AS6) (TQ)

1. According to modern periodic law, the properties of elements are the periodic function of their atomic number or electronic configuration.
2. So, the modern periodic table is classified depending upon the electronic configuration of an atom.
3. The elements having same outer shell electronic configuration are kept in the same group.
4. The elements have same chemical properties.
5. It is easy to predict the chemical properties of the elements which are in the same group.
6. So, I appreciate the role of electronic configuration of the atoms of elements in periodic classification.

12. Complete the following table by using the periodic table. (AS1)(TQ)

Period Number	Filling up orbital's (Sub-shell)	Maximum number of electrons filled in all the sub-shell	Total number of electrons in the period
1			
2			
3			
4	4S, 3d, 4P	18	18
5			
6			
7	7S, 5f, 6d, 7P	32	Incomplete

Period Number	Filling up orbital's (Sub-shell)	Maximum number of electrons filled in all the sub-shell	Total number of electrons in the period
1	1S	2	2
2	2S, 2P	8	8
3	3S, 3P	8	8
4	4S, 3d, 4P	18	18
5	5S, 4d, 5P	18	18
6	6S, 4f, 5d, 6P	32	32
7	7S, 5f, 6d, 7P	32	Incomplete

13. Complete the following table using the periodic table? (AS1)(TQ)

Period number	Total no. of electrons	Elements		Total number of electrons in			
		From	to	S-block	P-Block	d-lock	f-Block
1							
2							
3							
4							
5							
6							
7							

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Period number	Total no. of electrons	Elements		Total number of electrons in			
		From	to	S-block	P-Block	d-lock	f-Block
1	2	H	He	2	-	-	-
2	8	Li	Ne	2	6	-	-
3	8	Na	Ar	2	6	-	-
4	18	K	Kr	2	6	10	-
5	18	Rb	Xe	2	6	10	-
6	32(18+4)	Cs	Rn	2	6	10	14
7	Incomplete	Fr	---	2	Incomplete	7	14

14.Comment on the position of hydrogen in periodic table? (AS7) (TQ)

1. The atomic number of the hydrogen is 1. Its electronic configuration is $1s^1$.
2. Hydrogen can losses one electron and behave electropositive ion (H^+) like alkali metals.
3. Hydrogen can gain one electron and behave electronegative element (H^-) like halogens.
4. Its properties resembles with both Alkali metals (IA) and halogens (VIIA) because it can lose one electron like alkali metals as well as gain one electron as halogens
5. So, it is placed at the top of both alkali metals and halogens.

15. Identify the element that has the largest atomic radius in each pair of the following and mark it with a symbol (✓). (AS1) (TQ)

(i) Mg or Ca (ii) Li or Cs (iii) N or P (iv) B or *Al*

i) Mg or Ca:- Ca (✓) has larger atomic radius than Mg.

Reason:- 1. Since Mg and Ca belongs to same group and the atomic number of Ca is more than Mg in that group.
2. As we move top to bottom in a group atomic radius increases.

ii) **Li or Cs:-** Cs (✓) has larger atomic radius than Li.

Reason:- 1. Since Li and Cs belongs to same group and the atomic number of Cs is more than Li in that group.
2. As we move top to bottom in a group, atomic radius increases.

iii) **N or D:-** P (✓) has larger atomic radius than N.

Reason:- 1. Since N and P belongs to same group and the atomic number of P is more than N in that group.
2. As we move top to bottom in a group, atomic radius increases.

iv) **B or *Al*:-** *Al* (✓)has larger atomic radius than B.

Reason:- 1. Since B and Al belongs to same group and the atomic number of Al is more than B in that group.
2. As we move top to bottom in a group, atomic radius increases.

16. In period 2, element X is to the right of element Y. Then, find which of the elements have:

i) Low nuclear charge (AS1) (TQ)
ii) Low atomic size
iii) High ionization energy
iv) High electronegativity
v) More metallic character

i) In a period, nuclear charge increases from left to right so, Y has low nuclear than X.

ii) In a period, atomic radius decreases from left to right so, X has low atomic radius than Y.

iii) In a period, ionization energy increases from left to right so, X has high ionization energy than Y.

iv) In a period, electro negativity increases from left to right so, X has high electro negativity value than Y.

v) In a period, metallic character decreases from left to right so, Y has more metallic character than X.

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17. On the basis of atomic numbers predict to which block the elements with atomic number 9, 37, 46 and 64 belongs to? (AS2) (TQ)

1. The elements with atomic number a, belong to group 17 (VIIA). So, it belongs to p-block.
2. The element with atomic number 37, belongs to Group 1(IA). So, it belongs to s-block.
3. The elements with atomic number 46, belongs to Group10 (vIIB). So, it belongs to d-block.
4. The elements with atomic number 64, belongs to Lanthanides. So, it belongs to f-block.

18. Write the limitations of Dobernier law of triads?

Limitations:- 1. All the then known elements could not be arranged in the form of triads.
2. The law failed for very low mass or for very high mass elements.
3. In case of F, Cl, Br, the atomic mass of Cl is not an arithmetic mean of atomic masses of F and Br.
4. As the techniques improved for measuring atomic masses accurately, the law was unable to remain strictly valid.

19. What is ionization energy ? What are the factors influence it?

Ionization Energy:- 1. The energy required to remove electron from the outer most orbit or shell of a neutral gaseous atom is called ionization energy.
2. The following factors are influenced on Ionization energy.
   a) Nuclear Charge b) Screening Effect c) Penetrating power of the orbitals
   d) Stable configuration e) Atomic Size

20. Write the Newlands law of octaves and drawbacks of this rule?

1. Newlands law of octaves states that when elements are arranged in the ascending order of their atomic masses they fall into a pattern in which their properties repeat at regular intervals.
2. Every eighth element starting from a given elements resembles in its properties to that of the starting element.
3. Certain elements, totally dissimilar in their properties, were fitted into the same group.
4. The law was not valid for elements that had atomic masses higher than Calcium.
5. Newland's periodic table was restricted to only 56 elements.

21. How do the following properties change in Groups and periods?

a) Ionisation Energy b) Electronic affinity c) metallic and non-metallic nature

a) Ionisation Energy :-

Period : When we move from left to right it does follow a regular trend but generally increases due to increase in atomic number.

Group:- In groups from top to bottom, the ionization energy decrease due to increase in atomic size.

b) Electronic affinity:-

Period:- Electron affinity values increases from left to right in a period.

Group:- Electron affinity values decrease from top to bottom in a group.

c) Metallic and Non-metallic nature:-

Period:- Metallic nature decrease from left to right in a period and increase non-metallic nature.

Group:- Metallic nature increase from top to bottom in a group.

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4 Mark Questions

1. Newlands proposed the law of octaves. Mendeleeff suggested eight groups for elements in his table. How do you explain these observations in terms of modern periodic classification? (AS1) (TQ)

1. Newlands proposed the law of octaves. His classification is very well suitable for representative (IA to VIIA) elements up to Calcium.
2. According to Newland's law of octaves, every eighth elements starting from a given one be a repetition of the first with regard to its properties.
3. In Newland's table Hydrogen(1^{st} lement), Fluorine(8^{th} element) and chlorine (next coming 8^{th} element) shows a common electronegative valence is 1.
4. Similarly Lithium, Sodium and Potassium shows a common electropositive valence 1 and Beryllium, Magnesium and Calcium shows a common electropositive valency 2.
5. Mendeleeff also classified the elements into eight groups based on their common valency with respect to oxygen.
6. In Mendaleeff's periodic table , group number signifies the valence of the element belongs to that group if Oxygen is taken as standard.

Group	**I**	**II**	**III**	**IV**	**V**	**VI**	**VII**	**VIII**
Valency with respect to Oxygen	1	2	3	4	5	6	7	8
Formula of Oxide	R_2O	RO	R_2O_3	RO_2	R_2O_5	RO_3	R_2O_7	RO_4

7. Thus, both Newland and Mendanleeff's classify the elements similar to modern periodic classification based on their valence.

2. What are the limitations of Mendeleeff's periodic table? How could the modern periodic table overcome the limitations of Mendeleeff's table? (AS1) (TQ)

Limitations of Mendeleeff's periodic table:-

1) Position of Hydrogen:- 1. Hydrogen is placed in group IA.
2. However, it resembles the elements of group IA(alkalimetals) as well as the elements of group VIIA(Halogens).
3.Therefore the position of Hydrogen is not correctly defined in Mendaleeff's periodic table.

2) Anomalous pair of elements:- 1. In certain pairs of elements, the increasing order of atomic masses was not obeyed.
2. In these cases Mendaleeff placed the elements according to similarities in their properties but not in increasing order of their atomic masses.
3. For example Tellurium (atomic weight 127.6) is placed before Iodine(atomic weight 126.9).

3) Dissimilar elements placed together:- 1. Elements with dissimilar properties were placed in same group as sub-group A and sub-group B.
2. For example, elements of IA such as Li, Na and K were grouped with coinage metal like Cu, Ag and Au, though their properties are quite different.

4) Some similar elements are separated:- Some similar elements like 'copper and mercury' 'Silicon and thallium', etc, are placed in different groups of periodic table.

5) Position of Isotopes:- According to Mendeleeff's classification, isotopes should be placed at different places depending upon their atomic masses.
2. For example, isotopes of Hydrogen $_1H^1$, $_1H^2$, $_1H^3$ should be placed in three different places.

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Modern periodic table overcome the limitations of the Mendeleeff's table in the following way:-

1. Hydrogen is placed in IA group according to its electronic configuration.
2. The position of anomalous pairs can justify on the basis of increasing atomic number. (atomic number of Te is 52 and I is 53).
3. Dissimilar elements were placed in different groups in modern periodic table based on their valence shell configuration.
4. Copper and Mercury come in different groups according their electronic configuration.
5. All the isotopes of same element have same atomic number. So all Isotopes are placed in same group as a single element in modern periodic.

3. Define modern periodic law. Discuss the construction of the long of the periodic table? (AS1) (TQ)

Modern periodic law:- The Physical and chemical Properties of the elements are the periodic functions of their atomic number or electronic configuration.

Discription of long form of the periodic table:-

1. In a modern periodic table, the elements are arranged in increasing order of their atomic number.
2. The modern periodic table has eighteen vertical columns known as groups and seven horizontal rows known as periods.

Groups:-

3. There are 18 groups in the long form of the periodic table. They are represented by Roman numeral I to VIII as A and B groups.
4 According to the IUPAC, these groups are numbered from 1 to 18.
5. A group of elements is also called as element family or chemical family.

Group	Name of the family
IA	Alkalimetal family
IIA	Alkaline earth metal family
IIIA	Boron family
IVA	Carbon family
VA	Nitrogen family
VIA	Chalcogen family
VIIA	Halogen family
VIIIA	Noble gas family

6. Depending upon the last coming electron enters in the atom of the given element, the elements are classified as 's' 'p', 'd' and 'f' block elements.
7. s and p block elements are known as representative elements.
8. d- block elements are called Transition elements.
9. f-block elements are called Inner Transition elements.

Periods:-

10. The horizontal rows in the periodic table are called periods. They are seven periods in form of periodic table.
11. These periods are represented by Arabic numerals 1 through 7.
12. They are only two elements in first period e.g., hydrogen (H) and helium (He).
13. They are only Eight elements in Second and Third periods.
14. The fourth and 5_{th} period contains 18 elements.
15. The 6_{th} period contains 32 elements.
16. The seventh period is incomplete period.
17. Lanthanoids and actinoids are placed separately at the bottom of the periodic table.

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4. Explain how the elements are classified into s, p, d and f block elements in the periodic table and give the advantages of this kind of classification? (AS1) (TQ)

Depending on the valency shell electronic configuration the elements are classified into s, p, d and f block.

s-block elements:- 1. The elements in which the last electron enters the s-orbital of their outer most energy level is called s-block elements.
2. Its valence shell electronic configuration is ns^1 and ns^2 .
3. The elements of group IA and IIA belongs to s-block.
4. Execept hydrogen all the s-block elements are metals.

p-block elements:- 1. The elements in which the last electron enters the p-orbital of their outer most energy level is called p-block elements.
2. Its valence shell electronic configuration is $ns^2\ np^{1-6}$.
3. The elements of group IIIA and VIIIA belongs to p-block.
4. p-block contains metals, non-metals and metalloids.

s and p block elements are known as representative elements.

d-block elements:- 1. The elements in which the last electron enters the d-orbital of their outer most energy level is called d-block elements.
2. Its valence shell electronic configuration $ns^{1 \text{ or } 2}\ (n-1)d^{1-10}$ are called d-block elements.
3. The elements of group IB to VIIIB belongs to d-block.
4. All the d-block elements are metals.
5. d-block elements are placed in between the s-block p-block elements.
6. These are known as Transition elements.

f-block elements:- 1. The elements in which the last electron enters the f-orbital of their outer most energy level is called f-block elements.
2. Its valence shell electronic configuration is $(n-2)\ f^{1-14}\ (n-1)\ d^{0-1}\ ns^2$.
3. These are known as Inner Transition elements.
4. Lanthanoids and actinoids are belongs to f-block elements.

Advantage:- 1. The division of elements into s, p, d, and f blocks is helpful to study the properties of the elements easily.
Ex:- All s-block elements are soft and reactive metals.
2. Every group has the elements with same valence electronic configuration. So they have similar chemical properties.

5. Why was the basis of classification of elements changed from the atomic mass to the atomic number? (AS1) (TQ)

1. Generally elements are classified into various groups based on their chemical properties.
2. We know that the chemical properties of the elements depending upon the number of valency electrons present in the atom.
3. The elements which have same electrons in their valency shell shows similar chemical properties.
4. The property of different elements can be compared if we know their atomic numbers.
5. On the other hand the elements which have same atomic masses (Ar^{40}, Ca^{40} and Co^{59} and Ni^{59}) shows different chemical properties.
6. This means the chemical properties of the elements do not depending on their atomic masses.
7. Moreover, determination of atomic mass is not accurate.
8. Atomic number is considered as fundamental property of an atom than the atomic mass.
9. Because no two elements will not have same atomic number.
10. So, the basis, of the classification of elements changed from atomic mass to the atomic number.

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6. Identify the element that has the lower Ionization energy in each pair of the following and mark it with a symbol (✓). (AS1) (TQ)

(i) Mg or Na (ii) Li or O (iii) Br or F (iv) K or Br

i) Mg (or) Na:- Na (✓) has low ionization energy than Mg.

Reason:- 1. Since Na and Mg belongs to same period and Na is present left to Mg in that period.
2. As we move left to right across the period ionization energy increases.

ii) **Li (or) O** – Li (✓)has low ionization energy than O.

Reason:- 1. Since Li and O belongs to same period.
2. As we move left to right across the period ionization energy increases.

iii) **Br (or) F**:- Br (✓)has low ionization energy than F.

Reason:- 1. Since Br and F belongs to same group and the atomic number of Br is more than F in that group.
2. As we move top to bottom in a group ionization energy decreases.

iv) **K (or) Br**:- K (✓)has low ionization energy than Br.

Reason:- 1. Since K and Br belongs to same period and K is present left to Br in that period.
2. As we move left to right across the period ionization energy increases.

7. a) What is a periodic property? How do the following properties change in a group and period? Explain?

a) Atomic radius b) Ionization energy c) Electron affinity d) Electro negativity.

(b) Explain the ionization energy order in the following sets of elements:

a) Na, Al, Cl b) Li, Be, B c) C, N, O d) F, Ne, Na e) Be, Mg, Ca.

Periodic property:- The property of an element which is related and repeated according to electronic configuration of the atoms of elements is known as periodic property.

a) Atomic radius:- The distance between the centers of the nucleus to the outermost shell of an atom is called atomic radius.

In a groups:- Atomic radius increases from top to bottom in a group.
In a periods:- Atomic radius decreases from left to right in a period.

b) Ionization energy:- The energy required to remove an electron from the outer most orbit of a neutral gaseous is called ionization energy.

In a groups:- Ionization energy decreases as we go, down in a group.
In a periods:- Ionization energy generally increases from left to right in period.

c) Electron affinity:- The electron affinity of an element is defined as the energy liberated when an electron is added to its neutral gaseous atom.
In a groups:- Electron affinity decreases as we go down in a group.
In a periods:- Electron affinity increases along a period from left to right.

d) Electro negativity:- The electro negativity of an element is defined as the relative tendency of its atom to attract electrons towards it when it is bounded to the atoms of another element.
In a groups:- Electro negativity decreases as we go down in a group.
In a periods:- Electro negativity increases along a period from left to right.

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ii) **a) Na, Al, Cl:-** 1. All these elements belong to same period.
2. The order of their atomic size is Na > Al > Cl.
3. As we move from left to right in a period Ionization energy increases.
∴ The order of ionization energy of these elements are Cl > Al > Na.

b) Li, Be, B :- 1. All these elements belong to same period.
2. The electronic configuration of Li – $1s^2\ 2s^2$; Be- $1s^2\ 2s^2$; B- $1s^2\ 2s^2\ 2p^1$
3. The penetration power of 2p is less compared to 2s. So, it is easy to remove electron from 2p.
∴ The order of ionization energy of these elements are Be > Li > B.

c) **C, N, O :-** 1. All these elements belong to same period.
2. The electronic configuration of c – $1s^2\ 2s^2\ 2p^2$: N- $1s^2\ 2s^2\ 2p^3$; O – $1s^2\ 2s^2\ 2p^4$
3. Nitrogen has half filled configuration in degenerated orbital.
4. So, it is more stable compare to C & O, so, N has high ionization energy.
∴ The order of ionization energy of these elements are N > C > O.

d) **F, Ne, Na**:- 1. Ne is an inert gas, so it has highest ionization energy.
2. Na has larger size compare to F. So, it has low ionization energy.
∴ The order of ionization energy of these elements are Ne > F > Na.

e) **Be, Mg, Ca**:- 1. These elements belongs to same group the atomic size of these elements is in the order of Ca > Mg > Ba.
2. As atomic size increases ionization energy decreases.
∴ The order of ionization energy of these elements are Be > Mg > Ca.

8. Aluminum does not react with water at room temperature but reacts with both dil. HCl and NaOH solutions. Verify these statements experimentally. Write your observations with chemical equations. From these observations, can we conclude that Al is a metalloid? (AS3) (TQ)

1. Metalloids are elements which resemble both metals and non-metals.
2. The valence shell of metalloids contain 3, 4, 5, 6 elements starting from periods 2 to 5 respectively.
3. Al belongs to 3rd period. It contains 3 valence electrons.
4. So, it is not a metalloid as it contains 3 valence electrons instead of 4.
5. Al doesn't react with water at room temperature. But it reacts with water at high temperature.
$$2Al + 6H_2O \rightarrow 2Al(OH)_3 + 3H_2$$
6. Al reacts with dil Hcl & liberates Hydrogen gas
$$2Al + 6\ HCl \rightarrow 2AlCl_3 + 3H_2\uparrow$$
7. Al reacts with dil NaOH and liberates hydrogen gas
$$2Al + 2NaOH + 6\ H_2O \rightarrow [Na_2\ Al(OH)_4] + 3H_2\uparrow$$
8. From the above reactions, we conclude that all react with both acids as well as bases. So, it is amphoteric.

9. Collect the information about reactivity of VIIIA group elements (noble gases) from internet or from your school library and prepare a report on their special character when compared to other elements of periodic table. (AS4) (TQ)

1. Helium(He), Neon(Ne), Argon(Ar), Kripton(Kr), Xenon(Xe) and Radon(Rn) are called VIIIA group elements.
2. The VIIIA group elements are chemically inactive.
3. All of them have stable "octet" in their valence shells except helium.
4. The noble gases have high ionization energy and zero electron affinity values.
5. Consequence to this loosing or gaining an electron or sharing of electrons is difficult.
6. But some compounds of these gases have been prepared under suitable conditions.

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7. Xenon (Xe) shows a tendency to lose an electron and exist in a positive oxidation state.
8. Therefore it reacts with highly electronegative elements like F_2 & O_2 only .

Ex:- XeO_3, XeO_4; XeF_2, XeF_4.

10. Collect information regarding metallic character of elements of IA group and prepare report to support the idea of metallic character increases in a group as we move from top to bottom?(AS4) (TQ)

1. The tendency of an element to lose electron and form positive ions is called metallic character.
2. The elements to the left of the periodic table i.e., IA group have greater tendency to lose electrons so, they are strong metals.
3. Li, Na, K, Rb, Cs (IA) are strong metals as they lose one electron and posses high reactivity.
4. As we go down in a group the atomic size increases and electrons in the outer shell experiences less nuclear attractions and so can lose electron easily thus increased metallic character.
5. Ionization energies decreases from LI to Cs and atomic radius increases from Li to Cs in IA group.
6. So, metallic character increases from Li to Cs in IA group.

11. Without knowing the electronic configurations of the atoms of elements Mendeleev still could arrange the elements nearly close to the arrangements in the Modern periodic table. How can you appreciate this? (AS6) (TQ)

1. Mendeleeff arranged the element known at that time in a chart in a systematic order in the increasing order of their atomic weight.
2. Mendeleeff tried to explain the similarities of elements in the same group in terms of their common valency.
3. Elements present in a given vertical column (group) have similar properties.
4. Each group is divided into 2 sub- group A and B. The elements within any sub group resemble each other to great extent.
5. A period comprises the entire range of elements after which properties repeat themselves.
6. There are 7 periods in the Mendeleeff's periodic table.
7. Based on the arrangements of the elements in the table he predicted that some elements were missing and left blank spaces at the appropriate places in the table.
8. His predicted properties were almost the same as the observed properties of those elements after their discovery.
9. In this way, without knowing the electronic configuration of the atoms of elements Mendeleeff still could arrange the elements nearly close to the arrangements in the modern periodic table.
10. Hence, I appreciate the effort of Mendeleeff.

12. How the positions of elements in the periodic table help you to predict its chemical properties? Explain with an example? (AS7) (TQ)

Position of elements in the periodic table helps us to predict their chemical properties.

1. The elements which are almost left in the periodic table are metals and highly reactive.
   Ex: Li, Na, K, Mg & Ca etc, are left in the periodic table these are metals and highly reactive.
2. The elements which are right in the periodic table are non-metals and gases.
   Ex: O, F, Cl, S etc, are right in the periodic table. These are non metals.
3. The elements which are in the 18^{th} group are noble gases and inert for chemical reactions.
   Ex: He, Ne, Ar etc, are noble gases which are in 18^{th} group (VIIIA). These are inert for chemical reactions.

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13. a) Why the elements are classificed :
b) What is the properity has to taken for classifying the elements by mendeleeff.
c) In mendeleefs periodic table some gaps are not filled by the elements ? Why?

a) They approximately more than 115 elements. We cannot easily understand chemical and physical properties of it. So there is a necessicity to classify the elements.

b) Mendeleeff's states that the physical and chemical properties of the elements are a periodic function of their atomic weights".

c) Based on the arrangement of the elements in the table he predicted that some elements were missing and left blank spaces at the appropriate places in the table. Mendeleff believed that some new elements wouldbe discovered definitely.

14. How do you appreciate the role of electronic configuration of the atoms of elements in periodic classification ?

1. Modern periodic table is based on electronic configuration. So elements are arranged in ascending order of their atomic number.
2. The chemical properties of elements depends on valence electrons the elements in same group has same number of valence electrons. So the elements belongs to same group have similar properties.
3. So the construction of modern periodic table mainly depends on electronic configuration.
4. Certain elements of highest atomic mass precede those with lower atomic mass. This type of Anomalous pair of elements are also rectified in Modern periodic table.
5. Hence electronic configuration play a major role in the preparation of Modern periodic table. So it is appreciated.

Periodicity

The simple technique to find out the Periodic Properties is as follows.

The simple technique was READ P-hysics.

Where, R ⟹ Stands for Reducing Nature.
E ⟹ Stands for Electro positivity.
A ⟹ Stands for Atomic size.
D ⟹ Stands for Decreases. (In)
P ⟹ Stands for Periods.

It means the three periodic properties like Reducing nature, Electro positivity and size are decreases in periods, increases in groups.

The remaining periodic properties are opposite to the above properties. I.e. Ionization energy, Electron affinity, Electro negativity and oxidising nature are increases in periods and decreases in groups.

READ P-hysics.

S.No	Atomic property	Periods (left to right)	Groups (top to bottom)
1	Reducing nature	Decreases	Increases
2	Electro positivity	Decreases	Increases
3	Atomic size	Decreases	Increases
4	Ionization energy	Do not follow any regular trend.	Decreases
5	Electron affinity	Increases	Decreases
6	Electro negativity	Increases	Decreases
7	Oxidising nature	Increases	Decreases

NOTE:- Don't confuse E-stands for Electro positivity but not Electro negativity or Electron affinity.

Chapter-10

CHEMICAL BONDING

1 Mark Questions

1. What is meant by a chemical bond?

Chemical bond:- The force of attraction between any two atoms or a group of atoms that results a stable entity is called a 'chemical bond'.

2. What are the affected and unaffected ones during the bond formation?

1. The nucleus and the electrons in the inner shell remain unaffected when atoms come close together.
2. But the electrons in the outermost shell (valence shell) of atoms get affected.

3. What is meant by Lewis symbol or electron dot structure?

1. The valence electrons in the atom of an element is depicted in a short form by Lewis symbol or electron dot structure.
2. We represent the nucleus and inner shell electrons of the atom by the symbol of the element and electrons in the outer shell by dots or cross marks.

4. Who proposed the electronic theory of valence?

Kossel and Lewis in 1916.

5. What is meant by a Kernel?

Kernel:- Kernel is the nucleus and all other electrons in the atom except the outer most shell electrons.

6. Who proposed the electrostatic bond?

Kossel proposed the ionic bond (electrostatic bond).

7. Define the term ionic bond?

Ionic bond:- Transfer of electrons from one atom to another atom leads to ionic bond.

8. Give example for ionic compounds?

Sodium chloride ($NaCl$), Magnesium chloride ($MgCl_2$), Aluminium chloride ($AlCl_3$).

9. Define Co-ordination Number?

Co-ordination Number:- Number of ions of opposite charges that surrounds a given ion in a crystal is known as co-ordination number.

10. Why ionic bond is also called as electrostatic bond or electrovalent bond?

1. We know ionic bond is formed between two charged particles known as ions.
2. Sometimes based on the forces being electrostatic, the bond is also called the electrostatic bond.
3. As the valence concept has been explained in terms of electrons, it is also called the electrovalent bond.

11. What is meant by a group number or valence?

Group number:- The number of electrons lost from a metal atom is the valence of its element which is equal to its group number.

Ex:- Na and Mg have valence 1 and 2 respectively.

12. What is the structure of NaCl?

NaCl is said to possess face centred cubic lattice crystal structure.

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13. What is meant by a cation and anion?

Cation:- A positively charged ion is called a cation.

Ex:- $_{11}Na \rightarrow 2, 8, 1$; $_{11}Na^{+} \rightarrow 2, 8.$

Anion:- A negatively charged ion is called a anion.

Ex:- $_{17}Cl \rightarrow 2, 8, 7$; $_{18}Cl^{-} \rightarrow 2, 8, 18.$

14. What are the factors that affecting the cations and anions?

The tendency of losing electrons to form cations (or) gaining electron to form anions depends on the following factors.

1. Atomic size.
2. Ionisation potential.
3. Electron affinity.
4. Electronegativity.

15. Write the conditions that are favourable for the formation of cations?

The atoms of elements with low conisation energy, low electron affinity high atomic size and low electro negativity form cations.

16. Write the conditions that are favourable for the formation of anions?

The atoms of elements with high ionisation potential, high electron affinity, small atomic size and high electro negativity form anion.

17. What is meant by a covalent bond? Who proposed this concept?

Covalent bond:- The sharing of electrons between two atoms leads to covalent bond.

18. Give examples for covalent compounds?

Oxygen molecule (O_2), Nitrogen molecule (N_2), Methane molecule (CH_4), Ammonia molecule (NH_3), water molecule (H_2O).

19. What is meant by a double bond? Give one example?

Double bond:- The sharing of two pairs of electrons between two atoms in a covalent bond is called double bond.

Ex:- Formation of O_2.

20. What is meant by a triple bond? Give one example?

Triple bond:- The sharing of three pairs of electrons between two atoms in a covalent bond is called triple bond.

Ex:- Formation of N_2.

21. Explain the difference between the valence electrons and the covalence of an element ?

Valence electrons:- The electrons present in the outer most orbit of an atom are called valence electrons.

Covalency:- The total number of covalent bonds that an atom of an element forms is called its covalency.

22. Write the draw backs of electronic theory of Valency?

Draw backs of electronic theory of Valency:- 1. It cannot explain the shapes of molecules.
2. It cannot explain the bond angles of molecules.
3. It explains the reactivity of inert gas elements.

23. Who proposed the quantum mechanical model of an atom(valence bond theory)?

Linus Pauling (1954).

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24. What is VSEPRT (theory) ? Who proposed it ?

1. To explain the bond angles in the molecules through covalent bonds the valence-shell-electron Pair repulsion theory was proposed.
2. This theory was proposed by Sidgwick and Powell (1940) and improved by Gillespie (గిలెస్పీ) and Nyhlom (నైహోమ్) (1957).

25. What is meant by an end-on-end overlap or Sigma (σ) bond?

Sigma (σ) bond:- 1. In the end-on-end type of overlap, the end part of an orbital overlaps with the end part of another orbital.
2. The resultant bond formed by such an overlap is called Sigma (σ) bond.
3. Sigma bond can exist independently. So it is a strong bond.

26. What is meant by a side on overlap or pi (π) bond?

Pi (π) bond:- 1. In side on overlap an orbital overlaps with another side ways.
2. the bond formed by such an overlap is called 'pi'bond designated as 'π'.
3. Pi (π) bond is a weak bond than sigma **(σ)** bond.

27. Who proposed hybridization?

Hybridisation of atomic orbital's' was proposed by Linus Pauling (1931).

28. What is hybridization?

Hybridization:- The process of mixing of atomic orbital's of nearly same energy to produce a set of entirely new orbital's of equivalent energy is known as hybridisation.

29. Give examples of elements which are stable in their atomic state ?

Helium, Neon, Argon, Krypton, Xenon, Radon are stable in their Atomic state.

30. Why the Noble gases are least reactive?

Except Helium other Noble gases have eight electrons in their outer most shell. i.e., why Noble gases are least reactive.

31. What is octet rule?

Octet rule:- The outer most shell having the eight electrons is called octet rule.

32. Why is the chemical formula of water is H_2O why not HO_2 ?

1. The valence of Hydrogen = 1.
2. The valence of oxygen = 2.
3. So two Hydrogen atoms shares their electron with one oxygen atom.
4. Hence the chemical formula of water is H_2O.

33. Name the bond formed between Alkali metals and Halogens?

Ionic bond is formed between Alkali metals and Halogens.

34. What type of bond is formed in 17^{th} group / VII A group elements?

Covalent bond

35. What is coordination number? Write the coordination number of sodium chloride?

1. The number of ions of opposite charge that surround a given ion of given charge is known as co-ordination number.
2. Co-ordination number of solid sodium chloride is 6.

36. Bond length of F_2 is 1.44 A°. What does it mean?

The equilibrium distance between the nuclei of two fluorine atoms is 1.44 A^0.

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37. The Bond dissociation energy of H – F molecule (Hydrogen fluoride) molecule is 570 KJ mol^{-1}. What does it mean?

570 KJ mol^{-1} energy is needed to break the covalent bond of hydrogen fluoride molecule.

38. Why the bond angle reduced in water molecule?

1. In water molecule, the central atom oxygen has two lone pair and two bond pair of electrons.
2. Due to lone pair Lone pair electron repulsions bond angle reduced to minimize the repulsion forces.

39. Why do some elements and compounds reach vigorously while other is inert?

Elements which do not have octet configuration in there valence shell react vigorously with other elements and which have octet in their valence shell chemically inert in nature.

40. Define co – ordination number?

Co – ordination number:- The number of oppositely charged ions covered a given ion of given charge is known as co – ordination number.

41. What is the bond angle in a molecule?

It is the angle subtended by two imaginary lines that pass from the nucleus of two atoms which from the covalent bonds with the central atom through the nucleus of the central atom at the central atom.

2 Mark Questions

1. List the factors that determine the type of bond that will be formed between two atoms? (AS1) (TQ)

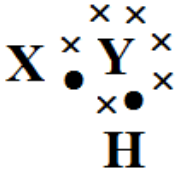
The factors that determine the type of bond is as follows. They are,

1. The force of attraction or repulsion between the electrons and protons.
2. Number of valence electrons present in the valence shell of the atom
3. Electro negativity.
4. Atomic size
5. Ionization potential
6. Electron affinity.

2. Explain the difference between valence and covalence? (AS1) (TQ)

Valence electrons	Covalence
1. Number of electrons present in the valence shell is known as valence electrons.	1. The capacity of atoms to neither gain, nor loose or share electrons is known as covalence.
2. Number of valence electrons is equal to the group number of the atom.	2. Covalence is equal to the number of electrons participate in the bonding.
3. Valence electrons number is always a positive integer	3. Covalence may be positive or negative.
4. Ex:- The valence of Sodium is 1.	4. Ex:- The covalence of Hydrogen is 1.

3. A chemical compound has the following Lewis notation:



a) How many valence electrons does element Y have?
b) What is the valence of element Y?
c) What is the valence of element X?
d) How many covalent bonds are there in the molecule?
e) Suggest a name for the elements X and Y.

a) Six (6)
b) Two (2)
c) One (1)

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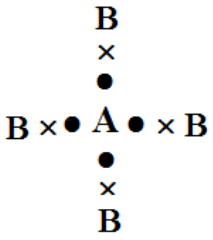
d) Two (2)
e) Element X = hydrogen ($_1H^1$)
Element Y = Oxygen ($_8O^{16}$) The formed molecule may be H_2O.

4. A chemical compound has the following Lewis notation:-



A) Write the valence electrons of A.
B) Write the valence electrons of B.
C) How many covalent bonds are there in the molecule?
D) Suggest a name for the elements A and B.

A) 4
B) 1
C) 4
D) CH_4

5. Why do only valence electrons involve in bond formation? Why not electron of inner shell? Explain? (AS1) (TQ)

1. The electrons present in the outermost orbital of an atom are known as valence electrons.
2. They are very active.
3. They are weakly attracted to the nucleus. So that involves a chemical bond formation
4. Electrons present in the inner shells cannot participate in bond formation.
5. Because the electrons present in the inner shells are strongly attracted by nucleus .
6. The electrons present in the inner shells are stable.

6. A,B and C are three elements with atomic number 6, 11 and 17 respectively?(AS1) (TQ)

i) Which of these cannot form ionic bond? Why?
ii) Which of these cannot form covalent bond?
iii) Which of these can form ionic as well as covalent bonds?

Here given elements are, A – Carbon ($_6C^{12}$)
B – Sodium ($_{11}Na^{23}$)
C – Chlorine ($_{17}Cl^{34}$)

i) 1. A – Carbon ($_6C^{12}$) forms covalent bonds and cannot form ionic bond.
2. Because its valence is 4. So, it is difficult to lose or gain 4 electrons to get octet configuration.
3. But it forms a covalent bond by sharing of electrons.

ii) 1. B – Sodium ($_{11}Na^{23}$) forms ionic bond and cannot form covalent bonds.
2. It valence is 1. So, it is easy to donate that one electron to get noble gas configuration.
3. So, it can form ionic bond by losing of one electron.

iii). The atomic number of Chlorine is 17. i.e. 'C' can form ionic as well as covalent bond.

7. Predict the reasons for low melting point for covalent compounds when compared with ionic compounds? (AS2) (TQ)

1. In ionic compounds the ions are bounded by strong electrostatic force of attractions.
2. Therefore they are strong solids with high melting points and boiling points.
3. In covalent compounds the atoms are bounded by weak forces.
4. Therefore covalent compounds are gases and liquids at room temperature.
5. Hence covalent compounds have low melting and boiling points.

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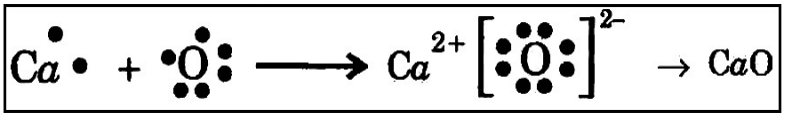
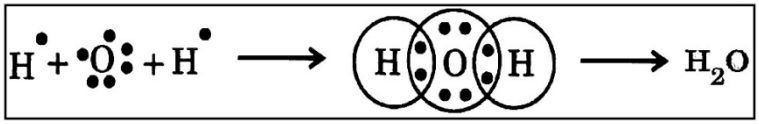
8. Draw simple diagrams to show how electrons are arranged in the following covalent molecules:
a. Calcium oxide (CaO) b. Water (H_2O) c. Chlorine (Cl_2) (AS5) (TQ)

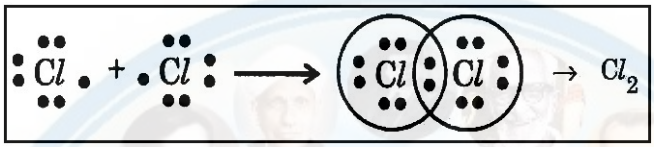
a. <u>Calcium oxide (CaO):</u> Calcium atom has two valence electrons and Oxygen has six valence electrons.



b. <u>Water (H_2O)</u>:- Each Hydrogen atom has one valence electron and Oxygen has six valence electrons.



c. <u>Chlorine (Cl_2):</u> Each Chlorine atom has seven electrons in their valence shell.



9. Represent the molecule H2O using Lewis notation? (AS5) (TQ)

1. One atom has six valence electrons.
2. So it can achieve the electronic configuration of Neon by sharing two electrons, one with each Hydrogen atom.

10. Represent each of the following atoms using Lewis notation: a. Beryllium b. Calcium c. Lithium (AS5) (TQ)

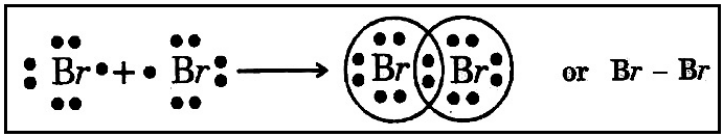
a. Beryllium: Beryllium has two valence electrons. 

b. Calcium: Calcium has two valence electrons. 

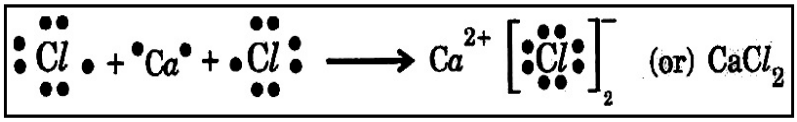
c. Lithium: Lithium has one valence electrons. 

11. Represent each of the following molecules using Lewis notation: (AS5) (TQ)
(a) Bromine gas (Br_2)
(b) Calcium chloride ($CaCl_2$)
(c) Carbon dioxide (CO_2)
(d) Which of the three molecules listed above contains a double bond?

(a) <u>Bromine gas</u> (Br_2):-



(b) <u>Calcium chloride</u>($CaCl_2$):-



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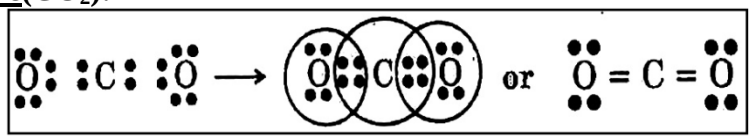
(c) Carbon dioxide(CO_2):-



(d) Which of the three molecules listed above contains a double bond?

Carbon dioxide (CO_2) contains double bond.

12. Two chemical reactions are described below. (AS5) (TQ)

i) Nitrogen and hydrogen react to form ammonia (NH_3)

ii) Carbon and hydrogen bond to form a molecule of methane (CH_4).

For each reaction, give:

a) The valence of each of the atoms involved in the reaction.

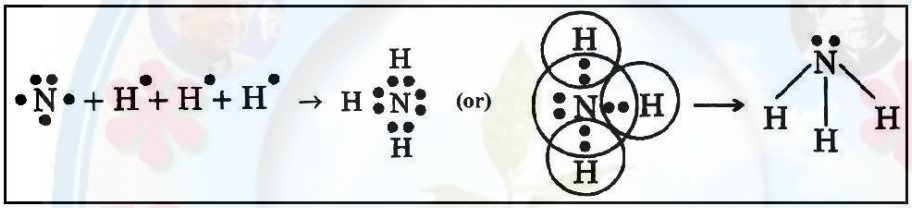
b) The Lewis structure of the product that is formed.

i) Nitrogen combines with hydrogen to form Ammonia (NH_3).

$$N_2 + 3H_2 \rightarrow 2NH_3$$

a) Valence of Nitrogen is 3 and hydrogen is 1.

b) The Lewis structure of NH_3 is,

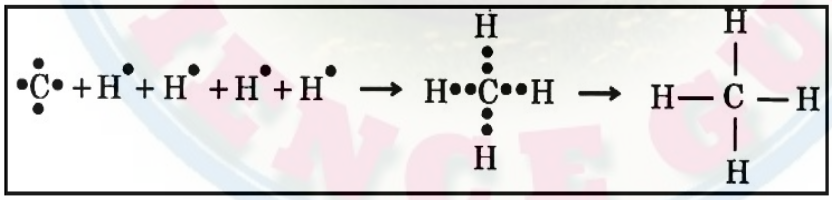


ii) Carbon combines with hydrogen to form methane (CH_4).

$$C + 2H_2 \rightarrow CH_4$$

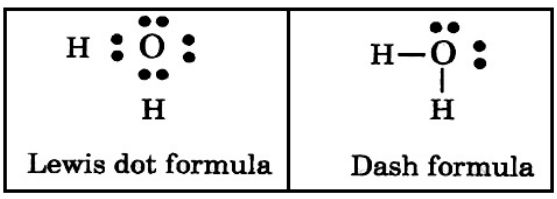
a) Valence of carbon is 4 and hydrogen is 1.

b) The Lewis structure of CH_4 is,



13. How Lewis dot structure helps in understanding bond formation between atoms? (AS6) (TQ)

1. Lewis dot structure of molecule or ion shows how atoms are bonded with each other.
2. Bonding electrons are indicated either by two dots or by a dash.
3. For example, a water molecule can be represented by either of the following two diagrams.
4. Lewis dot formulae show only the number of valence electrons, the number and kind of bonds.



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14. What is octet rule? How do you appreciate role of the octet rule in explaining the chemical Properties of elements? (AS6) (TQ)

Octet rule:- The tendency of atoms to achieve eight electrons in their outermost shell is known as octet rule.

1. The atoms of all elements try to attain either 2 or 8 electrons in their outermost energy level which is of maximum stability and hence of minimum energy.
2. If the compounds or elements satisfies octet rule that they became most stable.
3. Hence, they have high melting and boiling points.
4. So I appreciate the role of octet rule in explaining the chemical properties of elements.
5. But some compounds like BF_3, PCl_5 violates octet rule.

15. Write the difference between ionic and covalent compounds?

Ionic compound	Covalent compound
1. They are formed by the transfer of electrons between two atoms.	1. These are formed by the mutual sharing of electrons between the atoms.
2. These are having high melting and boiling points.	2. These are having low melting and boiling points.
3. These are soluble in polar solvents like water.	3. These are soluble in non-polar solvents like benzene and CCl_4.
4. These are highly reactive in polar solvents.	4. These are less reactive in polar solvents.
5. These posses ionic reactions and reactions are instantaneous.	5. These possess molecular and are slow at room temperature.

4 Mark Questions

1. Explain the formation of sodium chloride and calcium oxide on the basis of the concept of electron transfer from one atom to another atom? (AS1) (TQ)

Formation of sodium chloride (NaCl):- Sodium chloride is formed from the elements sodium (Na) and chlorine (C*l*).

Cation formation:- 1. The atomic number of sodium is 11. Its electronic configuration is 2, 8, 1.
2. Sodium loss one electron, it forms a cation (Na^+) and gets Neon (Ne) electronic configuration.

$$_{11}Na \rightarrow {}_{10}Na^+ + e^-$$

Anion formation:- 1. The atomic number of Chlorine is 17. Its electronic configuration is 2, 8, 7.
2. Chlorine receives one electron, it forms an anion ($Cl^{-)}$ and gets Argon(Ar) electronic configuration.

$$_{17}Cl + e^- \rightarrow {}_{18}Cl^-$$

These two oppositely charged ions Na+ and Cl- gets attracted each other due to electrostatic forces and forms the compound Sodium chloride (NaCl).

$$Na+ + Cl- \rightarrow NaCl$$

Formation of Calcium Oxide (CaO):- Calcium Oxide(CaO) is formed from the elements Calcium (Ca) and Oxygen (O).

Cation formation:- 1. The atomic number of Calcium is 20. Its electronic configuration is 2,8,10.
2. Calcium losses two electrons, it forms a cation($Ca2^+$) and gets Argon(Ar) electronic configuration.

$$_{20}Ca \rightarrow {}_{10}Ca^{2+} + 2e^-$$

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Anion formation:- 1. The atomic number of Oxygen is 8. Its electronic configuration is 2, 6.
2. Oxygen receives two electrons, it forms a anion(O^{2-}) and get a Neon(Ne) electronic configuration.

$$_8Cl + 2e^- \rightarrow {}_{10}Cl^{2-}$$

These two oppositely charged ions Ca^{2+} and Cl^{2-} gets attracted each other due to electrostatic forces and form the compound calcium Oxide (CaO).

$$Ca^{2+} + O^{2-} \rightarrow CaO.$$

2. How bond energies and bond lengths of molecule help us in predicting their chemical properties? Explain with examples? (AS1) (TQ)

1. **Bond length:-** It is defined as the distance between the 2 nuclei of the atoms which involved in bonding.
2. **Bond Energy:-** It is defined as the energy required to break the bond between 2 atoms of a di-atomic covalent compound in its gaseous state.
3. Generally, bond energies and bond lengths of molecule help us in predicting their chemical properties.
4. If a molecule is having low bond energy and high bond length values, it is a very active one.
5. They are having polar nature. They actively participate in chemical reactions.

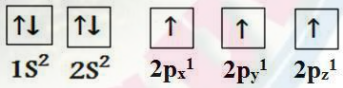
6. **For example:-** In Iodine molecule, as the bond length between the atoms is high due to its large sized atoms.
7. So, amount of energy required for bond breakage is low. So, it is highly reactive in reactions.

$$\text{i.e Bond energy } \alpha \frac{1}{\text{Bond length}}.$$

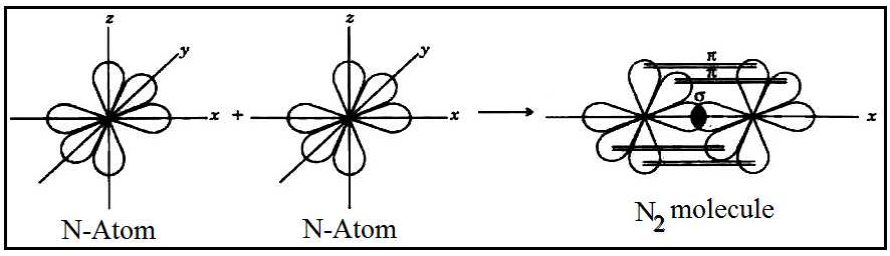
8. So, higher the bond energy, more stable and less reactive in case of chemical reactions.
9. Similarly, Melting and Boiling points of a substance can also be determined by this bond energies and bond lengths.

3. Explain the formation of the following molecules using valence bond theory. (AS1) (TQ)
a) N_2 molecule b) O_2 molecule.

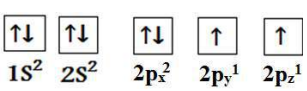
a) Formation of N_2 molecule:- 1. The atomic number of Nirogen is 7.

2. Its electronic configuration is $1s^2\ 2s^2\ 2p_x^1\ 2p_y^1\ 2p_z^1$ (or) 

3. Suppose that 2px orbital of one 'N' atom overlaps the '2px'orbital of the other 'N' atom giving $\sigma p_x - p_x$ bond, along the inter-nuclear axis.
4. Similarly $2p_y$ and $2p_z$ orbitals of one 'N' atom, overlap with $2p_y$ and $2p_z$ orbital of other 'N' atom laterally, respectively perpendicular to inter nuclear axis given $\pi p_y - p_y$ and $\pi\ p_z - p_z$ bonds.
5. So, N_2 molecule has a triple bond between two Nitrogen atoms.



b) Formation of O_2 molecule:- 1. The atomic number of oxygen is 8.

2. Its electronic configuration is $1s^2\ 2s^2\ 2p_x^2\ 2p_y^1\ 2p_z^1$ (or) 

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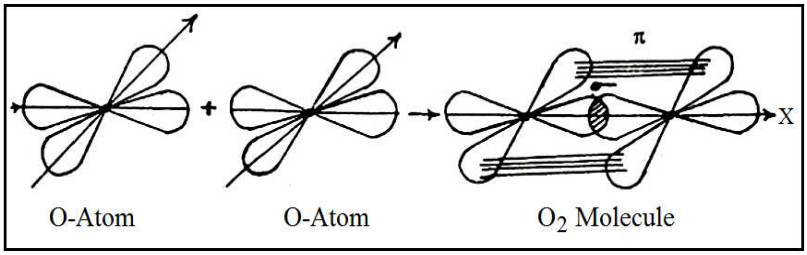
3. If the $2p_y$ orbital of one Oxygen atom overlaps with $2p_y$ orbital of another Oxygen atom and forms a σ $p_y - p_y$ bond is formed.
4. Similarly $2p_z$ orbital of 'O' atom overlaps with $2p_z$ orbital of other 'O' atom laterally, perpendicular to the inter nuclear axis giving a π $p_z - p_z$ bond.
5. O_2 molecule has a double bond between two Oxygen atoms.



4. What is hybridization? Explain the formation of the following molecules using hybridization.
a) Be Cl_2 b) BF_3 (AS1 (TQ)

Hybridization:- The process of mixing of atomic orbital's of nearly same energy to produce a set of entirely new orbital's of equivalent energy is known as hybridisation.

a) Formation of $BeCl_2$:- 1. The atomic number of Beryllium = 4.
2. Its electronic configuration is $1s^2$ $2s^2$. Since there are no unpaired electrons in the valence shell.
3. In excited state 2s-orbital is first unpaired and an electron is shifted to 2p-orbital.
4. Ground state electronic configuration of 'Be' is, ↑↓ $1S^2$ ↑↓ $2S^2$ □ $2p_x^o$ □ $2p_y^o$ □ $2p_z^o$
5. Excited state electronic configuration of 'Be' is, ↑↓ $1S^2$ ↑ $2S^1$ ↑ $2p_x^1$ □ $2p_y^o$ □ $2p_z^o$
6. Now there is hybridization between one 's' and p-orbital.
7. Two orbital's of same shape and energy come into existence.
8. The overlap with p-orbital each of two chlorine atoms forming two sigma (σ) bonds.
9. The molecule formed is linear with a bond angle 180^0.

b) Formation of Boron Trichloride (BCl_3):- 1. The atomic number of Boron is 5.
2. Its electronic configuration is $1s^2$ $2s^2$ $2p^1$.
3. In ground state, it has one unpaired orbital which can form only covalent bond.
4. To get trivalency, the 2s-orbital is unpaired and the electron is shifted to 2p- orbital.
5. Now in excited state the three unpaired orbitals undergo hybridisation giving rise to three hybrid orbitals which are 120^0 apart.
6. Ground state electronic configuration of 'B' is, ↑↓ $1S^2$ ↑↓ $2S^2$ ↑ $2p_x^1$ □ $2p_y^o$ □ $2p_z^o$
7. Excited state electronic configuration of 'B' is, ↑↓ $1S^2$ ↑ $2S^1$ ↑ $2p_x^1$ ↑ $2p_y^o$ □ $2p_z^o$
8. The three hybrid orbitals overlap with three p-orbitals from three Fluorine atoms forming three sigma bonds.
9. The molecule formed is triangular planar.

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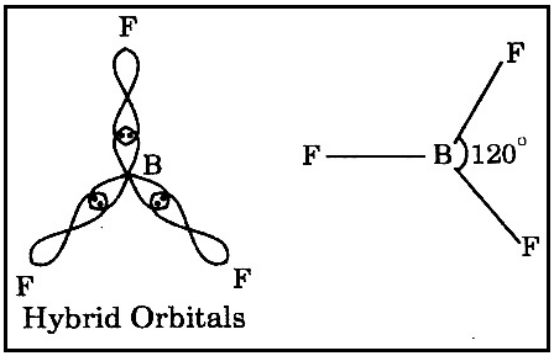

Hybrid Orbitals

5. Collect the information about properties and uses of covalent compounds and prepare a report? (AS4) (TQ)

Properties of covalent compounds:-

1. Covalent compounds exists as gases (or) liquids of low boiling (or) melting points.
2. In general, covalent substances are bad conductors of electricity.
3. These are freely soluble in non polar solvents like benzene, carbon tetrachloride, but soluble in polar solvents like water.
4. These are bad conductors of electricity.
5. They undergo molecular reactions.
6. Rate of reactions are low.

Uses of covalent compounds:-

1. 99% of our body, was made up of covalent compounds
2. Water is a covalent compound. We know its many uses.
3. Methane gas is used for cooking purpose.
4. Some covalent compounds are used for polyesters.
5. Covalent compound like Naphthalene balls are used for household purpose.
6. They are used for laboratory purpose and medicinal purpose.

6. Write the properties of Ionic and Covalent compounds?

Ionic Compounds:- 1. Ionic compounds are solids in state.
2. They have high MP and BP's due to strong electrostatic of attractions.
3. They soluble in polar solvents.
4. Their chemical reactivity is mole because of no bond making and bond breaking.

Covalent compounds:- 1. They are liquid and gases at room temperature
2. They have low MP and BP's due to weak force of attraction.
3. They soluble in both polar as well as non polar solvents.
4. They are less or moderate reactive because of bond making and bond breaking involved in chemical reactions.

7. Write the postulates of valence shell electrons pair repulsion (VSEPR) theory?

VSEPRT was proposed by Sidgwick and Powell (1940). It was further improved by Gillespie and Nyholm (1957).

Postulates:- 1. Every central atom in a molecule may possess two types of electron pairs bond pair and lone pair of electrons.
2. Lone pair of electrons may or may not present in a molecules.
3. There are repulsive forces among these pair of electrons. This follows,
   Lone pair – Lone pair > Lone pair – bond pair > bond pair – bond pair
4. The presence of lone pairs of electrons on central atom causes slight distortion of bond angles.
5. Hence the molecules deviate from their original shape, to reduce the repulsive forces.
6. A multiple bond is treated as if it is a single electron pair and the two or three electron pairs of a multiple bond are treated as a single super pair.

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Note :- The shapes of the molecules are depends on bonding electrons and lone pair of electrons. Obseve the following table for an idea to known about the shape of the molecules.

S.No	No. of bond pairs	No. of loan pairs	Bond angle	Shape of the molecule	Example
1	2	---	180^0	Linear	$BeCl_2$
2	3	---	120^0	Trigonal-planar.	BF_3
3	4	---	109^028^I	Tetrahedron	CH_4
4	3	1	107^048^I	Triagonal pyramidal	NH_3
5	2	2	104^031^I	V-Shape	H_2O

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Chapter-11

ELECTRIC CURRENT

1 Mark Questions

1. Give one live example which provides evidence for the motion of charge in the atmosphere?

Lightning.

2. Define conductors?

Conductors:- The material which allow the current passes through them is called conductors.
Ex:- All metals.

3. Define Insulators or non-conductors?

Insulators:- The material which do not allow the current passes through them is called insulators.
Ex:- Plastic, rubber, wood etc.

4. Define Semiconductors?

Semiconductors:- The material which allow the current partially passes through them is called semiconductors.
Ex:- Silicon and Germanium.

5. What is Electric current? Write their units?

Electric current:- 1. Electric current is defined as the amount of charge crossing any cross section of the conductor in one second.

$$\text{Electric current(I)} = \frac{\text{electric charge(Q)}}{\text{time interval(t)}}.$$

2. The SI unit of electric current is ampere denoted by A.

6. Define Ampere?

Ampere:- 1. If one coulomb of charge crosses any cross section of the conductor in one second, then the electric current flows through that conductor is "1 Ampere".
2. It is denoted with the letter A.
3. 1 Ampere = $\frac{1\ \text{Coloumb}}{1\ \text{Second}}$ i.e 1 A = 1 C/s

7. Write the value of magnitude of electric charge?

The magnitude of electric charge 'e' is 1.602×10^{-19}C.

8. What is the value of drift speed or drift velocity of the electrons in a conductors?

$v_d = 7 \times 10^{-5}$ m/s = 0.07mm/s.

9. How can we measure electric current?

1. Generally an ammeter is used to measure electric current.
2. It is always connected in series to the circuit.

10. What is electric potential difference or voltage?

Potential difference:- The work done to move a unit positive charge from one point to another it is called as potential difference or voltage.
2. It is denoted with the letter 'V'.

$$\text{voltage (v)} = \frac{\text{Workdone(W)}}{\text{charge(Q)}}.$$

3. Its SI unit is Volt'.

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11. Define the word emf?

emf:- emf is defined as the work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery.

12. Define volt?

Volt:- If 1 Joule work is done to move 1 coulomb of positive charge from one point to another, then the electric potential difference between those two points is 1 'volt'.

$$1 \text{ volt} = \frac{1 \text{ Joul}}{1 \text{Coloumb}}.$$

13. How can we measure potential difference or emf?

1. Generally a volt meter is used to measure potential difference or emf across an electric device.
2. It is always connected in parallel to the electric circuit.

14. Why does a bulb glow immediately when we switch on ?

When we switch on any electric circuit, irrespective of length of the connecting wire an electric field is set us throughout the conductor instantaneously due to the potential difference of the source connected to the circuit.

15. State the ohm's Law ?

Ohm's Law:- The potential difference between the ends of a conductor is directly proportional to the electric current passing through it at constant temperature.

$$\text{i.e } V \propto I$$

$$\Rightarrow V = IR$$

Where R is called resistance of the conductor.

16. What is resistance ?

Resistance:- 1. The resistance of a conductor is defined as the obstruction to the motion of the electrons in a conductor.

2. The SI unit of resistance is ohm(Ω).

17. Define Ohm?

Ohm(Ω):- If 1 Ampere of electric current passes between two points of potential differences 1 volt, then the resistance between them said to be 1 ohm.

$$1 \text{ Ohm} = \frac{1 \text{ Volt}}{1 \text{ Ampere}} \text{ (or) } 1\ \Omega = \frac{1V}{1A}$$

18. What is resistor ?

Resistor:- The material which offeas resistance to the motion of electrons is called resistor.

19. What are ohmic and non-ohmic conductors?

Ohmic conductors:- The material which obey the ohm's law is called ohmic conductors.

Ex:- All metals.

Non-ohmic conductors:- The material which do not obey the ohm's law is called non-ohmic conductors.

Ex:- LED.

20. What happens to our body if we touch live wire of 240V?

1. The current passing through our body when we touch a live wire of 240V is given by,

$$I = 240/100000 = 0.0024A.$$

2. When this quantify of current flows through the body the functioning of organs inside the body gets disturbed.
3. This disturbance inside the body is felt as electric shock.

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21. What is meant by a electric shock?

Electric shock:- The potential difference exists between one part of the body and another part is called an electric shock.

(or) The electric shock is a combined effect of potential difference, electric current and resistance of the human body.

22. What is multi meter?

Multi meter:- A multi meter is an electronic measuring instrument that combines several measurement functions like electric current, electric voltage, electric resistance in one unit.

23. Name the instrument used to measure both electric current and potential difference ?

Multimeter.

24. Why doesn't a bird get a shock when it stands on a high voltage wire?

1. When the bird stands on a high voltage wire, there is no potential difference between the legs of the bird because it stands on a single wire.
2. So no current passes through the bird.
3. Hence, it doesn't feel any electric shock.

25. What are the factors that affecting the resistance of a material ?

The factors affecting the resistance of a material are,

1. Temperature.
2. Nature of a material.
3. Length of a conductor.
4. Area of a crossection.

26. Define resistivity (or) specific resistance of a material? What is its S.I unit?

Resistivity:- 1. It is the resistance per unit length of a unit cross section of the material.
2. It is denoted with the letter 'ρ'.
3. The S.I unit of resistivity is ohm meter (Ω-m).

27. Define conductivity and write their units?

Conductivity:- 1. The reciprocal of resistivity is called conductivity (σ).
2. Its units are mho-m.

28. What is meant by a electric circuit?

Electric circuit:- A closed path created by the connecting wires through a battery along which electrons can flow is called a circuit.

29. When kirchhoff's rules are applicable in Electric current ?

The kirchhoff's rules are applicable to any DC circuit containing batteries and resistors connected in any way.

30. Name the two kirchhoff's laws ?

1. Junction Law 2. Loop Law

31. What is meant by a Kirchoff's junction law?

The junction law:- At any junction point in a circuit where the current can divide, the sum of the currents into the junction must equal the sum of the currents leaving the junction.

32. What is meant by a Kirchoff's loop law?

The loop law:- The algebraic sum of the increases and decreases in potential difference across various components of a closed circuit loop must be zero.

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33. What is electric power ? Write the S.I unit of electric power ?

Electric power:- 1. Electric power is the product of potential difference and the current.

$$P = \varepsilon I$$

2. The S.I unit of electric power is watt.

34. Which type of charge flows through an elecric wire when it is connected in an electric circuit ?

Negative.

35. What is electrical energy? Write the S.I unit of electrical energy?

Electrical energy:- 1. Electrical energy is the product of power and time.

Electrical energy = Power × time.

2. Units of electrical energy is W-s and KWH.

36. How should we connect the fuse in house wiring circuit ? In series parallel ? Why?

The fuse wire in house wiring circuit is connected in series. When the current exceeds the safely limit, the fuse wire melts and breaks the circuit. The electric installations are thus saved from getting damaged.

37. Why do we use fuses in house hold circuits?

To prevent damages due to over loading and high power supply, we connect an electric fuse to the house hold circuits.

38. What is a value of 1KWh in joules (AS1) (TQ)

1KWh = 1000 w × 1 hour

= 1000 × 3600 sec (1W= 1Joule/ sec)

= 36×10^5 Joules

= 3.6×10^6 Joules.

39. Silver is a better conductor of electricity than copper. Why do we use copper wire for conduction for electricity? (AS1) (TQ)

1. Silver is a better conductor of electricity than copper.
2. But silver is a costly metal than copper.
3. Hence copper is widely used for conduction for electricity.

40. Why do we consider tungsten as suitable material for making the filament of a bulb? (AS2) (TQ)

Tungsten is a suitable material for making filament of the bulb because,

1. It has high resistance(5.56×10^{-8} Ω-m).
2. High melting point(3422^0C).
3. High temperature coefficient of resistance.
4. It emits bright light.

41. Are the headlights of a car connected in series or parallel? Why? (AS2) (TQ)

Head lights of the car are connected in parallel because one of the lights in the parallel combination fuses are fails other head light keeps working.

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2 Mark Questions

1. Write the difference between potential difference and emf? (AS1) (TQ)

Potential difference	emf
1. The work done by the electric force on one unit positive charge to move it through a distance 'l' from one point to another is called potential difference.	1. The work done by the chemical force to move unit positive charge from negative terminal to positive terminal of the battery is called emf.
2. Potential difference is calculated for any two points in the circuit.	2. EMF is calculated for the battery.
3. Potential difference, $v = \frac{W}{q} = \frac{F_e}{q}$	3. emf, $\varepsilon = \frac{W}{q} = \frac{F_c}{q}$.
4. The SI unit of potential difference is 'Volt'.	4. The SI unit of emf is 'Volt'.
5. Potential difference is measured by using the voltmeter.	5. emf is measured by using the voltmeter.

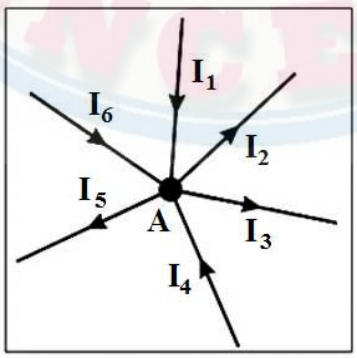
2. What are the factors one which the resistance of conductor depends? Give the corresponds the relation? (OR) Derive $R = \rho\frac{l}{A}$.(AS1) (TQ)

1. The resistance of a conductor is directly proportional to the length of the conductor.
   i.e., $R \propto l$ …… (1)
2. The resistance of a conductor is inversely proportional to the area of a cross section of the conductor.
   i.e., $R \propto \frac{1}{A}$ …… (2)
3. From (1) and (2), we get $R \propto \frac{l}{A} \Longrightarrow R = \rho\frac{l}{A}$.
   Where 'ρ' is a constant called specific resistance or resistivity.
4. The S.I unit of resistivity is Ω- m.

3. Explain Kirchhoff's laws with examples? (AS1) (TQ)

Kirchhoff's laws: - Kirchhoff, in 1842, gave two general laws which are extremely useful in analyzing electric circuits. They are1. The Junction law 2. The Loop law.

1.**The Junction Law: -** At any junction point in a circuit where the current can devide, the sum of the currents into the junction must equal the sum of the currents leaving the junction.



Example:- 1. In the figure A is called junction.
2. From the figure, we have Therefore, $I_1 + I_4 + I_6 = I_2 + I_3 + I_5$.

2. The Loop Law: - The algebraic sum of increments and decrements in potential differences across various components of a closed circuit loop must be zero.

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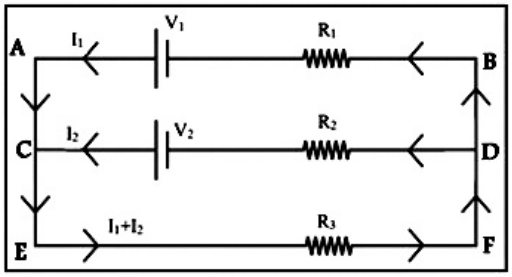


Example:- 1. Let us apply Kirchhoff's second law to the above figure, for the loop ACDBA,

$$-V_2 + I_2R_2 - I_1R_1 + V_1 = 0.$$

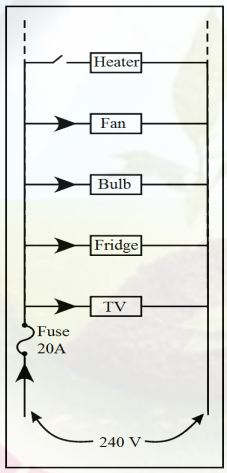
2. For the loop EFDCE, $-(I_1+I_2)\,R_3 - I_2R_2 + V_2 = 0$.
3. For the loop EFBAE, $-(I_1+I_2)\,R_3 - I_1R_1 + V_1 = 0$.

4. Explain over loading of household circuits? (AS1) (TQ)

Over loading:- 1. Generally we observe the values noted on the digital meters fixed at home as follows.

Potential difference = 240V.
Electric current = 5A – 20A.

2. This means the line wires that are entering the meter have a potential difference of 240 V.
3. The minimum and maximum limit of current that can be drawn from the mains is 5A to 20A.
4. If the current drawn from the mains is more than 20A then over heating may occur and causes fire.
5. This is called over loading of household circuit.



5. Why do we use fuses in household circuits? (AS1) (TQ)

1. The fuses are consists of a thin wire of low melting point.
2. The minimum and maximum limit of current that can be drawn from the mains is 5A to 20A.
3. When the current in the fuse exceeds 20A, the wire will heat up and melt.
4. If fuse melts the circuit is open and no current passing through the home appliances.
5. Hence all the electric devices are saved from damage that could be caused by overloading.
6. So, a fuse is a safety device that does not allow any unduly high electric current to flow through an electric circuit.

6. Why don't we use series arrangement of electrical appliances like bulb, television, fan and others in domestic circuits? (AS1) (TQ)

1. If the electrical appliance are connected in series combination then same amount of current passes through them.
2. All the appliances start working all the time.
3. We cannot operate them individually.
4. If one of appliances is damaged, all the appliances are stopped working.
5. Hence we don't connect series arrangement of electrical appliances like bulb, television, fan etc.
6. So, the appliances are connected in parallel which gives same potential difference.

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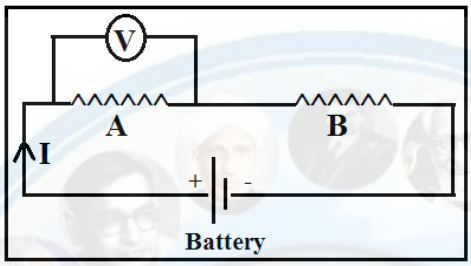
7. a) Take a battery and measure the potential difference make a circuit and measure the potential difference when the battery is connected in a circuit. Is there any difference in potential difference in battery? (AS4) (TQ)

b) Measure the resistance of a bulb (filament) in open circuit with a millimeter. Make a circuit with elements such as bulb, battery of 12v and key in series. Close the key. Then again measure the resistance of same bulb for every 30 seconds. Record the observations in a proper table. What can you conclude from above results?

a). We do not find any change in potential difference of the battery.
b). The resistance of the bulb increases due to increase in temperature of the bulb.

8. Draw a circuit diagram for a circuit in which two resistors A and B are connected to measure the potential difference across the resistor A? (AS5) (TQ)

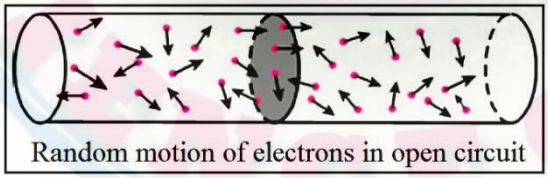


A, B – Resistors.
V – Voltmeter.

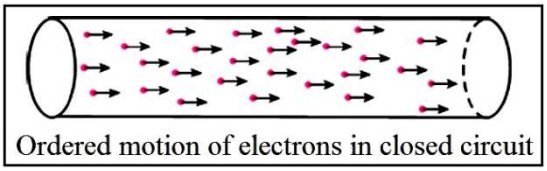
4 Mark Questions

1. Explain how electron flow causes electric current with lorentz – Drude theory of electrons? (AS1) (TQ)

1. Drude and Lorentz, scientists of 19th century, proposed that conductors like metals contain large number of free electrons as while the positive ions are fixed in their locations.
2. The arrangement of the positive ions are called lattice.
3. When the conductor is in an open circuit. The elctrons move randomly in latice space as shown in the figure.


Random motion of electrons in open circuit

4. If we imagine any cross section, the number of electrons, crossing the cross section from left to right in one second is equal to that of electrons passing the cross section from right to left in one second.
5. Hence the net charge moving along a conductor through any cross section is zero.
6. When the ends of the conductor are connected to the battery through a bulb, the bulb glows because energy flow takes place from battery to the bulb.
7. This is because the orderly motion of electrons.
8. When the electrons are in ordered motion, there will be a net charge crossing through any cross section of the conductor as shown in the figure.


Ordered motion of electrons in closed circuit

9. This ordered motion of electrons is called electric current.

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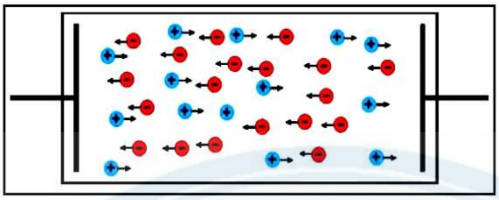
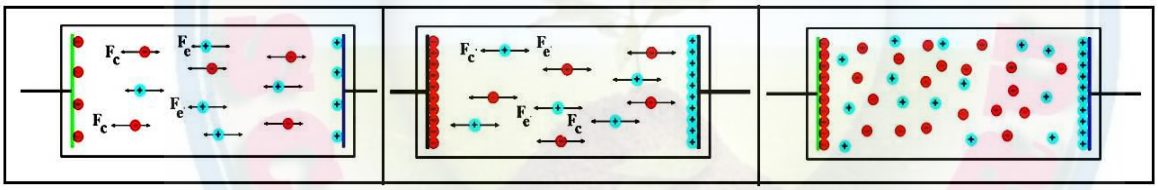
2. How does a battery work? Explain ? (AS1) (TQ)

1. A battery consists of two metal plates(electrodes) and a chemical(lectrolyte).
2. The electrolyte consists of positive and negative ions which move in opposite directions.
3. This electrolyte exerts a force called chemical force (Fc) to make ions move in a specified direction.
4. Positive ion move towards one plate and accumulate on that, as a result this plate becomes positively charged (Anode).
5. Negative ions move to another plate and accumulate on that. As a result this plate becomes negatively charged.
6. This accumulation continues till both plates are sufficiently charged.



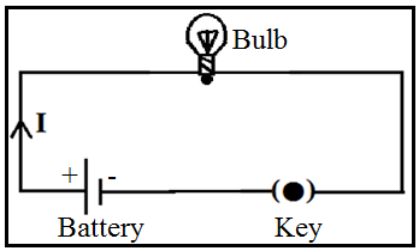
7. But the ions experience another force called electric force (Fe), when sufficiently number of charges accumulated on the plates.
8. The direction of Fe is opposite to Fc and magnitude depends on the amount of charges accumulated on plates
9. The accumulation of charges on plates is continuous till Fe becomes equal to Fc. Now there will not be any motion due to balance of Fe and Fc.
10. The new battery that we buy from the shop is under the influence of balanced forces. This is the reason for constant potential difference between the terminals of battery.
11. When a conducting wire is connected to terminals of the battery, a potential difference is created between the ends of the conductor which sets up an electric field throughout the conductor.



12. The large number of electrons in the conductor near the positive terminal of battery is attracted by it and start to move towards positive terminal.
13. As a result the amount of positive change on this plate decreases.
14. So Fe becomes weaker than Fc and Fc pulls negative ions from anode towards cathode.
15. The negative terminal pushes one electron into the conductor because of stronger repulsion between negative terminal and negative ion.
16. Hence, total number of electrons in a conductor remains constant during current flow.

3. How can you verify that resistance of conductor is temperature dependent? (AS1) (TQ)

1. Measure the resistance of the bulb when it is in open circuit, using a multimeter.
2. Note the reading in your book.
3. Connect the circuit as shown in figure.



4. Switch on the circuit after a few minutes switch off the circuit and measure the resistance of bulb using multimeter.

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5. Note this reading in your note book.
6. The value of resistance in second instance is more than the resistance bulb in open circuit.
7. When bulb is connected in a circuit and current is passed through it, the bulb gets heated. This is responsible for increase in the resistance of bulb.
8. Hence the value of resistance of conductor depends on temperature for constant potential difference between the ends of conductor.

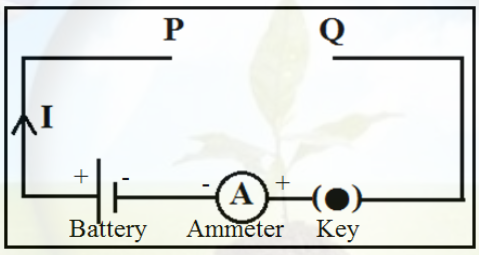
4. What do you mean by electric shock? Explain how it takes place? (AS1) (TQ)

1. If we touch a line wire of 240V, 0.0024A current flows through our body.
2. Due to this functioning of organs inside our body get disturbed.
3. This disturbance inside our body is felt as electric shock.
4. If the current reaches 0.07 A, it effects the functioning of the heart and if this much current passes through the heart for more than one second it could be fetal.
5. This can be experienced if there is a potential difference between one part of the body and another part.
6. The electric shock is a combined effect of potential difference, electric current and resistance of the human body.

5. How do you verify that resistance of a conductor is proportional to the length of the conductor for constant cross section area and temperature? (AS1) (TQ)

Aim:- To verify the resistance of a conductor is proportional to the length of the conductor.

Appratus:- A cell, an ammeter, iron spokes of different lengths but same area.



Procedure:- 1. Make the circuit or shown in the figure.
2. Then connect one of the iron spokes between P and Q.
3. Measure the value of current using the ammeter connected to circuit and note it in your note book.
4. Repeat this experiment for other lengths of iron spokes.
5. Note the corresponding values of currents in your note book as shown below.

S.No	Length of spoke	Current
1		
2		
3		
4		

6. We observe that current decreases as the length of spoke increases.
7. We know that resistance increases as current decreases.
8. Hence we resistance of iron spoke increases as its length increases.
9. Hence we conclude that the resistance of conductor is directly proportional to length.

i.e $R \alpha l$

6. Deduce the expression for equivalent resistance of three resistors connected in series? (AS1) (TQ)

When an end of one resistor is connected to the beginning of the next resistor and so forth, the resistors are said to be connected in series.

1. In series combination, the total potential difference across the series combination of resistor is equal to sum of voltage across the individual resistors.

i.e $V = V_1 + V_2 + V_3$ -------(1)

2. Connect the circuit as shown in figure.

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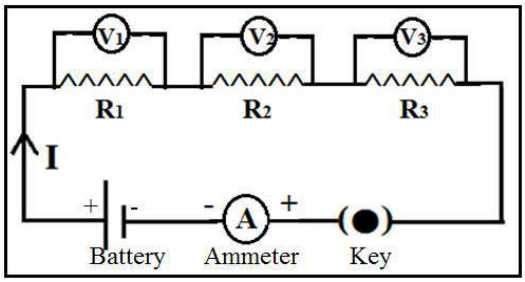


3. The cell connected across the series combination of three resistors maintains a potential difference (V) across the combination.
4. Let us replace the combination of resistors of three resistors by a single resistor R_{eq}, such that current doesn't change.

R_{eq} is given by,

$$R_{eq} = \frac{V}{I} \Rightarrow V = I R_{eq} \text{-------(2)}$$

5. The potential differences V_1, V_2, V_3 across the resistors R_1, R_2, R_3 respectively are given by,

$V_1 = IR_1$; $V_2 = IR_2$; $V3 = IR_3$ (Since from Ohm's law)

6. Since resistors connected in series combination. So,

$$V = V_1 + V_2 + V_3$$
$$= IR_1 + IR_2 + IR_3$$
$$= I (R_1 + R_2 + R_3)$$
$$I R_{eq} = I (R_1 + R_2 + R_3) \quad \text{(Since V = I Req)}$$
$$R_{eq} = R_1 + R_2 + R_3$$

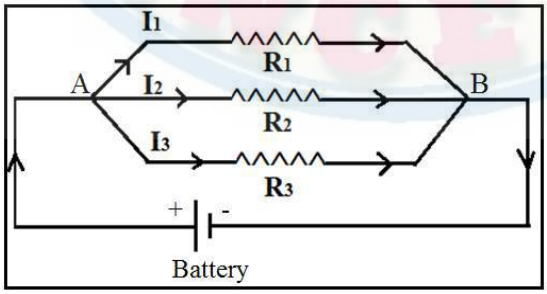
The equivalent resistance of the combination is equal to sum of the individual resistances.

7. Deduce the expression for equivalent resistance for three resistors connected in parallel? (AS1) (TQ)

When two or more resistors are connected between two common points whose end will be at higher potential and other at lower potential in a circuit, the resistors are said to be in parallel.

For parallel combination, we know that

1. The total current(I) flowing into the combination is equal to the sum of currents passing through the individual resistors.
2. The potential difference is same in all resistors connect the circuit as shown.



3. The cell connected across three resistors maintains the same potential difference across each resistor.
4. The current (I) divided into I_1, I_2, I_3 which flows through resistors R_1, R_2, R_3 Respectively.
5. Let replace the all resistors with equivalent resistance Req.

Equivalent resistance, $R_{eq} = \frac{V}{I} \Rightarrow I = \frac{V}{R_{eq}}$ -------(1)

6. Similarly, $I_1 = \frac{V}{R_1}$, $I_2 = \frac{V}{R_2}$ and $I_3 = \frac{V}{R_3}$.
7. Since Resistance in parallel combination. So, $I = I_1 + I_2 + I_3$

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$$\frac{V}{R_{eq}} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}.$$

$$\Rightarrow \frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\text{(or)} \quad R = \frac{R_1R_2R_3}{R_1R_2+R_2R_3+R_3R_1}$$

When resistors are connected in parallel, the reciprocal of their equivalent resistance is equal to the sum of the reciprocals of the individuals resistances.

8. Why should we connect electric appliances in parallel in household circuit? What happens if they are connected in series? (AS2) (TQ)

Advantages of parallel circuit:- 1. In one of the component is switched off, other works properly.
2. Each appliance gets same voltage.
3. Total resistance of the circuit decreases on increasing number of output devices.
4. So the current draws more current from the mains supply.

Disadvantages of series circuit:-1. More the components circuit has the greater will be its resistance.
2. All the appliances start working all the time. We cannot operate them individually.
3. If one of appliances is damaged, all the appliances are stopped working.
4. The electrical appliances need current of widely different values to operate properly. But in series same current flows through each device.

9. State Ohm's law? Suggest an experiment to verity it and explain the procedure? (AS3) (TQ)

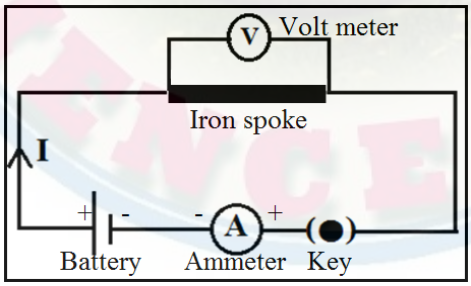
Ohm's law:- At constant temperature, the potential difference between the ends of a conductor is directly proportional to electric current passing through it.

Verification:-

Aim:- To verify the Ohm's law To show that the ratio $\frac{V}{I}$ is a constant for a conductor.

Appratus:- Five dry cells, of 1.5v each, conducting wires, an ammeter thin iron spoke, a voltmeter, LED and key.

Procedure:- 1. Connect a circuit as shown in figure.



2. Solder the connecting wires to the ends of iron spoke. Close the key.
3. Note the readings of current from ammeter and voltmeter reading in following table.

S.No	Potential difference(v)	Current (I)	$\frac{V}{I}$ = Constant
1			
2			
3			
4			

4. Now connect two cells instead of one cell in circuit. Note the values of ammeter and voltmeter and record then in above table.
5. Repeat the same for three cells, four cells and five cells respectively.
6. Record the values of V and I respectively to each case in the table.
7. Find $\frac{V}{I}$ for each set of values.

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9. We notice that $\frac{V}{I}$ is constant.

i.e V α I $\Rightarrow \frac{V}{I}$ = Constant.

10. This constant value is known as resistance. So $\frac{V}{I}$ = R $\Rightarrow$ V = IR.

Hence Ohm's law is verified.

10. How can you appreciate the role of a small fuse in house wiring circuit in preventing damage to various electrical appliances connected in a circuit? (AS7) (TQ)

1. A fuse wire is a thin wire made up of a high resistance material and has low melting point.
2. The fuse wire should be connected in series with electrical device.
3. So, the entire current from mains must pass through the fuse.
4. When the current in the fuse overloaded, the wire get heated and melted.
5. Now the circuit becomes open and prevents the flow of current.
6. Hence, all the electrical appliances are saved from damage that could be caused by overload.
7. So, I appreciate the role of small fuse in house wiring circuit in preventing damage to various electrical appliances.

Problems

1. Two bulbs have ratings 100W, 220V and 60W, 220V. Which one has the greatest resistance? (AS1)

1. We know that, P = $\frac{v^2}{R} \Longrightarrow$ R = $\frac{v^2}{P}$

2. For the first bulb, P = $\frac{v^2}{R} = \frac{(220)^2}{100} = \frac{48400}{100}$ = 484Ω

3. For the second bulb, P = $\frac{v^2}{R} = \frac{(220)^2}{60} = \frac{48400}{60}$ = 806.6Ω

4. The second bulb having the 60W, 220W has the greater resistance.

2. A wire of length 1m and radius 0.1mm has a resistance of 100Ω. Find resistivity of the material? (AS1) (TQ)

Given:- l = 1m, r = 0.1 mm= 10^{-4} m, R= 100Ω

Resistivity, ρ=?

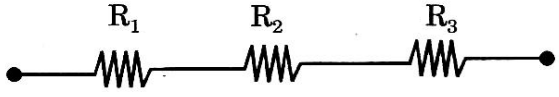
Area of cross section of the wire, A= $\pi r^2 = 3.14 \times (10^{-4})^2 = 3.14 \times 10^{-8}$ m^2.

Restivity, ρ = $\frac{RA}{l} = \frac{100 \times 3.14 \times 10^{-8}}{1}$ = 3.14×10^{-6} Ohm-meter.

3. Suppose that you have three resistors each of value 30Ω. How many resistors can you obtain by various combinations of these three resistors? Draw diagrams in support of your predictions. (AS2)

Given:- $R_1 = R_2 = R_3 = 30$ **Ω.**

1. If the resistors are connected in series, effective resistance is 90Ω.

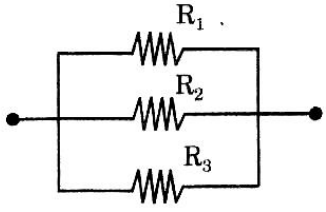


R = $R_1 + R_2 + R_3$ = 30+30+30 = 90Ω.

2. If the resistors are connected in parallel, effective resistance is 10 Ω.

$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} = \frac{1}{30} + \frac{1}{30} + \frac{1}{30} = \frac{1+1+1}{30} = \frac{3}{30} = \frac{1}{10} \Rightarrow \frac{1}{R} = \frac{1}{10}$

$\Rightarrow$ R = 10 Ω.



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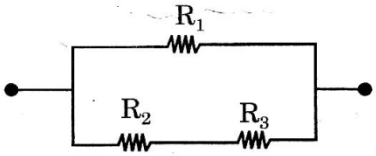
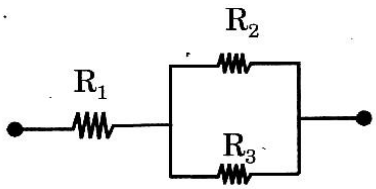
3. If two resistors are in series and other one is in parallel then effective resistance is 20 Ω.

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2 + R_3} = \frac{1}{30} + \frac{1}{30+30} = \frac{1}{30} + \frac{1}{60} = \frac{3+1}{60} = \frac{4}{60} = \frac{1}{20}$$

$$\frac{1}{R} = \frac{1}{20} \Rightarrow R = 20\ \Omega.$$



4. If two resistors are in parallel and other one is in series then effective resistance is 60Ω.



4. In the figure below the potential at A is ———————— when the potential at B is zero. (AS7) (TQ)

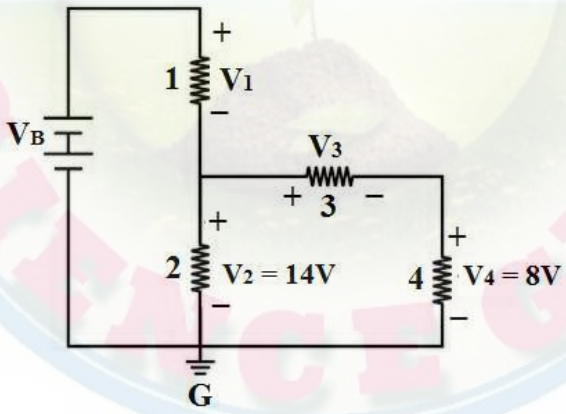
Applying Kirchhoff's law, $V_A - (1 \times 5) - 2 = V_B$

$\Rightarrow V_A - 5 - 2 = 0$

$\Rightarrow V_A - 7 = 0$

$\Rightarrow V_A = 7V.$

5. Observe the circuit and answer the questions given below. (AS7) (TQ)



Q_1. Are resistors 3 and 4 in series?

Yes, resistors 3 and 4 are in series because end to end connection is possible.

Q_2. Are resistors 1 and 2 in series?

No, 1 and 2 are not in series because different values of current flow.

Q_3. Is the battery in series with any resistors?

Yes it is in series for V_1 and V_2.

Q_4. What is the potential drop across the resistor?

The potential drop across the resistor '3' is V_3=6V.

Because 3 and 4 are in series. So the potential drop is, $V_4 + V_3 = 8+V_3$.

Combination of 3 and 4 is parallel to 2. So $V_2 = V_3 + V_4$

$\Rightarrow 14 = V_3 + 8 \Rightarrow V_3 = 14-8 \Rightarrow V_3 = 6V.$

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Q_5. What is the total emf in the circuit if the potential drop across the resistor 1 is 6V?

The total emf in the circuit, $\varepsilon = V_1 + V_2 = 6+14 = 20V$.

5. If the resistance of your body is 100000Ω what would be the current that flow in your body when you touch the terminals of a 12V battery? (AS7) (TQ)

Given: - V=12V
R = 1, 00,000Ω
i =?

From Ohm's law, $i = \frac{V}{R} = \frac{12}{1,00,000} = 0.00012$ Ampere.

∴ Current flows in body = 0.00012A.

6. A uniform wire of resistance 100Ω is melted and recasts into wire of length double that of the original. What would be resistance of the new wire formed? (AS7) (TQ)

Given: - $R_1 = 100\Omega$ $l_1 = 'l'$ (Say)
$R_2 = ?$ $l_2 = 2l$

Formula:- $\frac{R_1}{R_2} = \frac{l_1^2}{l_2^2} \Rightarrow \frac{100}{R_2} = \frac{l^2}{(2l)^2} \Rightarrow \frac{100}{R_2} = \frac{1}{4} \Rightarrow R_2 = 400\Omega$

7. A house has 3 tube lights, two fans and a Television. Each tube light draws 40W. The fan draws 80W and the Television draw 60W. On the average, if all the tube lights are kept on for five hours, two fans for 12 hours and the television for five hours every day. Find the cost of electric energy used in 30 days at the rate of Rs. 3.00 per KWH? (AS7) (TQ)

Energy consumed by 3 tube lights in a day $E_1 = p \times t = 3\times40W\times5h = 600$ Wh.

Energy consumed by 2 fans in a day $E_2 = p \times t = 2\times 80W \times12h = 1920$ Wh.

Energy consumed by television in a day $E_3 = p \times t = 60W \times 5h = 300$ Wh.

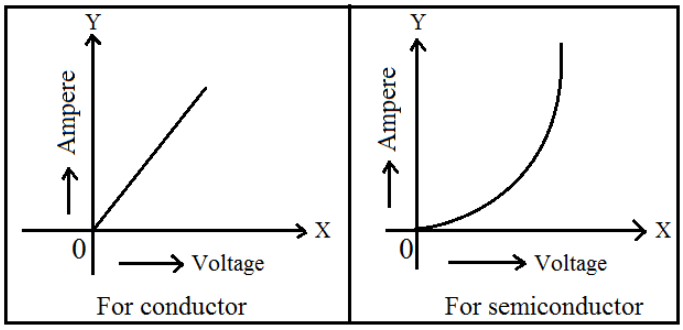
Total energy consumed in a day = 600 + 1920 + 300 = 2820 Wh.

Total energy per month = 2820 Wh × 30 = 84600 Wh = 84.6 KWh.

Cost of 1 unit charge = Rs. 3.00/-

∴ Cost of 84.6 Watts = 84.6 x 3 = Rs. 253.8/-

8. Draw a graph between V and I where V is the potential difference between the ends of the wire and 'I' is the current through it? What is the shape of the graph? (AS5)



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Chapter-12
Electromagnetism
1 Mark Questions

1. What is meant by an electromagnetism?

Electromagnetism:- The branch of science which deals with the electromagnetic phenomena i.e. magnetism produced by an electric current.

2. What is meant by a magnetic flux? Write their units?

Magnetic flux (Φ):- 1. The number of magnetic lines passing through the plane of area 'A' perpendicular to the field is called magnetic flux.

2. It is denoted by 'Φ'.

3. Its units are 'Weber'.

3. Define Magnetic Flux density or magnetic field induction?

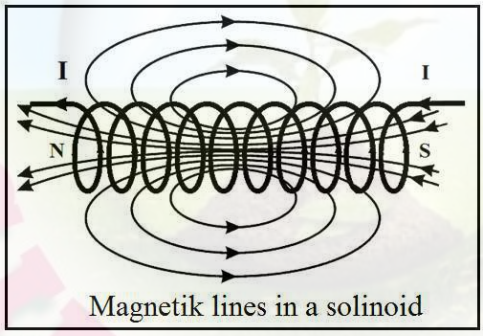
Magnetic flux density (B):- Magnetic flux density is defined as the ratio of flux passing through a plane perpendicular to field and the area of the plane.

$$\text{Magnetic flux, } B = \frac{\text{Magnetic flux } (\varphi)}{\text{Area } (A)}.$$

2. Its units are Weber/ m^2.

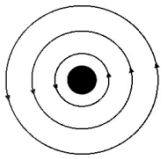
4. What is meant by a solenoid?

Solenoid:- A solenoid is a long wire wound in a close packed helix.



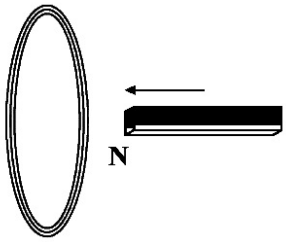
Magnetik lines in a solinoid

5. See figure, magnetic lines are shown. In what direction does the current through wire flow? (AS1) (TQ)



1. In the diagram the magnetic lines are in anti-clock wise direction.
2. According Ampere right hand rule the direction of current is vertically upwards.

6. A bar magnet with North Pole facing towards coil moves as shown in fig.-3. What happens to magnetic flux passing through the coil? (AS1) (TQ)



When the north pole of a bar magnet is moved towards the coil, magnetic flux of the coil increases. This gives induced current in the coil.

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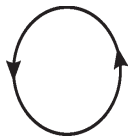
7. A coil is kept perpendicular to page. At P, current flows into the page and at Q it comes out of the page as shown in figure Q-4. What is the direction of magnetic field due to coil? (AS1)(TQ)

1. At the top i.e. near Q, the direction of the magnetic field is anti clock wise direction.
2. At the bottom i.e. near P, the direction of the magnetic field is clock wise direction.

8. The direction of current flowing in a coil is shown in figure. What type of magnetic pole is formed at the face that has flow of current as shown in figure? (AS1) (TQ)



1. North Pole is forms at the face that has flow of current as shown in the figure.
2. Here the current is in anti clockwise direction.

9. State the Faraday's Law?

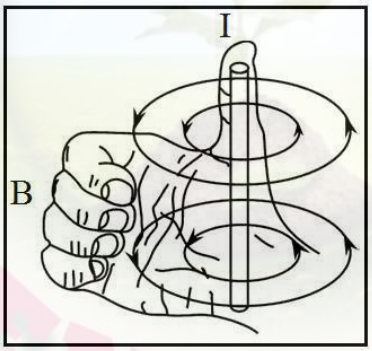
Faraday's Law:- The induced EMF generated in a closed loop is equal to the rate of change of magnetic flux passing through it.

10. State the Lenz's Law?

Lenz's Law:- The induced current set up in the coil is in such a direction that it opposes the changes in the flux.

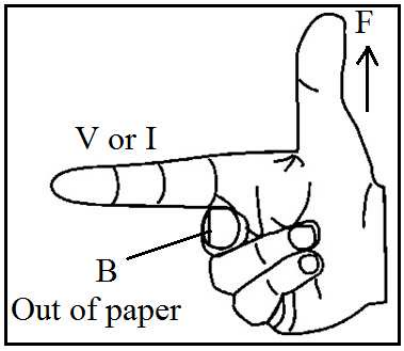
11. What is right hand thumb rule?

Right hand thumb rule:- If you hold the current carrying wire with your right hand in such a way that the thumb is in the direction of current and then the curled fingers show the direction of magnetic field produced around the wire.



12. State Fleming's right hand rule?

Fleming's right hand rule:- Stretch the forefinger, middle finger and thumb mutually perpendicular to each other, the fore finger gives the direction of velocity of charge or current (I), middle finger points to the direction of field (B) then the thumb gives the direction force.



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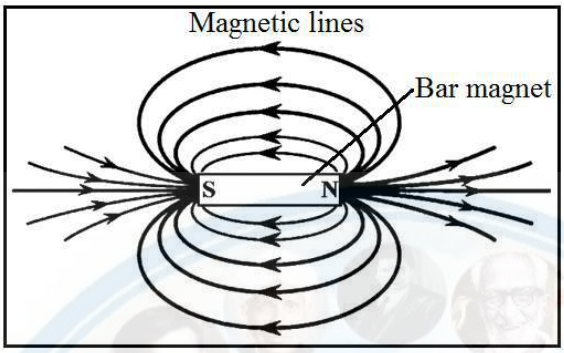
2 Mark Questions

1. Are the magnetic lines closed? Explain? (AS1) (TQ)

1. Yes, magnetic lines are always forms closed loops and any two field lines can never intersect each other.
2. Inside the magnet the direction of magnetic lines of force is from South Pole to its north pole.
3. Outside the magnet each line comes out from North Pole and goes into the South Pole.
4. Thus, the magnetic lines of force are closed loops.

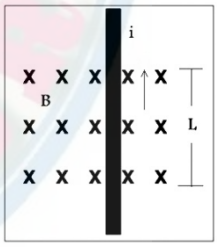


2. Why do the picture appear distorted when a bar magnet is brought close to the screen of a television? Explain (AS1) (TQ)

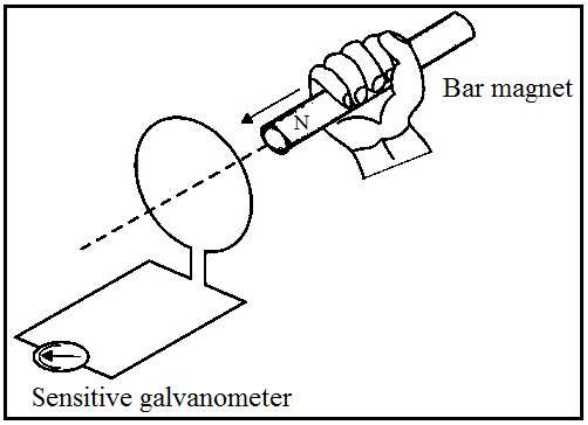
1. Television has a picture tube which produces a motion of electrons on the screen.
2. These electrons are affected by magnetic field of a bar magnet.
3. Because the magnetic field exerts a force on the electrons reaching the screen.
4. So the picture destroyed when a bar magnet is brought close to the screen of a television.

3. Symbol 'X' indicates the direction of a magnetic field into the page. A straight long wire carrying current along its length is kept perpendicular to the magnetic field. What is the magnitude of force experienced by the wire by the magnetic field? In what direction does it act? (AS1) (TQ)

1. The force experienced by the wire due to magnetic field, F=BIL.
   Where B = Magnetic field induction.
   I = Electric current through wire.
   L = Length of the wire.
2. Applying the Fleming left hand rule,
   B = Into the plane.
   I = Along the wire from Q to P.
   L= Towards left.
3. So, the direction of force is towards left side.



4. Explain Faraday's law of induction with the help of activity? (AS1) (TQ)



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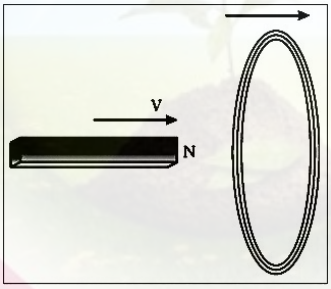
1. Connect the two terminals of a coil to sensitive galvanometer as shown in the figure.
2. Push a bar magnet towards the coil whose north pole is facing towards the coil.
3. While the magnet is moving towards the coil, the needle in galvanometer deflects, showing that a current has been set up in the coil,
4. If the magnet is moved away from the coil, the needle in the galvanometer again deflects but in the opposite direction.
5. Which means that a current is set up in the coil in the opposite direction.
6. Whenever there is a continuous change of magnetic flux linked with closed coil, the current is generated in the coil.
7. This is one of the form of Faraday's law.

5. Rajkumar said to you that the magnetic field lines are open and they start at North Pole of bar magnet and end at South Pole. What questions do you ask Rajkumar to correct him by saying "field lines are closed"? (AS2) (TQ)

1. Are these magnetic field lines are closed or open loops.
2. How do the magnetic field lines behave inside the magnet?
3. What is field lines indicate?
4. What is the direction of the magnetic field lines inside the magnet?
5. Are the direction of field lines is from its South Pole or North Pole?
6. Why the magnetic compass needle following a curved path from one pole to another?
7. Can you say now, the magnetic field lines are open or closed?

6. As shown in figure both coil and bar magnet moves in the same direction. Your friend is arguing that there is no change influx. Do you agree with his statement? If not what doubts you have? Frame questions about doubts you have regarding change in flu? (AS2) (TQ)



1. Yes, I will agree.
2. The induced EMF will not produce when the coil and magnet are moving in the same direction with same velocity.
3. Hence my friend's argument is correct.

I have the following droughts:- 1. What happened if both magnet and coil move in same direction?
2. What happens if both magnet and coil move in opposite direction?
3. Does the coil changes its orientation?
4. What is the direction of current in the coil?
5. Is the coil moving with same velocity of that of the magnet?
6. If both move in same direction, is there any linkage of flux with the coil?
7. When North pole is moved towards the coil what is the direction of current?
8. If the magnet is reversed, what is the direction of current in the coil?

7. Collect information about generation of current by using faraday's law? (AS4) (TQ)

1. Faraday's law is change in magnetic flux induces EMF in the coil.
2. Electric current can be generated by moving a coil through a magnetic field.
3. This is applicable to both alternate current (AC) and direct current (DC).
4. Transformer also works on principle of electromagnetic induction, which used to transmit the current.

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5. If the wire is made into a loop in the magnetic field, we can get the continuous current.
6. The more loops of wire passing through the magnetic field, then higher the voltage that is created.

8. How do you appreciate the Faraday's law, which is the consequence of conservation of energy? (AS6) (TQ)

1. Law of conservation of energy says energy neither be created nor be destroyed but can be converted from one form to another.
2. Faraday's Law says whenever there is a continuous change of magnetic flu linked with a closed coil, a current is generated in the coil.
3. This induced emf is equal to the rate of change of magnetic flux passing through it.
4. We have to do some work to move the magnet through a cell. This work produced energy.
5. This energy is converted into electrical energy in the coil.
6. So conservation of energy takes place in electromagnetic induction.
7. So, I appreciate the Faraday's law, which is the consequence of conservation of energy.

9. Give a few applications of faraday's law of induction in daily life? (AS7) (TQ)

Applications of faraday's law:-

1. During the security check, people made to walk through a large upright coil which produces a weak Ac magnetic field.
2. If we are carrying any significant quantities of iron, the magnetic flux changes and the induced current generated in the coil triggers an alarm.
3. The tape recorder which we use to listen to songs (or) record voices works on the principle of electromagnetic induction.
4. The principle of electromagnetic induction in the case of using ATM card when it's magnetic strip is swiped through a scanner.
5. An induction stove works on the principle of electromagnetic induction.
6. Transformers, electrical generators work on the principle of electromagnetic induction.

10. What are the differences between electric motor and a generator?

Electric motor	Generator
1. Motor converts electrical energy into mechanical energy.	1. Generator converts mechanical energy into electrical energy.
2. It works on the principle of Fleming's left hand rule.	2. It works on the principle of Fleming's right hand rule.

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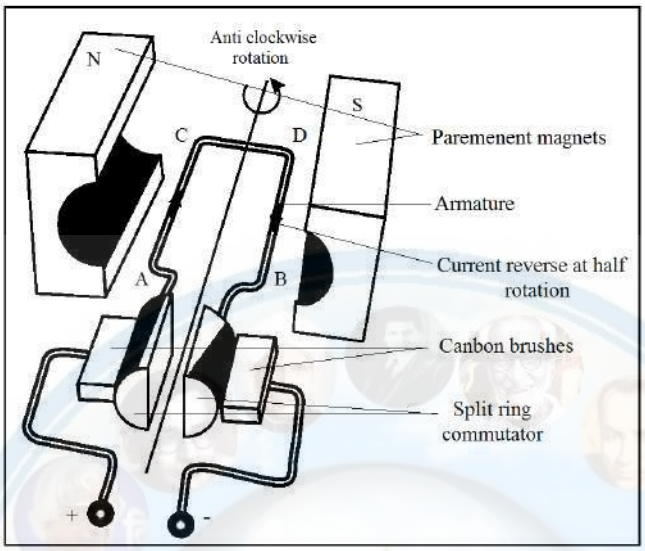
4 Mark Questions

1. Explain the working of electric motor with a neat diagram? (AS1) (TQ)

Electric motor:- It is a device which converts the electrical energy into mechanical energy.

Principle:- When a current carrying conductor placed in a magnetic field experiences a force, the direction of force is given by Fleming's left hand rule.

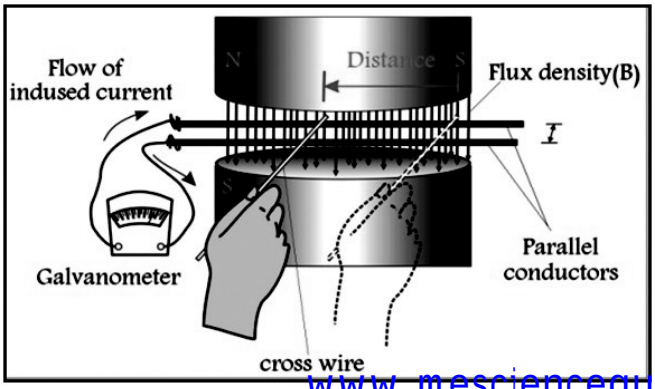


Working of electric motor:- 1. An electric motor consists of a rectangular coil ABCD is called armature.

2. The armature is kept in between the permanent magnets as shown in the figure.
3. When electric current is passed through the rectangular coil, this current produces a magnetic field around the coil.
4. The magnetic field of horse shoe type magnet then interacts with the magnetic field of the coil and causes the coil to rotate continuously.
5. If ABCD is in horizontal position current from battery enters the coil through brush B_1, and commutator half ring C_1.
6. The current flows in the direction ABCD and leaves ring and brush B_2.
7. The direction of current is from A to B, the direction of current is from C to D.
8. Whereas the force on the side C of the coil is in the upward direction. ABCD rotates in anti-clock wise direction.
9. While rotating, the coil reaches vertical position then the brushes B_1 and B_2 will touch the gap between the commutator rings and current to the coil is cut off.
10. The coil CD comes on the left side and AB comes to the right side. Again they come in contact with brush B_1, current direction is reversed.
11. The reversing of current in the coil is repeated after every half rotation.
12. So the coil continue to rotate as long as current from the battery is passed through it.

2. Derive Faraday's law of induction from conservation of energy. (AS1) (TQ)

Faraday's law:- The induced emf generated in the closed loop is equal to the rate of change of magnetic flux passing through it.



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1. Let us arrange the appratus as shown in the figure.
2. It consists of a pair of parallel bare conductors which are spaced one meter apart in uniform magnetic field 'B'.
3. We can hold another bare conductor makes in such a way that it is in contact with the two parallel conductors to complete an electric circuit.
4. Suppose that the cross wire is moved to the right to a distance of 'S'in a time of 'Δt'.
5. The work done by the applied force, $W = F \times S$.
   $W = BIL \times S$ (Since force on the conductor, F = BIL)
   $W = (BLS) \times I$ -------(1)
6. As we move the cross wire to the left, the area of the circuit decreases and the flux through the loop also decreases.
   The decrease in flux, $\Delta\varphi = BLS$ -------(2)
7. Subatitute $\Delta\varphi = BLS$ in equation (1). We have $W = \Delta\varphi \times I$ -------(3)
8. We know electrical power, P = Rate of work done.

$$\text{i.e } P = \frac{W}{t}$$

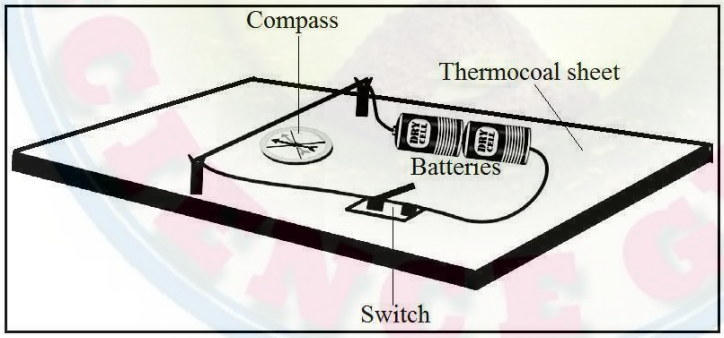
$$= \frac{\Delta\varphi \times I}{t}$$

$$= \left(\frac{\Delta\varphi}{\Delta t}\right) \times I.$$

$$P = \varepsilon \times I \quad \left(\text{Since } \varepsilon = \frac{\Delta\varphi}{\Delta t}\right)$$

9. Thus the mechanical energy used to move the cross wire to a distance 'S' in one second is converted into electrical energy ($\frac{\Delta\varphi}{\Delta t}$).
10. Therefore it leads to conservation of energy.

3. Explain with the help of two activities that current carrying wire produces manetic field? (AS1)(TQ)



Activity-1:- 1. Take a thermocol sheet and fix two thin wooden sticks of height 1Cm which have small slit at the top of their ends.
2. Arrange of copper wire of 24 gauge so that it passes thought these slits and make a circuit.
3. The circuit of 3 or 9v battery, key and copper wire which is connected in series as shown in figure.
4. Now, keep a magnetic compass below the wire and bring a bar magnet close the compass.
5. The needle in the compass deflects. This deflection is due to magnetic field produced by bar magnet.
6. Take the bar magnet far away from the circuit and switch on the circuit.
7. Observe the changes in compass. The compass needle deflects.
8. This deflection is due to magnetic field produced by current carrying conductor (wire).

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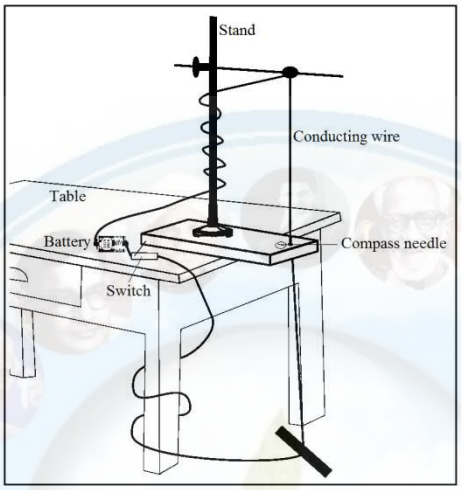
Activity-2:- 1. Take a wooden plank and make a hole as shown in figure.
2. Place this plank on a table. Now place a retort stand on the plank.
3. Pass a 24 gauge copper wire through a hole of the plank and rubber knob of the retort stand in such a way that the wire be arranged in a vertical position and doesn't touch the stand.
4. Connect the two ends of wire to a battery via switch.
5. Place 6 to 10 compass needles in a circular path around the hole so that its centre coincides with the hole.
6. Use 3 or 9 volts battery in a circuit. Now switch on, the current flows through the wire.
7. The compass needle deflects in a particular direction.
8. The deflection is due to magnetic field produced by current carrying wire.



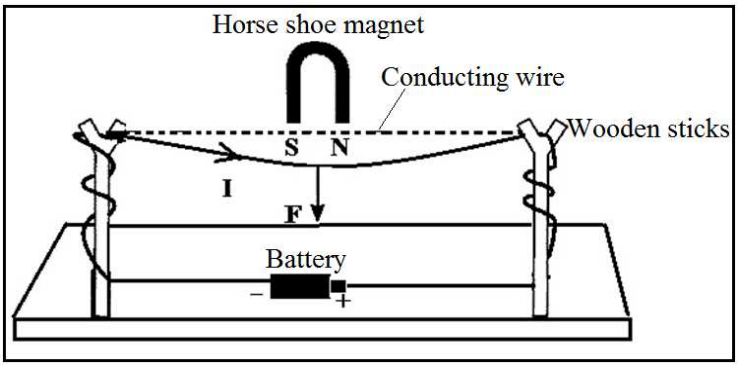
4. How do you verify experimentally that the current carrying conductor experiences a force when it is kept in magnetic field? (AS1) (TQ)

Aim:- To verify the existence of force on current carrying conductor in a magnetic field.

Required apparatus:- Strong horse-shoe magnet, wooden plank, battery, plug key, vertical stand and connecting wires.

Procedure:- 1. Take a wooden plank. Fix two long wooden sticks on it.
2. These wooden sticks are split at their top ends.
3. A copper wire is passed through these splits and the ends of the wire are connected to battery of 3 volt, through a switch.
4. Close the switch to make the circuit. Current passes through the wire.
5. Now bring a horseshoe magnet near the copper wire.
6. Then a force experienced on wire.
7. Reverse the polarities of magnet and then the direction of force is also reversed.
8. The right hand rule helps the direction of flow of current.

Conclusion:- The current carrying conductor experiences a force when it is kept in magnetic field.



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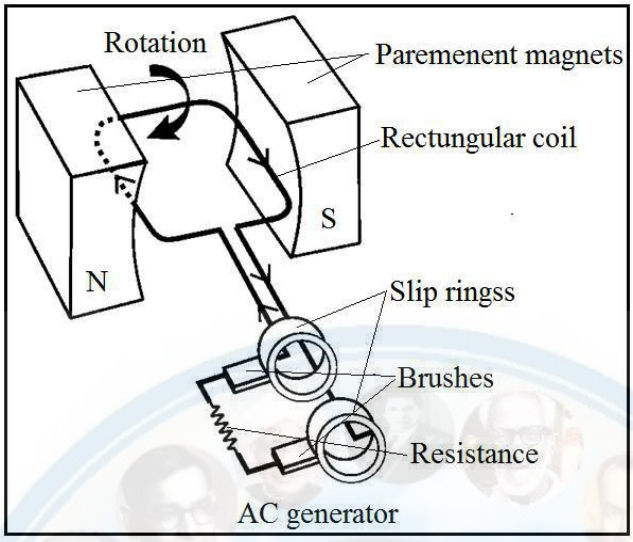
5. Explain the working of AC electric generator with a neat diagram? (AS1) (TQ)

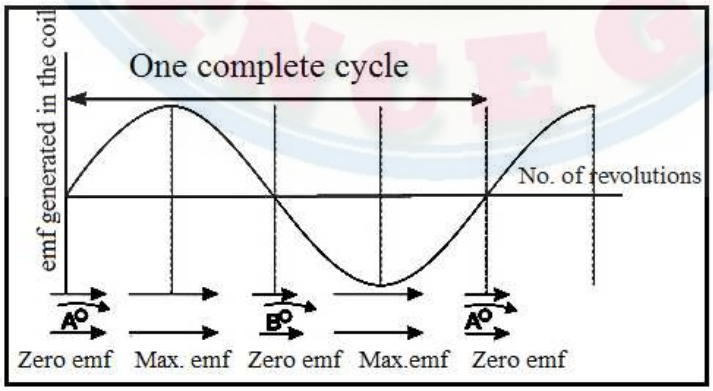
AC electric generator:- Electrical generator is a device which converts the mechanical energy into electrical energy.

Principle:- It works on the principle of electromagnetic induction.



Working:- 1. Consider the rectangular coil is held between the poles of curve-shaped permanent magnet as shown in the figure.

2. When the coil is at rest in vertical position, with side (A) of coil at top position and side (B) at bottom position, no current will be induced in it.
3. Thus current in the coil is zero at this position.
4. When the coil is rotated in clockwise direction, current will be induced in it and it flows from A to B.
5. During the first quarter of rotation, the current increases from zero to a maximum and reaches peak value.
6. If we continue the rotation of coil, current decreases during the second quarter of the rotation and once again becomes zero.
7. When the coil comes to vertical position with side B at top (A) at bottom position.
8. During the second part of the rotation, current generated follows the same pattern as that in the first half except that the direction of current is reversed.



Usage of induced current produced:-

1. The ends of the coil are connected to two slip rings and two carbon brushes are arranged in such a way that they press the slip rings to obtain current form the coil.
2. When these brushes are connected to external devices like T.V, bulb etc. we can make them work with the current supplied from ends of carbon brushes.
3. This current is known as alternating current (AC).

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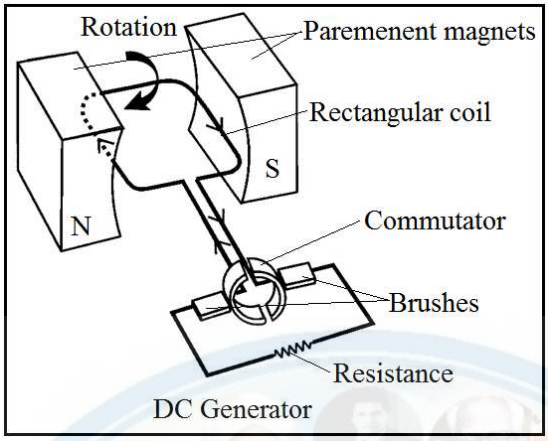
6. Explain the working of DC generator with a neat diagram. (AS1) (TQ)

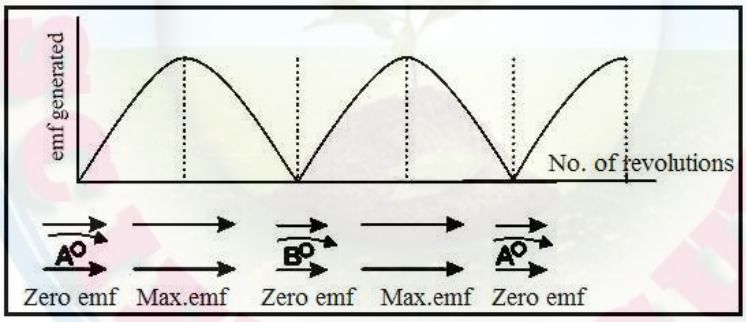
DC electric generator:- Electrical generator is a device which converts the mechanical energy into electrical energy.

Principle:- It works on the principle of electromagnetic induction.



Working:- 1. Consider the rectangular coil is held between the poles of curve-shaped permanent magnet as shown in the figure.

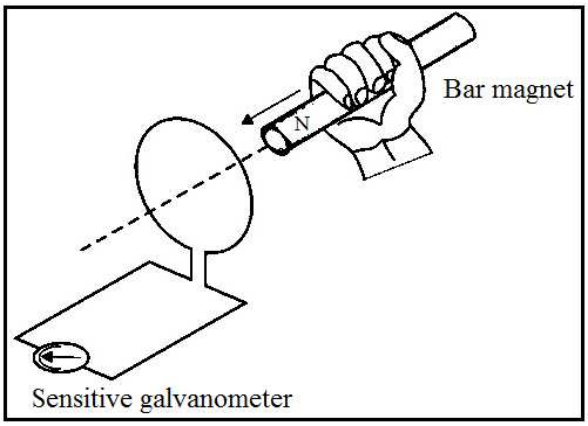
2. When the coil is in vertical position the induced current generated during the first half rotation, rises from zero to maximum and falls to zero again.
3. As the coil moves further from this position, the ends of the coil go to other slip rings.
4. Hence, during the second half rotation, the current is reversed in the coil itself.
5. The current is generated in the second half rotation of the coil is identical with that during the first half of the direct current for one revolution.
6. This current is known as direct current (DC).



7. What experiment do you suggest to understand faraday's law? What material is required? What suggestions do you give to get good results of the experiment? Give precautions? (AS3) (TQ)

Aim:- To understand Faraday's law of induction.

Material Required:- Galvanometer, bar magnet and a coil of wire.



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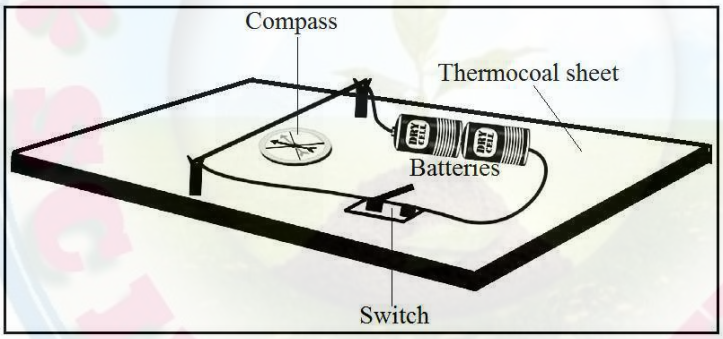
Procedure:- 1. Connect the terminals of a coil to sensitive galvanometer as shown in the figure.
2. Push a bar magnet towards the coil whose north pole is facing towards the coil.
3. While the magnet is moving towards the coil, the needle in galvanometer deflects, showing that a current has been set up in the coil,
4. If the magnet is moved away from the coil, the needle in the galvanometer again deflects but in the opposite direction.
5. Which means that a current is set up in the coil in the opposite direction.
6. If we use the end of the South Pole instead of North Pole, the results i.e., the deflection of galvanometer is exactly opposite to each other.
7. Whenever there is a continuous change of magnetic flux linked with closed coil, the current is generated in the coil.

Precautions:- 1. The coil should be kept on an insulating surface.
2. The bar magnet should be a strong magnet.
3. The area of the coil should be more.
4. The number of turns in the coil should be more.
5. The centre of galvanometer scale must be zero.

8. How can you verify that current carrying wire produces magnetic field with the help of experiment? (AS3) (TQ)

Aim:- To verify that current carrying wire produces magnetic field.

Required Apparatus:- Thermocol sheet, battery, key, wooden sticks, compass needle, bar magnet etc.



Procedure:- 1. Take a thermocol sheet and fix two thin wooden sticks of height 1cm which have small slit at the top of their ends.
2. Arrange of copper wire of 24 gauges so that it passes thought these slits and make a circuit.
3. The circuit of 3 or 9v battery, key and copper wire which is connected in series as shown in figure.
4. Now, keep a magnetic compass below the wire and bring a bar magnet close the compass.
5. The needle in the compass deflects. This deflection is due to magnetic field produced by bar magnet.
6. Take the bar magnet far away from the circuit and switch on the circuit.
7. Observe the changes in compass. The compass needle deflects.
8. This deflection is due to magnetic field produced by current carrying conductor (wire).

9. Collect information of experiments done by Faraday? (AS4) (TQ)

1. Connect the terminals of a coil to sensitive galvanometer as shown in the figure.
2. Push a bar magnet towards the coil whose north pole is facing towards the coil.
3. While the magnet is moving towards the coil, the needle in galvanometer deflects, showing that a current has been set up in the coil,
4. If the magnet is moved away from the coil, the needle in the galvanometer again deflects but in the opposite direction.

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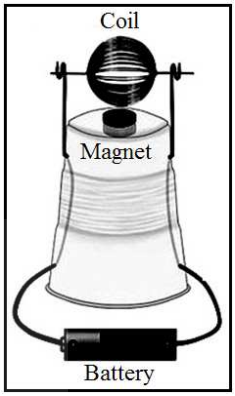
5. Which means that a current is set up in the coil in the opposite direction.
6. If we use the end of the South Pole instead of North Pole, the results i.e., the deflection of galvanometer is exactly opposite to each other.
6. Whenever there is a continuous change of magnetic flux linked with closed coil, the current is generated in the coil.

10. Collect information about material required and procedure making simple electric motor from internet and make a simple motor on your own? (AS4) (TQ)



Aim:- To prepare a simple electric motor.

Material Required:- 1.5m copper wire (about 25 gauge), 2 safety pins, 1.5 battery, magnets, and rubber bands.

Procedure:- 1. Wind the copper wire nearly 10-15 turns to make a coil.
2. Copper coil is arranged in between the two safety pins as shown in the figure.
3. The other ends of the pins are fixing vertically to a battery as shown in the figure.
4. This completes the simple electric motor.
5. We can observe the rotation of the coil.

11. How do you appreciate the relation between magnetic field and electricity that changed the lifestyle of mankind? (AS6) (TQ)

1. The idea of Oersted is, current carrying conductor behaves like a magnet.
2. Faraday law is, continuous change of magnetic flux linked with closed coil produces the current.
3. The relation between magnetic field and electricity enables us to use electric motors, generators, fans grinders and induction stoves etc.
4. Life style of man has been enhanced socio economically, in transportation, jobs and leisure time.
5. We are able to construct motors to convert electrical energy into mechanical energy.
6. We are able to construct generators to convert mechanical energy into electrical energy.
7. All these are possible with the relation between magnetic field and electricity.
8. So I appreciate the relation between magnetic field and electricity that changed the lifestyle of mankind.

12. Which of the various methods of current generation protects the nature well? Give examples to support your answer? (AS7) (TQ)

There are so many reasons the world is looking towards alternative energy sources in an effort to reduce the pollutants and green house gasses. They are,

1. Tidal Energy:- 1.Ocean waves can be used to generate the wave power.
2. The kinetic and potential energy of high and low tidal energies are converted into electrical energy.
3. The ocean is an example of a natural resource.

2. Hydro electrical energy:- Hydro electrical power comes from the potential energy of dammed water driving a water turbine and generator.

3. Wind energy:- Wind energy comes from the wind to propel the blades of wind turbines.

4. Solar energy:- 1. Solar energy comes from hot sun rays.
2. But it has some limitations like, non-availability at all times, more production cost and less storage capacity.

5. Nuclear energy:- 1. Nuclear energy is comes from Uranium isotopes by controlling the chain reactions.
2. Nuclear reactor is used for this purpose.

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6. Geothermal energy:- Geothermal energy is to be improved and it has to be brought into the wide useas.

13. The value of magnetic induction of uniform field is 2T. What is the flux passing through the surface of area 1.5 m^2 perpendiculars to field? (AS1) (TQ)

Given:- Magnetic field induction, B =2T
Surface area, A = 1.5 m^2
Magnetic flus, Φ=?

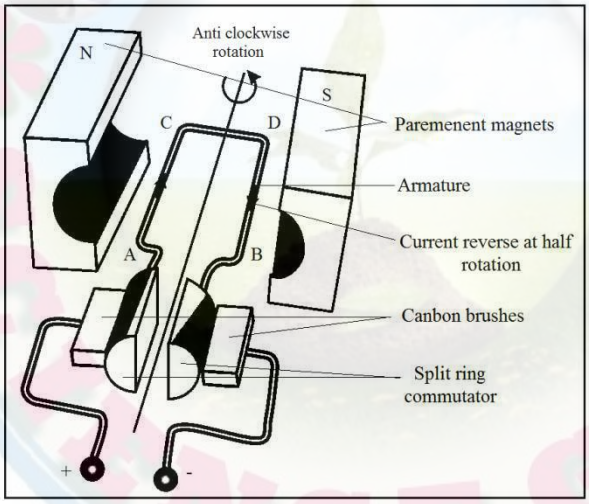
Formula:- Magnetic flus, Φ = BA = 2 x 1.5 =3 Weber.

14. An 8N force acts on a rectilinear conductor 20cm long placed perpendicular to magnetic field. Determine the magnetic field induction if the current in the conductor is 40A? (AS1) (TQ)

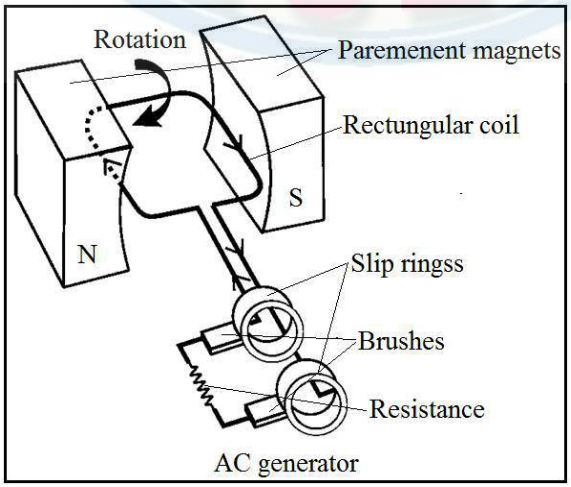
Given:- F =8N
l = 20 cm or $20x10^{-2}$ m
i= 40 A
B =?

Formula:- $B = \frac{F}{il} = \frac{8}{40 \times 20 \times 10^{-2}} = \frac{8 \times 10^2}{40 \times 20} = \frac{800}{800} = 1$Tesla.

15. Draw a neat diagram of electric motor. Name the parts? (AS5) (TQ)



16. Draw a neat diagram of AC generator? (AS5) (TQ)



Chapter 13

Metallurgy

1 Mark Questions

1. What is metallurgy?

Metallurgy:- The process of extraction of metals from their ores is called metallurgy.

2. What are minerals?

Minerals:- The elements (or) compounds of the metals that occur in nature in earth crust are called as Minerals.

3. Define the term ores?

Ores:- The minerals from which metals are extracted profitably are known as ores.

Ex:- Aluminium ore is "Bauxite" ($Al_2O_3 .2H_2O$)

4. Do you agree with the statement "All ores are minerals but all minerals need not be ores?" Why?

Yes I agree with the statement because ore is a mineral from which the metals are extracted with out economical loss.

5. What are the metals present in the Bronze Alloy?

Copper and Tin (Cu + Sn).

6. List three metals that are found in nature in uncombined form? (AS1) (TQ)

1. Gold(Au) 2. Silver(Ag) 3. Copper(Cu)

7. Write the names of any two ores of iron? (AS1) (TQ)

1. Haematite - Fe_2O_3.
2. Magnetite – Fe_3O_4.

8. Which metals exist in the nature in free state?

Gold (Au), Silver(Ag), Platinum (Pt).

9. Write the stages involved in the extraction of metals from the ores?

The extraction of a metal from its ore involves three stages. They are,

1. Concentration or Dressing.
2. Extraction of crude metal.
3. Refining (or) purification of the metal.

10. Which method do you suggest for the dressing of a ore containing magnetic and non magnetic and substances?

1. I suggest Magnetic separation method.
2. Because in magnetic separation method electro magnets are used to separate the magnetic and non-magnetic substances.

12. Name two metals which corrode easily and two metals which do not corrode readily?

1. Iron, and copper corrode easily.
2. Gold and platinum do not corrode.

13. Which purification method is used if the impurities have high boiling point ?

Distillation process is used if the impurities have high boiling point. In this method the extracted metal in the molten state is distilled to obtain the pure metal as distillate.

14. Define the terms 1. Gangue 2. Slag. (AS1) (TQ)

Gangue:- The impurities like clay, sand present in the ore is called a Gangue.

Slag:- The impurities obtained during the poling process get oxidized to form slag(scum) over the surface of the molten metal.

Ex:- $CaSiO_3$, $FeSiO_3$.

15. What is flux? Give an example?

Flux:- The new substance added to ore for remove gangue is called a flux.

Ex:- SiO_2 (Acidified flux), Cao (Base flux)

16. Which method is used to extract magnesium from its ore carnalite ?

1. The formula of carnalite is $KCl.MgCl_2.6H_2O$.
2. Electrolytic reduction method is used to extract magnesium from its ore Carnalite.

17. What is activity series?

Activity series:- Arrangement of the metals in decreasing order of their activity is known as activity series.

18. What is the use of adding impurities to the ore?

Suitable impurities are added to the ore to decrease its melting point.

19. What is meant by a refining of metal?

The process of obtaining the pure metal from the impure metal is called refining of the metal.

20. What are the stages involved in the refining of metal?

Refining of the metal involves several types of processes. They are,

1. Distillation.
2. Poling.
3. Liquation.
4. Electrolysis.

21. Does the reactivity of a metal and form of its ore has any relation with process of extraction?

1. Yes, they have relation.
2. Metals like K, Na, Ca, Mg and Al are so reactive and exists in all forms.
3. Moderate reactive metals like Zn, Fe, Pb exists as oxides, sulphides and carbonates.
4. Least reactive metals Au, Ag found in free state.

22. Magnesium is an active metal if it occurs as a chloride in nature, which method of reduction is suitable for its extraction?

1. Magnesium is an active metal. It occurs in chloride form as $MgCl_2$.
2. Hence electrolysis is suitable method for its reduction.

23. Mention two methods which produce very pure metals?

Electrolysis and reduction are the two methods that produce pure metals.

24. In nature, Ag, Au, Cu available in free state. Justify the statement?

In nature, Ag, Au and Cu are available in free state due to their least reactive nature with their surroundings.

25. Define the process of refining of metal?

The process of obtaining of pure metal from the impure metal is known as refining of metal.

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26. Is the VI group were known as chalcogens? Justify your answer?

1. VI group was known as chalcogens, Since, most of the ores are in the form of oxides (or) sulphides and so on.
2. These are called as chalcogens which means ore forming elements.

27. What is the use of a Bisphenol?

Bisphenol is a chemical used for prevention of corrosion of metals.

28. Write a chemical name of rusting of iron and mention its formula?

The rusting of Iron is a Iron Oxide. Its formula is Fe_2O_3.

29. Write the chemical formula for hydrated ferric oxide(Rust)?

Fe_2O_3. X H_2O.

30. What is a poling?

Poling:- The molten metal is stirred with poles of green wood. The impurities are removed either as gases or they get oxidized and form slag over the surface of the molten metal the process is called a poling.

31. What is Liquation ?

Liquation:- A low melting metal can be made to flow on a slopy surface to separate it from high melting impurity.

Ex:- Tin.

32. What is a stainless steel?

Stainless steel is an alloy of Iron, Nickel and Chromium.

33. What are the cathode and Anode used for electrolytic refining process?

In the electrolytic refining process the impure metal used as a Anode and a pure metal used as a cathode.

2 Mark Questions

1. List three metals that are found in nature as Oxide ores. (AS1) (TQ)

S.No	Name of the Metal	Ore	Chemical Formula
1	Zinc(Zn)	Zincate	ZnO
2	Iron(Fe)	Haematite	Fe_2O_3
3	Lead(Pb)	Galena	PbS

2. Write a note on ore dressing in metallurgy? (AS1) (TQ)

Ore that are mined from the earth are usually contaminated with large amount of impurities such as soil and sand etc.

1. Dressing or concentration means, simply getting rid of as much of the unwanted rocky materials as possible before the ore is converted into the metal.
2. The impurities are known as “gangue”.
3. The Physical methods like hand picking, washing, froth floatation and magnetic separation are used to enrich the ore depending on the physical properties of ore and gangue.

3. What is an ore? On what basis a mineral is chosen as an ore? (AS1) (TQ)

Ore:- The mineral from which the metals are extracted without economical loss are called ores.

A mineral is chosen as an ore based on the following conditions.

1. The percentage of the metal in that mineral.
2. Economically profitable while extracting the metal from the mineral.
3. Convenience of extraction of metal.

4. How do metals occur in nature? Give examples to any two types of minerals? (AS1) (TQ)

1. The earth crust is the major sources of metals.
2. Some metals are available in nature in free state as they are least reactive.

   Ex:- Gold(Au), Silver(Ag) and Copper(Cu).
3. Most of the metals are found in nature in the combined form due to their more reactivity.
4. The elements or compounds of the metals which occur in nature in the earth's crust are called minerals.
5. They are many types of minerals or ores . They are as follows.

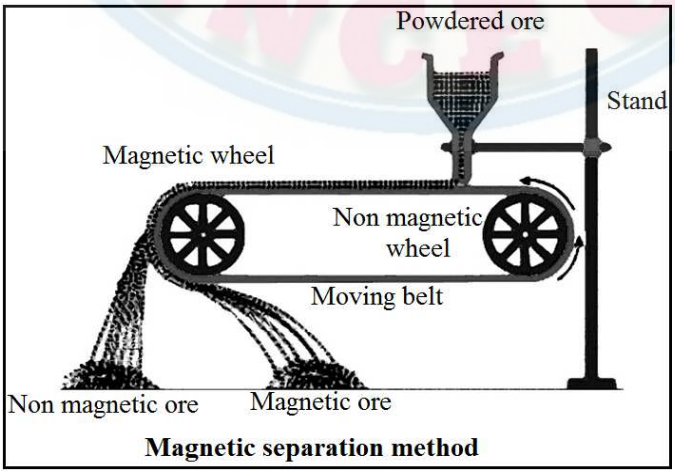
S.No	Type of the mineral	Name of the mineral
1	Oxide mineral	1. Bauxite ($Al_2O_3 . 2H_2O$) 2. Hematite (Fe_2O_3) 3. Zincite(ZnO)
2	Sulphide mineral	1. Zinc Blende(ZnS) 2. Cinnabar (HgS) 3. Galena (PbS)
3	Chloride mineral	1. Horn silver (AgCl) 2. Rock salt(NaCl)
4	Carbonate mineral	1. Magnesite ($MgCO_3$) 2. Lime stone($CaCO_3$)

5. When do you use magnetic separation method for concentration of an ore? Explain with an example? (AS1) (TQ)

In the ore or impurity, one of them is magnetic substance and the other non-magnetic substance, they are separated by electromagnetic separation method.

Ex:- 1. The magnetic ores like iron pyrites (FeS) and magnetite (Fe_3O_4) are concentrated by this method.

2. The crushed ore is allowed to pass through electromagnetic belts.
3. The mineral particles are retained and gangue particles are thrown away.



Magnetic separation method

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6. What is the difference between roasting and calcinations? Give one example for each? (AS1) (TQ)

Roasting	Calcination
1. Roasting is a pyrochemical process in which the ore is heated in the presence of air.	1. Calcination is a pyrochemical process in which the ore is heated in the absence of air.
2. The product obtained in this process are in solid state.	2. The ore generally decomposed in this process.
3. It is used for sulphide ores	It is used for carbonate ores
4. $2ZnS(s) + 3O_2(g) \rightarrow 2ZnO(s) + 2SO_2(g)$	4. $MgCO_3(s) \xrightarrow{\Delta} MgO(s) + CO_2(g)$

7. Magnesium is an active metal if it occurs as a chloride in nature, which method of reduction is suitable for it extraction? (AS2) (TQ)

1. Magnesium is an active metal. It occurs in chloride form as $MgCl_2$.
2. Hence electrolysis is suitable method for its reeducation.
3. During the electrolysis the following chemical reactions are takes place.

$MgCl_2 \rightarrow Mg^{2+} + 2\ Cl^-$.

At cathode: $Mg^{2+} + 2e^- \rightarrow Mg$.

At Anode: $2\ Cl^- \rightarrow Cl_2 + 2e^-$

8. Mention two methods which produce very pure metals? (AS2) (TQ)

The process of obtaining the pure metal from the impure is called refining of the metal.

1. Distilation:- 1. This method is very much useful for purification of low boiling metals like Zinc and Mercury.

2. Because they have high boiling point containing substances as impurities.

2. Liquation:- In this method a low melting metal like Tin can be made to flow on a slopy surface to separate it from high melting impurities.

9. Which method do you suggest for extraction of highly reactive metals? Why? (AS2) (TQ)

High reactivity metals like K, Ca, Mg, Ca etc, can be extracted by electrolysis.

Reason:- 1. Simple reduction methods like heating with C, Co, etc. to reduce the ores of these metals are not feasible.

2. The temperature required for the reduction is too high and more expensive.
3. Hence electrolysis is the suggestible method to extract high reactive metals.

Ex:- 1. To extract Na from NaCl, fused NaCl is electrolysed with steel cathode(-) and graphite anode(+).

2. The metal (Na) will be deposited at cathode and chlorine liberated at the anode.
3. **At Cathode:-** $2Na^+ + 2e^- \rightarrow 2Na$

   At Anode:- $2C^- \rightarrow Cl_2 + 2e^-$.
4. For this process a large quantity of electricity is required to keep the ore in molten state.

10. Which method is used to purify Blister (copper copper obtained from its sulphide ore) Explain?

1. Blister copper is purified by poling.
2. In this method the motten metal is stirred with logs (Pores) of green.
3. The impurities are removed either as gases or they ge oxidized and form slag over the motten metal.
4. The reducing gases evolved from the wood prevents the oxidation of copper.

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11. Where do we use handpicking and washing methods in our daily life? Give examples. How do you correlate examples with enrichment of ore? (AS7) (TQ)

Hand picking:- If the ore particles and the impurities are different in one of the properties like colour, size etc. are separated by hand picking.

Ex:- Separating mud particles and stones from rice, Wheat etc.

Washing:- 1. Ore particles are crushed and kept on a slopy surface.
2. They are washed with controlled flow of water.
3. Less densive impurities are carried away by water flow, leaving the more densive ore particle behind.

Ex:- Washing of clothes in daily life.

12. Give examples for the metals undergo corrosion? Why do they corrode? How to prevent corrosion?

1. Iron, silver, copper. Generally undergo corrosion.
2. In metallic corrosion a metal is oxidised by loss of electron's generally to oxygen and results in the farmation of oxides.

Prevantion:- Covering the surface with paint or some chemicals.

Ex:- 1. Bisphenol.
2. Electroplating.

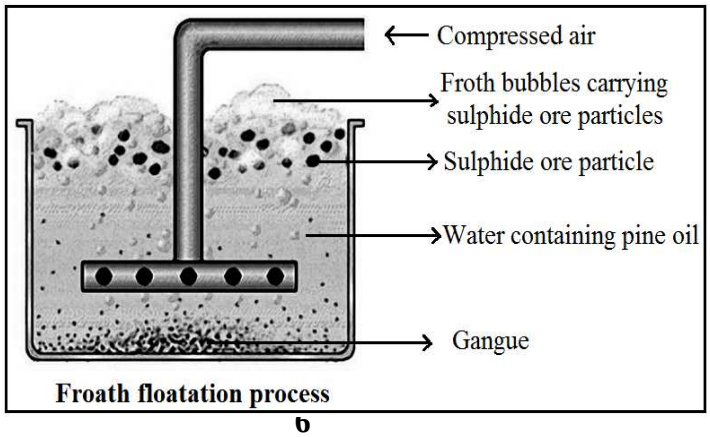
13. What is the main difference in Blast furnace and Reverberatory furnace regarding fire box and hearth ?

1. In Blast Furnace both fire box and hearth are combined in big chamber which accommodates both ore and fuel.
2. In Reverbaratory Furnace fire box and hearth are separated, but the vapours obtained due to the burning of the fuel touch the ore in the hearth and heat it.

4 Mark Questions

1. Write short notes on froth floatation process? (AS1) (TQ)

Froth floatation process:- 1. Froth Flotation method is used for dressing the sulphide ore.
2. The ore with impurities is finely powdered and kept in water, containing pine oil taken in a floatation cell.
3. Air under pressure is blown to produce forth in water.
4. Froth so produced, takes the ore particles to the surface.
5. The impurities settle at the bottom.
6. Forth is separated and washed to get ore particles.



Froath floatation process

6

2. Write short notes on each of the following: 1. Roasting 2. Calcination 3. Smelting. (AS1) (TQ)

1. Roasting:- 1. Roasting is a pyrochemical process in which the ore is heating in the presence of Oxygen (or) air below its melting point.
2. The products obtained in the process are also in solid state.
3. Generally reverberatory furnance is used for roasting.

Ex:- $2ZnS(s) + 3O_2(g) \rightarrow 2ZnO(s) + 2SO_2(g)$

2. Calcination:- 1. Calcination is a pyrochemical process in which the ore is heated in the absence of air.
2. The ore is generally decomposed in the process.

Ex:- $MgCO_3(s) \rightarrow MgO(s) + CO_2(g)$

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

3. Smelting:- 1. Smelting is a pyrochemical process, in which the ore is mixed with flux and fuel, and then it is strongly heated.
2. During smelting, the impurities (gangue) in the ore react with flux to form slag which is removed.
3. For haematite ore, coke is used as fuel and lime stone is used as flux.

Ex:- The following reactions are takes place inside the furnace.

$2C(s) + O_2 \rightarrow 2CO$

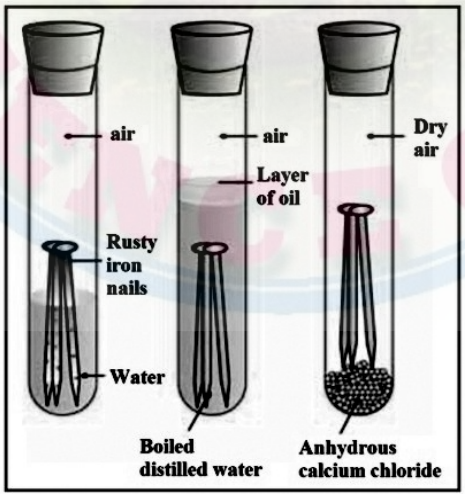
$Fe_2O_3(s) + 3CO\ (g) \rightarrow 2Fe\ (l) + 3CO_2(g)$

$CaCO_3(s) \rightarrow CaO(s) + CO_2$

$CaO(s) + SiO_2(s) \rightarrow CaSiO_3(l)$

3. Suggest an experiment to prove that presence of air and water is essential occurrences of corrosion and explain the procedure? (AS3) (TQ)

Aim:- To prove that the presence of air and water are essential occurrences of corrosion.
Apparatus:- Three test tubes, three corks, Distilled water, anhydrous calcium chloride, clean iron nails and oil etc.



Procedure:-
1. Take 3 test tubes and place clean iron nails in each of them. Label the test tubes A, B and C.
2. Pour some water in test tube A and cork it.
3. Pour boiled distilled water in test tube B, and about 1ml of oil and cork it.
4. Put some anhydrous calcium chloride in test tube C and cork it.
5. Leave these test tubes for a few days and then observe.
6. After a few days, we will observe that iron nails rust in test tube A, but they do not rust in test tubes B and C.

Reason:- 1. In test tube A, the nails are exposed to air and water. Hence the nails rusted.

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2. In test tube B, the nails are exposed only to water, but not to air, because the oil float on water and prevent the air not rested.
3. In test tube C, the nails are exposed to dry air, because anhydrous $CaCl_2$ will absorb the moisture, if any from the air. Hence the nails are not rusted.

Conclusion:- From the above experiment, we can prove that air and water are essential for corrosion.

4. What is the activity series? How it helps in extraction of metals? (AS6) (TQ)

Activity Series:- 1. Arrangement of the metals in descending order of their reactivity is known as activity series.

2. The activity series of metal is $\frac{\text{K,Na,Ca,Mg,Al}}{\text{High reactivity}}$, $\frac{\text{Zn,Fe,Pb,Cu}}{\text{Moderate reactivity}}$, $\frac{\text{Ag,Cu}}{\text{Low reactivity}}$.

The advantage of activity series in extraction of metals:-

It is very useful to judge the nature of metal and how it exists.

1. The metals at the top of the activity series (highly reactive) can be extracted by electrolysis.
2. The metals at the middle of the activity series can be extracted by,
   a. Reduction of metal oxide with carbon
   b. Reduction of oxide ores with co(Carbon monoxide)
   c. Self reduction of sulphide ores
   d. Reduction of ores with more reactive metals (thermite process)
3. The metals at the bottom of the activity series (less reactive) can be extracted by heating alone, because they are often found in free state.

5. Collect information about extraction of metals of low reactivity Silver, Platinum and Gold and prepare a report? (AS4) (TQ)

Extraction of Silver:- 1. Silver can be extracted from Ag_2S by displacement from their aqueous solution.

2. If we get the Silver the following reactions takes place.

$$Ag_2S + 4CN^- \rightarrow 2[Ag(CN)_2]^- + S^{2-}$$

$$2[Ag(CN)_2]^- (aq) + Zn(s) \rightarrow [Zn(CN)_4]^{2-} (aq) + 2Ag (s)$$

Extraction of Platinum: 1. Platinum is rarely found on its own, but in combination with other base and precious metals.

2.The extraction process of platinum is quite complex, which includes milling the ore and smelting it at high temperatures.
3. This removes the base metals, iron and sulphur and concentrate platinum.
4. In this way, Platinum is extracted from its ore.

Extraction of Gold: 1. Gold is extracted from gold ore like electrum.

2. In all methods of gold ore refining, the ore is usually washed and filtered at the mine, then sent to the mill.
3. At the mill, the ore is ground into smaller particles with water, then ground again in a ball mill to further pulverize the ore.
4. Several processes can be used to separate the gold from its ore. They are,

a. Cyanide process:-

1. The ground ore is put in a tank containing a weak cyanide solution and then zinc is added.
2. The zinc causes a chemical reaction which separates the gold from the ore.
3. The gold is then removed from the solution with a filter press.

b. Carbon-in-pulp Method:-

1. In this method, the ground ore is mixed with water before cyanide is added.
2. Then carbon is added to bond with the gold.
3. The carbon-gold particles are put into caustic carbon solution, separating out in the gold.

c. Heap leaching:-

1. The ore is placed on open-air pads and cyanide is sprayed over them, taking several weeks to leach down to an imperious base.
2. The solution then poured and pad into a pound and is pumped from there to a recovery plant, where the gold is recovered.
3. Heap-leaching helps recover gold from ore that would be otherwise too expensive to process.

6. What is thermite process? Mention its applications in daily life? (AS7) (TQ)

Termite process:-

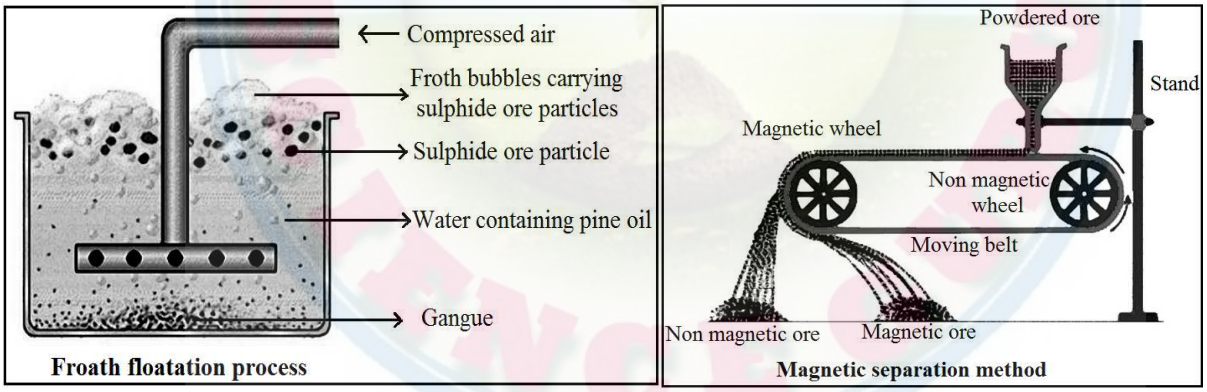
1. When highly reactive metals such as Na, Ca, Al are used as reducing agents they displace metals of lower reactivity from their compounds.
2. These displacement reactions are highly exothermic.
3. The amount of heat evolved is so large that the metals produced in molten state.
4. The reaction of Iron Oxide (Fe_2O_3) with aluminium is used to join reaction is known as the thermite reaction.

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe + Heat.$$

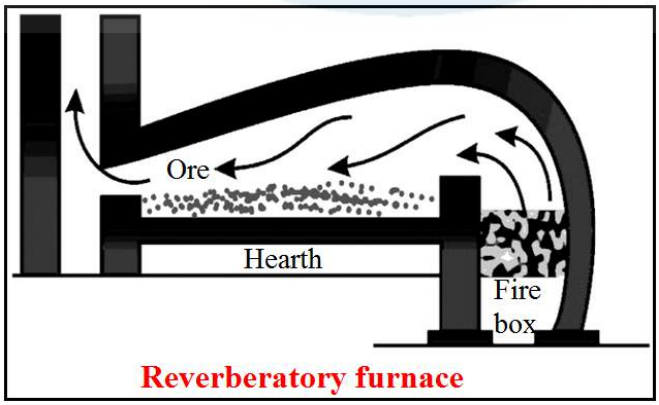
5. This reaction is known as thermite process.

Applications:- 1. Terminate process used for join railing of railway tracks
2. It is used to join cracked machine parts.

7. Draw the diagram showing (i) Froth flotation (ii) Magnetic separation? (AS5) (TQ)



8. Draw a neat diagram of Reverberatory furnace and label it neatly? (AS5) (TQ)



Chapter 14

Carbon and its Compounds

1 Mark Questions

1. Name the simplest hydrocarbon? (AS1) (TQ)

Methane **(CH_4)** is the simplest hydrocarbon.

2. Name the carboxylic acid used as a preservative? (AS1) (TQ)

Acetic acid (or) Ethanoic acid (CH_3 COOH) is used as a preservative.

3. Name the product other than water formed on burning of ethanol in air? (AS1) (TQ)

When ethanol is burnt in air the product formed other than water is carbon dioxide (CO_2).

$$C_2H_5OH + 3\ O_2 \rightarrow 2CO_2 + 3\ H_2O + \text{Energy}.$$

5. What do we call the Self linking property of carbon? (AS1) (TQ)

1. The self linking property of carbon is catenation.
2. Catenation is the phenomenon in which atoms of same elements join together to form a long chain.

6. Name the simplest ketone and write its molecular formula? (AS1) (TQ)

The simplest ketone is acetone.

Formula:- $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$

IUPAC Name:- 2 – propanone.

7. Name the compound formed by heating ethanol at 443 K with excess of conc.H_2SO_4? (AS1) (TQ)

1. When ethanol is heated with excess of .Conc. H_2SO_4 at 443K 'Ethane' is formed.

$$\underset{\text{Ethyl alcohol}}{CH_3\ CH_2\ OH} + H_2SO_4 \xrightarrow{443\ K} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$$

2. H_2SO_4 is an dehydrating agent and removes H_2O.
3. So it is a dehydration reaction.

8. Name the acid present in vinegar? (AS1) (TQ)

1. The acid present in vinegar is as 5 - 8% ethanoic acid (or) Acetic acid.
2. Its chemical formula is CH_3COOH.

9. Give an example for estarification reaction? (AS1) (TQ)

The reaction between carboxylic acid and alcohol in the presence of conc. H_2SO_4 to form a swept odoured substance, ester with functional group is called estarification.

$$\underset{\text{Acetic acid}}{CH_3COOH} + \underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \xrightleftharpoons{Conc.H_2SO_4} \underset{\text{Ethyl acetate}}{CH_3COOH\ CH_2\ CH_3} + H_2O$$

10. Name the product obtained when ethanol is oxidized by either chromic anhydride or alkaline potassium permanganate? (AS1) (TQ)

Ethanol undergoes oxidation to form the product of acetaldehyde and finally acetic acid.

$$\underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \xrightarrow[\text{Acidified K2 Cr2 O7+Heat}]{\text{Alkaline KMnO4+Heat}} \underset{\text{Acetaldehyde}}{CH_3CHO} \xrightarrow{(O)} \underset{\text{Acetic acid}}{CH_3COOH}$$

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11. Write the chemical equation represent the reaction of preparation of ethanol from ethane?(AS1) (TQ)

Ethanol is prepared on large scale from ethane by the addition of water vapor to it in the presence of catalysts like P_2O_5, Tungsten oxide at high pressure and temperature.

$$CH_2{=}CH_2 + H_2O \xrightarrow[100-300\ atm\ at\ 300^0\ C]{Catalyst} CH_3CH_2OH$$

12. Write the IUPAC name of the next homologous of $CH_3OHCH_2CH_3$? (AS1) (TQ)

$CH_3\,CH_2\ CH_2\ CH_2\,OH \rightarrow$1-butanol.

13. Give the name functional group (i) –CHO (ii) –C=O? (AS1) (TQ)

i. –CHO is Aldehyde. ii. –C=O is Ketone.

14. Name the acid present in the vinegar? (AS1) (TQ)

Acetic acid(CH_3COOH) is present in the vinegar.

15. What happens when a small piece of sodium is dropped into ethanol? (AS2) (TQ)

When a small piece of sodium is dropped into ethanol, it shows brisk effervescence and liberates hydrogen gas and forms sodium ethoxide.

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2\uparrow$$

Ethanol — Sodium ethoxide

16. What is the position of the carbon in modern periodic table?

1. Carbon is a non-metal.
2. It belongs to the fourteenth group or IV A group in the modern periodical table.

17. Who introduced the concept of hybridization?

Linus Pauling (1931).

18. What is meant by a SP^3 hybridization?

SP^3 hybridization:- 1. In the excited carbon atom its one s-orbital (2s) and three p-orbitals ($2p_x$, $2p_y$, $2p_z$) intermix and reshuffle into four identical orbitals known as sp^3 orbitals.

2. Thus, carbon atom undergoes sp^3 hybridisation.

Example:- Formation of methane(CH_4).

19. What is meant by a SP^2 hybridization?

SP^2 hybridization:- 1. In the excited carbon atom its one s-orbital (2s) and two p-orbitals ($2p_x$, $2p_y$) intermix and reshuffle into three identical orbitals known as sp^2 orbitals.

2. Thus, carbon atom undergoes sp^2 hybridisation.

Example:- Formation of ethylene($H_2C = CH_2$).

20. What is meant by a SP hybridization?

SP^2 hybridization:- 1. In the excited carbon atom its one s-orbital (2s) and one p-orbital ($2p_x$) intermix and reshuffle into two identical orbitals known as sp orbitals.

2. Thus, carbon atom undergoes sp hybridization.

Example:- Formation of ethyne($HC \equiv CH$).

21. What is allotropy? What are the allotropy forms of carbon?

Allotropy:- 1. The occurrence of same element in two or more different forms is known as allotropy.

2. The different forms of the element are called allotropes.
3. The allotropy forms of carbon are,

i. Amorphous forms. ii. Crystalline forms.

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22. Write the names of Amorphous forms of carbon?

Amorphous forms of carbon:- Coal, Coke, Wood Charcoal, Animal charcoal, Lamp black, Gas carbon, Petroleum coke, Sugar charcoal.

23. Write the names of crystalline allotropic forms of carbon?

Allotropic forms of carbon:- Diamond, graphite and buck minister fullerene.

24. How are Allotropes formed?

Allotropes are formed due to difference in arrangement of atoms in the molecule.

25. Who discovered the buckminsterfullerene?

Robert F. Curl, Harold W. Kroto and Richard E. Smalley from Rice in 1985.

26. What is meant by a buckyballs?

Buckyballs:- Spherical fullerenes are also called buckyballs.

27. Who discovered the nanotubes?

Sumio li jima in 1991.

28. What is meant by a catination?

Catination:- Catination is the phenomenon in which atoms of same elements join together to form a long chain.

29. What are hydro carbons?

The compounds containing only carbon and hydrogen in their molecules are called hydrocarbons.

30. How many types of Hydrocarbons are there? What are they?

Hydrocarbons are two types. They are,

1. Saturated hydrocarbons (alkanes).
2. Unsaturated Hydrocarbons (alkenes and Alkynces).

31. What is meant by a functional group in carbon compound?

Functional group:- The characteristic properties of an organic compound depend mainly on an atom or group of atoms in its molecule known as the functional group.

32. What is meant by a isomerism?

Isomerism:- 1. Molecules having the same molecular formula but different structures are called isomers.

2. This phenomenon is called isomerism.

33. What is meant by a soap?

Soap:- 1. Soap is a sodium or potassium salt of a higher fatty acid like palmitic acid ($C_{15}H_{31}COOH$), stearic acid ($C_{17}H_{35}COOH$), oleic acid ($C_{17}H_{33}COOH$) etc.

2. The formula of a soap in general is RCOONa or RCOOK, where R = $C_{15}H_{31}$; $C_{17}H_{35}$ etc.

34. What is meant by a glycerol?

Glycerol:- Fats are esters of higher fatty acids and the trihydroxy alcohol known as glycerol.

$$\text{Glycerol is } \begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array} \rightarrow \text{propane – 1, 2, 3 – triol.}$$

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35. What is meant by a saponification?

Saponification:- Alkaline hydrolysis of tristers of higher fatty acids producing soaps is called saponification.

36. What is a true solution?

True solution:- A true solution is that in which the solute particles dispersed in the solvent are less than 1nm in diameter.

37. What is a colloidal solution?

Colloidal solution:- A colloidial solution contains the solute known as 'dispersed phase' with its particles with diameters greater than 1nm but lesser than 1000 nm in the solvent known as 'dispersion medium'.

38. What is meant by a CMC?

CMC:- The particular concentration of a true solution is known as critical micelle concentration.

39. What is micelles or associated colloids?

Micelles:- The soap particles get aggregated and these aggregated particles are of colloidal size known as micelles or associated colloids.

40. Give the electronic configurations of carbon in both group state and exited states.

Electronic configuration of carbon atom,

In ground states $\rightarrow 1s^2 2s^2 sp^2$

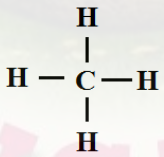
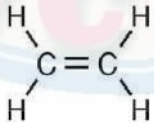
In excited state $\rightarrow 1s^2\ 2s^1 2p^3$

41. Mention the bond angles between H-C-H in, a) CH_4 b) C_2H_4 c) C2H2

a) The bond angle of CH_4 is $109^0\ 28^1$.

b) The bond angle of C_2H_4 is 120^0.

c) The bomd amgle of C_2H_2 is 180^0.

S.No	Molecule	Structure	Bond Angle
1	CH_4		$109^0 28^I$
2	C_2H_4		120^0
3	C_2H_2	H – C ≡ C –H	180^0

42. Mention the structure of each carbon atom in diamond & graphite?

Diamond – Tetrahedral arrangement.

Graphite – Trigonal arrangement.

43. What is meant by homologous?

The individual compound in a homologous series is known as homologos.

44. Define combustion reaction?

Combustion reaction:- The process of burning of carbon (or) carbon compounds in excess of Oxygen to give heat & light is known as combustion reaction.

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45. What is hybridisation? What are hybrid orbitals?

Hybridisation:- the redistribution of orbitals of almost equal energy in individual atoms to give equal number of new orbitals with identical properties like energy and shape is called "Hybridisation" The newly formed orbitals are called as "hybridorbitals."

46. What are Aldehydes and Ketones?

Aldehydes:- The hydrocarbons with functional group of –CHO are called aldehydes.'

Ex : Farmaldehyde, Accetal dehyde.

Ketones:- The hydrocurbons with – C=O group are called ketones.

Ex : Acetone, Methyl ketone

47. What is Isomerism? And what is Iromers?

Isomerism:- 1. The phenomenon of possessing same molecular formula but different properties by the compounds is known as Isomerisom.

2. The compound that exhibit isomerism is called Isomers.

48. What are subtitution reactions ?

Subtitution reactions:- A reaction in which an atom or a group of atoms in a given compound is replaced by other atom or group of atoms is called a substitution reaction.

49. How ethyl alcohol is prepared from ethane ?

Ethanol is prepared on large scale from ethane by the addition of water vapour to it in the presence of catalysts P_20_5, tungsten Oxide at high pressure and temperature.

$$CH_2 = CH_2 + H_2O \xrightarrow[\substack{100-300\ atm \\ at\ 300^oC}]{Catalist} CH_3\ CH_2OH$$

50. What is Pk^a?

Pk^a:- Pk^a is the negative value of logarithm of dissociation constant of an acid.

$$Pk^a = \log_{10} K^a$$

51. What is Micelle?

Micelle:- A spherical aggregated of soap molecules in water is called micelle.

52. What is saponification reaction?

Saponification reaction:- The sodium salts of these higher fatty acids being soaps the reaction is the soaps the recton is the soap formation reaction which is generally called as "Saponification reaction".

(or) Alkaline hydrolysis of tristers of higher fatty acids producing soaps is called saponification.

53. What are hydrophilic and hydrophobie parts in soaps ?

1. The polar end in soap with carboxy is called hydrophilic end.
2. The non-polar end in soap with hydrocarbon chain in called hydrophobic end.

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2 Mark Questions

1. What are the general molecular formula of alkanes, alkenes and alkynes? (AS1) (TQ)

S.No	Hydrocarbon	Formula
1	Alkanes	$C_n H_{2n+2}$
2	Alkenes	$C_n H_{2n}$
3	Alkynes	$C_n H_{2n-2}$

2. A mixture of oxygen and ethyne is burnt for welding; can you tell why a mixture of ethyne and air is not used? (AS1) (TQ)

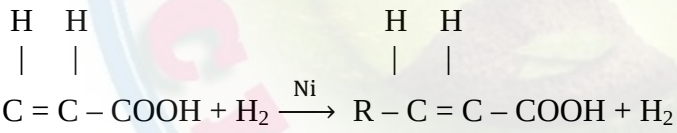
1. The heat and temperature is produced by an acetylene flame depend upon the amount of oxygen used to burn it.
2. Air- Acetylene(ethyne) produces a flame temperature around 4000^0F.
3. This heat is not enough to weld a metals like iron and steel.
4. When acetylene is burned in the presence of pure oxygen, the flame temperature may be as high as 5730^0C or 3166^0C.
5. This heat is enough to weld a metals or solder aluminum work glass.
6. Hence the mixture of Ethyne and Oxygen burnt is used for welding.

3. How an addition reaction is used in vegetable ghee industry? Explain with the help of a chemical equation? (AS1) (TQ)

1. Hydrogenation of oils converts fats in vegetable ghee industry.
2. During this addition reaction, unsaturated fatty acids (contain double bond) are converted into saturated fatty acids (contain single bond).

$$\text{unsaturated fatty acids} + H_2 \xrightarrow{Ni} \text{Saturated Fattyacids.}$$

$$\text{Oil} + H_2 \rightarrow \text{fats}$$



Ex:- $R - C = C - COOH + H_2 \xrightarrow{Ni} R - C = C - COOH + H_2$

4. Explain with the help of a chemical equation, how an addition reaction is used in vegetable ghee industry? (AS1) (TQ)

1. Vegetable oils are unsaturated fats having double bonds between some of their carbon atoms.
2. When a vegetable oil is heated t 400-500^0 C with hydrogen in the presence of Nickel as catalyst, then saturated oil called vegetable ghee is formed.
3. This reaction is called hydrogenation of oils.

$$\text{unsaturated fatty acids} + H_2 \xrightarrow{Ni} \text{Saturated Fattyacids.}$$

$$\text{Oil} + H_2 \rightarrow \text{fats}$$

Ex:- $R - C = C - COOH + H_2 \xrightarrow{Ni} R - C = C - COOH + H_2$

5. Why does carbon form compounds mainly by covalent bonding? (AS1) (TQ)

1. The atomic number of carbon if 6, its electronic configuration is $1S^2\ 2S^2\ 2P^2$.
2. Carbon has 4 electrons in its valence shell.
3. The formation of C^{4+} ions by losing '4' electrons or the formation of C^{4-} ions by gain of '4' electrons is very difficult process.

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4. Carbon has to satisfy its tetra valence by sharing electrons with other atoms.
5. So it has to form four covalent bonds either with its own atoms or atoms of other elements.

6. Allotropy is a property shown by which class substances: elements, compounds or mixtures? Explain allotropy with suitable examples? (AS1) (TQ)

Allotropy: 1. The occurrences of same element in two or more different forms are known as allotropy.
2. Allotropy is a property shown by elements only.

Eg:- The allotropes of carbon are classified into two types they are,

1. Amorphous form:- Coal, Coke, Camp black etc,
2. Crystalline form:- Diamond, Graphite, and Buck minster fullerene.

7. Explain how sodium ethoxide is obtained from ethanol? Give chemical equations? (AS1) (TQ)

When ethanol is react with sodium to liberate hydrogen and form sodium ethoxide.

$$2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$$

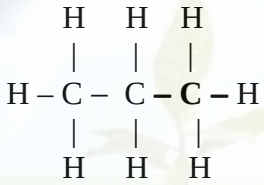
8. Describe with chemical equation how ethanoic acids may be obtained from ethanol? (AS1) (TQ)

Ethanol undergoes oxidation to form the product Acetaldehyde and finally Acetic acid.

$$CH_3CH_2OH \xrightarrow[\text{Acidified K2 Cr2 O7+Heat}]{\text{Alkaline KMnO4+Heat}} CH_3CHO \rightarrow CH_3COOH$$

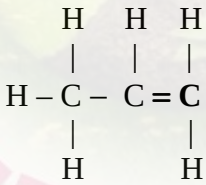
9. Two carbon compounds A and B have molecular formula C_3H_8 and C_3H_6 respectively. Which one of the two is most likely to show addition? Justify your answer? (AS2) (TQ)

C_3H_8 :- 1. The structure of C_3H_8 is,



2. It is an alkane called ethane and it cannot participate in addition reaction as it C-C.

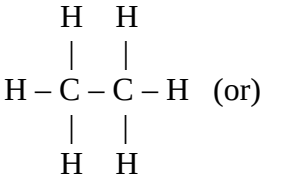
C_3H_6 :-1. The structure of C_3H_6 is,



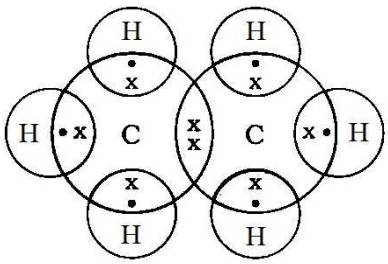
2. It is an alkene called propene and participate in addition reaction as it has C=C.

10. Draw the electronic dot structure of ethane molecule (C_2H_6)? (AS5) (TQ)

Structure of Ethane(C_2H_6) :-



(or)



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11. How do you appreciate the role of esters in everyday life? (AS6)

1. Esters are sweet or pleasant smell substances.
2. Esters are used in preparing artificial perfumes due to the fact that most of the esters have a pleasant smell.
3. The alkaline hydrolysis of esters is known as saponification to produce soaps.
4. These are used in the making of perfumes.
5. Hence, I appreciate the role of esters in everyday life.

12. Suggest a chemical test to distinguish between ethanol and ethanoic acid and explain the procedure? (AS3) (TQ)

1. Take ethanol and ethanoic acid in two different test tubes.
2. Add few ml. of sodium hydroxide (NaOH) solution in each test tube.
3. Ethanoic acid reacts with sodium hydroxide to form salt and water where as ethanol does not react with sodium hydroxide.

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O.$$

$$C_2H_5\ OH + NaOH \rightarrow \text{No reaction.}$$

13. An organic compound 'X' with a molecular formula C_2H_6O undergoes oxidation in the presence of alkaline KMnO4 and forms the compound 'Y', that has molecular formula $C_2H_4O_2$. (AS3) (TQ)

a. Identify 'X' and 'Y'

b. Write your observation regarding the product when the compound 'X' is made to react with compound 'Y' which is used as a preservative for pickles.

a. X = Ethanol (C_2H_6O).
Y = Ethanoic acid ($C_2H_4O_2$).

b. Ethyl alcohol undergoes oxidation to form the product accetaldehyde and finally Acetic acid.

$$\underset{\text{Ethanol}}{CH_3\ CH_2\ OH} \xrightarrow{\text{Alkaline } KMNO_4} \underset{\text{Accetaldehyde}}{CH_3\ CHO} \rightarrow \underset{\text{Ethnenoic acid}}{CH_3COOH}$$

Here CH_3COOH is used as preservative for pickles.

14. Mention the hybridization of carbon in the following compounds.

a) C_2H_4; b) CH_4; c) C_2H_2

S.No	Compound	Type of hybridization
1	C_2H_4	sp^2
2	CH_4	sp^3
3	C_2H_2	sp

15. Why we are advised not to use animal fats for cooking?

1. Animal fats contain saturated fatty acids. They are harmful to human health.
2. They are not eatable.

Ex:- Palmitic acid ($C_{15}\ H_{31}COOH$)

16. Which oil is recommended for cooking? Why?

1. Natural oil like sun-flower oil, groundnut oil, coconut oils are obtained from natural plants.
2. They are eatable and they contain proteins.
3. They are healthy for human beings.
4. They contain unsaturated fatty acids.

Ex:- Stearic acid ($C_{17}\ H_{35}COOH$).

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17. 1ml of acetic acid and 1ml of ethanol are mixed together in a test tube. Few drops of concentrated sulphuric acid is added in the mixture are warmed in a water bath for 5 min.

Answer the following:

a. Name the resultant compound formed.

b. Represent the above change by a chemical equation.

c. What term is given to such a reactions.

d. What are the special characteristics of the compound formed?

a. Ethyl acetate($CH_3COOC_2H_5$).

b. $CH_3COOH + C_2H_5OH \xrightarrow{Conc.H_2SO_4} CH_3COOC_2H_5 + H_2O$.

c. Estarification.

d. It has fruit (or) pleasant smell.

18. Carbon is versatile in nature. Justify the statement?

The ability of carbon to form bonds in so many ways made it as versatile in nature i.e.,

1. To form largest carbon compounds.
2. Catenation.
3. To form various types of bonds.

19. Define alkanes, alekenes and alkynes ?

Alkanes:- The saturated hydro carbons containing single bonds between carbon atoms are called alkanes.

Alkenes:- The unsaturated hydro carbons containing atleast one double bond between carbon atoms are called Alkenes.

Alkynes:- The unsaturated hydro carbons containing atleast one triple bond between carbon atoms are called Alkynes.

4 Mark Questions

1. Give the IUPAC name of the following compounds. If more than one compound is possible name all of them? (AS1) (TQ)

i. An aldehyde derived from ethane. **ii. A ketone derived from butane.**

iii. A chloride derived from propane. **iv. An alcohol derived from pentane.**

i. $CH_3CHO \rightarrow$ Ethanal.

ii. $CH_3 - \underset{\underset{O}{\|}}{C} - CH_2 - CH_2 \rightarrow$ 2-Butanone.

iii 1. $H_3C - \underset{\underset{Cl}{|}}{CH} - CH_3 \rightarrow$ 2-Chloro propane.

2. $H_3C - CH_2 - \underset{\underset{Cl}{|}}{CH_2} \rightarrow$ 1-Chloro propane.

iv. 1. $H_3C - CH_2 - CH_2 - CH_2 - CH_2 - OH \rightarrow$ Pentan-1-ol.

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2. $H_3C-CH_2-CH_2-\underset{\underset{OH}{|}}{CH}-CH_3$ → Pentan-2-ol.

3. $H_3C-CH_2-\underset{\underset{OH}{|}}{CH}-CH_2-CH_3$ → Pentan-2-ol.

2. a. What are the various possible structure formulae of a compound having molecular formula C_3H_6O?

b. Give the IUPAC names of the above possible compounds and represent them in structures?(AS1)

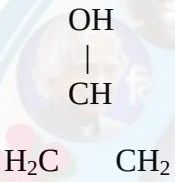
c. What is the similarity in these compounds? (AS1) (TQ)

a. **$\underline{C_3H_6O}$:-** 1. CH_3COCH_3

2. CH_3CH_2CHO

3. $CH_2 = CH - CH_2OH$

4. $CH_2 - CH - CH_3$

5. 

6. $CH_2 = CH - OCH_3$

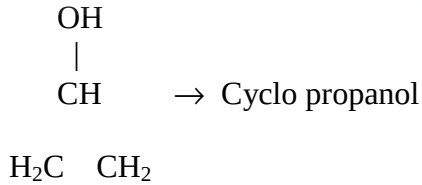
b. 1. $H_3C - \underset{\underset{O}{||}}{C} - CH_3$ → Propanone.

2. $H_3C - CH_2 - \underset{\underset{H}{|}}{C} = O$ → Propanal

3. $CH_2 - CH - CH_2OH$ → Prop-2-en-1-ol.

4. $CH_2-CH-CH_3$ → 1,2-epoxy propane.

5. $CH_2 = CH - OCH_3$ → Methoxy ethane.

6. 

c. <u>Similarities</u>:- 1. The six compounds are derivatives of hydrocarbons i.e., organic compounds.
2. All are having same molecular formula.
3. All are functional isomers.

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3. Define homologoes series of carbon compounds? Mention any two characteristics of homologous series? (AS1) (TQ)

Homologoes series:- the series of carbon compounds in which two successive compounds differ by $-CH_2$ unit is called homologoes series.

Characteristics:- 1. They have general formula.

EX:-

S.No	Hydrocarbon	Formula
1	Alkanes	$C_n H_{2n+2}$
2	Alkenes	$C_n H_{2n}$
3	Alkynes	$C_n H_{2n-2}$

2. Successive compounds in the series possess a difference of ($-CH_2$) unit.
3. They posses similar chemical properties due to same functional group.
4. They show a regular gradation in their physical properties.

4. Explain the cleansing action of Soap? (AS1) (TQ)

1. Suppose that we put dirty cloth in the soap solution. Dirt is mainly greasy matter.

2. Soap has one polar end (the end with $-C-OH$ carboxyl) and one non-polar end (the end with hydrocarbon chain) as shown here.
3. The polar end is hydrophilic in nature and attracted towards water.
4. The non-polar end is hydrophobic in nature and attracted towards grease or oil on the cloth, but not towards water.
5. When soap dissolves in water, its hydrophobic ends attach themselves to dirt and remove it from cloth, as shown sequentially in the figure.
6. The hydrophobic end of the soap molecules move towards the dirt or grease particle.
7. The hydrophobic ends attach themselves to dirt particle and try to pull out.
8. The molecule of soap surrounds the dirt particles at the centre of the cluster and forms a spherical structure called micelle.
9. These micelles remain suspended in water-like particles in a colloidal solution.
10. The various micelles present in water do not come together to form a precipitate as each micelle repels. The other because of the ion-ion repulsion.
11. Thus, the dirt particles remain trapped in micelles and are easily rinsed away with water. Hence, soap micelles remove dirt by dissolving in water.

5. Distinguish between essterfication and saponification reactions of organic compounds? (AS1) (TQ)

Esterfication	Saponification
1. The reaction between carboxylic acid and alcohol in the presence of conc. H_2SO_4 to form a swept odoured substance ester and this process is called estarification.	1. The process of making soap by the hydrolysis of fats and oils with alakalies is called saponification.
2. Alcohol reacts with carboxylic acids to produce esters.	2. Higher fatty acids reacts with basis to form Soaps.
3. $CH_3COOH + CH_3CH_2OH \overset{Conc.H2SO4}{\Longleftrightarrow} CH_3COOH\ CH_2\ CH_3 + H_2O$	3. $(C_{17}\ H_{33}COO)_3\ C_3\ H_5 + 3\ Na\ OH \rightarrow 3\ C_{17}\ H_{33}\ COO\ Na + CH_2\ OH\ CH\ (OH)-CH_2OH$
4. Water is by product in esterification reaction.	4. Glycerol is byproduct in esterification reaction.
5. This reaction is example for dehydration reaction.	5. This reaction is example for hydrolysis.
5. This reaction is slow and reversible.	5. This reaction is irreversible.
6. This process is used for preparation of different esters.	6. This is used for the preparation of soaps.

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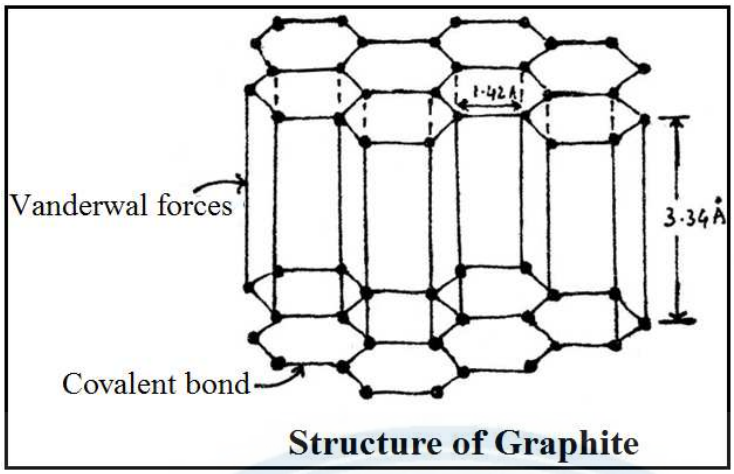
6. Explain the structure of Graphite in terms of bonding and give one property based on this structure? (AS1) (TQ)



Structure of Graphite

Graphite:- 1. Graphite is a grayish block coloured crystalline solid.
2. In a graphite the carbon atoms are in hexagonal arrangement.
3. It has a metallic luster and soapy to touch. So, it is used as a lubricant.
4. It is a good conductor of electricity.
5. It has a density of 2.25 gm/cm^3.
6. The C-C bond length is 1.42 A^o, and bond angle is 120^0.
7. Two successive graphite layers are separated by a a distance of 3.35 A^o.
8. The layers of carbon can slide one over to the another because there is no strong covalent bonds between the atoms in the two adjacent layers.

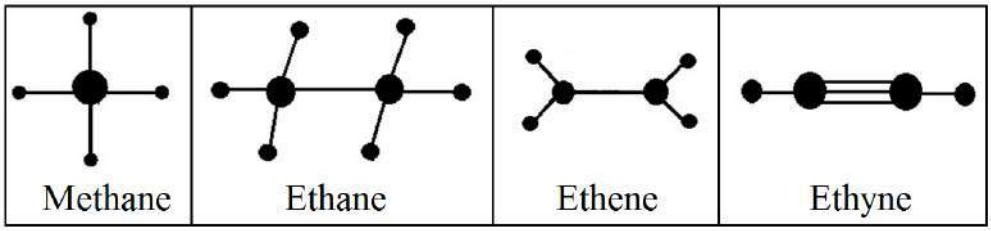
7. Suggest a test to find the hardness of water and explain the procedure? (AS3) (TQ)

Hard water:- A sample of water which does not give good lather with soap but forms stickly scum(precipitate) is called hard water.

Test:- Hardness of water can be tested with the help of good quality soap.

Procedure:- 1. Take 50ml of water from different sources i.e., tap water, well water, lake water, pond water, river water, etc, in different test tubes and label them as A, B, C, D etc.
2. Add 1gm of good quality soap to each test tube.
3. Close the each test tube with rubber corks.
4. Shake test tube A for 15 seconds and keep it. Undisturbed for 30 seconds.
5. Measure the height of the foam formed. Note the height of form in our notebook.
6. Repeat the process for each test tube and record your observation in your note book.
7. The water which gives less foam is considered as hard water.

8. Prepare a model of methane, ethane, ethene and ethyne molecules using clay balls and match sticks? (AS4) (TQ)



9. How do you condemn the use of alcohol as a social practice? (AS7) (TQ)

Negative Effects of alcohol:- 1. Alcohols slow down the activity of nervous system and the brain.
2. Drinking of alcohol causes the blurred vision, dizziness and vomiting.
3. Heavy drinking of alcohol makes a person alcoholic.
4. Heavy drinking of alcohol over a long period of time can damage the stomach, liver and heart.

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So, we may condemn the use of alcohols by,

1. Educate people on negative effects of alcohol that would help them to avoid alcohol.
2. Take the initiative of developing by a law that will debar the drinking bar keepers from selling alcoholic beverages.

10. An organic compound with molecular formula $C_2H_4O_2$ produces brisk effervescence on addition of sodium carbonate/bicarbonate. Answer the following? (TQ)

a. Identify the carbon compound? (AS1)
b. Name the gas evolved? (AS1)
c. How will you test the gas evolved? (AS2)
d. Write the chemical equation for the above reaction? (AS3)
e. List two important uses of the above compound? (AS1)

a. The organic compound is Ethanoic aid or acetic acid (CH_3COOH).

b. **Chemical Equation:-** $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$

c. The gas evolved is carbon dioxide (CO_2).

d. **Test:-** Pass the evolved gas in to the lime water then it turns to milky white.

$$Ca(OH)_2 + CO_2 \rightarrow CaCO_3 (\downarrow) + H_2O.$$

e. **Useas:-** 1. It is usead as Preservation for pickles.
2. esters are used as solvent in industry.
3. It is used in the Preparation of dyes, drugs.
4. It is used in the cooking of dishes like meat, fish etc.

11. Draw the isomers of C_5H_{12} and C_6H_{14} ?

1. C_5H_{12}:-

a). $CH_3 – CH_2 – CH_2 – CH_3 \rightarrow$ n – pentane.

b). $CH_3 – \underset{\underset{CH_3}{|}}{CH} – CH_2 – CH_3 \rightarrow$ 2 – methyl butane.

c). $CH_3 – \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} – CH_3 \rightarrow$ 2, 2 – di methyl pentane.

2. C_6H_{14}:-

a). $CH_3 – CH_2 – CH_2 – CH_2 – CH_3 \rightarrow$ n – hexane.

b). $CH_3 – CH_2 – CH_2 – \underset{\underset{CH_3}{|}}{CH} – CH_3 \rightarrow$ 2 – methyl pentane.

c). $CH_3 – CH_2 – \underset{\underset{CH_3}{|}}{CH} – CH_2 – CH_3 \rightarrow$ 3 – methyl pentane.

d). $CH_3 – \underset{\underset{CH_3}{|}}{CH} – \underset{\underset{CH_3}{|}}{CH} – CH_3 \rightarrow$ 2,3 – dimethyl butane.

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e). $CH_3– CH_3 – \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}} – CH_3$ $\rightarrow$ 2,2 - dimethyl butane.

f). $CH_3– \underset{\displaystyle CH_2}{\overset{|}{\underset{|}{CH}}} – CH_2 – CH_3$ $\rightarrow$ 2- ethyl butane.

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