ADHIKAANSH ACADEMY

(IITJEE NEET IX X XI XII)

RUN BY:

DEEPAK SAINI SIR

B.TECH, M.TECH (N.S.I.T. DELHI UNIVERSITY)

Ex. Faculty of

Resonance Kota, Career Point Kota

Aakash Institute Mumbai

QUESTION BANK SCIENCE

(CLASS 10TH) Term-1

Adhikaansh Academy

225/5, Panchsheel Colony, Apposite to Nandini Plaza ,

Garh Road Meerut. Contact no: 7665186856

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CHAPTER – 1

CHEMICAL REACTIONS AND EQUATIONS

MAIN POINTS/ KEYNOTES/ GIST/ SUMMARY OF THE CHAPTER

CHEMICAL REACTIONS

In chemical changes, new substances with new properties are formed and it is difficult to reverse these changes. Chemical changes are permanent.
Chemical reaction involves chemical changes.
During a chemical reaction, atoms of one element do not change into those of another element.Only a rearrangement of atoms takes place in a chemical reaction. It follows the law of Conservation of mass.

For e.g. Magnesium ribbon burns with a dazzling white flame and changes into a white powder. This powder is magnesium oxide. It is formed due to the reaction between magnesium and oxygen present in the air.

$$\underset{\text{(As ribbon)}}{\text{Magnesium}} + \underset{\text{(From air)}}{\text{Oxygen}} \xrightarrow{\text{HEAT}} \underset{\text{(White powder)}}{\text{Magnesium Oxide}}$$

The burning of magnesium in air to form magnesium oxide is an example of chemical reaction.

REACTANTS AND PRODUCTS

The substances which take part in a chemical reaction are called reactants. They are placed on the left-hand side of the chemical reaction.
The new substances produced as a result of chemical reaction are called products. They are placed on the right-hand side of the chemical reaction.

In the above chemical reaction, there are two reactants: Magnesium and Oxygen but only oneproduct; Magnesium oxide.

CHARACTERISTICS OF CHEMICAL REACTIONS

In a chemical reaction, reactants are transformed into products.
Chemical reaction may be accompanied by any one or more of the
following characteristics.

- ❖ Evolution of a gas
- ❖ Formation of a precipitate
- ❖ Change in colour
- ❖ Change in temperature and
- ❖ Change in state or cracking sound etc

Any one of these characteristics can tell us whether a chemical reaction has taken place or not.

CHEMICAL EQUATIONS

The method of representing a chemical reaction with the help of symbols and formulae of thesubstances involved in it is known as chemical equation.

1. A word-equation shows change of reactants to products through an arrow placed betweenthem.
2. The reactants are written on the left-hand side (LHS) with a plus sign (+) between them.
3. Products are written on the right-hand side (RHS) with a plus sign (+) between them.
4. The arrowhead points towards the products, and shows the direction of the reaction.
5. States of reactants and products are written in round brackets as subscripts along with the symbols.

Example When hydrogen reacts with oxygen, it gives water. This reaction can be represented by following chemical equation:

$$\text{Hydrogen} + \text{Oxygen} \Rightarrow \text{Water}$$

$$2H_2 + O_2 \rightarrow 2H_2O$$

In first equation words are used and in second symbols of substances are used to write the chemical equation. For convenience, symbol of a substance is used to represent chemical equations. Chemical Equation is a way to represent the chemical reaction in concise and informative way.

Chemical equation can be divided into two types – Balanced Chemical Equation and Unbalanced Chemical Equation.

Balanced Chemical Equation: A balanced chemical equation has number of atoms of each element equal on both sides.

Example: $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

In this equation, numbers of atoms of zinc, hydrogen, sulphur and Oxygen are equal on both RHS & LHS, so it is a balanced chemical equation.

Unbalanced Chemical Equation: If the number of atoms of each element in reactants is not equal to the number of atoms of each element present in product, then the chemical equation iscalled unbalanced chemical equation.

Example: $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

In this example number of atoms of elements are not equal on both sides of the reaction. For example, on the LHS only one iron atom is present, while three iron atoms are presenton the RHS. Therefore, it is an unbalanced chemical equation. We balance the chemical equations to justify the law of conservation of mass.

BALANCING A CHEMICAL EQUATION:

To balance a chemical equation, follow these steps:

$C_6H_6 + O_2 \rightarrow CO_2 + H_2O$

Write the number of atoms of elements present in reactants and in products in a table; as shownhere.

Name of atom	No. of atoms in reactant	No. of atoms in product
Carbon	6	1
Hydrogen	6	2
Oxygen	2	3

1. Balance the atom which is the maximum in number; on either side of chemical equation.In this equation, the number of Carbon atoms are the maximum on the LHS.
2. To balance the Carbon, one needs to multiply the Carbon on the RHS by 6; so that the number of Carbon atoms becomes equal on both the sides.

   $C_6H_6 + O_2 \rightarrow 6\ CO_2 + H_2O$
3. Now, balance the number of hydrogen atoms. To balance it, one needs to multiply the hydrogen on the RHS by 3.

   $C_6H_6 + O_2 \rightarrow 6\ CO_2 + 3\ H_2O$
4. The number of oxygen atoms on the LHS is 2 , while it is 15 on the RHS. To balance it, multiply the oxygen on the LHS by $\frac{15}{2}$.

   $C_6H_6 + \frac{15}{2} O_2 \rightarrow 6\ CO_2 + 3\ H_2O$
5. As the balancing should not be in fractions, multiply the whole equation by the denominator i.e.

   $2\ C_6H_6 + 15\ O_2 \rightarrow 12\ CO_2 + 6\ H_2O$

Now the number of atoms of each element becomes equal on both sides. Thus, this is a balanced chemical equation.

Name of atom	No. of atoms in reactant	No. of atoms in product
Carbon	12	12
Hydrogen	12	12
Oxygen	30	30

After balancing, the above equation can be written as follows.

$$2\ C_6H_6 + 15\ O_2 \rightarrow 12\ CO_2 + 6\ H_2O$$

Writing the symbols of Physical States of substances in Chemical equation:

By writing the physical states of substances a chemical equation becomes more informative.

- Gaseous state is represented by symbol '*g*'
- Liquid state is represented by symbol '*l*'
- Solid state is written by symbol '*s*'
- Aqueous solution is written by symbol '*aq*'

Writing the condition in which reaction takes place: The condition is generally written above and/or below the arrow of a chemical equation.

Thus, by writing the symbols of physical state of substances and condition under whichreaction takes place, a chemical equation can be made more informative.

TYPES OF CHEMICAL REACTION

Chemical reactions can be classified in following types:

- Combination Reaction
- Decomposition Reaction
- Displacement Reaction
- Double Displacement Reaction
- Oxidation and Reduction Reaction

S NO	Types of reactions	Examples
1	**Combination reaction** A single product is formed from two or more reactants.	$2Mg + O2 \rightarrow 2MgO$
2	**Decomposition reaction** A single reactant breaks down to yield two or more products. i) Thermal decomposition – when reactants break down under the effect of heat.	$2\ Pb(NO_3)_2 \rightarrow 2\ PbO + 4\ NO_2 + O_2$
	ii) Electrolysis – when reactants break down under the effect of electricity.	$2\ H_2O \rightarrow 2\ H_2 + O_2$
	iii) Photolytic decomposition- when reactants decompose under the effect of sunlight.	$2\ AgBr \rightarrow 2\ Ag + Br_2$
3	**Displacement reaction** One less reactive element is displaced by another more reactive element.	$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$

4	**Double displacement reaction** Exchange of ions between reactants.	$AgNO_3 + NaCl \rightarrow AgCl + NaNO_3$
5	**Redox reaction** Both oxidation and reduction take place simultaneously.	$CuO + H_2 \rightarrow Cu + H_2O$

COMBINATION REACTION

Reactions in which two or more reactants combine to form one product are called COMBINATION REACTIONS.

Example: When magnesium is burnt in air (oxygen), magnesium oxide is formed. In thisreaction, magnesium combines with oxygen.

$2Mg + O_2 \rightarrow 2\ MgO$ Magnesium + Oxygen ⇨ Magnesium oxide

When carbon is burnt in oxygen (air), carbon dioxide is formed. In this reaction, carbon is combined with oxygen.

$$C + O_2 \rightarrow CO_2$$

Carbon + Oxygen ⇨ Carbon dioxide

When hydrogen reacts with chlorine, hydrogen chloride is formed.

$$H_2 + Cl_2 \rightarrow 2\ HCl$$

Hydrogen + Chlorine ⇨ Hydrogen chloride

When calcium oxide reacts with water, calcium hydroxide is formed

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

Calcium oxide + Water → Calcium hydroxide

When carbon monoxide reacts with oxygen,carbon dioxide is formed.

$$2\ CO + O_2 \rightarrow 2\ CO_2$$

Carbon monoxide + Oxygen → Carbon dioxide

DECOMPOSITION REACTION

Reactions in which one compound breaks down to form two or more compounds or elements are known as DECOMPOSITION REACTION. Decomposition reaction is just opposite of combination reaction.

Example: When calcium carbonate is heated, it decomposes into calcium oxide and carbondioxide

$$CaCO_3 \rightarrow CaO + CO_2$$

Calcium carbonate → Calcium oxide + Carbon dioxide

When ferric hydroxide is heated, it decomposes into ferric oxide and water

$$2\ Fe(OH)_3 \rightarrow Fe_2O_3 + 3\ H_2O$$

Ferric hydroxide → Ferric oxide + Water

When lead nitrate is heated, it decomposes into lead oxide, nitrogen dioxide and oxygen.

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

Lead nitrate ⇨ Lead oxide + Nitrogen oxide + Oxygen

In above examples, compound is decomposed because of heating, so, these reactions are called THERMAL DECOMPOSITION REACTION.

ELECTROLYTIC DECOMPOSITION

Reactions in which compounds decompose into simpler compounds because of passing ofelectricity, are known as ELECTROLYTIC DECOMPOSITION. This is also known as ELECTROLYSIS.

Example: When electricity is passed in water, it decomposes into hydrogen and oxygen.

$$2\ H_2O \rightarrow 2\ H_2 + O_2$$

PHOTOLYSIS OR PHOTOLYTIC DECOMPOSITION REACTION

Reactions in which a compound decompose because of sunlight are known as PHOTOLYSIS or PHOTO DECOMPOSITION REACTION.

Example: When silver chloride is put in sunlight, it decomposes into silver metal and chlorinegas.

$$2\ AgCl \rightarrow 2\ Ag + Cl_2$$

Similarly, when silver bromide is put under sunlight, it decomposes into silver metal andbromine gas.

$$2\ AgBr \rightarrow 2\ Ag + Br_2$$

Photographic paper has coat of silver chloride, which turns into grey when exposed to sunlight.It happens because silver chloride is white coloured compound, while silver is a grey metal.

DISPLACEMENT REACTION

Reactions in which a more reactive element displaces a less reactive element from its solution are known as DISPLACEMENT REACTION. Displacement reaction is also known as Substitution Reaction or Single displacement /Replacement Reaction.

Example:

1.When zinc reacts with hydrochloric acid, it gives hydrogen gas and zincchloride.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

Zinc being more reactive than hydrogen, displaces hydrogen from HCl solution

2.When zinc reacts with copper sulphate, it forms zinc sulphate and copper metal.

$$Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$$

Zinc being more reactive than copper, displaces copper from copper sulphate solution

3. When silver metal is dipped in copper nitrate, no reaction takes place because silver metal is less reactive than copper.

$$Ag + Cu(NO_3)_2 \rightarrow \text{No reaction takes place}$$

DOUBLE DISPLACEMENT REACTION

Reactions in which two compounds react by exchange of ions to form two new compounds are called double displacement reactions.

Example: 1. When solution of barium chloride reacts with the solution of sodium sulphate,white precipitate of barium sulphate is formed along with sodium chloride.

$$BaCl_2 + Na_2SO_4 \rightarrow BaSO_4 \downarrow + 2\ NaCl$$

2. When sodium hydroxide (a base) reacts with hydrochloric acid, sodium chloride and water are formed.

$$NaOH + HCl \rightarrow NaCl + H_2O$$

Double displacement reaction, in which precipitate is formed, is also known as precipitationreaction. Neutralisation reactions are also examples of double displacement reaction.

EXOTHERMIC AND ENDOTHERMIC REACTION

The chemical reactions which proceed with the evolution of heat energy are called exothermic reactions.

$$N_2 + 3\,H_2 \rightarrow 2\,NH_3 + \text{Heat}$$

All combustion reactions are exothermic. Heat energy is liberated as the reaction proceeds.

The chemical reactions which proceed with the absorption of heat energy are called endothermic reactions.

$$6\,CO_2 + 12\,H_2O + \text{sunlight} \xrightarrow{\text{Chlorophyll}} C_6H_{12}O_6 + 6\,O_2 + 6\,H2O$$

Most of the combination reactions are endothermic.
Most of the decomposition reactions are exothermic.
Respiration is a decomposition reaction in which energy is released.
When quick lime (calcium oxide) is added to water, it forms calcium hydroxide and releases energy.

OXIDATION AND REDUCTION REACTION:

Oxidation: Addition of oxygen or removal of hydrogen from a compound is known as oxidation. **Or** Loss of electrons from an element or compound is known as oxidation.
Elements or compounds in which oxygen is added or hydrogen is removed are said to be oxidized.

Oxidizing agent: Compounds which can add oxygen or remove hydrogen are known as oxidizing agents. Oxidising agent itself gets reduced.

Reduction: Addition of hydrogen or removal of oxygen from a compound is called reduction.
Or Gain of electrons by an element is called reduction.
The compound or element which goes under reduction is called to be reduced.

Reducing agent: Compounds or elements which can cause reduction are called reducing agents. Reducing agent itself gets oxidized.

Learning Tip: LEOGER : LEO (Loss of electrons : Oxidation)
GER(Gain of electrons: Reduction)

In a chemical reaction where oxidation and reduction both take place simultaneously, such reactions are also known as REDOX REACTIONS. In the word REDOX, 'Red' stands for reduction and 'Ox' stands for oxidation.

Example: When Magnesium reacts with air, it forms Magnesium oxide

$$2\,Mg + O_2 \rightarrow 2\,MgO$$

In this reaction, oxygen is added to magnesium, Magnesium is oxidized. Here oxygen is oxidizing agent.

When cupric oxide reacts with hydrogen, it gives copper and water.

$$CuO + H_2 \rightarrow Cu + H_2O$$

In this reaction, oxygen is removed from copper and oxygen is added to hydrogen. So, cupric oxide is reduced to copper and hydrogen is oxidized to water. Cupric oxide is oxidizing agentand hydrogen is reducing agent.
When sodium hydroxide reacts with hydrochloric acid, it gives sodium chloride and water.

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

In this reaction, ferric oxide is reduced to iron since oxygen is removed from ferric oxide. Aluminium is oxidized to Aluminium oxide. Ferric oxide is the oxidising agent and Aluminium is the reducing agent.

In this reaction oxidation and reduction both takes place simultaneously, thus it is an exampleof redox reaction.

SIGNIFICANCE OF OXIDATION REDUCTION IN EVERYDAY LIFE:

- Respiration is oxidation reaction in which food is oxidized to produce energy.
- Iron gets oxidized to form rust; which leads to corrosion of iron in the long run.
- Most of the metals react with atmospheric oxygen and it leads to formation of a layer on the metal article. The metal gets corroded in the long run.
- Rusting of iron can be prevented by painting the iron article. This can also be preventedby applying a layer of zinc over iron article. This process is known as galvanization.
- Fried food gets oxidized when exposed to air. This spoils the taste of the food and adds-on unwanted smell. Food becomes unfit for consumption. The spoiling of fried food because of oxidation iscalled rancidity. Fried food is often packed in airtight packets or flushed with N_2 to prevent rancidity.
- We are able to utilize various types of fuel because of oxidation. Oxidation of fuel helpsin producing energy.

CORROSION

Corrosion is a slow process in which the surface of metallic objects are coated with oxides, hydroxide, carbonates or sulphides of the metal due to reaction with O_2. It is defined as the slow and steady destruction of a metal by the environment. It resultsin the deterioration of the metal to form metal compounds by means of chemical reactions with the environment.
When the surface of iron is in contact with moisture and air in the atmosphere a chemical reaction occurs.

PREVENTION OF CORROSION

Corrosion of metals is prevented by not allowing them to come in contact with moisture, CO_2 and O_2. This is achieved by the following methods:

· **By coating with paints:** Paint coated metal surfaces keep out air and moisture.

· **By coating with oil and grease:** Application of oil and grease on the surface of iron tools prevents them from moisture and air.

· **By alloying with other metals:** Alloyed metal is more resistant to corrosion.
· **Example:** stainless steel.

· **By the process of galvanization:** This is a process of coating iron sheets with molten zinc. In this zinc forms a protective layer of zinc carbonate on the surface of iron.This prevents corrosion.

· **Electroplating:** It is a method of coating one metal with another by passing electric current.Example: silver plating, nickel plating. This method not only lends protection but also enhances the metallic appearance.

· **Sacrificial protection:** Magnesium is more reactive than iron. When it is coated on the articles made of steel it sacrifices itself to protect the steel.

RANCIDITY

When fats and oils get oxidised, they become rancid i.e their smell and taste change. Rancidity is chemical decomposition of fats & oils in air.

PREVENTION OF RANCIDITY

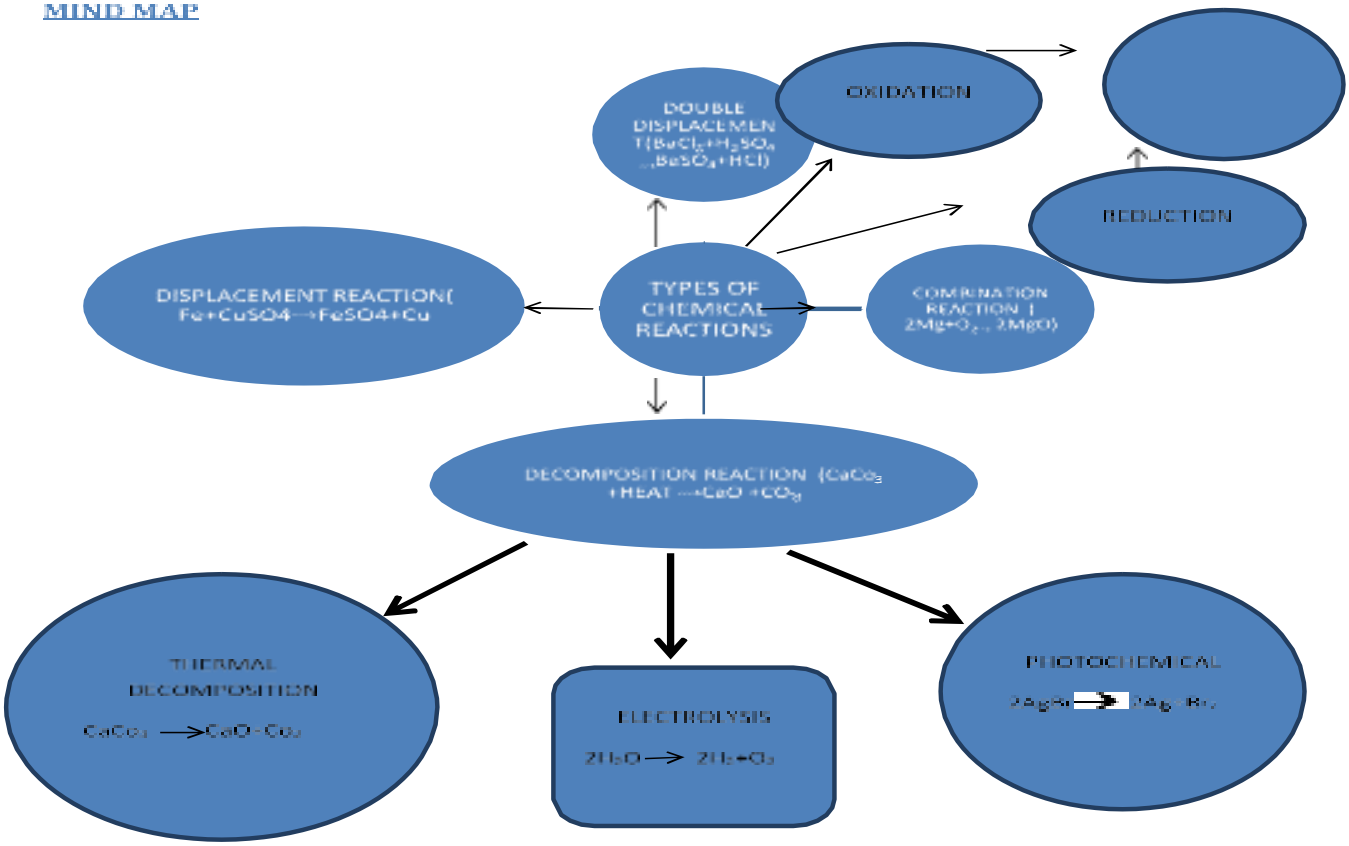
Rancidity can be avoided by:

1. Storing food in air tight containers
2. Storing food in refrigerators
3. Storing food in an environment of nitrogen
4. By adding antioxidants like BHA (Butylated hydroxy anisole) &, BHT (Butylated hydroxy toluene

Redox Reaction

$Cu + H_2O \rightarrow CuO + H_2$

MIND MAP


DOUBLE DISPLACEMENT
OXIDATION
REDUCTION
DISPLACEMENT REACTION(Fe+CuSO4→FeSO4+Cu
TYPES OF CHEMICAL REACTIONS
COMBINATION REACTION
DECOMPOSITION REACTION
THERMAL DECOMPOSITION
ELECTROLYSIS
PHOTOCHEMICAL

CHEMICAL REACTIONS AND EQUATIONS (MCQ)

Q1- Reaction of 'magnesium' with air is

A) Exothermic reaction
B) Endothermic reaction
C) Reversible reaction
D) Substitution reaction

Q2- What chemicals are used in fireworks?

A) Copper chloride
B) Calcium chloride
C) Barium chloride
D) All of above

Q3- When a magnesium ribbon is burnt in air, the ash formed is

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

Q4- Color of magnesium oxide is

A) White
B) Blue
C) Grey
D) Pink

Q5- If magnesium is gently heated, it forms

A) Magnesium oxide
B) Magnesium sulfide
C) Magnesium nitrite
D) Magnesium carbonate

Q6- When carbon dioxide is passed through lime water,

A) Calcium hydroxide is formed
B) White precipitate of CaO is formed
C) Lime water turns milky
D) Color of lime water disappears.

Q7- When crystals of lead nitrate are heated strongly in a dry test tube

A) Crystals immediately melt
B) A brown residue is left
C) White fumes appear in the tube
D) A yellow residue is left

Q8- Color of Solid magnesium is

A) Dark grey
B) Silver grey
C) Black
D) Whitish silver

Q9- Consider equations: $Ca^{+2}(aq) + 2OH^{-}(aq) \rightarrow Ca(OH)_2\ (s)$. Precipitate of calcium hydroxide will be of

A) Green color
B) Blue color
C) Brown color
D) White color

Q10- In writing chemical equations, inclusion of state symbols shall be done while

A) Correct chemical formulae of reactants and products are written
B) The equation is being balanced to fulfill the law of conservation of mass
C) The equation has been balanced
D) The chemical formulae of products and reactants have been changed to bring about quick balancing

Q11- Consider equation: Pb^{+2} (aq) + $2OH^-$ (aq) → $Pb(OH)_2$ (s). precipitate of lead (II) hydroxide will be of

A) Green color
B) Blue color
C) Brown color
D) White color

Q12- Consider equation: Cu^{+2} (aq) + $2OH^-$(aq) → $Cu(OH)_2$ (s). precipitate of Copper Hydroxide ($Cu(OH)_2$) will be of

A) Green color
B) Blue color
C) Brown color
D) White color

Q13- Consider reaction: $Na(s) + O_2(g) \rightarrow Na_2O(s)$. Moles of sodium needed to balance equation would be

A) 1
B) 2
C) 3
D) 4

Q14- Consider reaction: $S(s) + O_2(g) \rightarrow SO_2$. state of SO_2 in this reaction is

A) Liquid
B) Solid
C) Gaseous
D) All Three

Q15- Consider reaction: $P(s) + O_2(g) \rightarrow P_4O_{10}(s)$. Moles of $O_2(g)$ needed to balance equation will be

A) 1
B) 3
C) 5
D) 7

Q16- A substance 'X' is used in white-washing and is obtained by heating limestone in the absence of air. Identify 'X'.

A) $CaOCl_2$
B) $Ca(OH)_2$
C) CaO
D) $CaCO_3$

Q17- Consider reaction: $Al(s) + O_2(g) \rightarrow Al_2O_3$. Moles of Al(s) needed to balance equation are

A) 1
B) 2
C) 3
D) 4

Q18- Which one of the given processes involves chemical reactions?

A) Storing of oxygen gas under pressure in a gas cylinder
B) Keeping petrol in a China dish in the open
C) Liquefaction of air
D) Heating copper wire in the presence of air at high temperature

Q19- In which of the given chemical equations, the abbreviations represent the correct states of the reactants and products involved at reaction temperature?

A) $2H_2$ (l) + O_2 (l) → $2H_2O$ (g)
B) $2H_2$ (g) + O_2 (l) → $2H_2O$ (g)
C) $2H_2$ (g) + O_2 (g) → $2H_2O$ (l)
D) $2H_2$ (g) + O_2 (g) → $2H_2O$ (g)

Q20- The reaction in which two compounds exchange their ions to form two new compounds is called

A) Displacement reaction
B) Combination reaction
C) Double displacement reaction
D) Redox reaction

Q21- On immersing an iron nail in $CuSO_4$ solution for a few minutes, you will observe

A) No reaction takes place
B) The color of solution fades away
C) The surface of iron nails acquire a black coating
D) The color of solution changes to green

Q22- Which of the given statements is not a physical change?

A) Boiling of water to give water vapour
B) Melting of ice to give water
C) Dissolution of salt in water
D) Combustion of Liquefied Petroleum Gas (LPG)

Q23- An element X on exposure to moist air turns reddish-brown and a new compound Y is formed. The substances X and Y are

A) X = Fe, Y = Fe_2O_3
B) X = Ag, Y = Ag_2S
C) X = Cu, Y = CuO
D) X = Al, Y = Al_2O_3

Q24- The reaction of H_2 gas with oxygen gas to form water is an example of

A) Combination reaction
B) Redox reaction
C) Exothermic reaction
D) All of these reactions.

Q25- Rancidity can be prevented by

A) Adding antioxidants
B) Storing food away from light
C) Keeping food in refrigerator
D) All of these

Q26- In which of the given, heat energy will be evolved?

A) Electrolysis of water
B) Dissolution of NH_4Cl in water
C) Burning of L.P.G.
D) Decomposition of AgBr in the presence of sunlight

Q27- Dilute hydrochloric acid is added to granulated zinc taken in a test tube. The following observations are recorded. Point out the correct observation.

A) The surface of metal becomes shining
B) The reaction mixture turns milky
C) Odour of a pungent smelling gas is recorded
D) A colorless and odourless gas is evolved

Q28- Given reaction is an example of

$4NH_3 (g) + 5O_2 (g) \rightarrow 4NO (g) + 6H_2O (g)$ (a). Displacement reaction,

(b) Combination reaction

(c) Redox reaction

(d) Neutralization reaction.

A) (A) & (D)
B) (B) & (C)
C) (A) & (C)
D) (C) & (D)

Q29- Which of the following statements about the given reaction are correct?

$3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4 (s) + 4H_2 (g)$

(a) Iron metal is getting oxidized.

(b) Water is getting reduced.

(c) Water is acting as reducing agent.

(d)Water is acting as oxidizing agent.

A) (A), (B) & (C)
B) (C) & (D)
C) (A), (B) & (D)
D) (B) & (D)

Q30- Which of the following are exothermic processes?

(a) Reaction of water with quick lime

(b) Dilution of an acid

(c) Evaporation of water

(d) Sublimation of camphor (crystals)

A) (A) & (B)
B) (B) & (C)
C) (A) & (D)
D) (C) & (D)

Q31- A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple color of the solution fades and finally disappears. Which of the given equation is the correct explanation for the observation?

A) $KMnO_4$ is an oxidizing agent, it oxidizes $FeSO_4$

B) $FeSO_4$ acts as an oxidizing agent and oxidizes $KMnO_4$

C) The color disappears due to dilution, no reaction is involved

D) $KMnO_4$ is an unstable compound and decomposes in the presence of $FeSO_4$ to a colourless compound

Q32- Which among the following statement(s) is /are true? Exposure of silver chloride to sunlight for a long duration turns grey due to-

(a) The formation of silver by decomposition of silver chloride.

(b) Sublimation of silver chloride.

(c) Decomposition of chlorine gas from silver chloride.

(d) Oxidation of silver chloride.

A) Only (A)
B) (A) & (C)
C) (B) & (C)
D) Only (D)

Q33- Solid calcium Oxide reacts vigorously with water to form calcium hydroxide accompanied by liberation of heat. This process is called slaking of lime. Calcium hydroxide dissolves in water to form its solution called lime water. Which among the following is are true about slaking of lime and the solution formed?

(a) It is an endothermic reaction.
(b) It is exothermic reaction.
(c) The pH of the resulting solution will be more than seven.
(d) The pH of the resulting solution will be less than seven.
A) (A) & (B)
B) (B) & (C)
C) (A) & (D)
D) (C) & (D)

Q34- Barium chloride on reacting with ammonium sulphate forms barium sulphate and ammonium chloride. Which of the following correctly represents the type of the reaction involved?

(a) Displacement reaction
(b) Precipitation reaction
(c) Combination reaction
(d) Double displacement reaction
A) Only (A)
B) Only (B)
C) Only (D)
D) (B) & (D)

Q35- Which of the following is (are) an endothermic process(es)?

(a) Dilution of sulphuric acid
(b) Sublimation of dry ice
(c) Condensation of water vapours
(d) Evaporation of water
A) Both (A) & (C)
B) Only (B)
C) Only (C)
D) Both (B) & (D)

Q36- In the double displacement reaction between aqueous potassium iodide and aqueous lead nitrate, a yellow precipitate of lead iodide is formed. While performing the activity if lead nitrate is not available, which of the given can be used in place of lead nitrate?

A) Lead sulphate (insoluble)
B) Lead acetate
C) Ammonium nitrate
D) Potassium sulphate

Q37- Which of the given gases can be used for storage of fresh sample of an oil for a long time?

A) Carbon dioxide or oxygen
B) Nitrogen or oxygen
C) Carbon dioxide or helium
D) Helium or nitrogen

Q38- Fatty foods become rancid due to the process of _____

A) Oxidation
B) Corrosion
C) Reduction
D) Hydrogenation

Q39- Which information is not conveyed by a balanced chemical equation?

A) Physical states of reactants and products
B) Symbols and formulae of all the substances involved in a particular reaction
C) Number of atoms/molecules of the reactants and products formed
D) Whether a particular reaction is actually feasible or not

Q40- The chemical formula of lead sulphate is

A) Pb_2SO_4
B) $Pb(SO_4)_2$
C) $PbSO_4$
D) $Pb_2(SO_4)_3$

Q41- Chemically, rust is

A) Hydrated ferrous
B) Only ferric oxide
C) Hydrated ferric oxide
D) None of these

Q42- Both CO_2 and H_2 gases are

A) Heavier than air
B) Colourless
C) Acidic in nature
D) Soluble in water

Q43- A substance added to food containing fats and oils to prevent rancidity is called:

A) Oxidant
B) Rancid
C) Coolant
D) Antioxidant

Q44- In the decomposition of lead (II) nitrate to give lead (II) oxide, nitrogen dioxide and oxygen gas, the coefficient of nitrogen dioxide (in the balanced equation) is

A) 1
B) 2
C) 3
D) 4

Q45- We store silver chloride in a dark coloured bottle because it is

A) A white solid
B) Undergoes redox reaction
C) To avoid action by sunlight
D) None of the above

Q46- Silver article turns black when kept in the open for a few days due to formation of

A) H_2S
B) AgS
C) $AgSO_4$
D) Ag_2S

Q47- The respiration process during which glucose undergoes slow combustion by combining with oxygen in the cells of our body to produce energy, is a kind of:

A) Exothermic process
B) Endothermic process
C) Reversible process
D) Physical process

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Q48- Which of the given products is formed when calcium oxide reacts with water?

A) Slaked lime
B) Carbon dioxide
C) Calcium oxide
D) Oxygen gas

Q49- What is the chemical name for quick lime?

A) Calcium hydroxide
B) Calcium oxide
C) Carbon dioxide
D) Sodium oxide

Q50- What is the chemical name for slaked lime?

A) Calcium carbonate
B) Calcium oxide
C) Calcium hydroxide
D) Carbon monoxide

Assertion (A) and Reason (R) Questions

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true but R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

Q.1. Assertion (A) : Decomposition of vegetable matter into compost is an example of exothermic reactions.
Reason (R) : Exothermic reaction are those reactions in which heat is evolved.

Q.2. Assertion (A) : When HCl is added to zinc granules, a chemical reaction occurs.
Reason (R) : Evolution of a gas and change in colour indicate that the chemical reaction is taking place.

Q.3. Assertion (A) : Calcium carbonate when heated gives calcium oxide and water.
Reason (R) : On heating calcium carbonate, decomposition reaction takes place.

Q.4. Assertion (A) : Brown fumes are produced when lead nitrate is heated.
Reason (R) : Nitrogen dioxide gas is produced as a by product due to the decomposition of lead nitrate.

Q.5. Assertion (A) : White silver chloride turns grey in sunlight.
Reason (R) : Decomposition of silver chloride in presence of sunlight takes place to form silver metal and chlorine gas.

Q.6. Assertion (A): Pungent smelling gas is produced when sulphur burns in air.
Reason (R) : Sulphur trioxide is formed on reaction of sulphur with oxygen.

Q.7. Assertion (A) : In a reaction of copper with oxygen, copper serves as a reducing agent.
Reason (R) : The substance which gains oxygen in a chemical reaction acts as a reducing agent.

Q.8. Assertion (A) : In electrolysis of water, the volume of hydrogen liberated is twice the volume of oxygen formed.
Reason (R) : Water (H,0) has hydrogen and oxygen in the ratio of 1:2 by volume.

Q.9. Assertion (A): Corrosion of iron is commonly known as rusting.
Reason (R) : Corrosion of iron occurs in presence of water and air.

Q.10. Assertion (A) : The balancing of chemical equations is based on law of conservation of mass.
Reason (R) : Total mass of reactants is equal to total mass of products.

Q.11. Assertion (A): In a balanced chemical equation, total mass of the reactants is equal to the total mass of the products.
Reason (R): Mass can neither be created nor destroyed during a chemical change.

Q.12. Assertion (A): Iron articles are painted so as to prevent them from rusting.
Reason (R): When the surface of iron is coated with paint, its surface does not come in contact with oxygen and moisture therefore rusting does not take place.

Q.13. Assertion (A) : Chemical reaction changes the physical and chemical state of a substance.
Reason (R) : When electric current is passed through water (liquid), it decomposes to produce hydrogen and
oxygen gases.

Q.14. Assertion (A): When calcium carbonate is heated, it decomposes to give calcium oxide and carbon dioxide.
Reason (R): The decomposition reaction takes place on application of heat, therefore, it is an endothermic reaction.

Q.15. Assertion (A): Zinc reacts with sulphuric acid to form zinc sulphate and hydrogen gas and it is a displacement reaction.
Reason (R): Zinc reacts with oxygen to form zinc oxide.

Q.16. Assertion (A): Chips manufacturers usually Ilush bags of chips with gas such as nitrogen to prevent the chips from getting oxidised.
Reason (R): This increase the taste ot the chips and helps in their digestion.

Q.17. Assertion (A): Exposure of silver chloride to sunlight for a long duration turns grey due to the formation of silver by decomposition of silver chloride.
Reason (R): In this process, sublimation of silver chloride takes place.

Q.18. Assertion (A): Rusting of iron metal is the most common form of corrosion.
Reason (R): The effect of rusting of iron can be reversed if they are left open in sunlight.

Q.19. Assertion (A): AgBr is used on photographic and X-ray film.
Reason (R): AgBr is photosensitive and changes to Ag and bromine in presence of sunlight and undergoes decomposition reaction.

Q.20. Assertion (A): Magnesium ribbon keeps on burning in atmosphere of nitrogen.
Reason (R) : Magnesium reacts with nitrogen to form magnesium nitride and this reaction is combination reaction.

Q.21. Assertion (A): A lead nitrate on thermal decomposition gives lead oxide, brown coloured nitrogen dioxide and oxygen gas.
Reason (R): Lead nitrate reacts with potassium iodide to form yellow ppt. of lead iodide and the reaction is double displacement as well as precipitation reaction.

Q22. Assertion: Chemical reaction changes the physical and chemical state of a substance.
Reason: When electric current is passed through water (liquid), it decomposes to produce hydrogen and oxygen gases.

Q23. Assertion: In a balanced chemical equation, total mass of the each element towards reactant side= total mass of the same element towards product side.
Reason: Mass can neither be created nor destroyed during a chemical change.

Q24. Assertion: When calcium carbonate is heated, it decomposes to give calcium oxide and carbon dioxide.
Reason: The decomposition reaction takes place on application of heat, therefore, its an endothermic reaction.

Q25. Assertion: Chips manufacturers usually flush bags of chips with gas such as nitrogen to prevent the chips from getting oxidised.
Reason: This increase the taste of the chips and helps in their digestion.

Q26. Assertion (A)- Calcium Carbonate when heated gives calcium oxide and water
Reason (R) – on heating CaCO3, decomposition reaction takes place.

Q27. Assertion (A) - White silver chloride turns grey in sunlight.
Reason (R) – Decomposition of silver chloride in presence of sunlight takes place to form silver metal and chlorine gas.

PARAGRAPH BASED M.C.Q

PARAGRAPH – 1

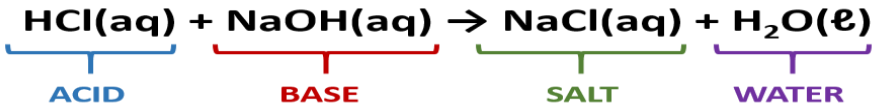
Double displacement) reactions occur when two chemical groups substitute for each other (change partners) in their respective compounds.

A general equation for a double displacement reaction is:

$$AB + CD \rightarrow AD + CB$$

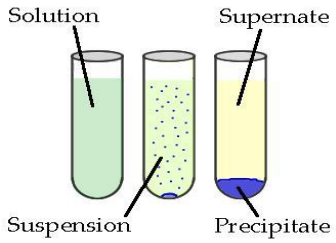
Two major types of double replacement reactions are Acid-Base Neutralization reactions and Precipitation reactions.

Acid-Base Neutralization reactions In an acid base neutralization reaction, an acid is combined with a base to form a salt and water.



Precipitation reactions. Precipitation reactions occur when cations and anions in aqueous solution combine to form an insoluble ionic solid called a **precipitate**

Precipitates are insoluble ionic solid products of a reaction, formed when certain cations and anions combine in an aqueous solution. The determining factors of the formation of a precipitate can vary. Some reactions depend on temperature, whereas others are dependent only on solution concentration. The solids produced in precipitate reactions are crystalline solids, and can be suspended throughout the liquid or fall to the bottom of the solution. The remaining fluid is called supernatant liquid. The two components of the mixture (precipitate and supernate) can be separated by various methods, such as filtration, centrifuging, or decanting.



Precipitation reactions even occur in the human body between antibodies and antigens;

Answer the following questions :

1. Silver nitrate and potassium chloride react with each other to form silver chloride and Potassium nitrate .

$$AgNO3(aq) + KCl(aq) \rightarrow AgCl(s) + KNO3(aq)$$

Which type of reaction is this :

(a) Combination reaction
(b) Decomposition reaction
(c) Precipitation reaction
(d) Both displacement and precipitation reaction

2. Factors of precipitate formation in a chemical reaction .

(a) temperature,
(b) concentration of solution
(c) Both temperature and concentration of solution
(d) None of these

3.Reaction between antibodies and antigens is

(a) Combination reaction
(b) Decomposition reaction
(c) Precipitation reaction
(d) All the above

4. which of the following are the examples of neutralisation reaction in our everyday life

(a) Use of vinegar to cure wasp stings .

(b) Use of baking powder to cure bee stings and ant bites .

(c) Baking powder is usually used to help the cakes rise.

(d) All the above

5. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of:-

(a)A combination reaction
(b)A displacement reaction
(c)A decomposition reaction
(d)A double decomposition reaction

PARAGRAPH -2

What is corrosion?

Corrosion is a process where the metal corrodes. Corrosion is a natural process and in the presence of a moist atmosphere, chemically active metals get corroded.

$$4Fe + 3O_2 + 2xH_2O \longrightarrow 2Fe_2O_3xH_2O$$

Iron Oxygen Water Hydrated iron (III) oxide (Rust)

Rusting is the process where iron corrodes due to exposure to the atmosphere. Corrosion is a process where the water or the moisture on the surface of the metal oxidizes with the atmospheric oxygen, it is an oxidation reaction. The main circumstance of corrosion occurs with iron because it is a structural material in construction, bridges, buildings, rail transport, ships, etc. Aluminum is also an important structural metal, but even aluminum goes under oxidation reactions. However, aluminum doesn't corrode or oxidize as rapidly as its reactivity suggests. An alloy of aluminum or any other metal like magnesium can make aluminum stronger, stiffer and harder.The alkali metals like sodium need to be stored in oil as they corrode quickly. Copper (Cu) corrodes and forms a basic green carbonate and lead corrodes to form a white lead oxide or carbonate.Silver articles became black after sometime when exposed to air because it react with sulphur in air to form a coating of silver sulphide.Corrosion and Rancidity are examples of oxidation.

Choose the correct option:

1.Corrosion can be prevented by

(a) Alloying (b) Tinning (c) Galvanizing (d) all of above

2.Chemically rust is :

(a) Hydrated ferrous oxide
(b) Hydrated ferric oxide
(c) Only ferric oxide
(d) None of these

3. The chemical reaction involved in the corrosion of iron metal is :

(a) Oxidation as well as displacement
(b) Oxidation as well as combination
(c) Reduction as well as combination
(d)Reduction as well as displacement

4. Conditions for corrosion of metals are :

(a) Presence of dry air
(b) Presence of moisture
(c) Presence of air and moisture
(d)None of the above

5. Silver articles becomes black on prolonged exposure to air. This is due to the formation of

(a) Ag2O
(b) Ag2S
(c) AgCN
(d) Ag2O and Ag2S

PARAGRAPH –3

Redox reactions

Oxidation is the process of gaining of oxygen, or losing of hydrogen. Reduction is the process of losing of oxygen or gaining of hydrogen.
Oxidizing agents **add** oxygen to another substance or **remove** hydrogen from it.
Reducing agents **remove** oxygen from another substance or **add** hydrogen to it.
Oxidation and reduction always take place together and these type of reactions are known as redox reactions. Some of the examples of redox reactions are given below: The equation below shows an oxygen transfer in a simple redox reaction:

Choose the correct option:

1.Which of the following statements about the given reaction are correct?
$3Fe\ (s) + 4H_2O\ (g) \rightarrow Fe_3O_4\ (s) + 4\ H_2\ (g)$

(i) Iron metal is getting oxidised
(ii) Water is getting reduced
(iii) Water is acting as reducing agent
(iv) Water is acting as oxidising agent

(a) (i), (ii) and (iii)
(b) (iii) and (iv)
(c) (i), (ii) and (iv)
(d) (ii) and (iv)

2. Oxidation is a process which involves
(a) addition of oxygen and removal of hydrogen
(b) addition of hydrogen
(c) removal of oxygen
(d) none of these

3.The process of reduction involves
(a) addition of oxygen
(b) addition of hydrogen and removal of oxygen
(c) removal of hydrogen
(d) none of these

4.$MnO_2 + 4HCl \rightarrow {}_2 + 2H_2O + Cl_2$

Identify the substance oxidized in the above . equation.

(a) $MnCl_2$
(b) HCl
(c) H_2O
(d) MnO_2

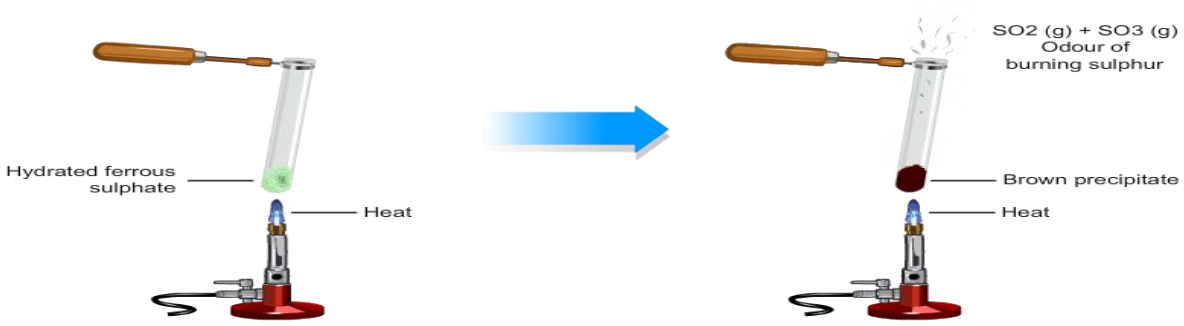
5.A dilute ferrous sulphate solution was gradually added to the beaker containing acidified permanganate solution. The light purple colour of the solution fades and finally disappears. Which of the following is the correct explanation for the observation?

(a) $KMnO_4$ is an oxidising agent, it oxidises $FeSO_4$.
(b) $FeSO_4$ acts as an oxidising agent and oxidises $KMNO_4$.
(c) The colour disappears due to dilution; no reaction is involved.
(d) $KMnO_4$ is an unstable compound and de-composes in presence of $FeSO_4$. to a colourless compound.

PARAGRAPH -4

Decomposition is a type of chemical reaction. It is defined as the reaction in which a single compound splits into two or more simple substances under suitable conditions. It is just the opposite of the combination reaction.

In a combination reaction, a substance is formed as a result of chemical combination, while in a decomposition reaction, the substance breaks into new substances.



Thermal Decomposition

For example: The digestion of food in our body is accompanied by a number of decomposition reactions. The major constituents of our food such as carbohydrates, fats, proteins, etc.,decompose to form a number of simpler substances. These substances further react, releasing large amounts of energy, which keeps our body working.

Thermal decomposition reaction (Thermolysis)

Decomposition of calcium carbonate: Calcium carbonate (lime stone) decomposes into calcium oxide (quick lime) and carbon dioxide when heated. Quick lime is the major constituent of cement.

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

Electrolytic decomposition reaction (Electrolysis)

Electrolytic decomposition may result when electric current is passed through an aqueous solution of a compound. A good example is the electrolysis of water. $2H_2O(l) \xrightarrow{\text{Electric current}} 2H_2(g) + O_2(g)$

Photo decomposition reaction (Photolysis) Decomposition of silver chloride:Place a small quantity of

silver chloride (AgCl) taken in a watch glass under sunlight for some time. The crystals slowly acquire a grey colour. On analysis, it is found that the sunlight has caused decomposition of silver chloride into silver and chlorine.

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

Most decomposition reactions require energy either in the form of heat, light or electricity. Absorption of energy causes the breaking of the bonds present in the reacting substance which decomposes to give the product.

Choose the correct option :

1. White silver chloride in sunlight turns to

(a) Grey (b) yellow (c) green (d) Red

2. When ferrous sulphate is heated strongly it undergoes decomposition to form ferric oxide as a main product accompanied by a change in colour from:

(a) Blue to green. (b) Green to blue. (c) Green to brown. (d) Green to yellow.

3. What is the chemical name of quick lime?

(a) Calcium hydroxide
(b) Calcium oxide
(c) Carbon dioxide
(d) Sodium oxide

4. In which of the following category will you put the reaction of heating of calcium carbonate?

(a) Decomposition reaction
(b) Thermal decomposition reaction
(c) Endothermic reaction
(d) All of the above.

5. The products of electrolytic decomposition of water are :

(a) hydrogen only (b) oxygen only (c) both hydrogen and oxygen (d) none of these

PARAGRAPH -5
CHEMICAL REACTIONS AND EQUATIONS :

Chemical reaction is in which the bonds are broken within reactant molecules, and new bonds are formed within product molecules in order to form a new substance. You must have observed that magnesium ribbon burns with a dazzling white flame and changes into a white powder. This powder is magnesium oxide. It is formed due to the reaction between magnesium and oxygen present in the air .
– when a magnesium ribbon is burnt in oxygen, it gets converted to magnesium oxide. This description of a chemical reaction in a sentence form is quite long. It can be written in a shorter form. The simplest way to do this is to write it in the form of a word-equation. The word-equation for the above reaction would be –
Magnesium + Oxygen → Magnesium oxide

A chemical equation represents a chemical reaction. If you recall formulae of magnesium, oxygen and magnesium oxide, the above word-equation can be written as –

$Mg + O2 \rightarrow MgO$

Count and compare the number of atoms of each element on left and right side of the arrow. If the number of atoms of each element the same on both the sides the equation is balanced. If not, then the equation is unbalanced because the mass is not the same on both sides of the equation.

Choose the correct option:

1.In a chemical change new substance is formed known as:

(a) Reactant
(b) New substance
(c) Product
(d) None of the above

2.When a magnesium ribbon is burnt in air, the ash formed is

(a) Black
(b) White
(c) Yellow
(d) Pink

3.Which one of the given processes involves chemical reactions?

(a) Storing of oxygen gas under pressure in a gas cylinder
(b) Keeping petrol in a China dish in the open
(c) Liquefaction of air
(d) Heating copper wire in the presence of air at high temperature

4.The type of reaction by which fatty foods react with air and become become rancid :

(a) Oxidation
(b) Corrosion
(c) Reduction
(d) Hydrogenation

5. A chemical reaction can be characterized by :

a) Evolution of gas
b) Change in color
c) Change in state
d) All the above

CHAPTER 2

ACIDS, BASES AND SALTS

MAIN POINTS/ KEYNOTES/ GIST/ SUMMARY OF THE CHAPTER

Gist of lesson

Acids
Bases
Mineral acids
Organic acids
Hydronium Ions
Universal Indicator
Strong acids
Weak acids
Chemical properties of acids
Chemical properties of bases
Indicators
pH scale

Keynotes

Acids :- Substances which furnish H^+ ions in their aqueous solutions, turn blue litmus solution red are called acids. Acids are sour in taste.

Bases :- Substances which furnish $OH^!$ ions in their aqueous solutions, change red litmus solution blue are called bases. They are bitter in taste.

Mineral acids :- Acids which are obtained from minerals like sulphates, nitrates, chlorides etc. are called mineral acids, e.g., H_2SO_4 (Sulphuric acids), HNO_3 (Nitric acids) and HCl (Hydrochloric acid).

Organic acids :- Acids which are obtained from plants and animals are called organic acids. E.g. citric acid, ascorbic acid, tartaric acid, lactic acid, acetic acid.

Hydronium Indicator :- They are formed by reaction H^+ (from acid) and H_2O. It is because H^+ is unstable.

Universal Indicator :- A universal indicator is a mixture of indicators which shows a gradual but well-marked series of colour changes over a very wide range of change in concentration of H^+ ion.

Strong Acids :- Acids which dissociate into ions completely when hydrated are called strong acids. Eg. H_2SO_4, HCl etc.

Weak acids :- Acids which do not dissociate into ions completely are called weak acids Eg. Citric acid, acetic acid.

Chemical properties of acids

(i) Acids react with active metals to give salt and hydrogen gas.

(ii) Acids react with metal carbonate and metals hydrogen carbonate to give salt, water and carbon dioxide.

(iii) Acids react with bases to give salt and water. This reaction is called a neutralization reaction.

(iv) Acids react with metal oxides to give salt and water.

Chemical properties of Bases

(i) Reaction with metals - Certain metals such as Zinc, Aluminium and Tin react with alkali solutions on heating and hydrogen gas is evolved.

(ii) Reaction with acids - Bases react with acids to form salt and water.

Indicators :- Indicators are substances which indicate the acidic or basic nature of the solution by their color change.

pH scale :- A scale for measuring hydrogen ion concentration in a solution. The pH of a solution is defined as the negative logarithm of hydrogen ion concentration in moles per litre.

$pH = -\log [H^+]$

$pH = -\log [H_3O^+]$

where $[H^+]$ or $[H_3O^+]$ represents concentrations of hydrogen ions in solution.

The pH of a neutral solution is 7

The pH of an acidic solution is < 7

The pH of a basic solution is > 7

Some Important Compounds and their uses

Common Name	Chemical Name	Chemical Formula	Uses
Washing Soda	Sodium carbonate decahydrate	$Na_2CO_3.10H_2O$	Manufacture of borax, caustic soda, Softening of hard water
Baking Soda	Sodium hydrogen carbonate	$NaHCO_3$	Used as antacid, ingredient of baking powder
Bleaching powder	Calcium oxychloride	$CaOCI_2$	Bleaching clothes, used as oxidizing agent, disinfecting water, manufacture of chloroform
Plaster of Paris	Calcium sulphate hemihydrate	$CaSO_4$ $½H_2O$	Plastering fractured bones, making toys, decorative materials, statues

EQUATIONS OF ACIDS, BASES AND SALTS

Acids + Metal → Salt + Hydrogen gas

$H_2SO_4 + Zn \rightarrow ZnSO_4 + H_2$

Base + Metal → Salt + Hydrogen gas

$2NaOH + Zn \rightarrow Na_2ZnO_2 + H_2$

(Sodium zincate)

Base + Acid → Salt + Water

$NaOH(aq) + HCl(aq) \rightarrow NaCL(aq) + H_2O(1)$

Acids give hydronium ions in water

$HCI + H_2O \rightarrow H_3O^+ + Cl^-$

Bases generate OH^- ions in water

$NaOH(aq) + H_2O \rightarrow Na^+(aq) + OH^-(aq)$

Reaction of Important Chemical Compounds

Preparation of Bleaching powder

By the action of chlorine on dry slaked lime

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

On heating, baking soda liberates CO_2

$2NaHCO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$

Washing soda (Sodium carbonate decahydrate)

By heating sodium hydrogen carbonate

$2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$

$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$

Plaster of Paris

Preparation of plaster of Paris

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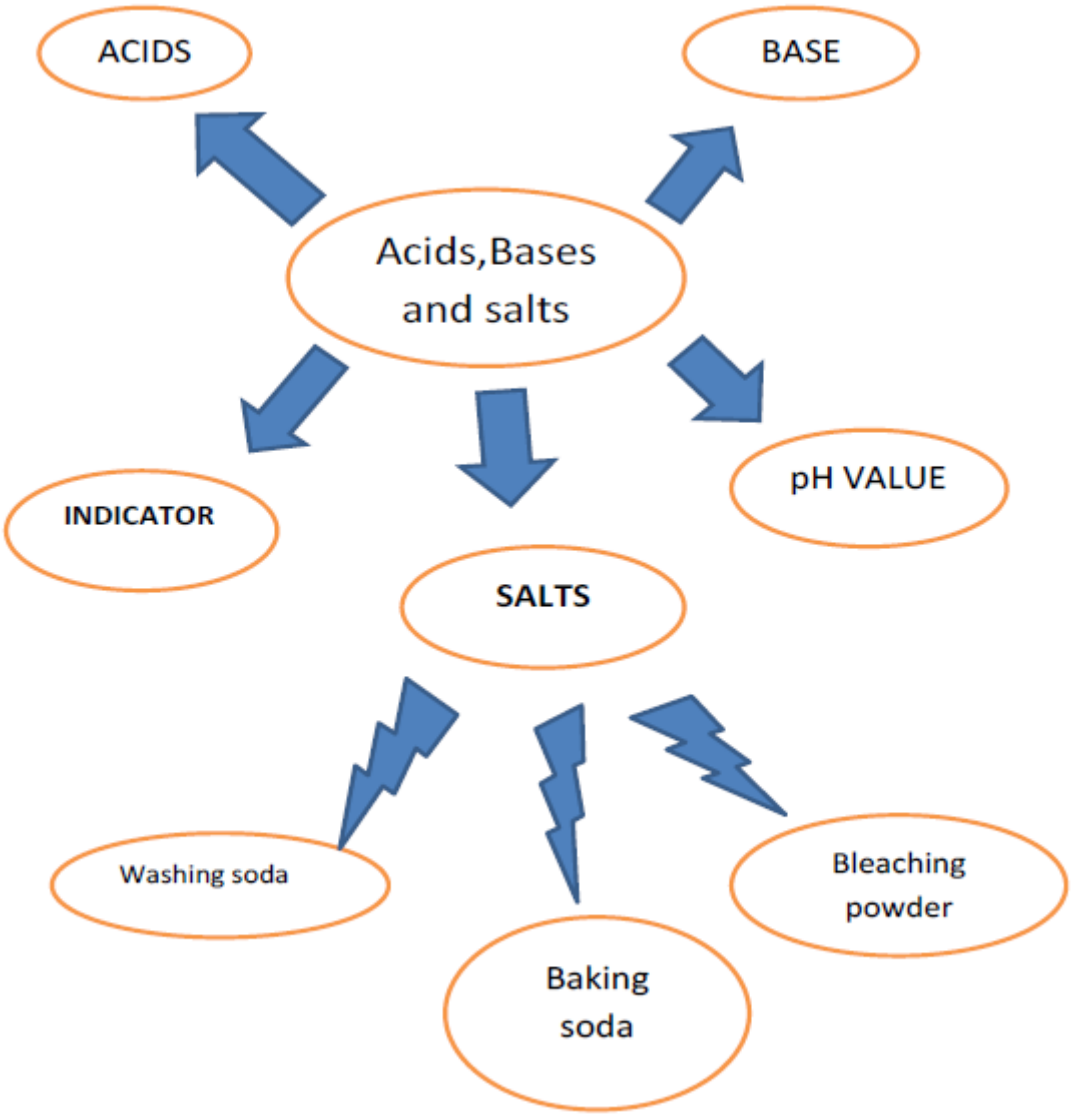
$CaSO_4 2H_2O$ 373K (Heat)→ $CaSO_4.½H_2O + 1.½H_2O$
On mixing plaster of Paris with water, gypsum is obtained
$CaSO_4.½H_2O + 1\ ½\ H_2O \rightarrow CaSO_4.2H_2O$

MIND MAP



Summary Points

1) Acid-base indicators are dyes or mixtures of dyes which are used to indicate the presence of acids and bases.
2) Acidic nature of a substance is due to the formation of $H^+(aq)$ ions in solution. Formation of $OH^-(aq)$ ions in solution is responsible for the basic nature of a substance.
3) When an acid reacts with a metal, hydrogen gas is evolved and a corresponding salt is formed.
4) When a base reacts with a metal, along with the evolution of hydrogen gas a salt is formed which has a negative ion composed of the metal and oxygen.

5) When an acid reacts with a metal carbonate or metal hydrogen carbonate, it gives the corresponding salt, carbon dioxide gas and water.
6) Acidic and basic solutions in water conduct electricity because they produce hydrogen and hydroxide ions respectively.
7) The strength of an acid or an alkali can be tested by using a scale called the pH scale (0-14) which gives the measure of hydrogen ion concentration in a solution.
8) A neutral solution has a pH of exactly 7, while an acidic solution has a pH less than 7 and a basic solution a pH more than 7.
9) Living beings carry out their metabolic activities within an optimal pH range.
10) Mixing concentrated acids or bases with water is a highly exothermic process.
11) Acids and bases neutralise each other to form corresponding salts and water.
12) Salts have various uses in everyday life and in industries.

MULTIPLE CHOICE QUESTIONS

Q 1. Some fruits like mango, lemon, raw grapes, orange, etc., have a sour taste due to the presence of:

(a) Acetic acid
(b) Citric acid
(c) Lactic acid
(d) Oxalic acid

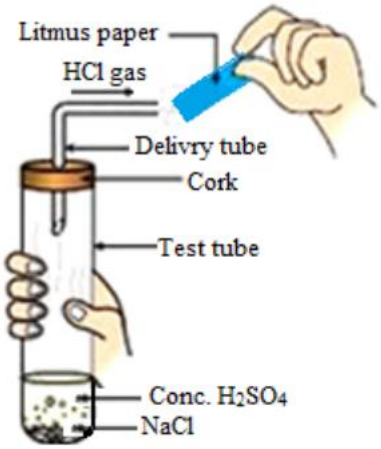
Q 2. Which of the following indicators turn red in an acidic solution.

i. Phenolphthalein
ii. Litmus
iii. Turmeric
iv. Methyl orange

Choose the correct option

(a) (i)and (ii)
(b) (ii) and (iii)
(c) Only (ii)
(d) (ii) and (iv)

Q 3. The figure given below represents the experiment carried out between conc. sulphuric acid and sodium chloride, which react with each other to form HCl gas.



Blue litmus paper is brought near the mouth of the delivery tube to check the presence of HCl acid but no change is observed in the color of litmus paper because:

(a) The litmus paper used is dry
(b) The litmus paper used is moist
(c) Blue litmus paper does not change its color with an acid
(d) The litmus paper is kept very close to the mouth of the delivery tube

Q 4. Zinc granules on treating with an acid X, form the zinc sulphate (ZnSO4) salt along with the evolution of a gas Y which burns with a pop sound when brought near to a burning candle. Identify the acid X and gas evolved Y.

(a) X- Sulphuric acid and Y- Oxygen gas
(b) X- Hydrochloric acid and Y- Oxygen gas
(c) X- Sulphuric acid and Y- Hydrogen gas
(d) X- Hydrochloric acid and Y- Hydrogen gas

5. Incorrect statement about acids is/are

(a) they have sour taste
(b) they may change the colour of indicator
(c) they changes the colour or blue litmus to red
(d) they change the colour of red litmus to blue

Q 6. Alkalis are

(a) Acids, which are soluble in water
(b) acids, which are insoluble in water
(c) bases, which are insoluble in water
(d) bases, which are soluble in water

Q.7. When CO_2 is passed through lime water, it turns milky. The milkiness is due to formation of

(a) $CaCO_3$
(b) $Ca(OH)_2$
(c) H_2O
(d) CO_2

Q.8. A blue litmus paper was first dipped in dil. HCl and then in dil. NaOH solution. It was observed that the colour of the litmus paper-

(a) changed to red
(b) first to red and then to blue
(c) changed blue to colourless
(d) remains blue in both the solutions

Q 9. What happens when a base is added to vanilla?

(a) Colour of vanilla changes into red
(b) Vanilla becomes colourless
(c) Vanilla loses its smell
(d) Nothing happens

Q 10. The organic acid present in tomato is

(a) oxalic acid
(b) Lactic acid
(c) Malic acid
(d) Tartaric acid

Q 11 . Reaction of an acid with a base is known as-

(a) Decomposition
(b) combination
(c) Redox reaction
(d) neutralization

Q 12. Which of the following acid does not react with metals-

(a) sulphuric acid
(b) phosphoric acid
(c) carbonic acid
(d) nitric acid

Q 13. When a base reacts with a metal, it forms a salt and hydrogen gas is released. By what method can the presence of hydrogen be detected?

(a) by water
(b) by litmus paper
(c) by methyl orange
(d) by a burning candle

Q 14. A solution reacts with crushed egg-shells to give a gas that turns lime-water milky. The solution contains

(a) NaCl
(b) HCl
(c) LiCl
(d) KCl

Q 15. The sample of soil from a particular place was tested for its pH value. It came out to be 5. Which one of the following should be added to the soil to make it suitable for the plant growth?

i. Calcium chloride
ii. Calcium Hydroxide
iii. Calcium oxide
Choose the correct option:

(a) Both (i) and (ii)
(b) Both (ii) and (iii)
(c) Only (i)
(d) Only (iii)

Q 16. Identify the products of the following reaction:

$CaCO_3$ + 2HCl ----------→ …… + …….

(a) Calcium hydrogen carbonate and chlorine gas
(b) Calcium chloride and water
(c) Calcium oxide, carbon dioxide and water
(d) Calcium chloride, carbon dioxide and water

Q 17. An ant's sting can be treated with ……which will neutralise the effect of the chemical injected by the ant's sting into our skin.
Choose the correct option from the following to be filled in the blank space:

(a) Methanoic acid
(b) formic acid
(c) Baking soda
(d) Caustic soda

Q 18. Which of the following salt will give acidic solution when dissolved in water?

(a) NH_4Cl
(b) NaCl
(c) Na_2CO_3
(d) CH_3COONa

Q 19. The correct statement regarding universal indicator is

(a) it is an indicator having pH = 7
(b) it gives blue colour at pH = 3
(c) it becomes colourless at pH = 7
(d) it gives orange colour at pH = 3

Q 20. You are having five solutions *A* , *B*,*C*, *D* and *E* with pH values as follows:

A = 1.8, *B* = 7, *C* = 8.5, *D* = 8 and *E* = 5

Which solution would be most likely to liberate hydrogen with magnesium powder?

(a) Solution *A* and *B*
(b) Solution *A*
(c) Solution *C*
(d) All of the above

Q 21. In the following reaction, identify the salt formed

$NH_4OH\ (aq) + H_2SO_4\ (aq) \rightarrow$ _____ + $2H_2O\ (l)$

(a) NH_4NO_3
(b) $(NH_4)_2SO_4$
(c) $(NH_4)_3PO_4$
(d) $(NH_4)_2S$

Q 22. Which of the following phenomena occur, when a small amount of acid is added to water?

i. Ionisation
ii. Neutralisation
iii. Dilution
iv. Salt formation

(a) (i) and (ii)
(b) (i) and (iii)
(c) (ii) and (iii)
(d) (ii) and (iv)

Q 23. Lactic Acid is present in-

(a) Orange
(b) Tea
(c) Curd
(d) Vinegar

Q 24. Which of the following are present in a dilute aqueous solution of Hydrochloric Acid?

(a) $H_3O^+ + Cl^-$
(b) $H_3O^+ + OH^-$
(c) $Cl^- + OH^-$
(d) Unionised HCl

Q 25. In which pH range does our body work to survive in the atmosphere?

(a) 5.5 to 8.5
(b) 7.0 to 7.8
(c) 2.3 to 7.0
(d) 7.5 to 12.5

Q 26. $CuSO_4.5H_2O$ In this Compound the water molecule is called –

(a) Pure Water
(b) Water of Crystallisation
(c) Soda Water
(d) None of these

Q 27. Which one of the following salts does not con-tain water of crystallisation?

(a) Blue vitriol
(b) Baking soda
(c) Washing soda
(d) Gypsum

Q 28. In terms of acidic strength, which one of the following is in the correct increasing order?

(a) Water < Acetic acid < Hydrochloric acid
(b) Water < Hydrochloric acid < Acetic acid
(c) Acetic acid < Water < Hydrochloric acid
(d) Hydrochloric acid < Water < Acetic acid

Q 29. Brine is an

(a) aqueous solution of sodium hydroxide
(b) aqueous solution of sodium carbonate
(c) aqueous solution of sodium chloride
(d) aqueous solution of sodium bicarbonate

Q 30. What is the pH value of distilled water?

(a) 7
(b) More than 7
(c) Less than 7
(d)Zero

Q 31. Lime water reacts with chlorine to give

(a) bleaching powder
(b) baking powder
(c) baking soda
(d) washing soda

Q 32. Tooth enamel is made up of

(a) calcium phosphate
(b) calcium carbonate
(c) calcium oxide
(d) potassium

Q 33. Sodium hydroxide is used

(a) as an antacid
(b) in manufacture of soap
(c) as a cleansing agent
(d) in alkaline batteries

Q 34. Chemical formula of washing soda is

(a) $Na_2CO_3 . 7H_2O$
(b) $Na_2CO_3 . 5H_2O$
(c) $Na_2CO_3 . 2H_2O$
(d) $Na_2CO_3 . 10H_2O$

Q 35. Bleaching powder gives smell of chlorine because it-

(a) is unstable
(b) gives chlorine on exposure to atmosphere
(c) is a mixture of chlorine and slaked lime
(d) contains excess of chlorine

Q 36. At what temperature is gypsum heated to form Plaster of Paris?

(a) 90°C
(b) 100°C
(c) 110°C
(d) 120°C

Q 37. Which among the following represents the chemical formula for 'Plaster of Paris'?

(a) $CaSO_4. 2 H_2O$
(b) $CaSO_4. 1/2 H_2O$
(c) $CaSO_4. H_2O$
(d) $CaSO_4. 10 H_2O$

Q 38. Copper sulphate crystals when heated strongly, lose their water of crystallization to give anhydrous copper sulphate accompanied by a change in color from:

(a) Blue to green
(b) Blue to white
(c) Blue to sky blue
(d) Blue to grey

Q 39. The difference of molecules of water in gypsum and POP is

(a) 5/2
(b) 2/1
(c) 3/2
(d) ½

Q 40. The chemical formula of caustic potash is

(a) NaOH
(b) $Ca(OH)_2$
(c) NH_4OH
(d) KOH

CCT BASED QUESTIONS

(Q41-45)

pH is quite useful to us in a number of ways in daily life. Some of its applications are:

1. **Control of pH of the soil:** Plants need a specific pH range for proper growth. The soil may be acidic, basic or neutral depending upon the relative concentration of H* and OH-. The pH of any soil can be determined by using pH paper. If the soil is too acidic, it can be corrected by adding lime to it. If the soil is too basic, it can be corrected by adding organic manure which contains acidic materials.

2. **Regaining shine of a tarnished copper vessel by use of acids:** A copper vessel gets tarnished due to formation of an oxide layer on its surface. On rubbing lenion on the vessel, the surface is cleaned and the vessel begins to shine again. This is due to the fact that copper oxide is basic in nature, which reacts with the acid (citric acid) present in lemon to form a salt (copper citrate) which is washed away with water. As a result, the layer of copper oxide is removed from the surface of the vessel and the shining surface is exposed.
3. **Self-defence by animals through chemical warfare:** Stings of bees and ants contain methanoic acid. When stung, it causes lot of pain and irritation. This can be cured by rubbing the affected area with mild base like baking soda.

Q 41. When black copper oxide placed in a beaker is treated with dilute HCl, its colour changes to

(a) White
(b) Dark red
(c) Bluish green
(d) No change

Q 42. P is an aqueous solution of acid and Q is an aqueous solution of base. When these two are diluted separately, then

(a) pH of P increases while that of Q decreases till neutralisation.
(b) pH of P decreases while that of Q increases till neutralisation.
(c) pH of both P and Q decrease.
(d) pH of both P and Q increase.

Q 43. Which of the following acids is present in bee sting?

(a) Formic acid
(b) Acetic acid
(c) Citric acid
(d) Carbonic acid

Q 44. Sting of ant can be cured by rubbing the affected area with soap because

(a) it contains oxalic acid which neutralises the effect of formic acid
(b) it contains aluminium hydroxide which neutralises the effect of formic acid
(c) it contains sodium hydroxide which neutralises the effect of formic acid
(d) none of these

Q 45. The pH of soil X is 7.5 while that of soil Y is 4.5. Which of the two soils, should be treated with powdered chalk to adjust its pH?

(a) X only
(b) Y only
(c) both X and Y only
(d) none of these

(Q- 46-50)

Sodium bicarbonate (sodium hydrogen carbonate), commonly known as baking soda or bicarbonate of soda, is a chemical compound with the formula $NaHCO_3$. It is a salt composed of a sodium cation (Na^+) and a bicarbonate anion (HCO_3^-). Sodium bicarbonate is a white solid that is crystalline, but often appears as a fine powder. It has a slightly salty, alkaline taste .Because it has long been known and widely used, the salt has many related names such as baking soda, bread soda, cooking soda, and bicarbonate of soda, and can often be found near *baking powder* in stores. In cooking, baking soda is primarily used in baking as a leavening agent. Sodium bicarbonate is used in as soda acid fire extinguishers. It is commonly used to neutralize unwanted acid solutions .

Q 46. Baking soda is produced by which of the following process?

(a) Chlor-alkali process
(b) Solvay process
(c) Soda process
(d) Dobereiner's Triads process

Q 47. Baking powder produces which of the following which makes bater soft?

(a) Sodium carbonate
(b) Carbon dioxide
(c) Oxygen
(d) Nitrogen

Q 48. If a few drops of a concentrated acid accidentally spills over the hand of a student, what should be done?

(a) Wash the hand with saline solution
(b) Wash the hand immediately with plenty of water and apply a paste of sodium hydrogen carbonate
(c) After washing with plenty of water applies solution of sodium hydroxide on the hand
(d) Neutralise the acid with a strong alkali

Q 49. One of the constituents of baking powder is sodium hydrogen carbonate, the other constituent is

(a) Hydrochloric acid
(b) Tartaric acid
(c) Acetic acid
(d) Sulphuric acid

Q 50. Sodium bicarbonate is a basic salt because it is a salt of

(a) Strong acid and strong base
(b) Weak acid and weak base
(c) Strong acid and weak base
(d) Weak acid and strong base

ASSERTION REASONING QUESTIONS

In the following questions, a statement of assertion (A) is followed by a statement of reason (R). Mark the correct choice as:

(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).
(b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).
(c) Assertion (A) is true but reason (R) is false.
(c) Assertion (A) is false but reasons (R) is true.
(d) Both Assertion and Reason are false.

1. **Assertion :** While dissolving an acid or base in water, the acids must always be added slowly to water with constant stirring.
   Reason : Dissolving an acid or a base in water is highly exothermic reaction.
2. **Assertion :** On adding H_2SO_4 ,aqueous solution get corrosive
   Reason : Hydronium ions are responsible for corrosive action.
3. **Assertion :** Phenolphthalein gives pink colour in basic solution.
   Reason : Phenolphthalein is a natural indicator.
4. **Assertion :** HCl gas does not change the colour of dry blue litmus paper.
   Reason : HCl gas dissolves in the water present in wet litmus paper to from H^+ ions.

5. **Assertion :** HCl produces hydronium ions (H_3O^+) and chloride ions (Cl^-) in aqueous solution.
   Reason : In presence of water, bases give H^+ ions.

6. **Assertion :** H_2CO_3 is a strong acid.
   Reason : A strong acid dissociates completely or almost completely in water.

7. **Assertion :** Sodium hydroxide reacts with zinc to produce hydrogen gas.
   Reason : Acids reacts with active metals to produce hydrogen gas.

8. **Assertion :** Salts are the products of an acid-base reaction.
   Reason : Salt may be acidic or basic.

9. **Assertion :** Ammonia solution is an alkali.
   Reason : Ammonia solution turns blue litmus paper red.

10. **Assertion :** Weak acids have low electrical conductivity.
    Reason : Strong acids and weak acids have concentration of hydrogen ions in their solutions.

11. **Assertion :**Baking soda creates acidity in the stomach.
    Reason : Baking soda is alkaline.

12. **Assertion :** During electrolysis of concentrated aqueous solution of sodium chloride, hydrogen gas produced at anode and chlorine gas is produced at cathode.
    Reason : Ions get attracted to oppositely charged electrodes

13. **Assertion :** To dilute, concentrated sulphuric acid, acid is added to the water slowly.
    Reason : A lot of heat energy will be given out in the dilution of concentrated sulphuric acid.

14. **Assertion :** Pure water is neither acidic nor basic.
    Reason : The pH of a solution is inversely proportional to the concentration of hydrogen ions in it.

15. **Assertion :** When common salt is kept open, it absorbs moisture from the air.
    Reason : Common salt contains magnesium chloride

16. **Assertion :** Gas bubbles are observed when sodium carbonate is added to dilute hydrochloride acid
    Reason : Carbon dioxide is given off in the reaction.

17. **Assertion :** pH of ammonium chloride solution is in acidic range.
    Reason : Solution of a salt of weak base and strong acid is acidic

18. **Assertion :** When zinc is added to dilute hydrochloric acid, hydrogen is given off.
    Reason : Hydrogen chloride molecules contain hydrochloric acid and hydrogen atoms.

19. **Assertion :** H_3PO_4 and H_2SO_4 are known as polybasic acids.
    Reason : They have two or more than two protons per molecule of the acid.

20. **Assertion:** If the pH inside the mouth decreases below5.5, the decay of tooth enamel begins.
    Reason : The bacteria present in mouth degrades the sugar and left over food particles and produce acids that remains in the mouth after eating. Acid produced reacts with tooth enamel and erodes it.

21. **Assertion :** pH = 7 signifies pure water.
    Reason : At this pH, $[H^+] = [OH^-] = 10^{-7}$.

22. **Assertion :** The aqueous solutions of glucose and alcohol do not show acidic character.
Reason : Aqueous solutions of glucose and alcohol do not give H^+ ions.

23. **Assertion :** The acidity of Mg $(OH)_2$ is two.
Reason : The acidity of a base is equal to the number of hydroxyl ions.

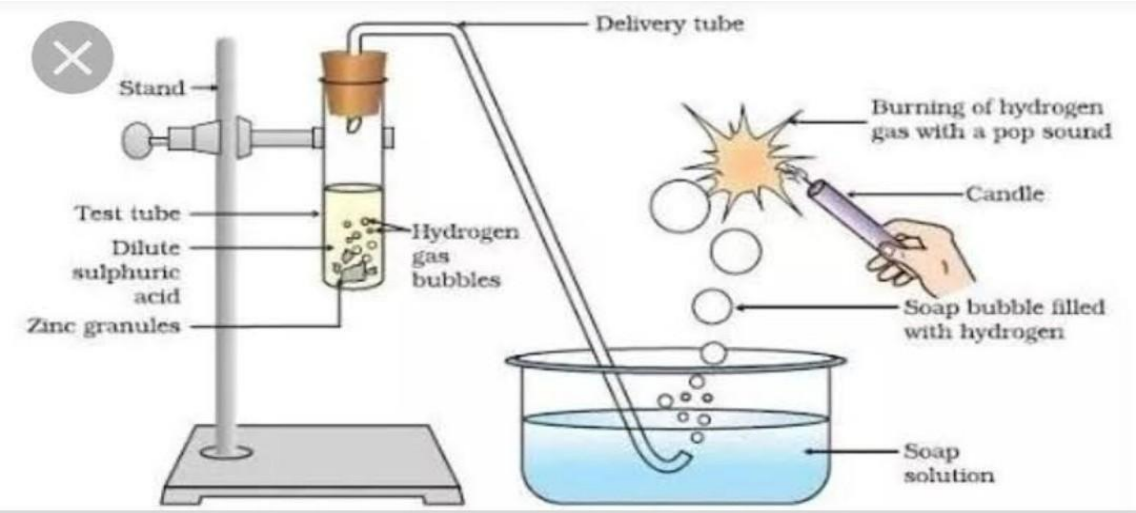
24. **Assertion:** Plaster of Paris is used by doctors by setting fractured bones.
Reason : When Plaster of Paris is mixed with water and applied around the fractured limbs, it sets into a hard mass.

25. **Assertion :** In water, Hydrochloric acid behaves as a weak monobasic acid.
Reason : In water, Hydrochloric acid acts as a proton donor.

PARAGRAPH BASED QUESTIONS

Paragraph -1

About 5 mL of dilute sulphuric acid is taken in a test tube and add a few pieces of zinc granules to it. The gas evolved is passed through the soap solution. The activity is repeated with any acid like HCl, HNO_3 and CH_3COOH



Answer the following-

Q-1 Which of the following observation is correct?

(i) When the gas evolved in test tube, is passed through a soap solution, the soap bubbles formed extinguish a burning candle.
(ii) When the gas evolved in test tube, is passed through a soap solution, the soap bubbles burn with a pop sound when a burning candle is brought near a bubble.
(iii) The gas evolved in a test tube ,turns soap solution milky
(iv) No gas evolved in this experiment.

Q-2 Which gas is evolved with pop sound in this experiment?

(i) CO_2
(ii) O_2
(iii) H_2
(iv) N_2

Q-3 Are the observations in test tube same when the activity is repeated with more acids like HCL, HNO_3 and CH_3COOH?

(i) Yes
(ii) No
(iii) Sometimes
(iv) Never

Q-4 Which form of Zinc is taken for this experiment?

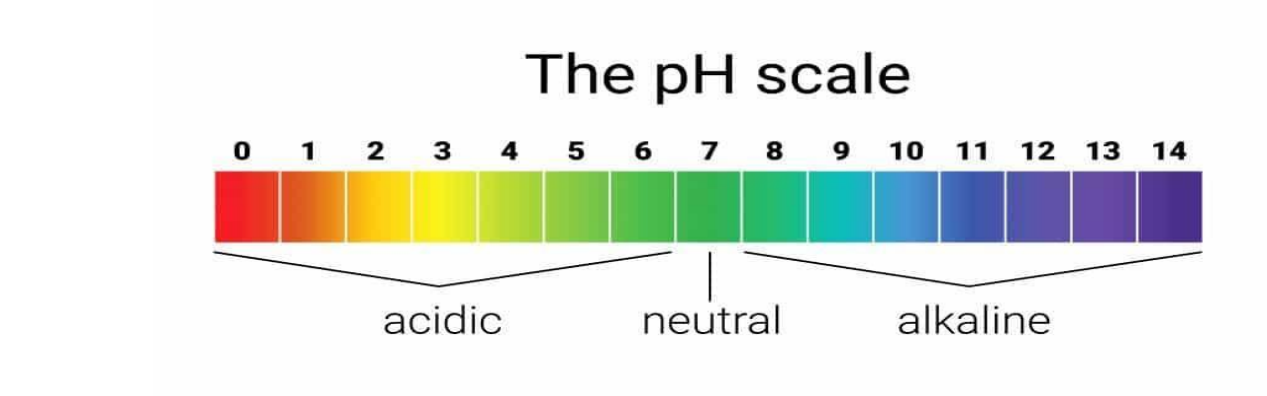
(i) Zinc solution
(ii) Zinc powder
(iii) Zinc granules
(iv) All

Q-5 When zinc metal reacts with hydrochloric acid and form hydrogen gas by displacing hydrogen atoms and form zinc chloride salt. write the correct and balanced equation.

(i) $Zn + HCL \text{---------} \rightarrow ZnCl + H_2$
(ii) $Zn + 2\ HCL \text{---------} \rightarrow ZnCl + H_2O$
(iii) $Zn + H_2SO_4 \text{---------} \rightarrow ZnSO_4 + H_2$
(iv) $Zn + 2\ HCL \text{---------} \rightarrow ZnCl_2 + H2$

Paragraph-2

Our body works within the pH range of 7.0 to 7.8. Living organisms can survive only in a narrow range of pH change. When pH of rain water is less than 5.6, it is called acid rain. When acid rain flows into the rivers, it lowers the pH of the river water. The survival of aquatic life in such rivers becomes difficult.
It is very interesting to note that our stomach produces hydrochloric acid. It helps in the digestion of food without harming the stomach. During indigestion the stomach produces too much acid and this causes pain and irritation. To get rid of this pain, people use bases called antacids. These antacids neutralise the excess acid. Magnesium hydroxide (Milk of magnesia), a mild base, is often used for this purpose.



Answer the following-

Q-1 What is the pH required for the survival of aquatic animals and plants?

(i) 7
(ii) 7.5
(iii) 6.5
(iv) 4.8

Q-2 Which of the following gases is responsible for the yellowing of the Taj Mahal?

(i) Organic carbon
(ii) Black carbon
(iii) Brown carbon
(iv) All of the mentioned

Q-3 The PH which is neither acidic nor basic-

(i) 6.2
(ii) 7
(iii) 8
(iv) 5.5

Q-4 Five solutions A, B, C, D and E when tested with universal indicator showed PH as 4, 1, 11, 7, 9 respectively. Which solution is-

a) Neutral b) strong base c) weak acid d) weak base e) strong acid

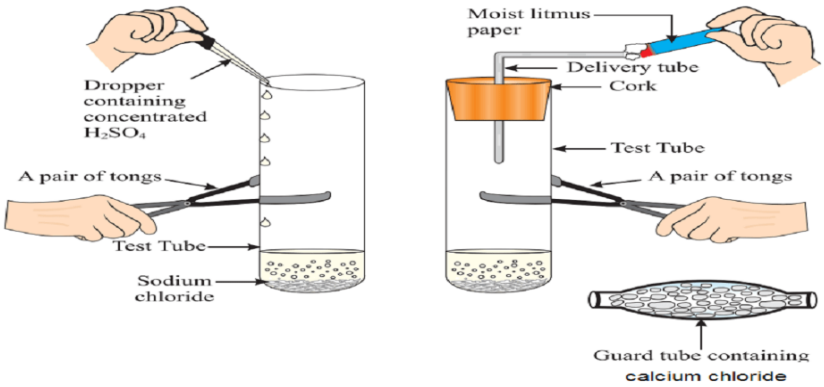
(i) 7, 11, 4, 9, 1
(ii) 7, 9, 4 ,11, 1
(iii) 1, 11, 9, 4, 7
(iv) 7, 9, 1 ,11 ,4

Q-5 pH of HCl in our stomach is-

(i) 1.0-2.0
(ii) 4.5-5.5
(iii) 3.5-6.5
(iv) 6-7

Paragraph -3

Take about 1g solid NaCl in a clean and dry test tube and set up the apparatus as shown in Fig. Add some concentrated sulphuric acid to the test tube.



Q-1 The gas produced in the test tube is-

(i) Sulphur di oxide
(ii) Hydrogen
(iii) Hydrogen chloride
(iv) Hydrogen sulphide

Q-2 If climate is humid, the HCl gas evolved is passed through a guard tube containing_____ to dry the gas.

(i) calcium hydroxide
(ii) calcium carbonate
(iii) calcium sulphate
(iv) calcium chloride

Q-3 Hydrogen ions must always be shown as $H^+(aq)$ or hydronium ion($H3O^{+)}$ as-

(i) Hydrogen ions combine with water to form hydronium ions
(ii) Hydrogen gas dissociates into ions
(iii) All acids dissociate into hydrogen ions in presence of a base
(iv) Hydrogen ions separate from acids on passing electricity

Q-4 On the basis of above activity, what do you infer about the acidic character of dry HCl gas-

(i) Acidic
(ii) Basic
(iii) not Acidic
(iv) not Basic

Q-5 On the basis of above activity, what do you infer about the acidic character of HCl solution-

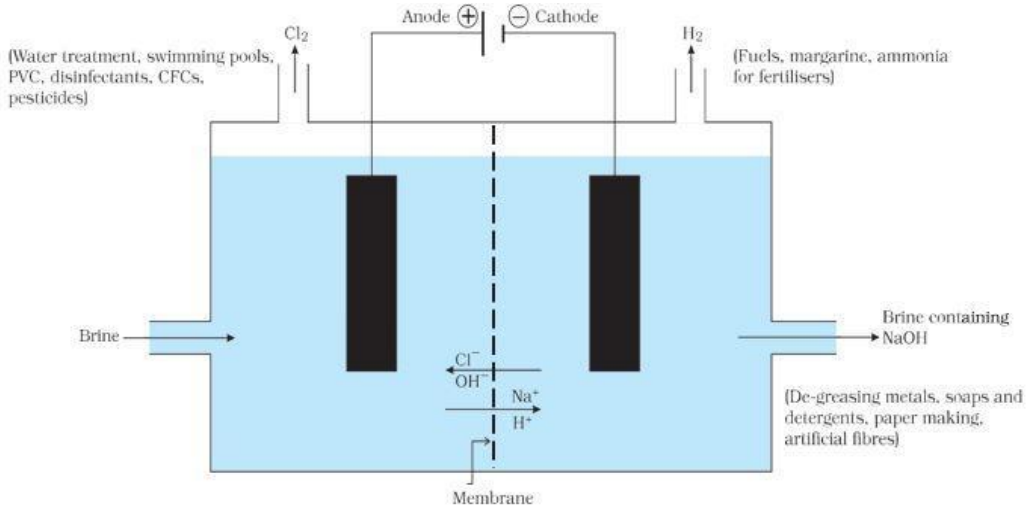
(i) Acidic
(ii) Basic
(iii) not Acidic
(iv) not Basic

Paragraph -4

The common salt is an important raw material for various materials of daily use, such as sodium hydroxide, baking soda, washing soda, bleaching powder and many more. When electricity is passed through an aqueous solution of sodium chloride (called brine), it decomposes to form sodium hydroxide. The process is called the chlor-alkali process because of the products formed– chlor for chlorine and alkali for sodium hydroxide.

$$2NaCl(aq) + 2H_2O(l) \rightarrow 2NaOH(aq) + Cl_2(g) + H_2(g)$$

Chlorine gas is given off at the anode, and hydrogen gas at the cathode. Sodium hydroxide solution is formed near the cathode. The three products produced in this process are all useful.



Answer the following-

Q-1 In Chlor -alkali process gas evolved, useful for disinfecting water is-

(i) Hydrogen
(ii) Oxygen
(iii) Chlorine
(iv) Bromine

Q-2 Brine is-

(i) Nacl(s)
(ii) NaOH(aq)
(iii) Nacl (aq)
(iv) H_2O

Q-3 Identify the correct representation of reaction occurring during chlor-alkali process.

(i) $2NaCl(l)+2H_2O(l)\rightarrow 2NaOH(l)+Cl_2(g)+H_2(g)$
(ii) $2NaCl(s)+2H_2O(aq)\rightarrow 2NaOH(aq)+Cl_2(g)+H_2(g)$
(iii) $2NaCl(aq)+2H_2O(l)\rightarrow 2NaOH(aq)+Cl_2(aq)+H_2(aq)$
(iv) $2NaCl(aq)+2H_2O(l)\rightarrow 2NaOH(aq)+Cl_2(g)+H_2(g)$

Q-4 Sodium hydroxide is used as a raw material_____

(i) To make Plastics
(ii) To make soap
(iii) To make Petrol
(iv) To make Rubber

Q-5 What is the correct half equation for the cathode in electrolysis of dilute Sodium chloride solution-

(i) H_2 ---------- $\rightarrow 2H^+ + 2e^-$

(ii) $H^+ + OH^-$ -------$\rightarrow H_2O$

(iii) $2H^+ + 2e^-$ -----$\rightarrow H_2$

(iv) H_2 -------$\rightarrow 2H - 2e^-$

Paragraph -5

Copper sulphate crystals which seem to be dry contain water of crystallisation. When we heat the crystals, this water is removed and the salt turns white. If you moisten the crystals again with water, you will find that blue colour of the crystals reappears. Water of crystallisation is the fixed number of water molecules present in one formula unit of a salt. Five water molecules are present in one formula unit of copper sulphate. Chemical formula for hydrated copper sulphate is $Cu\ SO_4.\ 5H_2O$. One other salt, which possesses water of crystallisation is gypsum. It has two water molecules as water of crystallisation. It has the chemical formula CaSO4 .2H2O. Plaster of Paris on heating gypsum at 373 K, it loses water molecules and becomes calcium sulphate hemihydrate ($CaSO_4.\ 1/2H_2O$). This is called Plaster of Paris, the substance which doctors use as plaster for supporting fractured bones in the right position. Plaster of Paris is a white powder and on mixing with water, it changes to gypsum once again giving a hard-solid mass.

$CaSO_4$ .1/ 2 H_2 O +1/1 2 H_2 O ------□ $CaSO_4$ .2H $_2$O

(Plaster of Paris) (Gypsum)

Plaster of Paris is used for making toys, materials for decoration and for making surfaces smooth. calcium sulphate hemihydrate called 'Plaster of Paris.

Answer the following-

Q-1 What is water of crystallization?

(i) Salt water

(ii) Water consumed while crystallization of salts

(iii) Water molecules present in salt crystals

(iv) Minimum amount of water which is required for crystallization of salts

Q-2 Which is the most common solvent used for Crystallization?

(i) Water

(ii) Alcohol

(iii) HCl

(iv) H_2SO_4

Q-3 What is the color of anhydrous copper sulphate?

(i) White

(ii) White grey

(iii) Blue grey

(iv) Green

Q-4 What is the chemical formula of hydrated copper sulphate-

(i) $CuSO_4$

(ii) $CuSO_4.2H_2O$

(iii) $CuSO_4.5H_2O$

(iv) $CuSO_4.1/2H2O$

Q-5 Chemical name of Plaster of Paris is-

(i) Calcium sulphate hemihydrate

(ii) Calcium sulphate dehydrate

(iii) Gypsum

(iv) Copper sulphate hemihydra

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CHAPTER 3

METALS AND NON-METALS

MAIN POINTS/ KEYNOTES/ GIST/ SUMMARY OF THE CHAPTER

Elements are classified broadly into two categories on the basis of properties:

- **Metals**: Iron, Zinc, Copper, Aluminium etc.
- **Non – metals**: Chlorine, Nitrogen, Hydrogen, Oxygen, Sulphur etc.Apart from metals and non-metals some elements show properties of both metals and non – metals, e.g. Silicon, Arsenic, Germanium .They are called metalloids

Comparison of physical properties of metals and non – metals:-

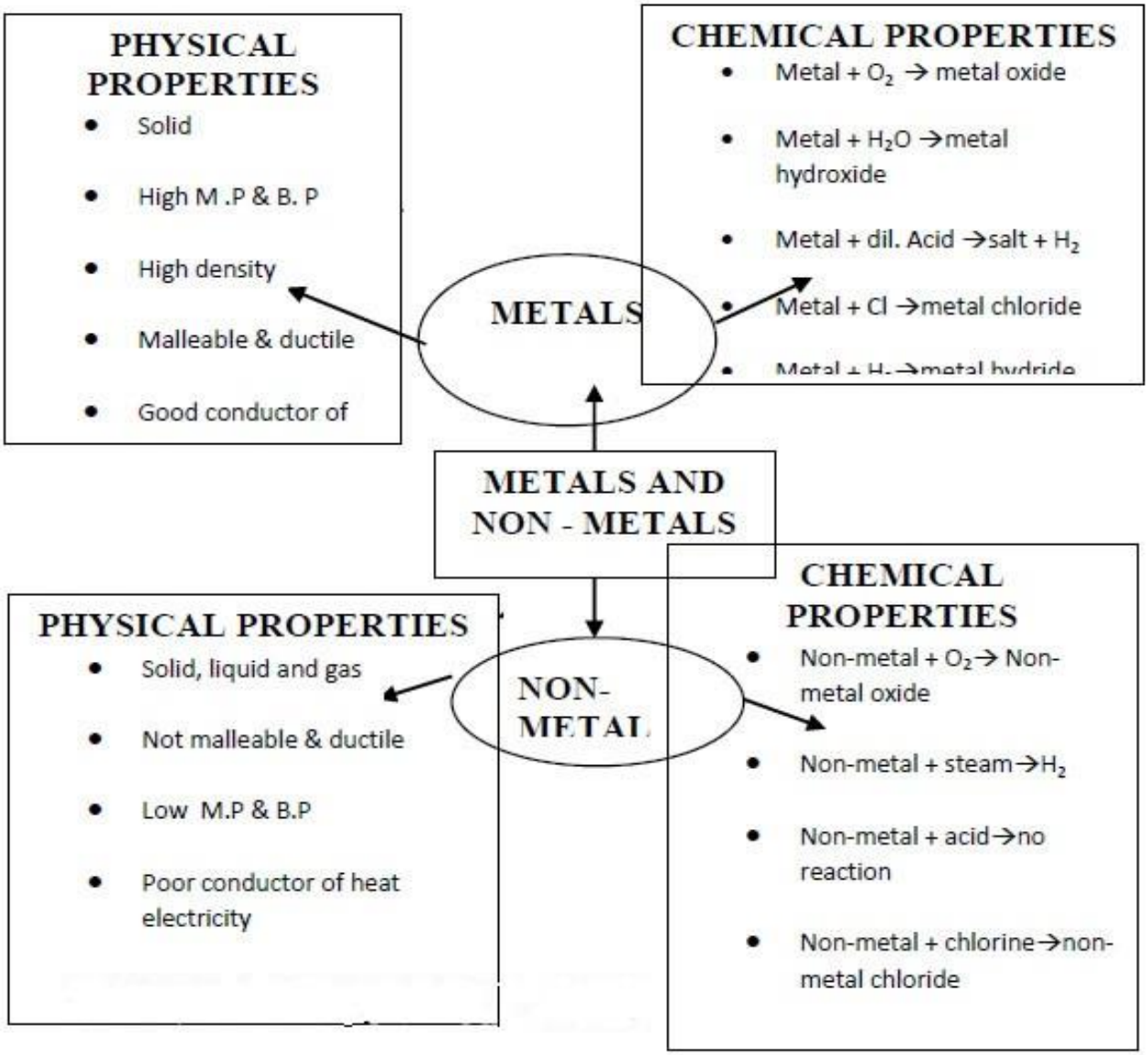
S.No	Property	Metals	Non-Metals
1	Physical State	Metals are solid at room temperature. Except mercury and gallium.	Non-metals generally exist as solids and gases, except Bromine.
2	Melting and boiling points	Metals generally have high m.pt and b.pt except gallium and cesium.	Non-metals have low m.pt and b.pt except diamond and graphite.
3	Density	Generally high.	Generally low.
4	Malleability and Ductility	Malleable and ductile.	Neither malleable nor ductile.
5	Electrical and thermal conductivity	Good conductors of heat and electricity.	Generally poor conductors of heat and electricity except graphite.
6	Lustre	In pure state ,they have a shining surface called lustre.	Do not have lustre except iodine.
7	Sonorous	Produce ringing sound on stricking is called sonorous.	Do not show the property of sonorous.
8	Hardness	Generally hard except Na, K	Generally soft except diamond.

Comparison of Chemical properties of metals and non – metals:-

1	**Reaction with Oxygen**	Metal + Oxygen→Metal oxide $4Na(s) + O_2(g) \rightarrow 2Na_2O(s)$ $4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3$ Metals form basic oxides Zn and Al form amphoteric oxides (they show the properties of both acidic and basic oxides) Most of the metal oxides are insoluble in water Some of them dissolve to form Alkali $Na_2O(s) + H_2O(l) \rightarrow 2NaOH(aq)$	Non-metal + Oxygen →Non-metal oxide $C + O_2 \rightarrow CO_2$ $S + O_2 \rightarrow SO_2$ Non-metals form acidic oxides CO and H_2O are neutral oxides(they are neither acidic nor basic in nature) Non- metal oxides are soluble in water They dissolve in water to form acids $SO_2 + H_2O \rightarrow H_2SO_3$
2	**Reaction with water**	Metals react with water to form metal oxides or metal hydroxide and H2 gas is released. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH + H_2(g) + heat$	Non-metals do not react with water, steam to evolve hydrogen gas. Because Non-metals cannot give electrons to hydrogen in water so that it can be released as H_2 gas.

3	**Reaction with dilute Acids**	Metal + Acid →Metal salt + Hydrogen **HCl** $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$ **H_2SO_4** $2Na(s) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + H_2(g)$ **HNO_3** Metal + HNO_3→ H_2 gas is not displaced. Except Mg,Mn **Reason-** HNO_3 is strong oxidizing agent. $Mn + 2HNO_3 \rightarrow Mn(NO_3)_2 + H_2$ H_2 gas from HNO_3	Non-metals do not react with acids to release H_2 gas **Reason-** Non-metals cannot loose electrons and give it to Hydrogen ions of acids so that the gas is released.
4	**Reaction with salt solutions**	When metals react with salt solution, more reactive metal will displace a less reactive metal from its salt solution. $CuSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$	When non-metals react with salt solution, more reactive non-metal will displace a less reactive non-metal from its salt solution. $2NaBr(aq) + Cl_2(g) \rightarrow 2NaCl(aq) + Br_2(aq)$
5	**Reaction with Chlorine**	Metal + Chlorine→ Metal Chloride ionic bond is formed. Therefore Ionic compound is obtained. $2Na + Cl_2 \rightarrow 2NaCl$	Non-metal + Chlorine→Non-metal Chloride covalent bond is formed. Therefore covalent compound is obtained. $H_2(g) + Cl_2 \rightarrow 2HCl$

MIND MAP



Reactivity Series of Metals

- The reaction of metals.
- How metals react differently to different substances.
- The number of electrons in the outermost shell of an atom determines its reactivity. Noble gases have low reactivity because they have full electron sheels.
- The gold is the least reactive metal present, and potassium is the most reactive metal.
- In a tabular form, It includes a sequence of the most reactive metals to the least reactive metals.

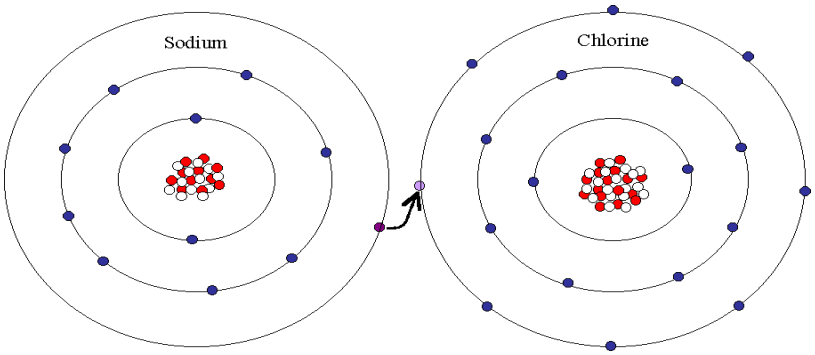
So if you go by the list, you will learn that if the metal is placed at a higher order, then it is of high reactivity.

K	Most reactive
Na	
Ca	
Mg	
Al	
Zn	Reactivity decreases
Fe	
Pb	
H	
Cu	
Hg	
Ag	
Au	Least reactive

Ionic Compound

Metals and non-metals leads to the formation of Compounds that possess charged species. These charged species are called ions. These oppositely charged positive and negative ions hold together in an ionic bonds such compounds are called ionic compounds.

- These charged species can be either positively charged called cation or negatively charged called anion. For instance, In sodium chloride (NaCl), Na exist as cation Na+ whereas Cl exist as anion Cl- . Hence it is an ionic compound.



Properties of ioniccompounds				
1.	**Physical nature**	:		solid and hard due to strong force of attraction. (generally brittle)
2.	**Melting point and boiling point**	:		have high M.P and B.P, as large amount of heat energy is required to break strong inter-ionic attraction.
3.	**Solubility**	:		soluble in water and insoluble in kerosene and pertrol.
4.	**Conduction of electricity**	:		ionic compounds in solid state-----does not conduct electricity.

MULTIPLE CHOICE QUESTIONS

1) The most abundant metal in the earth crust is
   a) Iron
   b) Aluminium
   c) Gold
   d) Potassium

2)Which of following metal is best conductor of heat
   a) Iron
   b) Gold
   c) copper
   d) Sodium

3)Name the metal which is poor conductor of electricity
   a) Silver
   b) Copper
   c) Aluminium
   d) Lead

4)The most reactive metal is
   a) Potassium
   b) Sodium
   c) Lithium
   d) Magnesium

5)Which of following is soft metal
   a) Copper
   b) Sodium
   c) Zinc
   d) iron

6)Most lustrous non-metal is
   a) hydrogen
   b) oxygen
   c) diamond
   d) chlorine

7) Silicon and Germanium are
   a) metals
   b) non-metals
   c) metalloids
   d) ores

8) Most malleable metal is
   a) Zinc
   b) Gold
   c) Magnesium
   d) Silver

9) Which of following metal is poor conductor of electricity
   a) Lead
   b) Silver
   c) Lithium
   d) Potassium

10) Name one element which behaves both as metal and non-metal
   a) Chlorine
   b) Hydrogen
   c) Zinc
   d) Lead

11) Identify basic oxide
   a) Na_2O
   b) CO_2
   c) SO_2
   d) CO
12) Al_2O_3 is------kind of Oxide
   a) Acidic
   b) Basic
   c) Amphoteric
   d) All of above
13) Iron reacts with
   a) Ice
   b) Water
   c) Steam
   d) None of above
14) Which of following property is generally not shown by metals
   a) Dullness
   b) Sonorous
   c) Ductility
   d) Electric conduction
15) The ability of metal to be drawn into thin wire is called
   a) Malleability
   b) Ductility
   c) Conduction
   d) Sonorousity
16) Which of following metals does not react with hot or cold water
   a) Na
   b) Ca
   c) Mg
   d) Fe
17) Lustrous non-metal is
   a) Iodine
   b) Fluorine
   c) Chlorine
   d) Bromine
18) Which one among following is acidic oxide
   a) MgO
   b) CaO
   c) CO
   d) Al_2O_3
19) Metal oxides dissolve in water to form
   a) Acid
   b) Base
   c) Both of above
   d) None of above
20) -------- is only non-metal that exist in liquid state
   a) Iodine
   b) Fluorine
   c) Chlorine
   d) Bromine

21) ---------non-metal is good conductor of electricity
a) Diamond
b) Graphite
c) Iodine
d) Oxygen

22) A metal that burns in air with dazzling white flame is
a) Na
b) Mg
c) Ca
d) Fe

23) What happens when Ca is treated with water
I. It does not react with water
II. It reacts violently with water
III. It reacts slowly with water
IV. Bubbles of hydrogen formed stick to the surface of calcium
a) I and IV
b) II and III
c) I and II
d) III and IV

24) Which one of the following four metals would be displaced from the solution of its salts by other three metals
a) Mg
b) Ag
c) Zn
d) Cu

25) Reaction between X and Y, forms compound Z. X loses electron and Y gains electrons . Which of following properties are not shown by Z
a) Has high melting point
b) Has low melting point
c) Conducts electricity in molten state
d) Occurs as solid

26) Which of following can undergo chemical reaction
a) $MgSO_4$+Fe
b) Zn SO_4+Fe
c) Mg SO_4+Pb
d) CuSO4+Fe

27) The atomic no. of four substances A, B, C, D are 5,8,10,11 respectively . Which two out of these four will react to form ionic bond
a) A and D
b) B and C
c) A and C
d) B and D

28) The atomic number of an element X is 13. X^+ will carry electrons
a) 11
b) 12
c) 13
d) 14

29) The atomic number of an element Z is 16, Z^{2-} will carry electrons
a) 14
b) 18
c) 20
d) 21

30) An element reacts with Oxygen to give a compound with high M.P. The compound formed is soluble in water . The element is likely to be

a) Ca
b) C
c) Fe
d) Si

31) Ag articles become black on prolonged exposure to air. This is due to formation of

a) Ag_2O
b) Ag_2S
c) AgCN
d) AgCl

32) Which of the following represents correct order of decreasing reactivity?

a) Mg> Al> Zn>Fe
b) Mg >Zn >Al >Fe
c) Al > Zn >Fe> Mg
d) Mg >Fe> Zn >Al

33) Which of following will give displacement reaction

a) Na Cl sol. With Cu
b) $MgCl_2$ with Al
c) $FeSO_4$ Sol. With Ag
d) $AgNO_3$ sol. With Cu

34) Metals react with Acid to form salt and --------

a) H
b) H_2
c) Any of above
d) None of above .

35) Metals do not give hydrogen on reacting with

a) HCl
b) H_2SO_4
c) HNO_3
d) None of above

36) Due to its semi-conductor properties non-metal used in computer, T.V. is

a) Carbon
b) Silicon
c) Fluorene
d) Chlorine

37)The electronic configuration of three elements A,B,C are A -2,8:B-2,8,7 :C-2,8,2,Which of the following is correct ?

a) A is a metal
b) B is a metal
c) C is a metal
d) B is non-metal and C is a metal

38) Which of following metal can displace Cu from solution of $CuSO_4$

a) Zn
b) Ag
c) Au
d) All of above

39) Ionic compounds are formed by combining of metal and non-metal involving

a) Electrovalent bond
b) Covalent bond
c) Any of above
d) None of above

40) During formation of ionic compound metal loses electron and becomes
   a) Electropositive
   b) Electronegative
   c) Neutral
   d) All of above

41) An Al strip is kept immersed in freshly prepared ferrous sulphate solution taken in a test tube, the change observed is
   a) Green solution slowly turns brown
   b) Test tube becomes slightly warm
   c) Gas with smell of sulphur is observed
   d) Light green solution turns blue

42) Which of following is formed when Fe reacts with steam
   a) FeO
   b) Fe_2O_3
   c) Fe_3O_4
   d) Fe_2O_3 and Fe_3O_4

43) A student placed iron nail in copper sulphate solution. He observed reddish brown coating on nail which is
   a) Soft and dull
   b) Hard and flat
   c) Smooth and shining
   d) Rough and granular

44) In given reaction,
   $Al_2O_3 + NaOH \rightarrow X + H_2O$, compound X is
   a) $NaAlO_2$
   b) Na_3Al
   c) Na_2O_3
   d) $NaAl_2O_3$

45) In general the number of electrons in outermost shell of a metal atom is
   a) 1
   b) 1 to 3
   c) 5
   d) 5 to 8

46) Food cans can be coated with tin but not with zinc because
   a) Zinc is costlier than tin
   b) Zinc has higher melting point than tin
   c) Zinc is more reactive than tin
   d) Zinc is less reactive than tin

47) Which is most reactive metal among following
   a) Fe
   b) Zn
   c) K
   d) Al

48) Which of following is an ionic compound
   a) CCl_4
   b) $MgCl_2$
   c) $CHCl_3$
   d) CH_3Cl

49) Which of following metal start floating after some time when immersed in water
   a) Ca
   b) Mg
   c) Both of above
   d) None of above

50) A metal that is used to preserve food stuff is
   a) Al
   b) Cu
   c) Mg
   d) Ag

51) Reactivity series of metals is based on property
   a) Tendency to participate in chemical reaction
   b) Tendency to lose electrons
   c) Both 0f above
   d) None of above

Metals and Non-Metals
Assertion and reasoning type questions

For question numbers 1-25, two statements are given-one labelled Assertion (A) and the other labeled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
(a) Both A and R are true, and R is correct explanation of the assertion.
(6) Both A and R are true, but R is not the correct explanation of the assertion.
(c) A is true, but R is false.
(d) A is false, but R is true.

1. **Assertion** : Different metals have different reactivities with water and dilute acids.
   Reason: Reactivity of a metal depends on its position in the reactivity series.
2. **Assertion**: Iron is the most widely used metal. But it is never used in its pure state.
   Reason: Pure iron is very soft and stretches easily when hot.
3. **Assertion:** Gold occurs in native state.
   Reason: Gold is a reactive metal.
4. **Assertion:** The property of beating a metal into sheets is called ductility.
   Reason: Gold and silver are most malleable metals.
5. **Assertion:** Silver and gold do not react with oxygen even at high temperatures.
   Reason: Silver and gold are less active metals.
6. **Assertion:** The oxides of sulphur and phosphorus are acidic in nature.
   Reason: Metal oxides are basic in nature.
7. **Assertion:** Bromine cannot displace chlorine from its salt solution.
   Reason: Chlorine is more reactive than bromine.
8. **Assertion:** MgO exists in liquid state.
   Reason: The electrostatic forces of attraction between Mg^{2+} and O^{2-} ions constitute ionic bond.
9. **Assertion:** On reacting with water, calcium starts floating over water.
   Reason: Calcium reacts with cold water at room temperature.
10. **Assertion:** The arrangement of metals in order of decreasing reactivities is called reactivity series.
    Reason: Metals at the top of series are very reactive and metals at the bottom are least reactive.
11. **Assertion:** Non-metals are electronegative in nature.
    Reason: They have tendency to lose electrons.
12. **Assertion:** lonic compounds have high melting and boiling points.
    Reason: A large amount of energy is required to break the strong inter-ionic attraction in ionic compounds.
13. **Assertion:** Metals in general have very high melting and boiling points.
    Reason: Metals have the strongest chemical bonds which are metallic in nature.
14. **Assertion** : Electrovalency of Na is +1.
    Reason: The number of electrons which an atom either loses or gains in the formation of an ionic bond is known as its valency.
15. **Assertion :** Metals generally act as reducing agents.
    Reason: The reducing character is expressed in terms of electron releasing tendency.
16. **Assertion:** Magnesium reacts with oxygen upon heating and burns brightly to form magnesium oxide.
    Reason: Magnesium oxide is basic in nature.

17. **Assertion:** The reaction of calcium with water is less violent in comparison to that of sodium.
Reason: The heat evolved is not sufficient for the hydrogen to catch fire.
18. **Assertion:** C and N do not react with dil. HCl and dil. H_2SO_4
Reason: Metals do not react with dil.HCl and dil. H_2SO_4
19. **Assertion:** Copper displaces silver from silver nitrate solution.
Reason: Copper is more reactive than silver.
20. **Assertion:** Aluminum oxide and zinc oxide are acidic in nature.
Reason: Amphoteric nature means that substance have both acidic and basic character.
21. **Assertion:** HCl produces hydronium ions (H_3O^+) and chloride ions (Cl^-) in aqueous solution.
Reason: In presence of water, basic give H^+ ions.
22. **Assertion:** Sodium hydroxide reacts with zinc to produce hydrogen gas.
Reason: Acids reacts with active metals to produce hydrogen gas.
23. **Assertion**: While dissolving an acid or base in water, the acids must always be added slowly to water with constant stirring.
Reason : Dissolving an acid or a base in water is highly exothermic reaction.
24. **Assertion:** Phenolphthalein gives pink colour in basic solution.
Reason: Phenolphthalein is a natural indicator.
25. **Assertion:** If the pH inside the mouth decreases below 5.5, the decay of tooth enamel begins.
Reason: The bacteria present in mouth degrades the sugar and left over food particles and produce acids that remains in the mouth after eating.

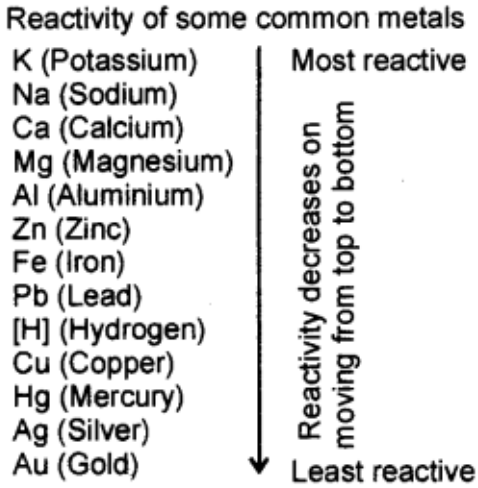
PARAGRAPH BASED QUESTIONS

PARAGRARH – 1

REACTIVITY SERIES

Reactivity Series of Metals: The order of intensity or reactivity of metal is known as Reactivity Series. Reactivity of elements decreases on moving from top to bottom in the given reactivity series.
In the reactivity series, copper, gold, and silver are at the bottom and hence, least reactive. These metals are known as Noble metals. Potassium is at the top of the series and hence, most reactive.
Reactivity of some metals are given in descending order :

K > Na > Ca > Mg > Al > Zn > Fe > Pb > Cu



Q-1 Which is the most reactive metal in the Reactivity series?

a) Potassium
b) Sodium
c) Zinc
d) Lead

Q-2 What property does a metal need to have to make a ‘ ***food can’***?

a) Highly reactive
b) Shiny surface
c) Inert (unreactive)
d) Easy to cut

Q-3 Complete the sentence using ***reduced*** and ***oxidised***.

The more reactive metal is _____ and the less reactive metal is _____.

a) Oxidised, reduced
b) Reduced, oxidised
c) Both of these
d) None of these

Q-4 Which of the following metals exist in their native state in nature?

a) Cu
b) Zn
c) K
d) Au

Q-5 Which is the least reactive metal in the Reactivity Series?

a) Gold
b) Sodium
c) Potassium
d) Copper

PARAGRAPH -2

Physical properties of non-metals

- **Hardness:** Non-metals are not hard rather they are generally soft. But the diamond is an exception; it is the hardest naturally occurring substance.
- **State:** Non-metals may be solid, liquid or gas.
- **Lustre:** Non-metals have a dull appearance. Diamond and iodine are exceptions.
- **Sonority:** Non-metals are not sonorous, i.e., they do not produce a typical sound on being hit.
- **Conduction:** Non-metals are a bad conductor of heat and electricity. Graphite which is an allotrope of carbon is a good conductor of electricity and is an exception.
- **Malleability and ductility:** Non-metals are brittle.
- **Melting and boiling point:** Non-metals have generally low melting and boiling points.
- **Density:** Most of the non-metals have low density.
- **Colour:** Non-metals exists in many colours.
  Carbon in the form of graphite is non-metal which conduct electricity.
  Iodine is non metal which is lustrous having a shiny surface
  Carbon in the form of diamond is a non-metal which is extremely hard.
  Diamond is a non-metal which has a very high melting point and boiling point.

Q-1 In which physical state non – metals are found commonly

a) Solid
b) Liquid
c) Gas
d) All of these

Q-2 Name the non-metal which is lustrous

a) Carbon
b) Iodine
c) Phosphorus
d) Helium

Q-3 Property of non-metal is

a) Malleability
b) Ductility
c) Brittle
d) None of these

Q-4 The hardest known Natural substance is

a) Iron
b) Graphite
c) Diamond
d) Calcium

Q-5 Which non-metal is good conductor of electricity

a) Graphite
b) Diamond
c) Sulphur
d) Phosphorus

PARAGRAPH – 3

Physical Properties of Metals

- **Hardness:** Most of the metals are hard, except alkali metals, such as sodium, potassium, lithium, etc. are very soft metals. These can be cut by using a knife.
- **Strength:** Most of the metals are strong and have high tensile strength. Because of this, big structures are made using metals, such as copper (Cu) and iron (Fe). (Except Sodium (Na) and potassium (K) which are soft metals).
- **State:** Metals are solid at room temperature except for mercury (Hg).
- **Sound:** Metals produce ringing sound, so, metals are called Sonorous. Sound of metals is also known as Metallic sound. This is the cause that metal wires are used in making musical instruments.
- **Conduction:** Metals are a good conductor of heat and electricity. This is the cause that electric wires are made of metals like copper and aluminium.
- **Malleability:** Metals are malleable. This means metals can be beaten into a thin sheet. Because of this property, iron is used in making big ships.
- **Ductility:** Metals are ductile. This means metals can be drawn into thin wire. Because of this property, a wire is made of metals.
    - **Melting and Boiling Point:** Metals have generally high melting and boiling points. (Except sodium and potassium metals which have low melting and boiling point.)
    - **Density:** Most of the metals have a high density except lithium.
    - **Colour:** Most of the metals are grey or silver in colour. But gold and copper are exceptions.

Q-1 Which of the following metal has low density?

a) Aluminium
b) Iron
c) Copper
d) Lithium

Q-2 Which of the following is a poor conductor of heat?

a) Lead
b) Silver
c) Copper
d) Iron

Q-3 The metal that can be easily cut by knife is:

a) Iron
b) Magnesium
c) Sodium
d) Copper

Q-4 Which of the following property is generally NOT shown by metals?

a) Electrical conduction
b) Dullness
c) Ductility
d) Sonority

Q-5 Which of the following metal has Yellow / Orange colour?

a) Iron
b) Silver
c) Sodium
d) Gold

PARAGRAPH – 4

Element: Is a substance that can not be broken down into more simpler substances. Elements are classified into three different categories:

- Metals
- Non Metals
- Metalloids

Metals are the elements that conduct heat and electricity and are malleable and ductile. Examples are Iron (Fe), Aluminium (Al), Silver (Ag), Copper (Cu), Gold (Au), Platinum (Pt), Lead (Pb), Potassium (K), Sodium (Na), Calcium (Ca) and Magnesium (Mg) etc.

Metals are the elements which form positive ions by losing electrons. Thus, metals are known as Electropositive Elements.

Non-Metals: Physical Properties of non-metals, chemical properties of non-metals, non-metal oxides, Reaction of metal and Non-metal, Ionic bonds and formation of an ionic bond. Non-metals are the elements that do not conduct electricity and are neither malleable nor ductile.

Examples: Sulphur (S), Phosphorous (P), Hydrogen (H), Oxygen (O), Nitrogen (N), Chlorine (Cl), Bromine (Br), Neon (Ne) and Argon (Ar) etc.

Non-metals are the elements which form negative ions by gaining an electron. Thus, non¬metals are also known as Electronegative Elements.

Metalloids: are elements with four electrons in their outer most shell. They do not form positive or negative ions. They always make covalent bond by sharing of electrons. Ex. Carbon, Silicon

Q-1 Which of the following forms positive ion by losing electrons?

a) Non metals
b) Metals
c) Both of these
d) None of these

Q-2 Elements can be classified as :

a) Metals
b) Non-metals
c) Ions
d) Both a and b

Q-3 Which of the following is a Non-metal?

a) Magnesium
b) Copper
c) Oxygen
d) Lead

Q-4 Non-metals can form negative ions by :

a) Losing electrons
b) Gaining electrons
c) Both of these
d) None of these

Q-5 The electronic configuration of three elements X, Y, Z are X – 2,8 ; Y – 2,8,7 ; Z – 2,8,2. Which of the following is correct?

a) X is a metal.
b) Y is a metal.
c) Z is a non metal.
d) Y is a non-metal and Z is a metal.

PARAGRAPH - 5

Properties of Ionic compound

- Ionic compounds are solid. Ionic bond has a greater(electrostatic) force of attraction because of which ions attract each other very strongly. This makes ionic compounds solid.
- Ionic compounds are brittle.
- Ionic compounds have high melting and boiling points because force of attraction between ions of ionic compounds is very strong.
- Ionic compounds generally dissolve in water.
- Ionic compounds are generally insoluble in organic solvents; like kerosene, petrol, etc.
- Ionic compounds do not conduct electricity in the solid state.
- The solution of ionic compounds in water conduct electricity. This happens because ions present in the solution of ionic compound facilitate the passage of electricity by moving towards opposite electrodes.
- Ionic compounds conduct electricity in the molten state.

Q-1 Ionic compounds don't conduct electricity in

a) Solution
b) Fused state
c) Solid state
d) None of these

Q-2 An element having 4 electrons in its outermost orbit forms bond by

a) Losing electrons
b) Gaining electrons
c) Sharing electrons
d) Any of the above

Q-3 When one atom transfers one or more valence electrons to another atom, _____ is formed.

a) Covalent bond
b) Ionic bond
c) Metallic bond
d) None of these

Q-4 When forming bonds, metals tend to

a) Lose electrons
b) Gain electrons
c) Lose proton
d) None of these

Q-5 Which of the following property belongs to ionic compounds?

a) Lustrous
b) Sonorous
c) Brittle
d) Ductile

CHAPTER 6
Life Processes

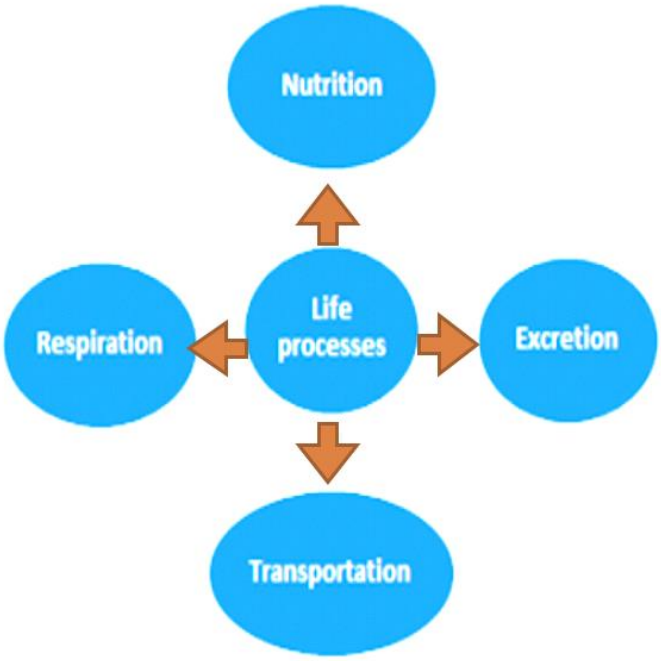
MAIN POINTS/ KEYNOTES/ GIST/ SUMMARY OF THE CHAPTER

DIFFERENCE BETWEEN LIVING AND NON-LIVING

All matter is non-living but if it **needs food, respire, excrete, respond to environment, move (exception plants), reproduce, grow and one day die**

All the processes mentioned above should be maintained and **the processes which together perform the maintenance are called Life Processes**

IMPORTANT LIFE PROCESSES



NUTRITION

We need materials from outside to grow, develop, synthesise protein and other substances needed in the body.The source of these materials is **FOOD.** The whole process through which an organism obtains its food is called nutrition

Mode of Nutrition:

- **Autotrophs**: Organisms which can synthesise their own food: **Green plants**:

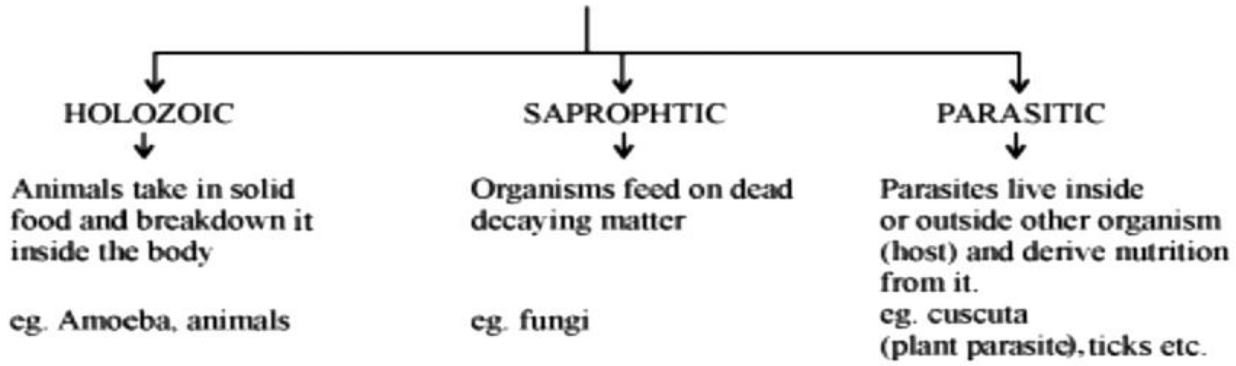
PHOTOSYNTHESIS: Photosynthesis is the process of conversion of carbon dioxide and water into sugar and oxygen in the presence of sunlight and chlorophyll.

Steps in photosynthesis:

- Absorption of light energy by chlorophyll
- Conversion of light energy to chemical energy and splitting of water molecule into hydrogen and oxygen
- Reduction of carbon dioxide to carbohydrates.

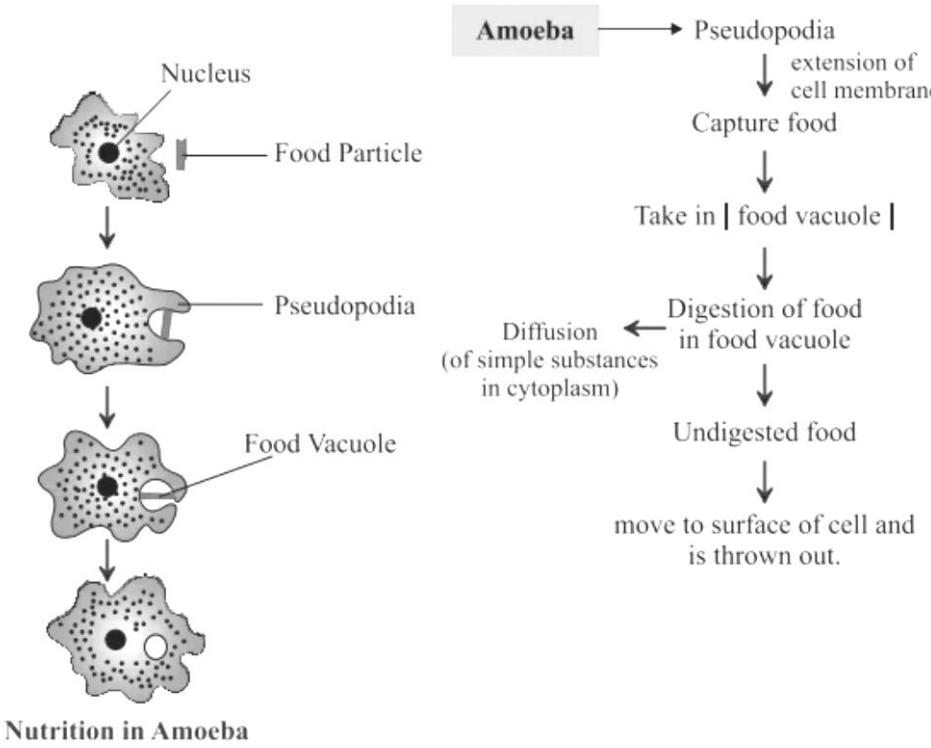
HETEROTROPHS:

Heterotrophic Nutrition



Nutrition in Single celled organisms:

- Amoeba through pseudopodia forming food vacuole



Nutrition in Amoeba

- Amoeba has a holozoic mode of nutrition. Thus, solid food particles are ingested which react with enzymes and are digested.

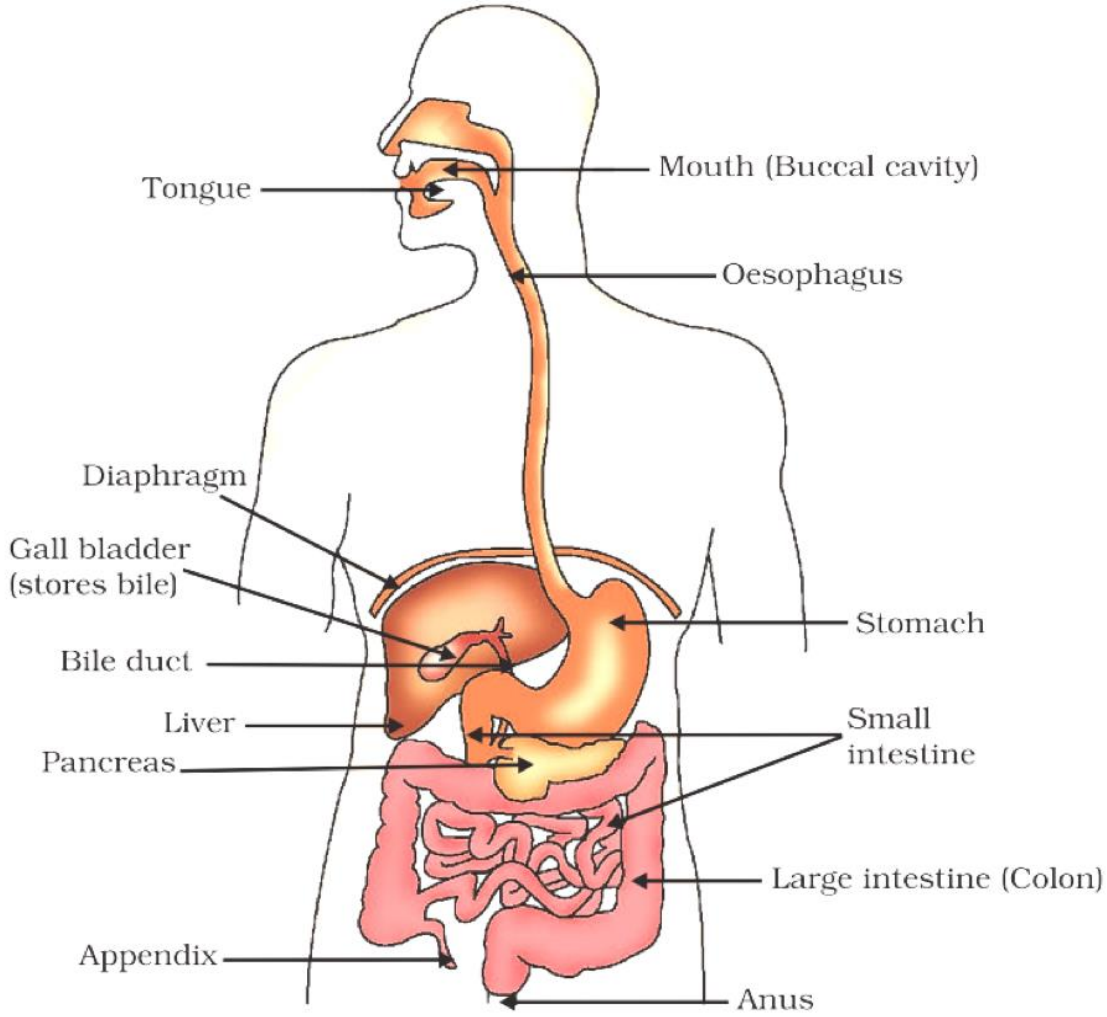
The five steps of holozoic nutrition are:

NUTRITION IN HUMAN BEINGS:

Digestive system in human beings consists of alimentary canal and digestive glands.

- Alimentary canal is made up of the mouth, buccal cavity, pharynx, oesophagus, stomach, intestine, rectum and anus.
- The digestive glands are the salivary glands, the gastric glands, the liver, the pancreas and the intestinal glands.

Human alimentary canal



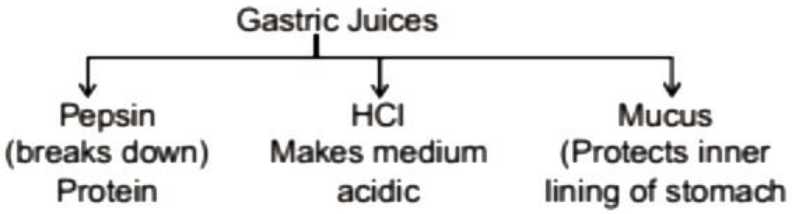
Parts of human digestive system and their role

1. **Mouth** — Salivary glands Secrete → Secrete saliva [Salivary amylase] → (change starch int sugar).

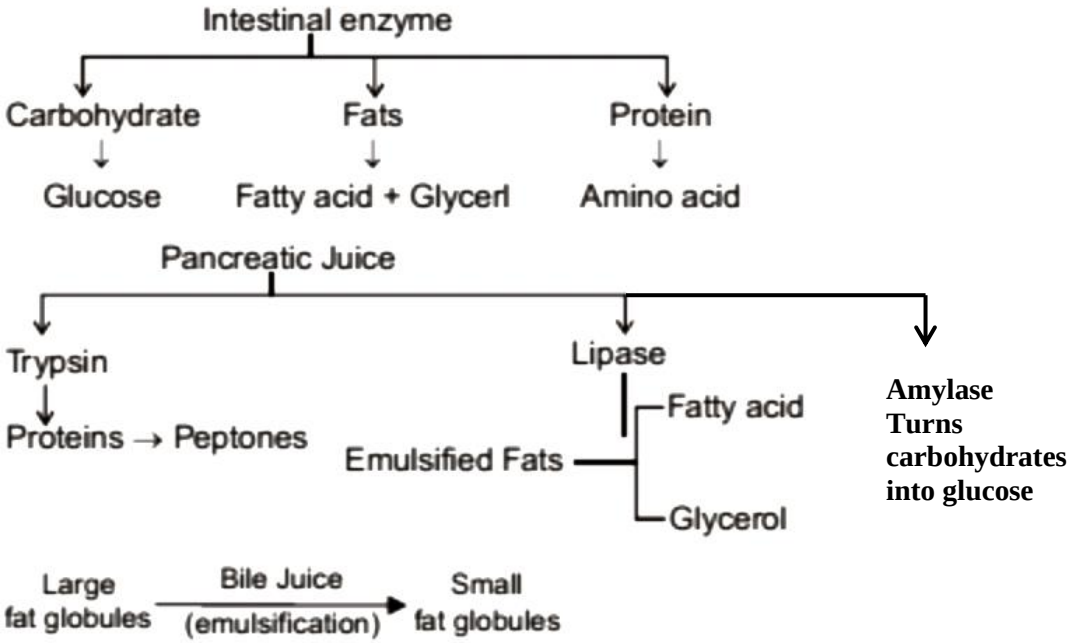
   Teeth (Chewing/grinding of food)
   Tongue (Rolling, tasting of food)

2. **Oesophagus** — Takes food from mouth to oesophagus by peristatic movements.
   (contraction and expansion of ailimentary canal)

3. **Stomach**



4. **Small Intestine** — Liver → Secretes bile
   Pancreas → secrete pancreatic juice

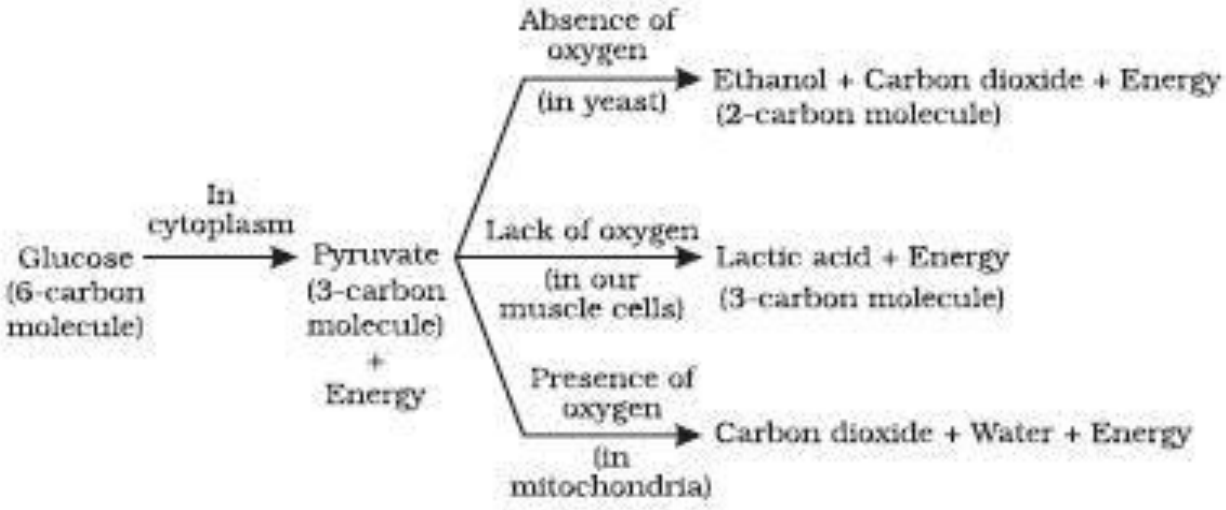


5. **Large Intestine** (absorbs excess water)
6. **Rectum** (Temporary collection of waste)

RESPIRATION

BREATHING: Exchange of gases with the environment

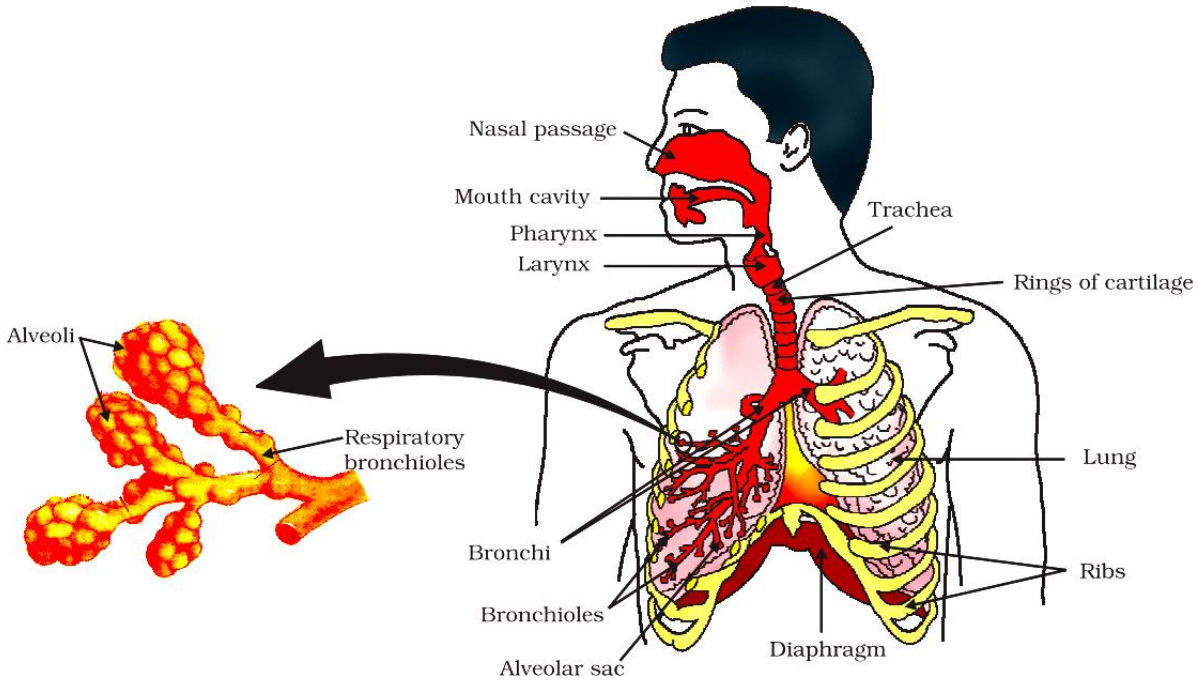
RESPIRATION: Break down of glucose into carbon dioxide and water to give energy.



Energy released during this cellular respiration is used to synthesise a molecule ATP (Adenosine triphosphate) which acts as fuel for all other activities and is known as energy currency of the cell.

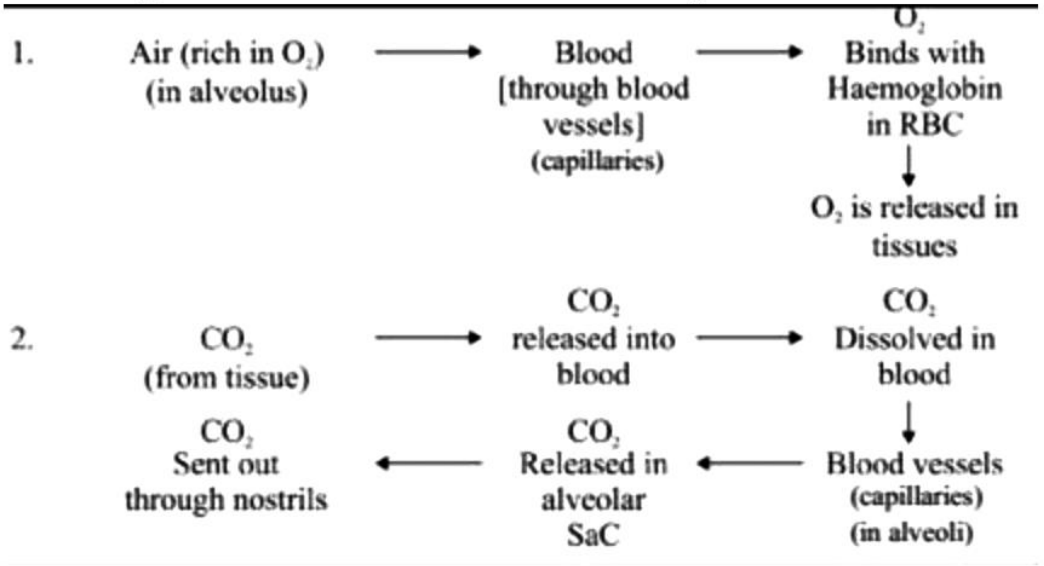
ATP breaks down to give ADP + 30.7 kj/mole of energy.

RESPIRATION IN HUMANS



Human respiratory system

- **Exchange of Gases between alveolus, blood and tissues.**



- **Mechanism of Breathing**

Mechanism of Breathing

Inhalation

1. During inhalation the thoracic cavity (chest cavity) expands
2. Ribs lift up
3. Diaphragm become flat in shape
4. Volume of lungs increases and air enters the lungs

Exhalation

1. Thoracic cavity contracts
2. Ribs move downwards
3. Diaphragm becomes dome shaped
4. Volume of lungs decreases and air exits from the lungs.

RESPIRATORY PIGMENT ----Haemoglobin

$Hb + O_2$ 6 HbO_2

DIAPHRAGM:

- The diaphragm's job is to help pump the carbon dioxide out of the lungs and pull the oxygen into the lungs.
- The diaphragm is a sheet of muscles that lies across the bottom of the chest cavity.
- As the diaphragm contracts and relaxes, breathing takes place.
- When the diaphragm contracts, oxygen is pulled into the lungs.
- When the diaphragm relaxes, carbon dioxide is pumped out of the lungs.

AQUATIC ORGANISMS:

- Rate of breathing is more as the amount of dissolved oxygen is very less in water.
- Fishes take in water through their mouths and pass out through gill slits. The dissolved oxygen is taken by blood

RESPIRATION IN PLANTS:

- Exchange of gases through stomata by diffusion.
- At night-----no sunlight --------- no photosynthesis---------carbon dioxide elimination is more.
- During the day-------carbon dioxide released during respiration is used for photosynthesis --------- oxygen release is more.

TRANSPORTATION

1. Heart
2. Blood vessels
    - Arteries
    - Veins
    - Capillaries
3. Blood

HEART:
Pumping organ, four chambered (two auricles & two ventricles), size of our right fist.
Blood passes through our heart twice so it is **double circulation**

BLOOD VESSELS:

Arteries: (distributing vessels) ---thick walled-----distribute oxygenated blood from heart to body

Exception: **pulmonary artery** ---- it carry deoxygenated blood from heart to lungs

Largest artery: **Aorta**

Veins : (collecting vessels)-----thin walled, have **valves** to ensure flow of blood in one direction----- collects deoxygenated blood from body to heart

Exception**: pulmonary vein**---- it carries oxygenated blood from lungs to heart

Superior vena cava collects deoxygenated blood from upper part of body

Inferior vena cava collects deoxygenated blood from lower part of body

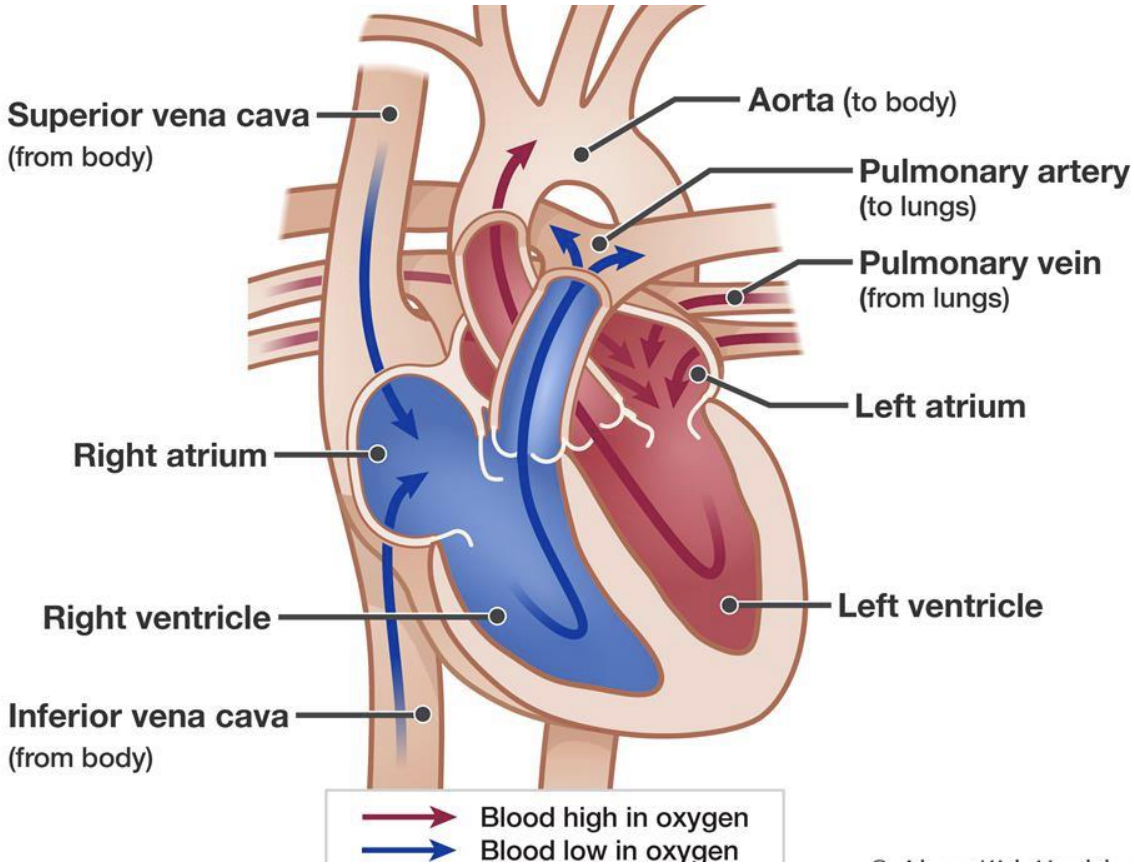
Capillaries---smallest vessels for exchange of material between blood and surrounding cells.

BLOOD:

It transports gases, digested food, hormones, and even the waste products

- **Plasma**---90% of blood is a liquid based in which cells and other materials are suspended
- **RBC**----carry oxygen through red pigment **Haemoglobin**
- **WBC**----develop immunity
- **Platelets**---clotting of blood at point of injury

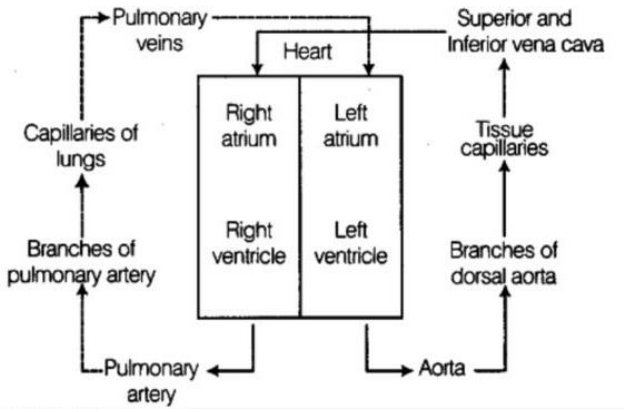
Structure and Working of Heart



- The **superior** and **inferior vena cava** are the main veins that receive blood from the body.
- The **right atrium** receives blood from the body via the vena cavae. The atria are on the top in the heart.
- The blood then passes through the right **atrioventricular valve**, which is forced shut when the ventricles contract, preventing blood from reentering the atrium.
- The blood goes into the **right ventricle** (note that it has a thinner wall; it only pumps to lungs). The ventricles are on the bottom of the heart.
- The right semilunar valve marks the beginning of the artery. Again, it is supposed to close to prevent blood from flowing back into the ventricle.
- The **pulmonary artery** is the main artery taking *deoxygenated* blood to the lungs.
- Blood goes to the right and left lungs, where capillaries are in close contact with the thin-walled alveoli so the blood can release CO_2 and pick up O_2.
- From the lungs, the **pulmonary vein** carries *oxygenated* blood back into the heart.
- The **left atrium** receives oxygenated blood from the lungs.
- The blood passes through the left **atrioventricular valve**.
- The blood enters the **left ventricle**. Note the thickened wall; the left ventricle must pump blood throughout the whole body.
- The blood passes through the left **semilunar valve** at the beginning of the aorta.
- The **aorta** is the main artery to the body. One of the first arteries to branch off is the coronary artery, which supplies blood to the heart muscle itself so it can pump. The coronary artery goes around the heart like a crown. A blockage of the coronary artery or one of its branches is very serious because this can cause portions of the heart to die if they don't get nutrients and oxygen. This is a **coronary**

heart attack. From the capillaries in the heart muscle, the blood flows back through the coronary vein, which lies on top of the artery.

- The aorta divides into **arteries** to distribute blood to the body.
- Small arteries are called **arterioles**.
- The smallest vessels are the **capillaries**.
- These join again to form **venules**, the smallest of the veins.
- These, in turn, join to form the larger **veins**, which carry the blood back to the superior and inferior vena cava.



Amphibians and reptiles have three chambered heart

Fishes have two chambered heart

LYMPH (Tissue fluid)

- Through pores in walls of capillaries some plasma, proteins and blood cells escape into intercellular spaces in tissue and form lymph.
- Colourless
- Contains less proteins
- Lymph drains into lymphatic capillaries from the intercellular spaces which join to form large lymph vessels that finally open into larger veins
- It carries digested and absorbed fats from intestine and drains excess fluid back to blood

TRANSPORTATION IN PLANTS

- **XYLEM**
  - Transports water and minerals obtained from the soil from root to upper parts of plants.

  Loss of water in form of vapour from aerial parts of plant is known as **transpiration**

  Transpiration helps in absorption and upward movement of water and minerals from roots to leaves

  During the day when stomata are open, the transpiration pull called suction pull becomes a major driving force in movement of water in xylem.

  It also helps in temperature regulation
- **PHLOEM**

  -transport products of photosynthesis from leaves to other parts of the plant. This process is called **translocation**

  Phloem also transports amino acids.

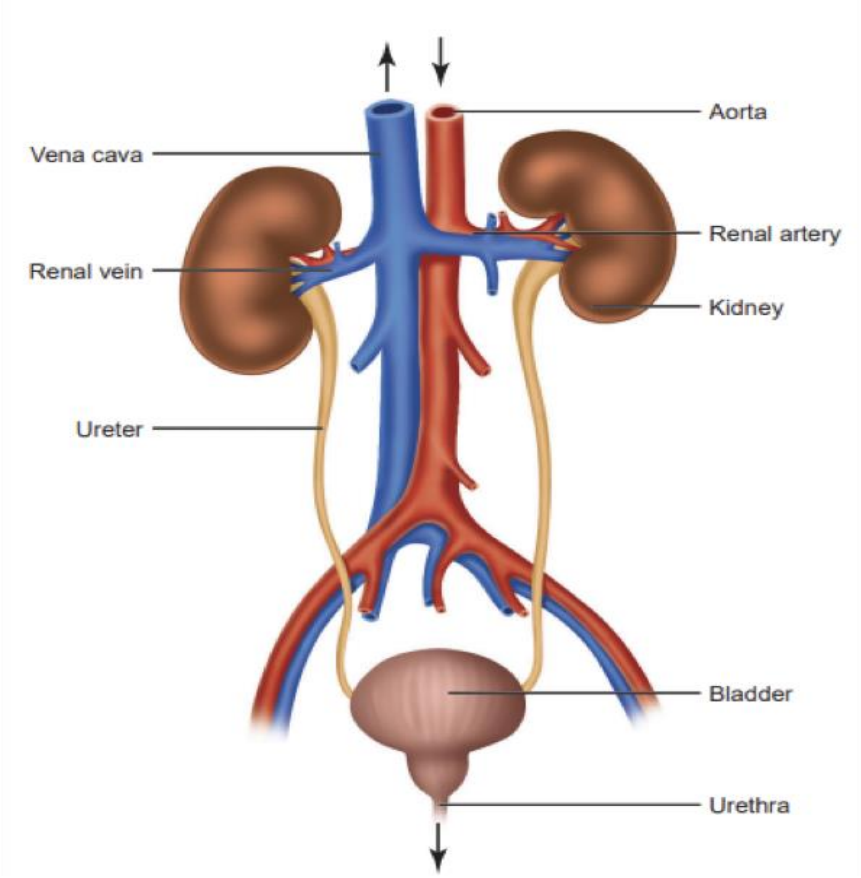
Translocation in phloem is achieved by utilising energy.
Sucrose is transferred to phloem using energy
Osmotic pressure increases causing water to move into it
This pressure moves materials in phloem to tissue having less pressure
Hence phloem moves material as per plant's need

Excretion

The excretory system is the system of an organism's body that performs the function of removal of harmful metabolic wastes from the body.
There are several parts of the body that are involved in this process, such as sweat glands, the liver, the lungs and the kidney system.

Parts of Excretory System

- One pair of kidney: located in abdomen on either side of backbone
- One pair of ureters
- Urinary bladder: muscular, stores urine
- Urethra



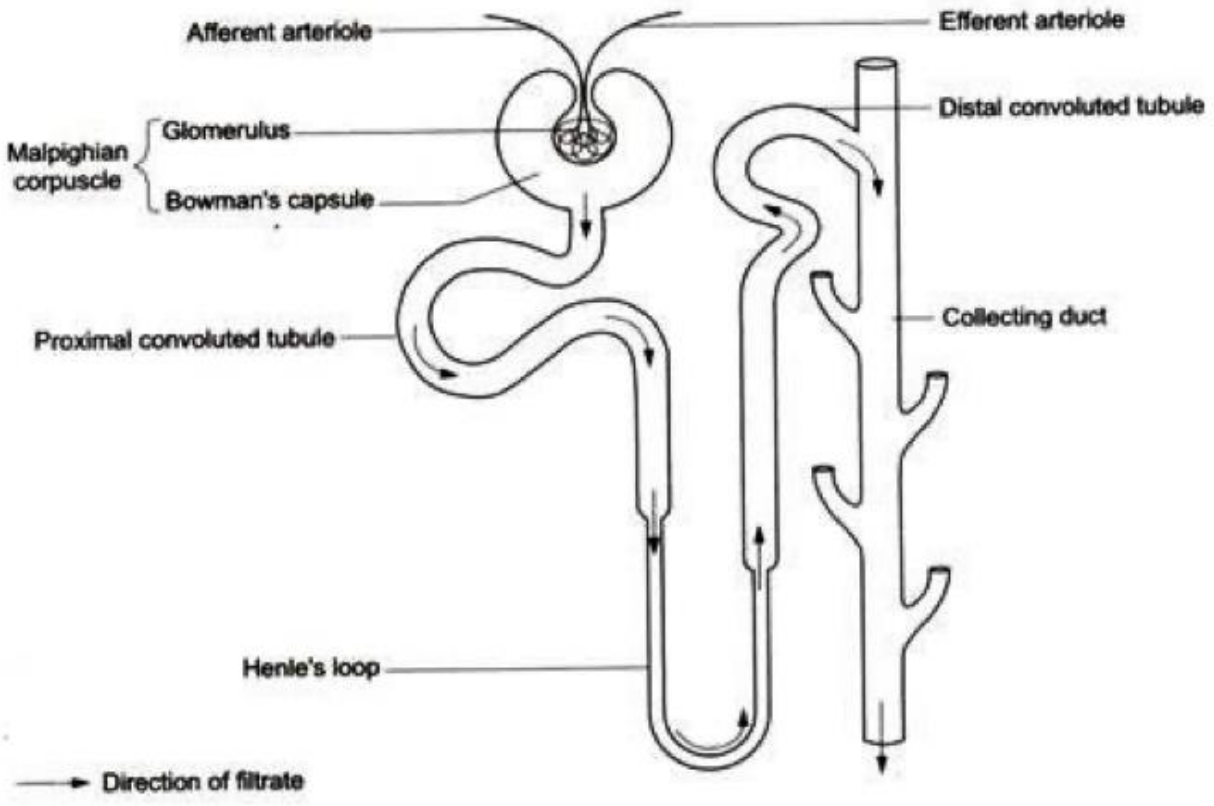
Role of Excretory system: to filter out waste products from blood
FUNCTIONS OF KIDNEY:

Reabsorption: glucose, amino acids, salts and water are selectively reabsorbed from initial filtrate

Osmoregulation: The process by which an organism regulates the water balance in its body and maintains the homeostasis /steady state of the body is called osmoregulation.

NEPHRON:

- Main excretory unit in kidney
- Cluster of thin-walled blood capillaries

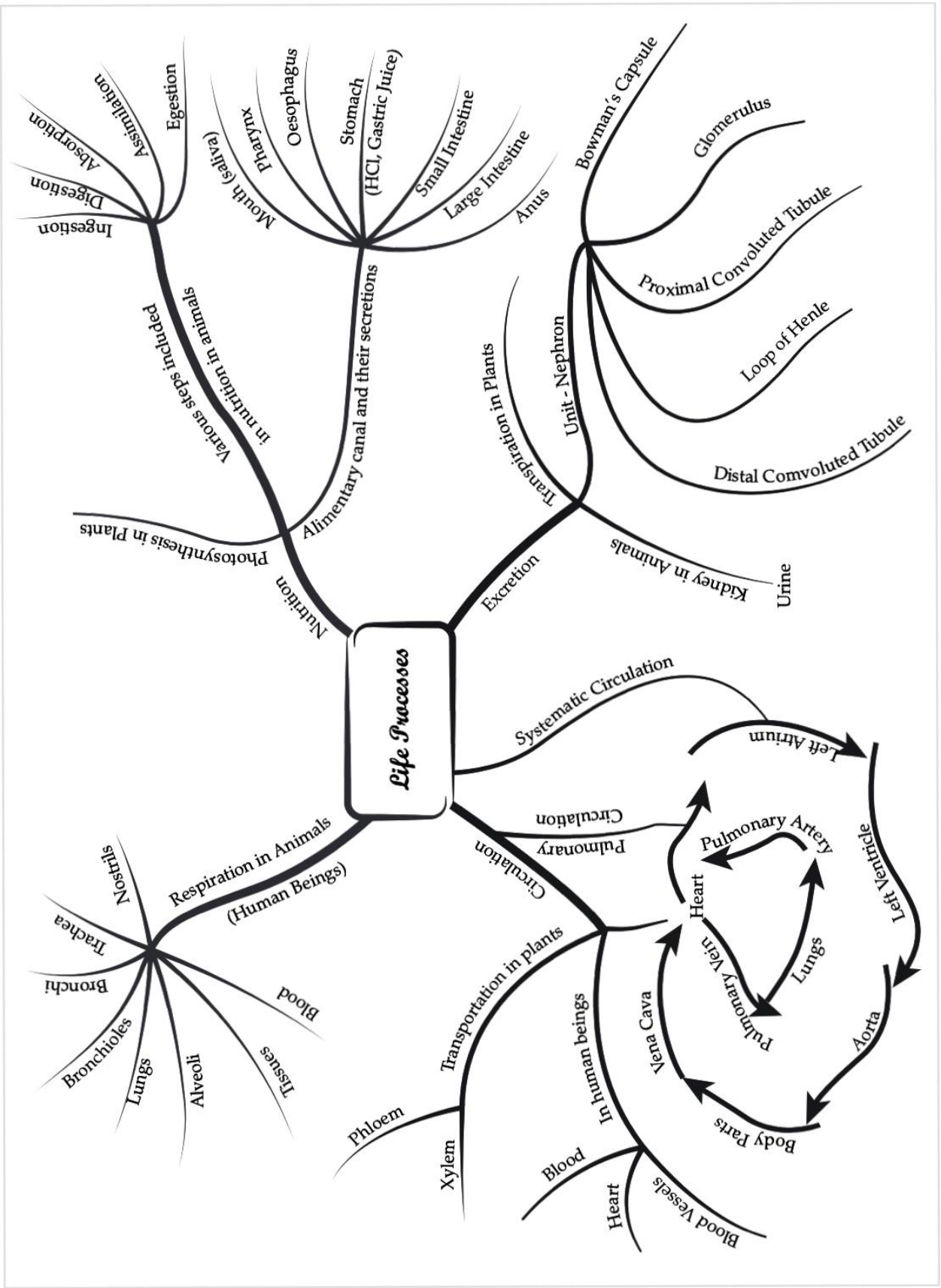


Different parts of a nephron

EXCRETION IN PLANTS:

- Oxygen comes out during photosynthesis
- Excess water by transpiration
- Dead cells as dry leaves
- In some, waste is stored in cellular vacuoles
- In some, waste is stored in dead leaves
- In others waste is stored as resins and gums

MIND MAP


Life Processes
Nutrition
Various steps included in nutrition in animals
Ingestion
Digestion
Absorption
Assimilation
Egestion
Alimentary canal and their secretions
Mouth (saliva)
Pharynx
Oesophagus
Stomach (HCl, Gastric Juice)
Small Intestine
Large Intestine
Anus
Photosynthesis in Plants
Excretion
Transpiration in Plants
Unit - Nephron
Bowman's Capsule
Glomerulus
Proximal Convoluted Tubule
Loop of Henle
Distal Comvoluted Tubule
Kidney in Animals
Urine
Respiration in Animals (Human Beings)
Nostrils
Trachea
Bronchi
Bronchioles
Lungs
Alveoli
Tissues
Blood
Circulation
Transportation in plants
Phloem
Xylem
In human beings
Blood
Heart
Blood Vessels
Systematic Circulation
Left Atrium
Pulmonary Circulation
Pulmonary Artery
Heart
Pulmonary Vein
Lungs
Left Ventricle
Aorta
Body Parts
Vena Cava

MULTIPLE CHOICE QUESTIONS

Q1- In which group of the organisms the food material is broken down outside the body?
A) Mushroom, green plants, amoeba
B) Yeast, mushroom, bread mould
C) Paramecium, amoeba, cuscuta
D) Cuscuta, lice, tapeworm

Q2- Select the correct statement –
A) Heterotrophs make their food
B) Heterotrophs utilise solar energy to make food
C) Heterotrophs do not make their own food
D) Heterotrophs are capable of converting carbon dioxide and water into carbohydrates

Q3- Which of the following statement about autotrophs is incorrect?
A) They synthesize carbohydrates by using carbon dioxide, water in presence of sunlight and chlorophyll
B) They store carbohydrates in form of starch
C) They convert carbon dioxide and water into carbohydrates in the absence of sunlight
D) They form the first trophic level in food chain

Q4- Which of these reactions occur in photosynthesis?
A) Carbon dioxide is reduced and water is oxidized
B) water is reduced and carbon dioxide is oxidized
C) carbon dioxide and water are oxidized
D) carbon dioxide and water are reduced

Q5- A few drops of iodine solution were added to rice water. The solution turned blue black in colour. This indicates rice water has –
A) complex proteins
B) simple proteins
C) starch
D) Fats

Q6- Which is the correct sequence -
A) mouth → stomach → small intestine → oesophagus → large intestine
B) mouth → oesophagus → stomach → large intestine → small intestine
C) mouth → stomach → oesophagus → small intestine → large intestine
D) mouth → oesophagus → stomach → small intestine → large intestine

Q7- If salivary amylase is lacking in saliva, which of the event in mouth will be affected-
A) Proteins breaking down into amino acids
B) starch breaking down into sugars
C) Fats breaking down into fatty acids and glycerol
D) Absorption of vitamins

Q8- The inner lining of the stomach is protected by one of the following from hydrochloric acid. Choose the correct one -
A) Mucus
B) Salivary amylase
C) Pepsin
D) Bile

Q9- Which part of alimentary canal receives bile from liver -
A) stomach
B) deodenum
C) large intestine
D) oesophagus

Q10- In which part of alimentary canal food is finally digested ?
A) large intestine
b) Stomach
C) Mouth cavity
D) small intestine

Q11- Choose the function of pancreatic juice from following :
A) Trypsin digests proteins and lipase digests carbohydrates
B) Trypsin digests emulsified fats and lipase digests proteins
C) Trypsin and lipase digest fats
D) Trypsin digests proteins and lipase digests emulsified fats

Q12- The correct sequence of anaerobic respiration -
A) Glucose → pyruvate → lactic acid
B) glucose → pyruvate → carbon dioxide + ethanol
C) glucose → pyruvate → ADP→ lactic acid
D) glucose -→ pyruvate → carbon dioxide + ethanol + energy

Q13- The pancreatic juice doesn't contain following enzymes-
A) Trypsin
B) Amylase
C) Lipase
D) Ptyalin

Q14- The pancreas pour their secretion into ___.
A) Small intestine
B) large intestine
C) stomach
D) Duodenum

Q15- The kidneys in human beings are part of _____.
A) Digestive system
B) Respiratory system
C) Excretory system
D) Circulatory system

Q16- The opening and closing of stomatal pore depends upon ___.
A) Oxygen
B) water in guard cells
C) concentration of carbon dioxide in stomata
D) temperature

Q17- In the human digestion system the enzymes pepsin and trypsin are secreted by ?
A) Pancreas and liver
B) pancreas and gall bladder
C) stomach and pancreas
D) stomach and salivary glands

Q18- Which of the statements is correct regarding bile?
A) secreted by duct and stored in liver
B) secreted by liver and stored in bile duct
C) secreted by liver and stored in gall bladder
D) secreted by gall bladder and stored in liver

Q19- Which of the following components of food is digested by s. amylase?
A) proteins
B) fats
C) Minerals
D) carbohydrates

Q20- Where are proteins first digested?
A) small intestine
B) stomach
C) large intestine
D) mouth

Q21- Which is the first enzyme that mixes with food?
A) S. amylase
B) trypsin
C) erepsin
D) gastric juice

Q22- The cellular energy reserves in autotrophs are____.
A) glycogen
B) starch
C) protein
D) fatty acids

Q23- The autotrophs require ____.
A) CO_2 and water
B) chlorophyll
C) sunlight
D) All

Q24- The breakdown of pyruvate into carbon dioxide, energy and water takes place in _____.
A) Mitochondria
B) Cytoplasm
C) Endoplasmic reticulum
D) ribosomes

Q25- When air is blown through lime water it turns milky because of _____.
A) water
B) carbon dioxide
C) limestone
D) calcium oxide

Q26- Write the correct sequence of air passage involved in inhalation?
A) larynx→ Nostrils → Pharynx → lungs
B) nostrils→ Pharynx→ larynx→ Trachea → alveoli
C) nasal passage → larynx → Trachea → Pharynx→ Alveoli
D) None

Q27- During respiration exchange of gases takes place in _____.
A) Trachea and larynx
B) alveoli of lungs
C) Alveoli and throat
D) Throat and larynx

Q28- What prevents back flow of blood during contraction?
A) Valves in heart
B) Thick muscular walls of ventricles
C) Thin walls of atria
D) All

Q29- The correct path of urine is __.
A) Kidney→ ureter → urethra→ urinary bladder
B) Kidney → urinary bladder → urethra → ureter
C) kidney→ ureter → urinary bladder→ urethra
D) urinary bladder → kidney → ureter →urethra

Q30- During deficiency of oxygen in tissues of humans, pyruvate is converted into lactic acid in____.
A) Muscles
B) chloroplast
C) mitochondria
D) golgi body

Q31- Xylem helps in ___.
A) transportation of water
B) translocation of food
C) both a and b
D) transportation of water and minerals

Q32- What is the approximate length of an alimentary canal?
A) 3m
B) 4m
C) 5m
D) 9m

Q33- Which organelle is called power house of cell?
A) Mitochondria
B) golgi body
C) ribosomes
D) none

Q34- Which respiration is much efficient?
A) aerobic
B) anaerobic
C) both are equal
D) none

Q35- Write full form of ATP.
A) adenosine diphosphate
B) adenosine phosphate
C) adenosine triphosphate
D) none

Q36- Which of the following statement is true about respiration?
A) During inhalation, ribs move inward and diaphragm is raised
B) In the alveoli, exchange of gases takes place i.e., oxygen from alveolar air diffuses into blood and carbon dioxide from blood into alveolar air sacs
C) Alveoli does not help in increasing surface area for exchange of gases
D) Haemoglobin has greater affinity for carbon dioxide than oxygen

Q37- During respiration exchange of gases takes place in___.
A) Trachea and larynx
B) Alveoli of lungs
C) Alveoli and throat
D) Throat and larynx

Q38- Which of the following statement is true about heart?
A) Left atrium receives oxygenated blood from different parts of body while right atrium receives deoxygenated blood from lungs.
B) Left ventricle pumps oxygenated blood to different body parts while right ventricle pumps deoxygenated blood to lungs.
C) Left atrium transfers oxygenated blood to the right ventricle which sends it to different body parts .
D) Right atrium receives oxygenated blood from different parts of the body while left ventricle pumps oxygenated blood to different parts of the body.

Q39- Single circulation i.e., blood flows through the heart only once during one cycle of passage through the body, is exhibited by____.
A) Labeo, Chameleon, Salamander
B) Hippocampus, Exocoetus, Anabas
C) Hyla, Rana, Draco
D) Whale, Dolphin, Turtle

Q40- Choose the correct statement that describes arteries:
A) They have thick elastic walls, blood flows under high pressure; collect blood from different organs and bring it back to the heart
B) They have thin walls with valves inside, blood flows under low pressure and carry blood away from the heart to various organs of the body
C) They have thick elastic walls, blood flows under low pressure; carry blood from the heart to various organs of the body
D) They have thick elastic walls without valves inside. The Blood flows under high pressure and carry blood away from the heart to different parts of the body.

Q41- The filtration units of the kidney are called ___.
A) urethra
B) ureter
C) Neuron
D) nephron

Q42- Oxygen released during photosynthesis comes from_____.
A) water
B) Chlorophyll
C) carbon dioxide
D) glucose

Q43- The blood leaving the tissues becomes rich in _____.
A) Haemoglobin
B) carbon dioxide
C) water
D) oxygen
Q44- Which of the following is incorrect statement:
A) Organism grow with time
B) Organisms must repair and maintain their structure
C) Movement of molecules does not take place among cells
D) Energy is essential for life processes

Q45- The internal (cellular) energy reservoir in autotrophs is:
A) glycogen
B) protein
C) starch
D) fatty acid

Q46- Choose the event that does not occur in photosynthesis?
A) Absorption of light energy by chlorophyll
B) Reduction of carbon dioxide to carbohydrates
C) Oxidation of carbon to carbon dioxide
D) Conversion of light energy to chemical energy

Q47- Choose the form in which most of the plants absorb nitrogen from the atmosphere ?
A) proteins
B) nitrates and nitrites
C) atmospheric nitrogen
D) amino acids

Q48- Which process converts light energy to chemical energy ?
A) Respiration
B) Photosynthesis
C) Transpiration
D) Transportation of water and minerals

Q49- Which of these is the simplest form of food ?
A) rice
B) wheat
C) Butter
D) Glucose

Q50- The vein which brings oxygenated blood from the lungs into the heart is known as:
A) Pulmonary vein
B) Hepatic vein
C) Superior vena cava
D) Pulmonary artery

ASSERTION AND REASONING

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true but R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

Q1. **Assertion (A) :** Bile is essential for digestion of lipids.

Reason (R): Bile juice contains enzymes.

Q2. **Assertion (A):** The purpose of making urine is to filter out undigested food from the intestine.

Reason (R): Kidney filter the wastes and produce urine.

Q3. **Assertion (A):** Raw materials needed for photosynthesis are carbon dioxide, water and minerals.

Reason (R): Nutrients provide energy to an organism.

Q4. **Assertion (A):** Lungs always contain a residual volume of air.

Reason (R): It provides sufficient time for oxygen to be absorbed and for carbon dioxide to be released.

Q5. **Assertion (A):** Arteries are thick-walled and elastic in nature.

Reason (R): Arteries have to transport blood away from the heart.

Q6. **Assertion (A):** The movement of water and dissolved salts in xylem is always upwards.

Reason: 'The upward movement of water is due to low pressure created by transpiration.

Q7. **Assertion (A):** The muscular walls of ventricles are thicker than auricles.

Reason (R): This helps in preventing the back flow of blood.

Q8. **Assertion (A):** Most of the living organisms carry out aerobic respiration.

Reason (R): Mitochondria is the site of aerobic respiration in the cell.

Q9. **Assertion (A):** Most of the living organisms carry out aerobic respiration.

Reason (R): Mitochondria is the site of aerobic respiration in the cell.

Q10. **Assertion (A):** Blood pressure is an arterial blood pressure.

Reason (R): It is measured by sphygmomanometer**.**

Q11**. Assertion (A):** Alveoli contains an extensive network of blood vessels.

Reason (R): Alveoli is the site where exchange of gases occur.

Q12**. Assertion (A):** Excretion is the biological process by which harmful wastes are removed from an organism's body.

Reason (R): The mode of excretion is same in both in unicellular and multicellular organisms.

Q13**. Assertion (A):** In plants there is no need of specialised respiratory organs.

Reason (R): Plants do not have great demands of gaseous exchange.

Q14. **Assertion (A):** The inner lining of the small intestine has numerous finger-like projections called villi.

Reason (R): The villi increase the surface area for absorption.

Q15. **Assertion (A):** The accumulation of lactic acid in the muscles causes muscle cramps.

Reason (R): During vigorous physical exercise leg muscles respire anaerobically.

Q16. **Assertion (A):** Valves are present in the arteries.

Reason (R): Arteries carry oxygenated blood from the heart to different body parts except pulmonary artery.

Q17**. Assertion (A):** Diffusion does not meet high energy requirements of multi-cellular organisms

Reason (R) : Diffusion is a fast process but occurs at the surface of the body.

Q18. **Assertion (A):** Rings of cartilage are present in the throat.

Reason (R) : These ensure that the air-passage does not collapse.

Q19. **Assertion (A):** In woody plants gaseous exchange takes place through lenticels.

Reason (R) : Lenticels are specialised cells found along with stomata on the stem of woody plants.

Q20. **Assertion (A):** In human beings, the respiratory pigment is haemoglobin

Reason (R) : It is a type of protein which has high-affinity for carbon dioxide.

Q21. **Assertion (A):** Ventricles have thicker walls than auricles.

Reason (R): Ventricles have to pump blood into various organs with great pressure.

Q22. **Assertion (A):** Lymph also known as tissue fluid is colourless.

Reason (R): It lacks erythrocytes.

Q23. Assertion (A): In anaerobic respiration one of the end product is alcohol.

Reason (R): There is an incomplete breakdown of glucose.

Q24.**Assertion:** The average number of heart beat of a person at rest is about 80 per minute.

Reason: One contraction and relaxation of the heart constitutes a complete heart beat.

Q25. **Assertion (A):** Pyruvate is a six-carbon molecule

Reason (R) : It is prepared in the cytoplasm as the first step to cellular respiration.

(PARAGRAPH BASED QUESTIONS

PARAGRAPH 1: COMPOSITION OF BLOOD

Blood is a mobile reddish coloured fluid composed of 55% plasma and 45% of formed elements including RBCs, WBCs, and platelets circulates in blood vessels in the human body. Since these living cells are suspended in plasma, blood is known as a fluid connective tissue and not just fluid. It Provides oxygen to the cells. Blood absorbs oxygen from the lungs and transports it to different cells of the body.Presence of oxygen carrying haemoglobin pigment in red blood cells make them look red.

Q.1 The cells in our blood which destroy disease-causing germs, are:

(a) platelets (b) skin cells
(c) RBCs (d) WBCs

Q.2 One of the following is not a constituent of blood .This one is

(a) sieve plate cells (b) white blood cells

(c) red blood cells (d) plasma

Q.3 The pigment which impart red colour to blood is

(a) haemocyanin (b) chlorophyll

(c) haemoglobin (d) none of these

Q.4 The blood leaving the tissues become richer in

(a) carbon dioxide (b) water

(c) haemoglobin (d) oxygen

Q.5 Coagulation of blood in a cut or wound is brought about by

(a) plasma (b) platelets

(c) WBC (d) RBC

PARAGRAPH 2: HUMAN DIGESTIVE SYSTEM

The human digestive system consists of gastrointestinal tract plus the accessory organs of digestion .It extends from the mouth to the anal opening (anus).The alimentary canal consists of several organs and digestive glands.Digestion function are taken care of by the gastric glands, present in the wall of stomach.These releases hydrochloric acid, a protein digesting enzyme and mucus.From stomach food enters into small intestine.Small intestine is the site of complete digestion.

Q.1 Which is the longest part of the alimentary canal which is fitted into a compact space because of extensive coiling?

(a) Oesophagus (b) Large intestine (c) Pancreas (d) Small intestine

Q.2 A secretion secreted by largest gland associated with alimentary canal is

(a) Bile juice (b) Intestinal juice (c) Pancreatic juice (d) None of these

Q.3 Which is the first enzyme to mix with food in the digestive tract ?

(a) Trypsin (b) Pepsin (c) Amylase (d) Cellulase

Q.4 Which of the following is the correct sequence of parts as they occur in the human alimentary canal?

(a) mouth---stomach---small intestine---oesophagus—large intestine

(b) mouth---Oesophagus ---stomach ---large intestine---small intestine

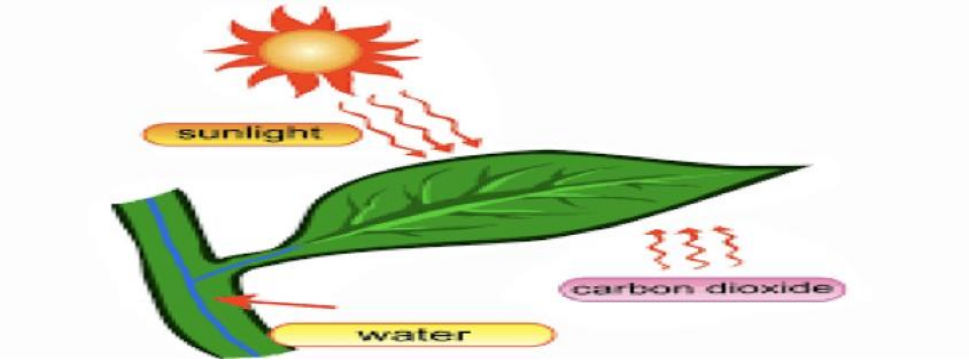
(c) Mouth---stomach---oesophagus---small intestine---large intestine

(d) mouth---oesophagus---stomach---small intestine---large intestine

Q.5 The inner lining of stomach is protected by one of the following from the harmful effect of hydrochloric acid.This is

(a) pepsin (b) mucus (c) saliva (d) bile

PARAGRAPH 3 : PHOTOSYNTHESIS



Plants are living things that need some form of energy. They have cells and tissues. They also grow in size and girth like human beings. They are the producers of the ecosystem. So, in order to synthesize food, they do have nutrient requirements.Like other living organisms ,plants also need organic food to fulfil their requirement of energy for various activities .Green plants are autotrophic in the sense that they synthesise organic food by the process of photosynthesis.The process of photosynthesis occurs only in green plants because this process requires presence of green –coloured pigment called chlorophyll.

Q1.Name the mode of nutrition performed by plants.

(a) saprotrophic (b) heterotrophic (c) parasitic (d) autotrophic

Q.2 Choose the event that does not occur in photosynthesis

(a) absorption of light energy by chlorophyll

(b) reduction of carbon dioxide to carbohydrates

(c) oxidation of carbon to carbon dioxide

(d) conversion of light energy to chemical energy

Q.3 The internal energy reserve in autotrophs is

(a) glycogen (b) starch (c) protein (d) fatty acid

Q.4 Which of the following equations is the summary of photosynthesis

(a) $6\ CO_2 + 12\ H_20 \longrightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$

(b) $6\ CO_2 + H_2O + \text{sunlight} \longrightarrow C_6H_{12}O_6 + O_2 + 6H_2O$

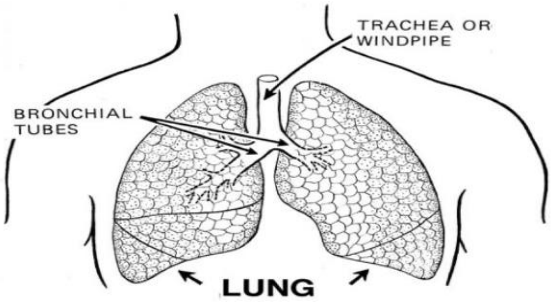
(c) $6\ CO_2 + 12\ H_2O + \text{chlorophyll} + \text{sunlight} \longrightarrow C_6H_{12}O_6 + 6\ O_2 + 6\ H_2O$

(d) $6\ CO_2 + 12\ H_2O + \text{chlorophyll} + \text{sunlight} \longrightarrow C_6H_{12}O_6 + 6\ CO_2 + 6\ H_2O$

Q.5 The process of conversion of light energy into chemical energy by the green parts of the plant is termed as :

(a) transpiration (b) nutrition (c) translocation (d) photosynthesis

PARAGRAPH 4 : HUMAN RESPIRATORY SYSTEM



In human beings air is taken into the body through the nostrils.From here,the air passes through the throat and into the lungs .Rings of cartilage are present in the tracheaThe trachea runs down the neck and divides into smaller tubes called bronchi at at its lower end.The two bronchi are connected to the two lungs.The bronchi further divides inside lungs to form a large number of still smaller tube called bronchioles.These have tiny air sacs at their ends called alveoli.Blood carry oxygen from alveoli and distribute to the cells of the body to perform respiration.

Q.1 Which of the following prevent the trachea?

(a) diaphragm (b) alveoli (c) Rings of cartilage (d) ribs

Q.2 Which is the correct sequence of air passage during inhalation?

(a) nostrils—larynx---pharynx---trachea---lungs

(b) Nasal passage---trachea---pharynx---larynx---alveoli

(c) larynx ---nostrils----pharynx---lungs

(d) nostrils---pharynx---larynx---trachea---alveoli

Q.3 During respiration exchange of gases take place in

(a) trachea and larynx (b) alveoli of lungs (c) alveoli and throat (d) throat and larynx

Q.4 The respiratory pigment present in blood has

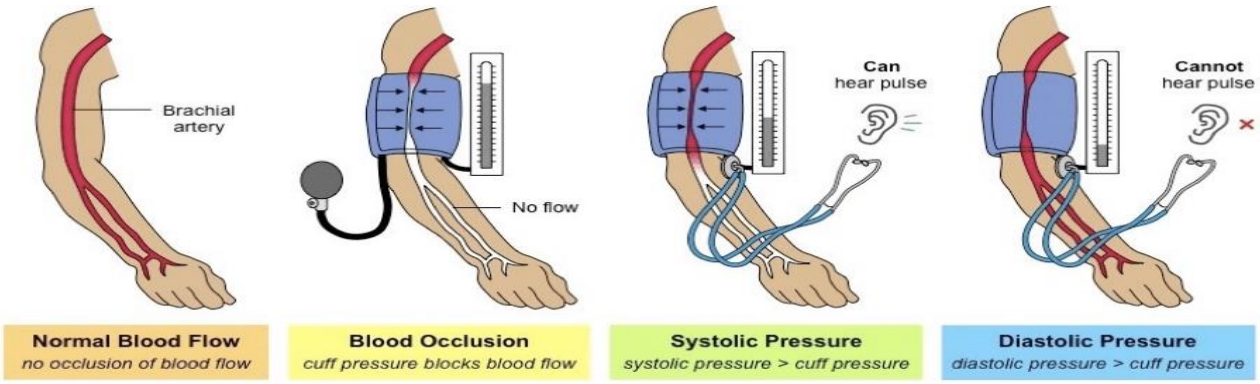
(a) high affinity for oxygen (b) low affinity for oxygen

(c) low affinity for carbon dioxide (d) none of these

Q.5 Energy in case of higher plants and animals is obtained by

(a) breathing (b) tissue respiration (c) organ respiration (d) digestion of food

PARAGRAPH 5: HEART AND BLOOD PRESSURE



The heart is a muscular organ which has the different chambers to prevent the oxygen –rich blood from mixing with the blood containing carbon dioxide .Different blood vessels are associated with the pumping organ heart.The force that blood exerts against the wall of a blood vessel is called blood pressure.This pressure is much greater in arteries than in veins.During ventricular systole ,the pressure of blood inside the artery is called systolic pressure and during ventricular diastole, the pressure in the artery is called diastolic pressure.

Q.1 Which of the following instrument is used to measure blood pressure

(a) spirometer (b) sphygmomanometer (c) haemometer (d) calorimeter

Q.2 What prevents backflow of blood inside the human heart during contraction?

(a) valves in heart (b) thick muscular walls of ventricles

(c) thin walls of atria (d) all of the above

Q.3 The sequence of events which takes place during the completion of one heartbeat is called

(a) cardiac output (b) cardiac input (c) double circulation (d) cardiac cycle

Q.4 The normal systolic pressure and diastolic pressure is

(a) 120/80 mm Hg (b) 80/120 mm Hg (c) 120/100 mm Hg (d) 100/120 mm Hg

Q.5 Hypertension is caused due to

(a) low blood pressure (b) high blood pressure (c) stable blood pressure (d) none of these

CHAPTER: 10
LIGHT – REFLECTION AND REFRACTION

MAIN POINTS/ KEYNOTES/ GIST/ SUMMARY OF THE CHAPTER

IMPORTANT POINTS:

Light is a form of energy, which gives us the power of vision.

Reflection of Light

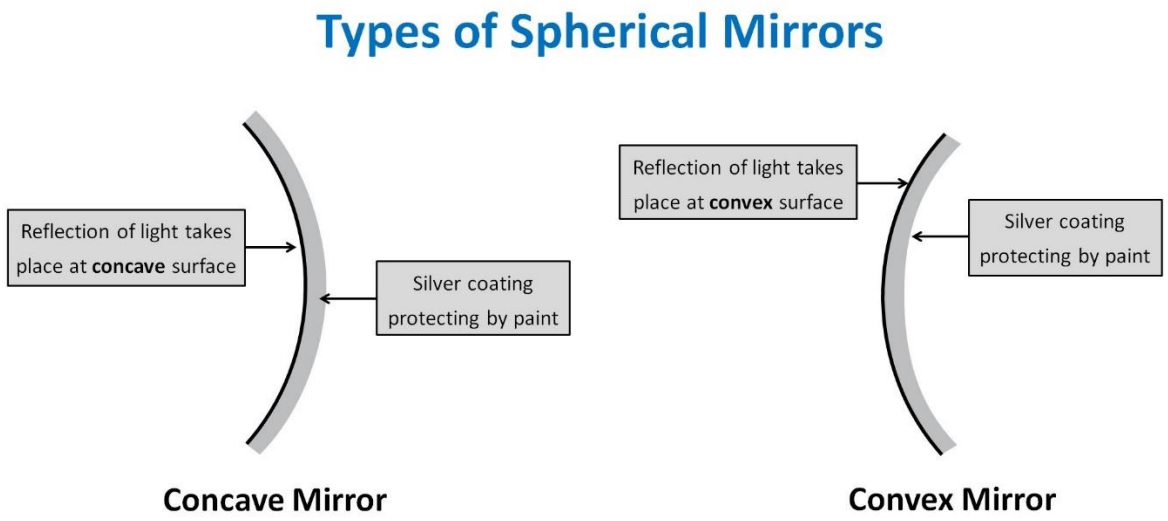
When the light is allowed to fall on highly polished surface, such as mirror, most of the light gets reflected.

Laws of Reflection

1. The angle of incidence is always equal to angle of reflection.
2. The incident ray, reflected ray and the normal to the reflecting surface at the point of incidence lie in the same plane.

Reflection of light by spherical Mirrors

Mirrors, whose reflecting surface are curved inward or outward spherically are called spherical mirror. For example – Spoon. The curved surface of shinning spoon can be considered as curved mirror.

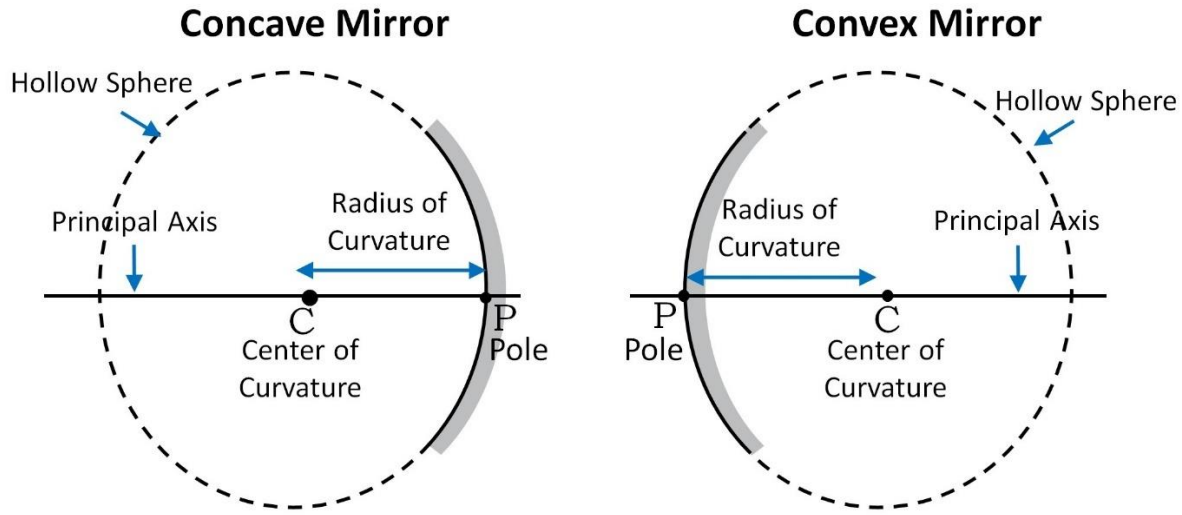


Curved mirrors whose reflecting surfaces curve inwards are called concave mirrors while those whose reflecting surfaces bulge outwards are called convex mirrors.

Few Basic terms related to Spherical Mirror:

1. **Principal axis:** Line joining the pole and centre of curvature of the spherical mirror.
2. **Pole**: The geometrical central point of the reflecting spherical surface. Denoted by (P).
3. **Aperture**: The width of reflecting spherical surface.
4. **Centre of curvature**: The centre of the hollow glass sphere of which the spherical mirror is a part is called as centre of curvature.
5. **Radius of curvature:** The distance between the pole and the centre of curvature. I.e. **PC = R** or The radius of the hollow sphere of which the mirror is a part.

Mirrors as a part of Sphere



6. **Focus point**: The point on the principal axis, where all parallel rays meet after reflection is called as Principal Focus or Focus. It is denoted by letter 'F'.

7**. Focal length:** The distance between the pole and focus point i.e. PF = f

Relationship between focal length and Radius of curvature. F= R/2

Image formation by spherical mirrors

Before we learn the formation of image or ray diagram, let us go through few tips:

(a) Remember, a ray of light which is parallel to principle axis always pass through focus (meet at focus) or vice-versa.

(b) A ray of light which passes through centre of curvature (it is also known as normal at the point of incidence on spherical mirror) will retrace their path after reflection.

(c) A ray of light falling on pole get reflected at the same angle on the other side of principal axis.

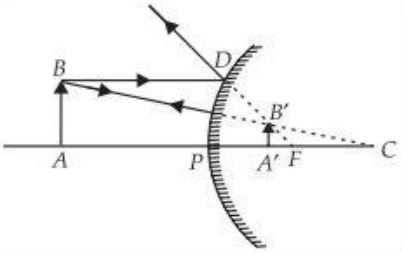
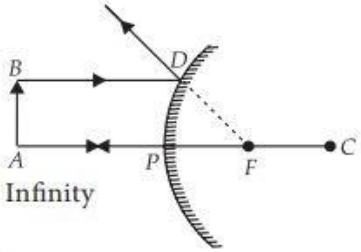
Note: The image will only form when two or more rays meets at a point.

For objects at various positions, the image formed can be found using the ray diagrams for the special two rays. The following table is for a concave mirror.

Position of the object	Position of the image	Size of the image	Nature of the image
At infinity	At focus F	Highly diminished, point sized	Real and inverted
Beyond C	Between F and C	Diminished	Real and inverted
At C	At C	Same size	Real and inverted
Between C and F	Beyond C	Enlarged	Real and inverted
At F	At infinity	Highly enlarged	Real and inverted
Between P and F	Behind the mirror	Enlarged	Virtual and erect

Note: The ray diagrams given in NCERT Books are to be followed.

Image formation by convex mirror:

Convex mirror				
Ray diagram		Object position	Image position	Nature of image
(a)		Between infinity and the pole	Behind the mirror between the focus and the pole	Virtual, smaller and erect
(b)		At infinity	Behind the mirror at the focus *F*	Virtual, point-sized and erect

Uses of Concave Mirror

1. Used in torches, search light and headlight of vehicle.
2. Used to see large image of face as shaving mirror
3. Used by dentist to see large images of the teeth
4. Large concave mirror used to focus sunlight (heat) in solar furnaces.

Uses of Convex Mirror

Used as rear-view mirror in vehicles because it gives erect image.
It also helps the driver to view large area.

Sign Convention for Reflection by Spherical Mirror

1. The object is always placed to the left side of mirror.
2. All distance should be measured from pole (P); parallel to principal axis.
3. Take 'P' as origin for measuring distances.
   Right of the origin (+x-Axis) are **taken positive**
   Left of the origin (–x-Axis) are **taken negative**
   Perpendicular to and above principal axis (+y-Axis) are **taken positive**
   Perpendicular to and below principal axis (–y-Axis) are **taken negative**

Mirror formula and Magnification

A formula which gives the relationship between object distance (u), image distance (v) and focal length (f) of a spherical mirror is known as mirror formula. It can be written as:

$$\mathbf{1/v + 1/u = 1/f}$$

Where 'u' is object distance, 'v' is the image distance and 'f' is the focal length of spherical mirror, which is found by similarity of triangles.

The magnification produced by a spherical mirror is the ratio of the height of the image to the height of the object. It is usually represented as 'm'.

$$\mathbf{m = h_2 / h_1}$$

Where h_2 is height of the image and h_1 is height of the object.
If the magnification has a plus sign, then the image is virtual and erect.
If the magnification has a minus sign, the image is real and inverted.

In terms of object distance and image distance, magnification is equal to the ratio of the image distance to

the object distance, with a minus sign.

$$\mathbf{m = -v/u}$$

Refraction of light:

Light travels in a straight line path as long as it is travelling in the same medium. If, however the light rays are made to go from one medium to another, the light rays change their direction at the boundary between the two media.
The phenomenon of bending of light or change in direction of light when it passes from one medium to another obliquely is called refraction of light.

Cause of refraction: The refraction of light is due to change in the speed of light on going from one medium to another.

Optically rarer medium and optically denser medium:

A medium in which speed of light is more is known as optically rarer medium.

A medium in which speed of light is less is known as optically denser medium.

Note: When a ray of light goes from a rarer medium to a denser medium, it bends towards the normal.

When a ray of light goes from a denser medium to a rarer medium, it bends away from the normal.

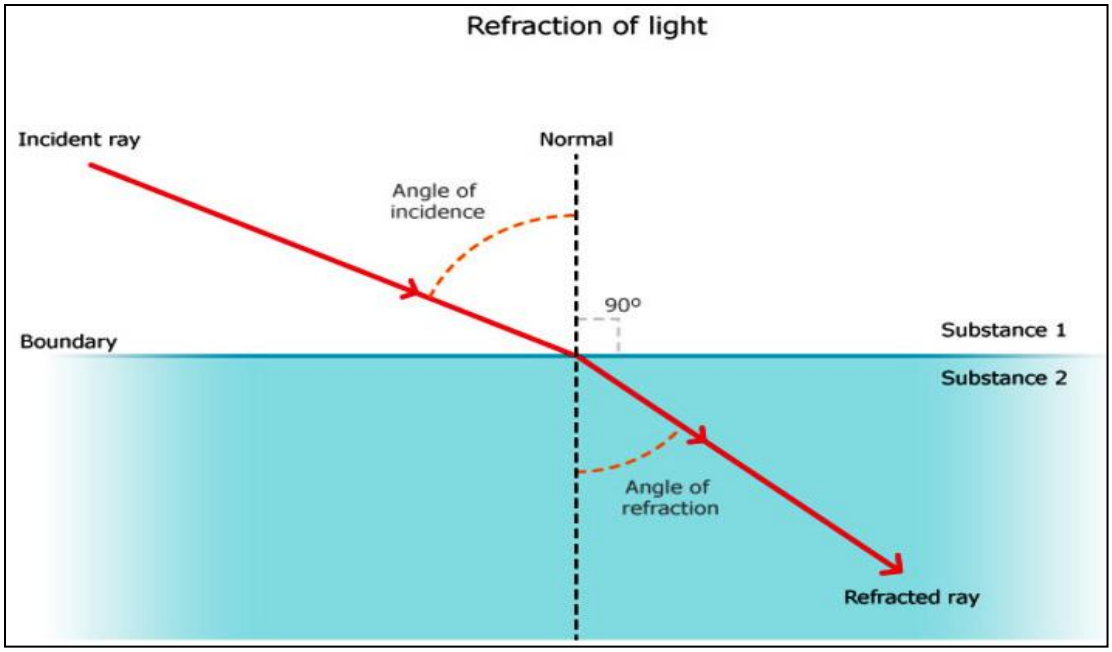
Laws of Refraction

- The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.
- The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant, for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction.

  $\sin i / \sin r = \text{constant}$

  This constant is called refractive index.

Refractive index of a medium gives an indication of the light bending ability of that medium. The refractive index can also be written as a ratio of speeds of light in the two media. Since the refractive index is a ratio of two similar quantities, it has no units. It is denoted by:
$n = \sin \angle i / \sin \angle r$ = speed of light in medium 1 / speed of light in medium2.

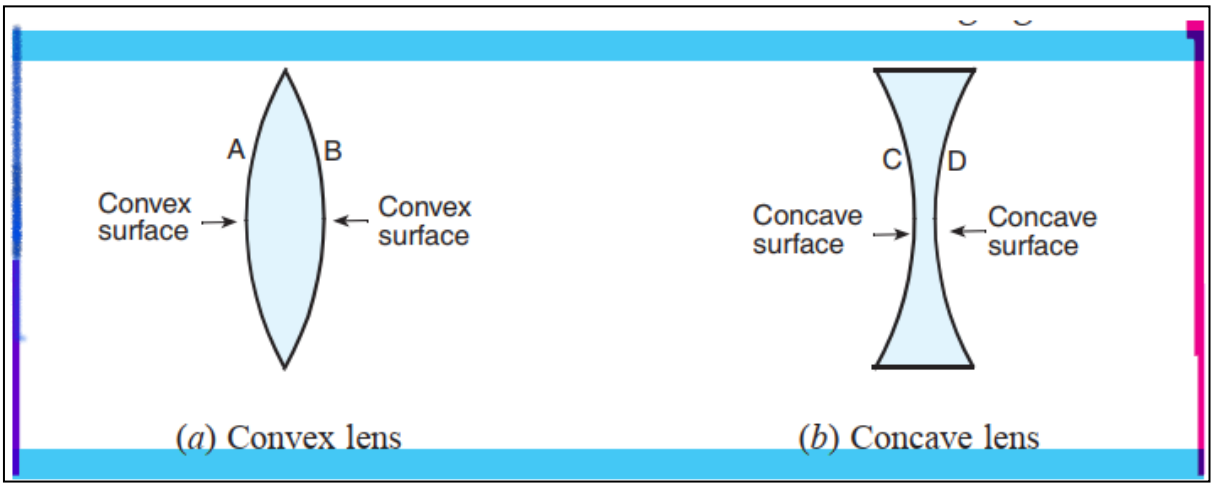


Refraction of light by spherical lenses:

When light is incident on a curved surface and passes through, the laws of refraction still hold true. For example lenses.

Spherical lenses

Spherical lenses are the lenses formed by binding two spherical transparent surfaces together. Spherical lenses formed by binding two spherical surfaces bulging outward are known as convex lenses while the spherical lenses formed by binding two spherical surfaces such that they are curved inward are known as concave lenses.

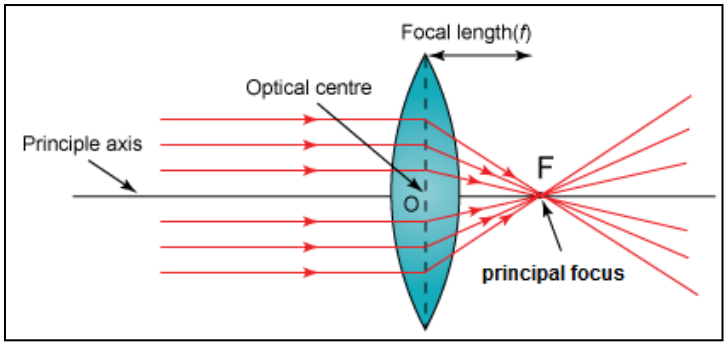


Principal focus and focal length of a convex lens:

The principal focus of a convex lens is a point on its principal axis to which light rays parallel to the principal axis converge after passing through the lens.

The focal length of a lens is the distance between optical centre and principal focus of the lens.

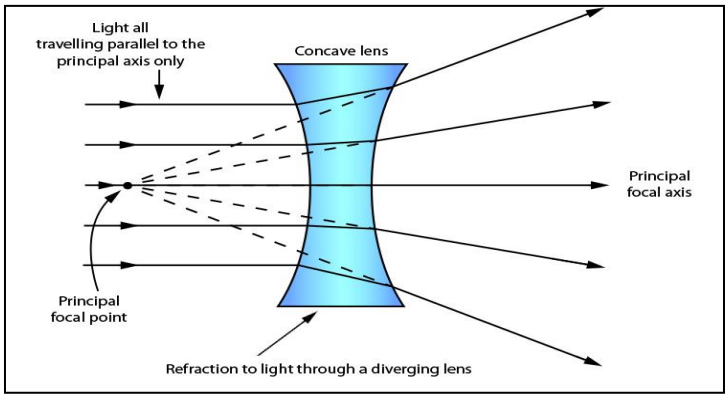
Note: The centre point of a lens is known as optical centre.



Principal focus and focal length of a concave lens:

The principal focus of a concave lens is a point on its principal axis from which light rays appear to diverge after passing through the concave lens.

The focal length of a lens is the distance between optical centre and principal focus of the lens.



Rules for obtaining images formed by convex lenses

1. A ray of light which is parallel to principal axis of a convex lens, passes through its focus after refraction through the lens.
2. A ray of light passing through the optical centre of a convex lens goes straight after refraction through the lens.
3. A ray of light passing through the focus of a convex lens becomes parallel to its principal axis after refraction through the lens.

Image formation by spherical lenses

The following table shows image formation by a convex lens.

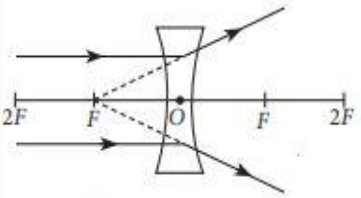
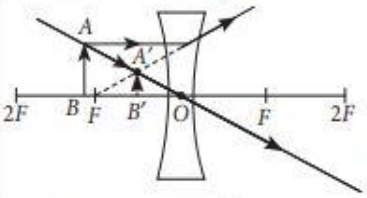
Position of the object	Position of the image	Relative size of the image	Nature of the image
At infinity	At focus F_2	Highly diminished, point-sized	Real and inverted
Beyond $2F_1$	Between F_2 and $2F_2$	Diminished	Real and inverted
At $2F_1$	At $2F_2$	Same size	Real and inverted
Between F_1 and $2F_1$	Beyond $2F_2$	Enlarged	Real and inverted
At focus F_1	At infinity	Infinitely large or highly enlarged	Real and inverted
Between focus F_1 and optical centre O	On the same side of the lens as the object	Enlarged	Virtual and erect

Note: The ray diagrams given in NCERT Books are to be followed.

Rules for obtaining images formed by concave lenses

1. A ray of light which is parallel to principal axis of a concave lens, appears to be coming from its focus after refraction through the lens.
2. A ray of light passing through the optical centre of a concave lens goes straight after refraction through the lens.
3. A ray of light going towards the focus of a concave lens becomes parallel to its principal axis after refraction through the lens.

Image formation by concave lens:

Concave lens				
	Ray diagram	Position of object	Position of image	Nature of image
(a)	 u = –ve, v = –ve and f = –ve	At infinity	At F	Virtual, erect and highly diminished
(b)	 u = –ve, v = –ve and f = –ve	Between infinity and O	Between F and O	Virtual, erect and diminished

Uses of convex lens:

1. The lens is employed in microscopes and magnifying glasses to converge all the incoming light rays to a specific point.
2. The lens is used as a lens system in cameras as they focus light rays for a clear image.
3. Lens has medical purposes as well, like the correction of hypermetropia.
4. It is used in a projector.

Uses of concave lens:

1. Concave lenses are used in spectacles to correct the defect of vision called myopia.
2. Concave lens is used in wide-angle spy hole in doors.

Lens Formula:

In simple words, the Lens Formula is a formula that shows the relationship between the distance of the object, the distance of the image, and the focal length of the lens is called Lens Formula.

The lens formula is given below:

$$1/v - 1/u = 1/f ,$$

where,

v is the distance of the image formed
u is the distance of the object and,
f is the focal length of the lens

The images which are formed by the Concave and the Convex lens can be real or virtual as well as they may have different sizes. The lens formula is applicable to both the concave and the convex lenses.

- If the distance of the image is negative, then it is a virtual image and is on the same side of the object.
- If the formula claims focal length to be negative, then the lens is converging, not diverging.

We should know that the distance is always measured from the optical centre of the lenses.

- If the image formed is virtual, then the distance of the image (v) is negative.
- If the image is formed real the distance of the image (v) is positive.

Magnification

Magnification of a lens is the ratio of the height of the image formed by the lens to the height of the object.

Magnification is equal to the ratio of the image distance to that of the distance of the object. It is denoted by *m.* The formula of magnification using lens formula is:

Magnification (m) = h'/h

Where,
m = Magnification
h' = height of the image
h = height of the object

The magnification that is produced by the lens is also related to the ratio of image distance to the object distance.
m = h'/h = v/u

Power of lens

The power of a lens is the measure of the degree of convergence or divergence of the light rays falling on it. The degree of convergence or divergence depends upon the focal length of the lens. Thus, we define the power of the lens as the reciprocal of the focal length of the lens used. It is given as:

P = 1/f (in metres)

Where f is the focal length of the lens used.
SI unit of power is Dioptre (D).
The power of the concave lens is negative, while the power of the convex lens can be positive.

Power of combination of lenses:

If a number of lenses are placed in close contact, then the power of combination of the lenses is equal to the algebraic sum of the powers of individual lenses.

If two lenses of powers p_1 and p_2 are placed in contact with each other then their resultant power is given by:

$$P = p_1 + p_2$$

MULTIPLE CHOICE QUESTIONS (MAIN POINTS)

Q-1 Focal length of plane mirror is
- a. At infinity
- b. Zero
- c. Negative
- d. None of these

Q-2 Image formed by plane mirror is
- a. Real and erect
- b. Real and inverted
- c. Virtual and erect
- d. Virtual and inverted

Q-3 A concave mirror gives real, inverted and same size image if the object is placed
- a. At F
- b. At infinity
- c. At C
- d. Beyond C

Q-4 Power of the lens is -40, its focal length is
- a. 4m
- b. -40m
- c. -0.25m
- d. -25m

Q-5 A concave mirror gives virtual, refract and enlarged image of the object but image of smaller size than the size of the object is
- a. At infinity
- b. Between F and C
- c. Between P and F
- d. At E

Q-6 In optics an object which has higher refractive index is called
- a. Optically rarer
- b. Optically denser
- c. Optical density
- d. Refractive index

Q-7 The optical phenomena, twinkling of stars, is due to
- a. Atmospheric reflection
- b. Total reflection
- c. Atmospheric refraction
- d. Total refraction

Q-8 Convex lens focus a real, point sized image at focus, the object is placed
- a. At focus
- b. Between F and 2F
- c. At infinity
- d. At 2F

Q-9 The unit of power of lens is
- a. Metre
- b. Centimeter
- c. Diopter
- d. M^{-1}

Q-10 The radius of curvature of a mirror is 20cm the focal length is
- a. 20cm
- b. 10cm
- c. 40cm
- d. 5cm

LIGHT- REFRACTION AND REFLECTION
MULTIPLE CHOICE QUESTIONS

Q1. Which of the following statement is or are correct?

a. Light travels in a straight line.

b. Those objects which do not emit light themselves but only reflect the light which falls on them, are called non luminous objects.

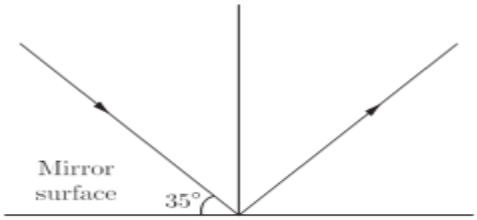
c. Light enables us to see objects from which it come or from which it is reflected.

d. All the above

Q2. The angle of incidence for a ray of light having zero reflection angle is

(a) 0^o
(b) 30°
(c) 45°
(d) 90°

Q3. Find the angle of incidence and angle of reflectionfrom the diagram



(a) 45^o, 40^o (b) 55^o, 55^o

(c) 60^o, 60^o (d) 30^o, 30^o

Q4. Light waves

(a) Require air or another gas to travel through

(b) Require an electric field to travel through

(c) Require a magnetic field to travel through

(d) Can travel through perfect vacuum.

Q5. The radius of curvature of concave mirror is 12 cm. Then, the focal length will be

(a) 12 cm (b) 6 cm

(c) -24 cm (d) -6 cm

Q6. Which of the following lenses would you prefer to usewhile reading small letters found in a dictionary?

(a) A convex lens of focal length 50 cm.

(b) A concave lens of focal length 50 cm.

(c) A convex lens of focal length 5 cm.

(d) A concave lens of focal length 5 cm

Q7. An object is placed 20.0 cm in front of a concavemirror whose focal length is 25.0 cm. What is the magnification of the object?

(a) + 5.0 (b)-5.0

(c) + 0.20 (d) -0.20

Q8. Which statement best describes the property of lightwaves illustrated in the diagram below?

(a) Some materials absorb light waves.
(b) Some materials refracted by some materials.
(c) Light waves are refracted by some materials.
(d) Light waves are emitted by some materials.

Q9. Which of the following mirror is used by a dentist to examine a small cavity?

(a) Convex mirror
(b) Plane mirror
(c) Concave mirror
(d) Combination of convex and concave mirror

Q10. A concave mirror of radius 30 cm is placed in water. It's focal length in air and water differ by

(a) 15

(b) 20

(c) 30

(d) 0

Q11. A ray of light is incident on a plane mirror making an angle of 90° with the mirror surface. The angle of reflection for this ray of light will be:

(a). 45°
(b). 90°
(c). 0°
(d). 60°

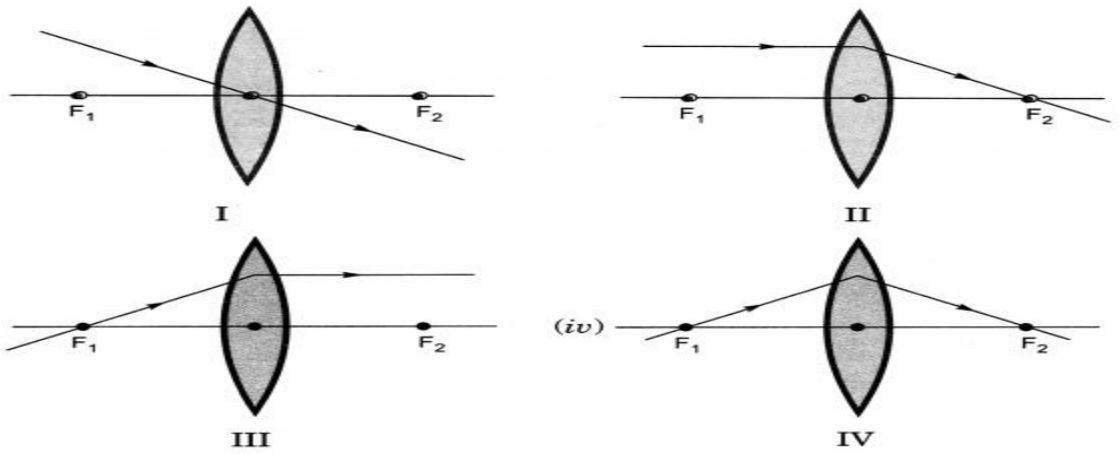
Q12. The image formed by a plane mirror is:

(a). Virtual, behind the mirror and enlarged.
(b). Virtual, behind the mirror and of the same size as the object.
(c). Real, at the surface of the mirror and enlarged.
(d). Real, behind the mirror and of the same size as the object.

Q13. A concave mirror produces magnification of +4. The object is placed:

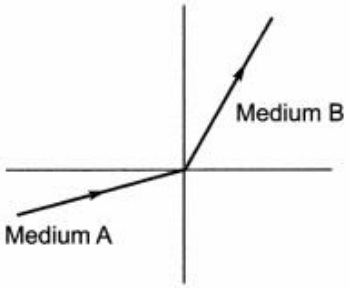
(a). At the focus
(b). Between focus and centre of curvature
(c). Between focus and pole
(d)]. Beyond the center of curvature

Q14. The diagrams showing the correct path of the ray after passing through the



(a) ii and iii only
(b) i and ii only
(c) i, ii and iii
(d) i, ii and iv

Q15. A light ray enters from medium A to medium B as shown in figure. The medium B relative to A will be



(a) more dense than A
(b) less dense than B
(c) equal to A
(d) none of the above

Q16. Magnification produced by a rear view mirror i

(a) is less than one

(b) is more than one

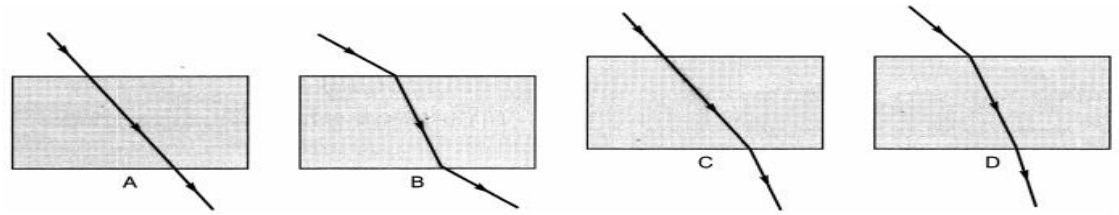
(c) is equal to one

(d) can be more than or less than one depending upon the position of the object in front of it

Q17. In torches, search lights and headlights of vehicles the bulb is placed

(a) between the pole and the focus of the reflector
(b) very near to the focus of the reflector
(c) between the focus and centre of curvature of the reflector
(d) at the centre of curvature of the reflector

Q18. The path of a ray of light coming from air passing through a rectangular glass slab traced by four students are shown as A, B, C and D in figure. Which one of them is correct?



(a) A
(b) B
(c) C
(d) D

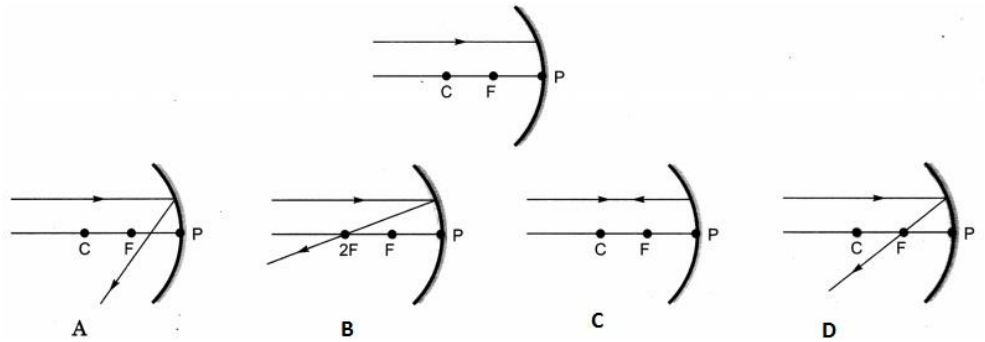
Q19. The deviation of light ray from its path when it travels from one transparent medium to another transparent medium is called

(a) Reflection
(b) Refraction
(c) Dispersion
(d) Scattering

Q20. Convex lens is also known as

(a) converging lens
(b) diverging lens
(c) radial lens
(d) axial lens

Q21. Which of the following ray diagrams is correct for the ray of light incident on a concave mirror as shown in figure?



(a) Fig. A
(b) Fig. B
(c) Fig. C
(d) Fig. D

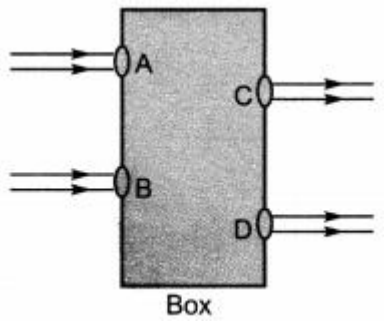
Q22. In which of the following, the image of an object placed at infinity will be highly diminished and point sized?

(a) concave mirror only
(b) convex mirror only
(c) convex lens only
(d) concave mirror, convex mirror, concave lens and convex lens.

Q23. Which of the following statements is true?

(a) a convex lens has 4 dioptre power having a focal length 0.25 m
(b) a convex lens has -4 dioptre power having a focal length 0.25 m
(c) a concave lens has 4 dioptre power having a focal length 0.25 m
(d) a concave lens has -4 dioptre power having a focal length 0.25 m.

Q24. Beams of light are incident through the holes A and B and emerge out of box through the holes C and D respectively as shown in the figure. Which of the following could be inside the box?



(a) a rectangular glass slab
(b) a convex lens
(c) a concave lens
(d) a prism

Q25. An object at a distance of 15 cm is slowly moved towards the pole of a convex mirror. The image will get
(a) shortened and real
(b) enlarged and real
(c) enlarge and virtual
(d) diminished and virtual

Q26. A concave mirror of focal length 20 cm forms an image having twice the size of object. For the virtual position of object, the position of object will be at

(a) -25 cm
(b) -40 cm
(c) -10 cm
(d) at infinity

Q27. The nature of the image formed by concave mirror when the object is placed between the focus (F) and Centre of curvature (C) of the mirror observed by us is

(a) real, inverted and diminished
(b) virtual, erect and smaller in size
(c) real, inverted and enlarged
(d) virtual, upright and enlarged

Q28. As light travels from a rarer to a denser medium it will have

(a) increased velocity
(b) decreased velocity
(c) decreased wavelength
(d) both (b) and (c)

Q29. You are given three media a, b and c of refractive index 1.33, 1.65 and 1.46. The medium in which the light will travel fastest is
(a) a
(b) b
(c) c
(d) equal in all three media.

Q30. Focal length of a concave mirror is

(a) negative
(b) positive
(c) depends on the position of object
(d) depends on the position of image

Q31. A spherical mirror and a spherical lens each have a focal length of -10 cm. The mirror and the lens are likely to be

(a) both concave
(b) both convex
(c) the mirror is concave and the lens is convex
(d) the mirror is convex and the lens is concave

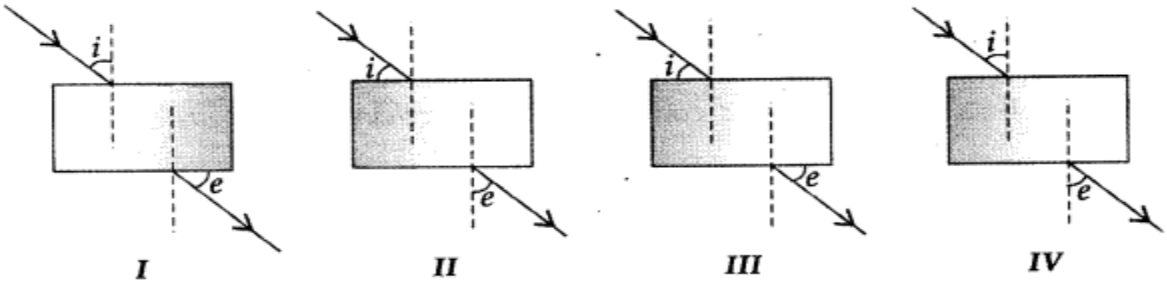
Q32. When the object is placed between f and 2f of a convex lens, the image formed is

(a) at f
(b) at 2f
(c) beyond 2f
(d) between o and f

Q33. A ray of light is travelling from a rarer medium to a denser medium. While entering the denser medium at the point of incidence, it

(a) goes straight into the second medium
(b) bends towards the normal
(c) bends away from the normal
(d) does not enter at all

Q34. A student does the experiment on tracing the path of a ray of light passing through a rectangular glass slab for different angles of incidence. He can get a correct measure of the angle of incidence and the angle of emergence by following the labelling indicated in figure:



(a) I
(b) II
(c) III
(d) IV

Q35. An object is placed at a distance of 0.25 m in front of a plane mirror. The distance between the object and image will be

(a) 0.25 m
(b) 1.0 m
(c) 0.5 m
(d) 0.125 m

Q36. An object is placed at the Centre of curvature of a concave mirror. The distance between its image and the pole is

(a) equal to f
(b) between f and 2f
(c) equal to 2f
(d) greater than 2f

Q37. If the power of a lens is – 2 D, what is its focal length?

(a) +50 cm
(b) -100 cm
(c) -50 cm
(d) +100 cm

Q38. A point object is placed at a distance of 20 cm from a convex mirror of focal length 20 cm. The image will form at:

(a) at infinity
(b) at focus
(c) at the pole
(d) behind the mirror

Q39. If the magnification produced by a lens has a negative value, the image will be

(a) virtual and inverted
(b) virtual and erect
(c) real and erect
(d) real and inverted

Q40. The unit of power of lens is

a. Metre

b. Centimeter

c. Diopter

d. M^{-1}

Q41. The radius of curvature of a mirror is 20cm the focal length is

a. 20cm

b. 10cm

c. 40cm

d. 5cm

Q42. Relationship between focal length and radius of curvature of a mirror is:

(a). F=2R

(b) f = R/2

(c) R= f/2

(d) f=2/R

Q43. What is the correct relation between focal length, object distance and image distance for lens:

(a) $\frac{1}{f} = \frac{1}{u} + \frac{1}{v}$ (c) $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

(b) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$ (d) $\frac{1}{f} = \frac{1}{u} - \frac{1}{v}$

Q44. The imaginary line passing through the Centre of curvature, focus and pole of a mirror is called:

(a). Focal length
(b) principal axis
(c) radius of curvature
(d) Image distance

Q45. The power of a lens will be one diopter if its focal length is:

(a) 10 cm
(b) 100 cm
(c) 1 cm
(d) 50 cm

Q46. Which mirror is used in the headlights of the motor vehicles?

(a) Plane mirror
(b) Convex mirror
(c) Concave mirror
(d) Concave lens

Q47. Speed of light in vacuum is:

(a) 3×10^8 m/s

(b) 3×10^7 m/s

(c) 3×10^9 m/s

(d) 3×10^6 m/s

Q48. Which statement is true for the reflection of light?

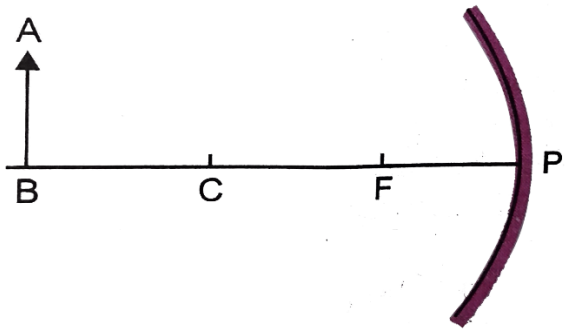
(a) the angle of incidence and reflection are equal.

(b) the reflected light is more brighter than the incident light.

(c) the sum of angle of incidence and reflection is always greater than 90^0.

(d) the beams of incident light after reflection diverge at unequal angles.

Q49. The image shows the path of incident rays to a concave mirror.



Where would the reflected rays meet for the image formation to take place?

(a) behind the mirror

(b) Between F and P

(c) Between C and F

(d) Beyond C

Q50. Refractive index of glass with respect to air is 3/2. The speed of light in glass is :

(a) 1.5×10^8 m/s

(b) 2×10^8 m/s

(c) 3×10^8 m/s

(d) 4.5×10^8 m

ASSERTION AND RESONING

Following questions consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(A) Both A and R are true and R is the correct explanation of A.

(B) Both A and R are true but R is not the correct explanation of A.

(C) A is true but R is false.

(D) A is false but R is true.

1. **Assertion (A) :** A ray passing through the centre of curvature of a concave mirror after reflection, is reflected back along the same path.
   Reason (R) : The incident rays fall on the mirror along the normal to the reflecting surface.
2. **Assertion (A) :** Light does not travel in the same direction in all the media.
   Reason (R) : The speed of light does not change as it enters from one transparent medium to another.
3. **Assertion (A) :** The Centre of curvature is not a part of the mirror. It lies outside its reflecting surface.
   Reason (R): The reflecting surface of a spherical mirror forms a part of a sphere. This sphere has a Centre.
4. **Assertion (A):** The emergent ray is parallel to the direction of the incident ray in case of a glass slab.
   Reason (R): The extent of bending of the ray of light at the opposite parallel faces (air- glass interface and glass-air interface) of the rectangular glass slab is equal and opposite.
5. **Assertion (A):** A ray of light travelling from a rarer medium to a denser medium slows down and bends away from the normal. When it travels from a denser medium to a rarer medium, it speeds up and bends towards the normal.
   Reason (R): The speed of light is higher in a rarer medium than a denser medium.
6. **Assertion (A):** The mirrors used in search lights are concave mirrors.
   Reason (R): In concave mirror the image formed is always virtual.
7. **Assertion (A):** Light travels faster in glass than in air.
   Reason (R): Glass is denser than air.
8. **Assertion (A):** Concave mirrors are used as make-up mirrors.
   Reason (R): When the face is held within the focus of a concave mirror, then a diminished image of the face is seen in the concave mirror.
9. **Assertion (A):** Refractive index has no units.
   Reason (R): The refractive index is a ratio of two similar quantities.

10. **Assertion (A):** The formula connecting u, v and f for a spherical mirror is valid only for mirrors whose sizes are very small compared to their radii of curvature.

    Reason (R): Laws of reflection are strictly valid for plane surfaces but not for large spherical surfaces.

11. **Assertion(A):** A person cannot see his image in a concave mirror, unless, he is standing beyond the center of curvature of the mirror.

    Reason (R) : In a concave mirror, image formed is real provided the object is situated beyond its focus.

12. **Assertion(A):** keeping a point object fixed, if a plane mirror is moved, the image will also moved.

    Reason (R) : In case of a plane mirror, distance of object and its image is equal from any point on the mirror.

13. **Assertion (A): If both plane mirror and object are moved through a distance x, then the image moves through a distance 3x.**

    Reason (R): When the object is fixed and plane mirror is moved through a distance x. Then the image is also move through the distance x.

14. **Assertion(A):** The focal length of the convex mirror will increase , if the mirror is placed in water.

    Reason (R) : The focal length of the convex mirror of radius R is equal to, f=R/2.

15. **Assertion(A):** An object is placed at a distance of u from a convex mirror of focal length f and its image will form at infinity.

    Reason (R) : The distance of image in convex mirror can never be infinity.

16. **Assertion(A):** Refractive index of glass with respect to air is different for red light and violet light.

    Reason (R) : Refractive index of a pair of media depends on the wavelength of the light used.

17. **Assertion(A):** Light travels in a straight line.

    Reason (R) : Transparent objects allow all the light to pass through them.

18. **Assertion(A):** Incident light is reflected in one direction from a smooth surface.

    Reason (R) : Since the angle of incidence and the angle of reflection are same, a beam of parallel rays of light falling on a smooth surface is reflected as a beam of parallel light rays in one direction only.

19. **Assertion(A):** For observing traffic at back, the mirror for driver is convex.

    Reason (R) : A convex mirror has a larger field of view than a plane mirror.

20. **Assertion (A):** A virtual image can be photographed.

    Reason (R) : Only real images can be photographed.

21. **Assertion(A):** Higher is the refractive index of a medium or denser the medium, lesser the velocity of the light in that medium.

    Reason (R): Refractive index is inversely proportional to the velocity.

22. **Assertion(A):** Mirror formula can be applied to a plane mirror.

    Reason (R): A plane mirror is a spherical mirror with infinite focal length.

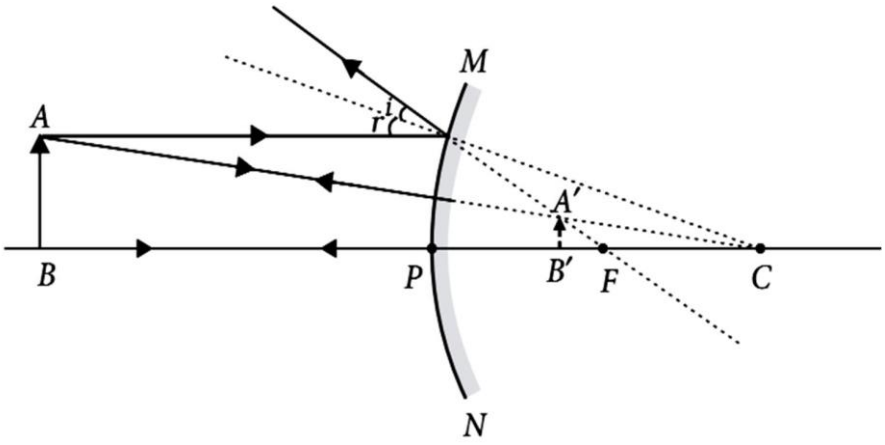
23. **Assertion (A):** As light travels from one medium to another, the frequency of light does not changes.
Reason (R): Because frequency is the characteristic of source.
24. **Assertion(A):** It is not possible to see a virtual image by eye.
Reason (R) : The rays that seems to emanate from a virtual image do not in fact emanates from the image.
25. **Assertion(A):** As the temperature of a medium increases, the refractive index decreases.
Reason (R) : When a ray travels from a vacuum to a medium, then μ is known as absolute refractive index of the medium.
26. **Assertion(A) :** When the object moves with a velocity 2 m/s, its image in the plane mirror moves with a velocity of 4 m/s.
Reason (R) : The image formed by a plane mirror is as far behind the mirror as the object is in front of it.
27. **Assertion(A):** Virtual images are always erect.
Reason (R) : Virtual images are formed by diverging lenses only.
28. **Assertion (A) :** The height of an image can be positive or negative.
Reason (R) : An image is always formed above the principal axis in this upward direction.(QUESTION CHANGED DUE TO REPETITION)
29. **Assertion(A) :** When the object moves with a velocity 2 m/s, its image in the plane mirror moves with a velocity of 5 m/s.(VALUE CHANGED DUE TO REPETITION OF QUESTION)
Reason (R) : The image formed by a plane mirror is as far behind the mirror as the object is in front of it.
30. **Assertion (A):** The mirrors used in search lights are convex spherical mirrors.
Reason (R): In convex spherical mirror the image formed is always virtual.(QUESTION CHANGED DUE TO REPETITION)

PARAGRAPH QUESTIONS: LIGHT-REFLECTION AND REFERACTION

PARAGRAPH 1

Read the following and answer any four questions from (i) to (v)

Convex mirrors are used as rear-view mirrors in vehicles. The image formed in a convex mirror is diminished (ray diagram is shown here) due to which it gives a wide field of view of the traffic behind the vehicle. Consider a convex mirror used on a moving automobile with radius of curvature 2 m and a truck is coming from behind it by maintaining a constant distance of 3.5 m.



1. The distance behind the mirror where the image is formed is
   (a) 0.28 m
   (b) 1.5 m
   (c) 0.78 m
   (d) 7.8 m

2. The nature of the image formed is
   (a) virtual and erect
   (b) real and inverted
   (c) real, erect and enlarged
   (d) none of these

3. The size of the image relative to the size of the truck is
   (a) 0.30 (b) 0.5
   (c) 0.78 (d) 0.22

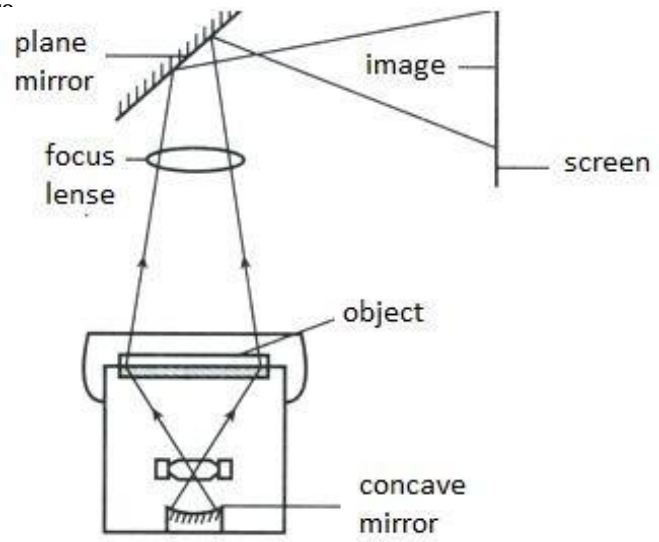
4. The focal length of the mirror is
   (a) 0.5 m (b) 1 m
   (c) 1.5 m (d) 2 m

5. If instead of 3.5 m, truck maintains a distance of 2 m, the image formed will be
   (a) real, erect and diminished
   (b) virtual, inverted and diminished
   (c) real, erect and enlarged
   (d) virtual, erect and diminished

PARAGRAPH 2

Read the following and answer any four questions from (i) to (v)

An overhead projector (OHP), like a film or slide projector; uses light to project an enlarged image on a screen. In the OHP, the source of the image is a page-sized sheet of transparent plastic film (also known as foils) with the image to be projected either printed or hand- written/drawn. These are placed on the glass surface of the projector, which has a light source below it and a projecting mirror and lens assembly above it as shown in the figur-



1. Based on the diagram shown, what kind of lens is used to make the overhead projector?
   (a) concave lenses (b) convex lenses (c) bifocal lenses (d) flat lenses

2. The image obtained will be erect and real. How?

   (a)The image when passed through the lens was erect and was directly obtained on the screen.
   (b) The image when passed through the lens was inverted and then it gets reflected on the mirror to be obtained on the screen.
   (c) The screen used automatically makes the image erect and real.
   (d) Both (b) and (c)

3. Why is concave mirror used and not convex mirror?

   (a) because concave mirror can give real image.
   (b) because convex mirror can give real image.
   (c) because concave mirror cannot give real image.
   (d) because convex mirror cannot give virtual image.

4. If the radius of curvature of concave mirror is 12 cm. Then, the focal length will be :
   (a) 12 cm (b) 6 cm (c) -24 cm (d) -6 cm

5. The power of a convex lens is_____and that of a concave lens is _____
   (a) positive, negative (b) positive, positive
   (c) negative, positive (d) negative, negative

PARAGRAPH 3

Read the following and answer any four questions from (i) to (v)

A mirror is a surface that reflects a clear image. Images can be of two types: Real image and virtual image. An image that can be formed on the screen is known as a real image and the one which cannot be formed on the screen is known as a virtual image. These images are formed when light falls on a mirror from the object and is reflected back by the mirror on the screen.

One useful tool that is frequently used to depict this idea is known as a ray diagram. A ray diagram is a diagram that traces the path that light takes in order for a person to view a point on the image of an object. On the diagram, rays (lines with arrows) are drawn for the incident ray and the reflected ray.

A ray diagram used arrow type lines to represent the incident ray and the reflected ray. It also helps to trace the direction in which light travels.

1. Convex mirror always forms, an image :
   (a) Virtual, erect and enlarge (b) Virtual, inverted and enlarged
   (c) Virtual, erect and diminished (d) Real, erect and diminished

2. A convex lens forms the image of sun at :
   (a) C (b) focus
   (c) pole (d) between focus and pole

3. A concave lens can form a real and inverted image, when :
   (a) Object is placed at 2f (b) Object is placed beyond 2f
   (c) Object is placed between f and 2f (d) It can never form a real and inverted image.

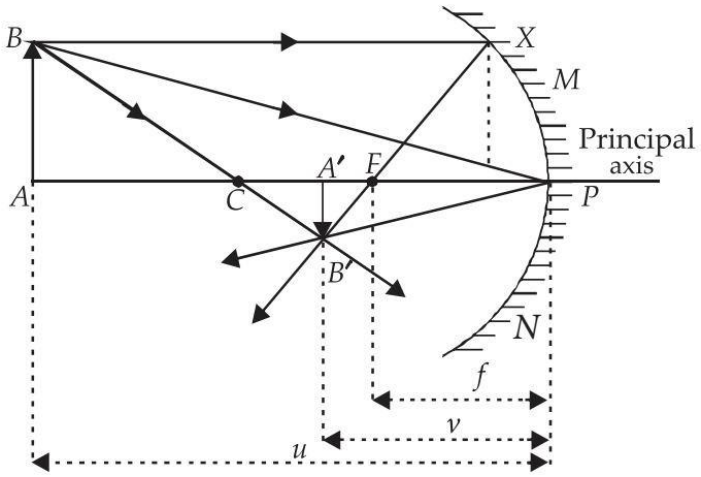
4. An object is placed beyond 2F, in front of a convex lens, image will be formed :
   (a) between F and 2F (b) at focus
   (c) at the centre of curvature (d) between focus and Optical centre

5. An object is placed at focus of a concave mirror, image will be formed at :
   (a) focus (b) between F and C (c) beyond C (d) at infinity

PARAGRAPH 4

Read the following and answer any four questions from (i) to (v)

Mirror formula is a relation between object distance (u), image distance (v) and focal length (f) of a spherical mirror.
It can be written as $1/u + 1/v = 1/f = 2/R$ where R is the radius of curvature of the mirror.
This formula is valid in all situations for all spherical mirrors for all positions of the object. Consider the case, in which a mirror forms a real image of height 4 cm of an object of height 1 cm placed 20 cm away from the mirror.



1. The distance from the object to its image is
   (a) 20 cm
   (b) 80 cm
   (c) 60 cm
   (d) 70 cm

2. The focal length of mirror is
   (a) -16 cm
   (b) 12 cm
   (c) -15 cm
   (d) 10 cm

3. The radius of curvature of the mirror is
   (a) -16 cm
   (b) -14 cm
   (c) -30 cm
   (d) -32 cm

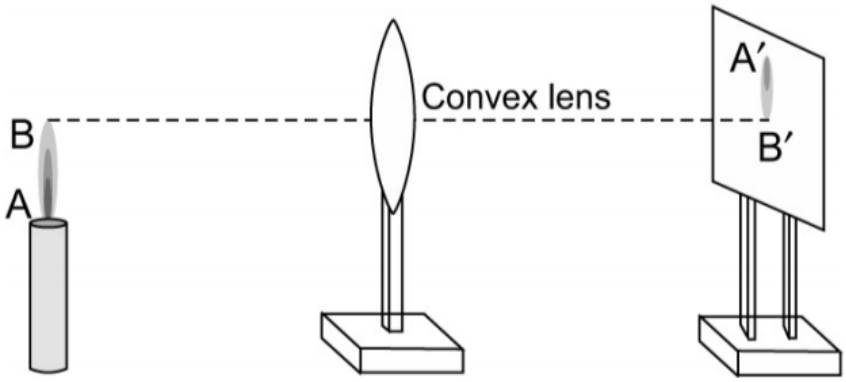
4. The magnification of the image is
   (a) 3
   (b) -6
   (c) -4
   (d) 8

5. At what distance must an object be placed from mirror in order that a real image double its size may be obtained?
   (a) -24 cm
   (b) 32 cm
   (c) -40 cm
   (d) 45 cm

PARAGRAPH 5

Read the following and answer any four questions from (i) to (v)

Aditya and his friend Manoj placed a candle flame in front of a convex lens at various distances from it and obtained the image of the candle flame on a white screen.
He noted down the position of the candle, screen and the lens as under
Position of candle = 20 cm
Position of convex lens = 50 cm Position of the screen = 80 cm



i. What is the position of the image formed from the convex lens?
(a) 80 cm
(b) 50 cm
(c) 30 cm
(d) 60 cm

ii. What is the focal length of the convex lens?
(a) 30 cm
(b) 15 cm
(c) -16 cm
(d) 16cm

iii. Where will the image be formed if he shifts the candle towards the lens at a position of 35 cm?
(a) At focus
(b) Between focus and pole
(c) At infinity
(d) Between f_2 and f_1

iv. Which of the following statement describes the best about the nature of the image formed if Aditya shifts the candle towards the lens to 36 cm?
(a) The nature of the image formed will be virtual, inverted and magnified.
(b) The nature of the image formed will be virtual, erect and magnified.
(c) The nature of the image formed will be virtual, erect and diminished.
(d) The nature of the image formed will be real, inverted and diminished.

v. Which of the following statement describes the best about the nature of the image formed if Aditya shifts the candle towards the lens to 28 cm?
(a) The nature of the image formed will be virtual, inverted and magnified.
(b) The nature of the image formed will be virtual, erect and magnified.
(c) The nature of the image formed will be virtual, erect and diminished.
(d) The nature of the image formed will be real, inverted and large. .(QUESTION CHANGED DUE TO REPETITION)

CHAPTER 11

HUMAN EYE AND THE COLOURFUL WORLD

MAIN POINTS/ KEYNOTES/ GIST/ SUMMARY OF THE CHAPTER

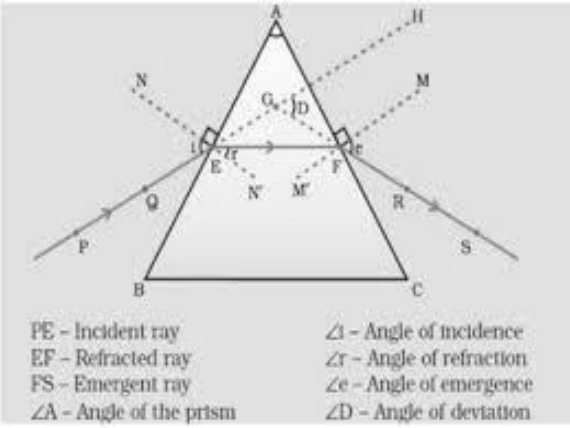
Refraction of Light through a prism

Prism: It is a piece of glass or any transparent material bounded by triangular and three rectangular surfaces. The rectangular surfaces are called refracting surfaces. The angle between two refracting surfaces is called **refracting angle or angle of prism.**

The line along which the two refracting surfaces meet is called refracting the edge. Any section of prism which is perpendicular to refracting edge is called principal section of edge.

Difference between refraction through glass prism and glass slab is as follows-

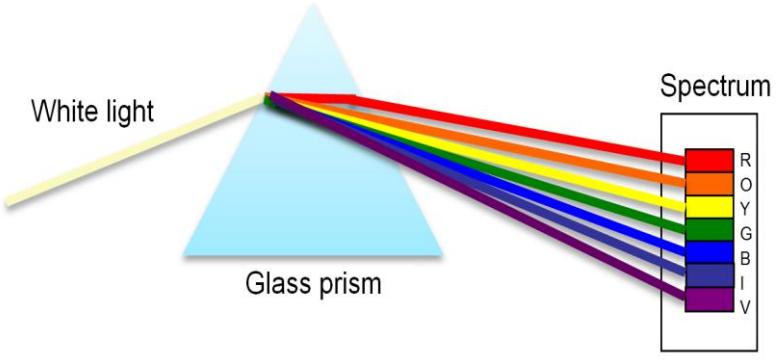
In slab, the emergent ray is parallel to the incident ray but in case of prism, emergent ray is not parallel to the incident ray because opposite faces of prism eye are not parallel to each other.



Angle of prism: The angle between the two sides of the reflecting faces of prism is called angle of prism.

Angle of deviation (δ): Angle between the incident ray and the emergent ray is called the angle of deviation.

DISPERSION OF LIGHT: The phenomenon of splitting of white light into its seven constituent colours when it passes through a glass prism is called dispersion of white light. The various colours seen are Violet, Indigo, Blue, Green, Yellow, Orange and Red. The sequence of colours remembers as VIBGYOR. The band of seven colours is called the spectrum. The different component colour of light bends at a different angle with respect to the incident angle. The violet light bends the least while the Red bends the most.



Spectrum The band of colored components of a light beam is called a spectrum consisting of seven colours is known as spectrum.

Composition of white light: White light consists of seven colours i.e., violet, indigo, blue, green, yellow, orange and red.

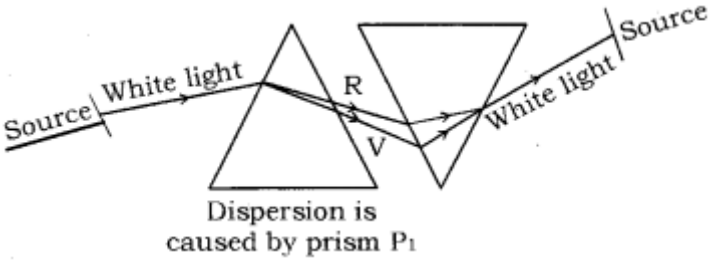
Monochromatic light: Light consisting of single colour or wavelength is called monochromatic light, example; a laser beam, sodium light.

Polychromatic light: Light consisting of more than two colours or a broad range of the wavelengths is called polychromatic light, example; white light.

Recombination of white light: Newton found that when an inverted prism is placed in the path of dispersed light then after passing through the prism, they recombine to form white light.

Issac Newton: He was the first, who obtained spectrum of sunlight by using glass prism. He tried to split the spectrum of white light more by using another similar prism, but he could not get any more colours.

He repeated the experiment using second prism in inverted position with respect to the first prism. It allowed all the colours of spectrum to pass through second prism. He found white light emerges on the other side of second prism.



Dispersion is caused by prism P_1

He concluded that Sun is made up of seven visible colours VIBGYOR.

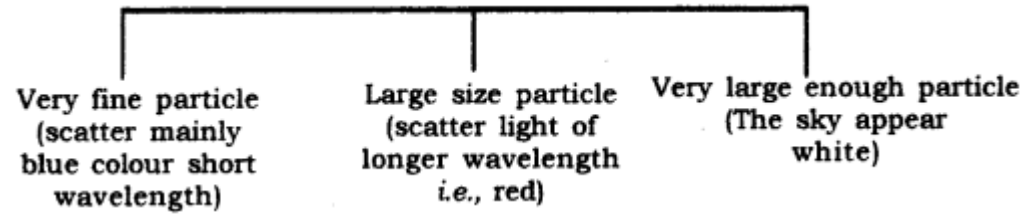
Atmospheric Refraction: The refraction of light caused by the Earth's atmosphere (having air layers of varying optical densities) is called Atmospheric Refraction.

Scattering of Light: When sunlight enters the atmosphere of the earth, the atoms and molecules of different gasses present in the air absorb the light. Then these atoms re-emit light in all directions. This process is known as Scattering of light.

Tyndall Effect: When a beam of light strikes, the minute particle of earth's atmosphere, suspended particles of dust and molecules of air, the path of the beam becomes visible. The phenomenon of scattering of light by the colloidal particle gives rise to Tyndall Effect.

It can be observed when sunlight passes through the canopy of a dense forest.

The colour of the scattered light depends on the size of the scattering particles in the atmosphere.

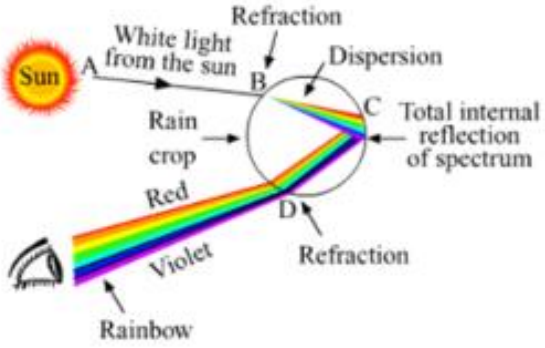


APPLICATIONS OF TYNDALL EFFECT IN DAILY LIFE

Rainbow formation Rainbow is formed by the dispersion of white light. The conditions for the rainbow to be observed is the sun should be at the back of the observer.

Every rain drop acts like a prism, so when sunlight falls on the rain drop first it refracts and disperses into

seven colours and then internally reflects and finally refracts and comes out of the rain drop in the form of a rainbow.



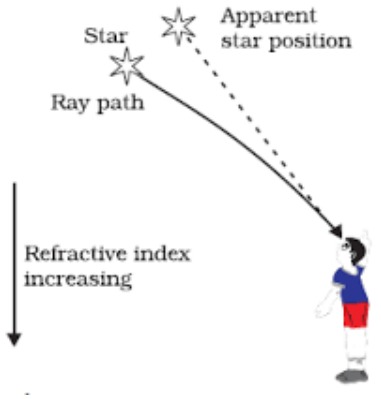
Three phenomenon which are involved in the formation of rainbow are-

1. Dispersion
2. Refraction
3. Internal reflection

TWINKLING OF STARS

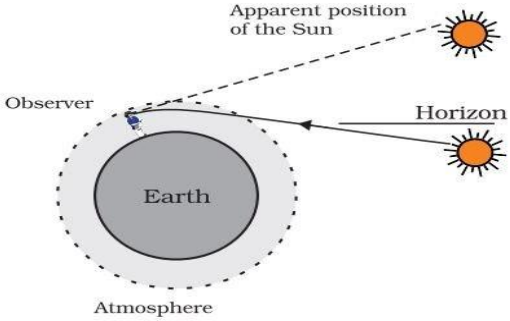
The twinkling of a star is due to **atmospheric refraction of starlight**. The starlight, on entering the earth's atmosphere, undergoes refraction continuously (because physical condition of earth's atmosphere is not stationary) before it reaches the earth. Hence, the amount of light enters our eyes fluctuate sometimes bright and sometime dim. This is the "Twinkling effect of star".

Appearance of Star Position: It is due to atmospheric refraction of star light. Distant star act as point source of light. When the starlight enter the Earth's atmosphere, it undergoes refraction continuously, due to changing refractive index i.e. from Rarer to denser.



Advance sunrise and delayed sunset:

Actual sun rise happens when it comes above the horizon in the morning. But the rays of light from the sun below the horizon reach our eyes 2 minutes earlier than actual sunrise due to atmospheric refraction of sunlight as it enters the earth's atmosphere. Similarly, the sun can be seen for about 2 minutes after the actual sun set due to the atmospheric refraction.



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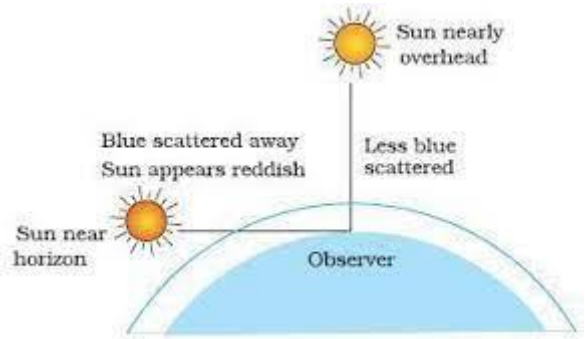
Blue Colour of sky: Sunlight reaches Earth's atmosphere and is scattered in all directions by all the gases and particles in the air. Blue light is scattered more than the other colors because it travels as shorter, smaller waves. This is why we see a blue sky most of the time.

Danger signal lights are red in colour: It is able to travel the longest distance through the fog, rain, etc. without being scattered or faded away.

Colour of the sun appears red during sunrise and sunset: At sunrise or sunset, the sun is located near the horizon, Hence, the light has to travel a long distance through the Earth's atmosphere. Therefore, most of the blue light and shorter wavelengths are scattered away by the suspended particles. Therefore, the light that reaches our eyes is of longer wavelengths, hence the sun appears red.



MULTIPLE CHOICE QUESTIONS

Q1. Which ray is least deviated by a prism?

(a) Violet ray
(b) Green ray
(c) Red ray
(d) Yellow ray

Q2. The dispersive power of prism depends upon

(a) The shape of the prism
(b) The material of the prism
(c) The angle of the prism
(d) Height of the prism

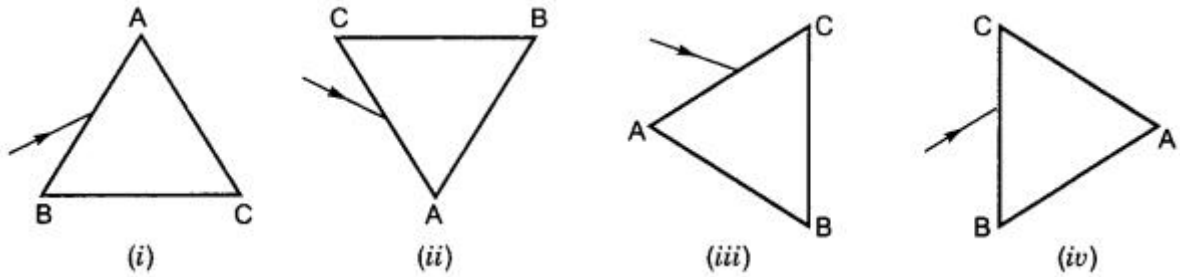
Q3. The star appear shifted from their actual position due to the phenomenon of:

(a) Diffraction of light
(b) Scattering of light
(c) Refraction of light
(d) Reflection of light

Q4. Blue colour of the sky is due to the phenomenon of:

(a) Reflection of light
(b) Refraction of light
(c) Dispersion of light
(d) Scattering of light

Q5. A prism ABC (with BC as base) is placed in different orientations. A narrow beam of white light is incident on the prism as shown in the Figures given below. In which of the following cases, after dispersion, the third colour from the top corresponds to the colour of the sky?



Q6. Which of the following phenomena of light are involved in the formation of a rainbow?

(a) Reflection, refraction and dispersion
(b) Refraction, dispersion and total internal reflection
(c) Refraction, dispersion and internal reflection
(d) Dispersion, scattering and total internal reflection.

Q7. Twinkling of stars is due to atmospheric
(a) dispersion of light by water droplets
(b) refraction of light by different layers of varying refractive indices
(c) scattering of light by dust particles
(d) internal reflection of light by clouds

Q8. The clear sky appears blue because

(a) blue light gets absorbed in the atmosphere.
(b) ultraviolet radiations are absorbed in the atmosphere.
(c) violet and blue lights get scattered more than lights of all other colours by the atmosphere.
(d) light of all other colours is scattered more than the violet and blue colour lights by the atmosphere.

Q9. Which of the following statements is correct regarding the propagation of light of different colours of white light in air?

(a) Red light moves fastest.
(b) Blue light moves faster than green light.
(c) All the colours of the white light move with the same speed.
(d) Yellow light moves with the mean speed as that of the red and the violet light.

Q10.The danger signals installed at the top of tall buildings are red in colour. These can be easily seen from a distance because among all other colours, the red light

(a) is scattered the most by smoke or fog.
(b) is scattered the least by smoke or fog.
(c) is absorbed the most by smoke or fog.
(d) moves fastest in air.

Q11. The bluish colour of water in deep sea is due to

(a) the presence of algae and other plants found in water
(b) reflection of sky in water
(c) scattering of light
(d) absorption of light by the sea

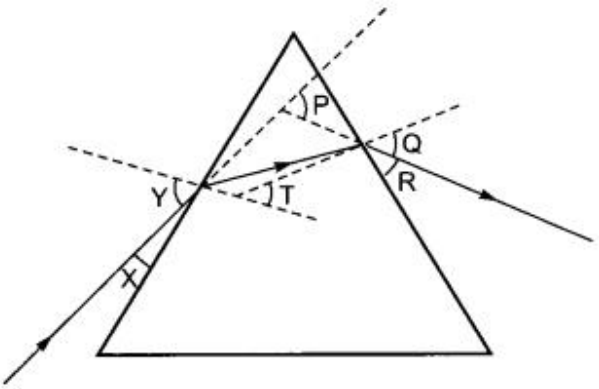
Q12. A student traces the path of a ray through a glass prism for four different values of angle of incidence. On analysing the diagrams he is likely to conclude that the emergent ray

(a) is always parallel to the incident ray.
(b) is always perpendicular to the incident ray.
(c) is always parallel to the refracted ray.
(d) always bends at an angle to the direction of incident ray.

Q13. A student is observing the diagram showing the path of a ray of light passing through a glass prism. He would find that for all angles of incidence the ray of light bends:

(a) towards the normal while entering into the prism and away from the normal while emerging out of the prism
(b) away from the normal while entering into the prism and towards the normal while emerging out of the prism.
(c) away from the normal while entering as well as while emerging out of the prism.
(d) towards the normal while entering as well as while emerging out of the prism.

Q14. n the following diagram, the path of a ray of light passing through a glass prism is shown:



In this diagram the angle of incidence, the angle of emergence and the angle of deviation respectively are (select the correct option):

(a) X, R and T
(b) Y, Q and T
(c) X, Q and P
(d) Y, Q and P

Q15. The splitting of white light into its component colours is called

(a) refraction
(b) reflation
(c) dispersion
(d) Tyndall effect

Q16. Reason behind advance sunrise and delayed sunset

(a) atmospheric refraction
(b) total internal reflection
(c) dispersion
(d) reflection

Q17. The effect of glass prism is only to separate the seven colours of

(a) White light
(b) light from bulb
(c) Sunlight
(d) All of the above

Q18. One cannot see through the fog, because

(a) refractive index of the fog is very high
(b) light suffers total reflection at droplets
(c) fog absorbs light
(d) light is scattered by the droplets

Q19. The air layer of atmosphere whose temperature is less than the hot layer behave as optically

(a) denser medium
(b) rarer medium
(c) inactive medium
(d) either denser or rarer medium

Q20. Which of the following is a natural phenomenon which is caused by the dispersion of sunlight in the sky?

(a) Twinkling of stars
(b) Stars seem higher than they actually are
(c) Advanced sunrise and delayed sunset
(d) Rainbow

Q21. Name the scientist who was the first to use a glass prism to obtain the spectrum of sunlight.

(a) Isaac Newton
(b) Einstein
(c) Kepler
(d) Hans Christian Oersted

Q22. Which light is easily scattered?

(a) Long wavelength light
(b) Short wavelength light
(c) Sunlight
(d) Coherent light

Q23. The phenomenon of scattering of light by the colloidal particles is called

(a) Dispersion of light
(b) Tyndall effect
(c) Atmospheric scattering
(d) Atmospheric refraction

Q24. When white light passes through a glass prism

(a) red coloured ray undergoes maximum deviation
(b) green coloured ray undergoes minimum deviation
(c) blue coloured ray undergoes minimum deviation
(d) violet coloured ray undergoes maximum deviation

Q25.The colour of a star is an indication of its :

(a) weight

(b) distance

(C) temperature

(d) size

Q26. Tyndall effect is due to

(a) scattering of light

(b) dispersion of light

(c) reflection of light

(d) refraction of light

Q27.What will be the colour of sky if there is no atmosphere on the earth?

(a)Dark blue

(b)Black

(c)white

(d) Red

Q28.Which light is easily scattered?

(a) Long wavelength light

(b) Short wavelength light

(c) Sunlight

(d) None

Q29.What is the colour of the sky when it is seen from moon's surface?

(a)Red

(b)blue

(c)white

(d)Black

Q30. Fibre optics work on the principle of

(a) Scattering of light
(b)Total internal reflection
(c)Total internal absorption
(d) Optical rotation

Q31. Which among the following acts as rarer medium?

(a) Hot air
(b) cold Air
(c) Both are same medium
(d) none

Q32. The dispersive power of prism depends upon

(a) The shape of the prism
(b) The material of the prism
(c) The angle of the prism
(d) Height of the prism

Q33. Which of the following are the primary colours of light?

(a) Red, Blue, Yellow
(b) Red, Green, Violet
(c) Yellow, Green, Blue
(d) Red, Green, Blue

Q34.For which of the following cases will the total internal reflection of light be possible?

(a) Angle of incidence is less than the critical angle.
(b) Angle of incidence is equal to the critical angle.
(c) Angle of incidence is greater than the critical angle.
(d) Angle of incidence is equal to the angle of refraction.

Q35.What is the time difference between actual sunset and apparent sunset?

(a) 2 sec
(b) 20 sec
(c) 2 min
(d) 20 min

Q36. When white light is incident on a green leaf...

(a) only green colour is absorbed
(b) only green colour is reflected
(c) all other colours are reflected
(d) the leaf appears black

Q37. When a ray of light travels from an optically denser medium to an optically rarer medium...

(a) it moves towards the normal
(b) it moves away from the normal
(c) it is not refracted
(d) it is reflected back in the denser medium

Q38. Which of the following is not due to total internal reflection?

(a) Sparkling of diamond
(b) Mirage
(c) Looming
(d) Twinkling of stars

Q39.The refractive index assumes the entrance of light from

(a) glass
(b) water
(c) vacuum
(d) gas

Q40. If the angle of incidence of light while leaving the denser object is zero, the light would

(a) be reflected back
(b) go straight without any refraction
(c) be refracted
(d) end up at the boundary of the object

Q41.Clouds appears white due to

(a)Water droplets scatters all wavelength
(b)Water in frozen conditions looks icy white
(c)Fog is formed around clouds
(d) all of these

Q42.Sunlight passes through a canopy of a dense forest is due to

(a)Raman effect
(b)Newton's ring
(c)Spectral effect
(d)Tyndall effect

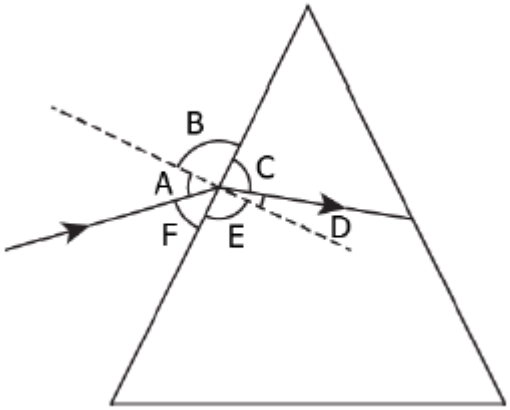
Q43. The star appear shifted from their actual position due to the phenomenon of:

(a) Diffraction of light
(b) Scattering of light
(c) Refraction of light
(d) Reflection of light

Q44. When white light enters a glass prism from air, the angle of deviation is least for

(a) blue light
(b) yellow light
(c) violet light
(d) red light

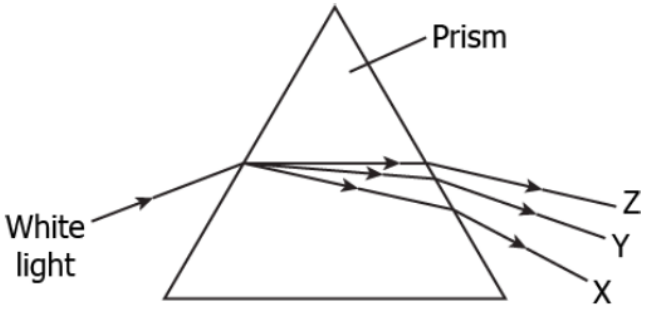
Q45.The image shows a light ray incident on a glass prism.



The various angles are labelled in the image. Which angle shows the angle of incidence and angle of refraction, respectively?

(a) A and D
(b) B and E
(c) C and F
(d) D and F

46. The image shows the dispersion of the white light in the prism.



What will be the colours of the X, Y and Z?

(a) X: red; Y: green; Z: violet
(b) X: violet; Y: green; Z: red
(c) X: green; Y: violet; Z: red
(d) X: red; Y: violet; Z: green

Q47.When white light enter a prism, it gets spilt into its constituent colours. This is due to

(a) different refractive index for different wavelength of each colour
(b) each colour has same velocity of the prism
(c) prism material have high density
(d) scattering of light

Q48. Refraction of light by the earth's atmosphere due to variation in air density is called

(a) atmospheric reflection
(b) atmospheric dispersion
(c) atmospheric scattering
(d) atmospheric refraction

Q49. The stars twinkle, while the planets do not . Why?

a) Closer planets are not point sources but due to long distance stars appear as point sources
b) Stars have ability light fragments while planets transmit light continuously
c) Light from star travel faster than planets
d) None of these

Q50. Rainbows are created by sunlight

(a)water particles
(b)wind
(c)dust particles
(d)snow

ASSERTION AND REASONING

Direction *(Q Nos. 1 – 25) In each of the following questions, a statement of Assertion is given by the corresponding statement of Reason. Of the statements, mark the correct answer as*

(a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion.
(b) If both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.
(c) If Assertion is true, but Reason is false.
(d) If Assertion is false, but Reason is true.
(e) If Assertion and Reason both are false.

Q.1. Assertion(A) : White light is dispersed into its seven-colour components by a prism.
Reason (R) : Different colours of light bend through different angles with respect to the incident ray as they pass through a prism.

Q.2. Assertion (A): The phenomenon of scattering of light by the colloidal particles gives rise to Tyndall effect.
Reason (R): The colour of the scattered light depends on the size of the scattering particles.

Q.3. Assertion(A): When white light is passed through glass prism it splits into seven colours and this phenomenon is called dispersion.
Reason (R) : Different wavelengths travel with different speeds inside the prism.

Q.4. Assertion(A) : A rainbow is sometimes seen in the sky in rainy season only when observer's back is towards the Sun.
Reason (R) : Internal reflection in the water droplets cause dispersion and the final rays are in backward direction.

Q5. Assertion(A) : Danger signals are made of red colour.
Reason (R) : Velocity of red light in air is maximum, so signals are visible even in dark.

Q.6. Assertion(A): The sky looks dark and black instead of blue in outer space.
Reason (R) : No atmosphere containing air in the outer space to scatter sunlight.

Q.7 Assertion (A): The stars twinkle, while the planets do not.
Reason (R) : The stars are much bigger in size than the planets.

Q.8. Assertion(A): The Sun appears flattened at sunrise and sunset.
Reason (R) : The apparent flattering of the Sun's disc at sunrise and sunset is due to atmospheric refraction.

Q.9. Assertion (A) : Blue colour of sky appears due to scattering of blue colour.
Reason (R) : Blue light has shortest wavelength.

Q10. Assertion(A) : Tyndall Effect is an optical phenomenon of light used to explain atmospheric refraction.
Reason (R) : The tiny particles of dust disperse sunlight in it falls through foliage in forest

Q 11. Assertion(A) : On a clear summer night twinkling of stars is observed.
Reason (R) : The twinkling of stars is caused by dispersion of star light by the atmosphere.

Q12. Assertion(A) : On mid-day, the colour of the sunlight becomes white.
Reason (R) : No atmospheric refraction is caused due to overhead sun.

Q13. Assertion(A) : The light of violet colour deviates the most and the light of red colour the least, while passing through a prism.
Reason (R) : For a prism material, refractive index is highest for red light and lowest for the violet light.

Q14. Assertion(A) : Secondary rainbow is fainter than primary rainbow.
Reason (R) : Secondary rainbow formation is three step process and hence, the intensity of light is reduced at the second reflection inside the rain drop.

Q15. Assertion(A) : There exists two angles of incidence for the same magnitude of deviation (except minimum deviation) by a prism kept in air.
Reason (R) : In a prism kept in air, a ray is incident on first surface and emerges out of second surface. Now if another ray is incident on second surface (of prism)

Q16. Assertion(A) : A white light on passing through prism splits into its component colors as such that the red light emerges nearest to the base of the prism.
Reason (R) : Wavelength of red light is more than other component colours and hence, red light deviates least.

Q17. Assertion(A) : A rainbow is sometimes seen in the sky in rainy season only when observer's back is towards the sun.
Reason (R) : Internal reflection in the water droplets cause dispersion and the final rays are in backward direction.

Q18. Assertion(A) : Rainbow is an example of the dispersion of sunlight by the water droplets.
Reason (R) : Light of shorter wavelength is scattered much more than light of larger wavelength.

Q19. Assertion(A) : The twinkling of stars is due to the fact that refractive index of the earth's atmosphere fluctuates.
Reason (R) : In cold countries, the phenomenon of looming (i.e., ship appears in the sky) takes place, because refractive index of air decreases with height.

Q20. Assertion(A) : Danger signals are made of red colour.
Reason (R) : Velocity of red light in air is maximum, so signals are visible even in dark.

Q21. Assertion(A) : Sunlight reaches us without dispersion in the form of white light and not as its components.
Reason (R) : Dispersion takes place due to variation of refractive index for different wavelength but in vacuum the speed of light is independent of wavelength and hence vacuum is a non-dispersive medium.

Q22. Assertion(A) : In case of rainbow, light at the inner surface of the water drop gets internally reflected.
Reason (R) : The angle between the refracted ray and normal to the drop surface is greater than the critical angle.

Q23. Assertion(A) : The sky looks dark and black instead of blue in outer space.
Reason (R) : No atmosphere containing air in the outer space to scatter sunlight.

Q24. Assertion(A) : If there were no atmosphere, the duration of the day on the earth would be decrease.
Reason (R) : Due to the refraction in the atmosphere, the sun appears to rise earlier and sets later.

Q25. Assertion(A) : There is no dispersion of light refracted through a rectangular glass slab.
Reason (R) : Dispersion of light is the phenomenon of splitting of a beam of white light into its constituent colours.

PARAGRAPH QUESTIONS

Passage 1:

Read the following passage and answer following the questions from (i) to (v).
The spreading of light by the air molecules is called scattering of light. The light having least wavelength scatters more. The sun appears red at sunrise and sunset, appearance of blue sky it is due to the scattering of light. The colour of the scattered light depends on the size of particles. The smaller the molecules in the atmosphere scatter smaller wavelengths of light. The amount of scattering of light depends on the wavelength of light. When light from sun enters the earth's atmosphere, it gets scattered by the dust particles and air molecules present in the atmosphere. The path of sunlight entering in the dark room through a fine hole is seen because of scattering of the sun light by the dust particles present in its path inside the room.

(i) To an astronaut in a spaceship, the colour of earth appears
(a) red
(b) blue
(c) white
(d) black

(ii) At the time of sunrise and sunset, the light from sun has to travel.
(a) longest distance of atmosphere
(b) shortest distance of atmosphere
(c) both (a) and (b)
(d) can't say

(iii) The colour of sky appears blue, it is due to the
(a) refraction of light through the atmosphere
(b) dispersion of light by air molecules
(c) scattering of light by air molecules
(d) all of these.

(iv) At the time of sunrise and sunset
(a) Blue colour scattered and red colour reaches our eye
(b) Red colour scattered and blue colour reaches our eye
(c) Green and blue scattered and orange reaches our eye
(d) None of these

(v) The danger signs made red in colour, because
(a) the red light can be seen from farthest distance
(b) the scattering of red light is least
(c) both (a) and (b)
(d) none of these

Passage 2:

Read the passage and answer the following questions from (i) to (v)
Atmospheric refraction is the phenomenon of bending of light on passing through earth's atmosphere. As we move above the surface of earth, density of air goes on decreasing. Local conditions like temperature etc. also affect the optical density of earth's atmosphere. On account of atmospheric refraction, stars seen appear higher than they actual are; advanced sunrise; delayed sunset, oval appearance of the sun at sunrise and sunset; stars twinkle, planets do not.

(i) Due to atmospheric refraction, apparent length of the day
(a) increases
(b) decreases
(c) remains the same
(d) all of these

(ii) Apparent position of the star appears raised due to
(a) atmospheric refraction
(b) scattering of light
(c) both (a) and (b)
(d) none of these

(iii) The sun appears oval shaped or flattened due to
(a) dispersion
(b) scattering
(c) atmospheric refraction
(d) cannot say

(iv) Twinkling of stars and non-twinkling of planets is accounted for by
(a) scattering of light
(b) dispersion of light
(c) atmospheric refraction
(d) none of these

(v) In absence of atmosphere, the colour of sky appears
(a) blue
(b) black
(c) red
(d) yellow

Passage 3.

Read the following passage and answer following the questions from (i) to (v).
In addition to being absorbed or transmitted, electromagnetic radiation can also be reflected or scattered by particle in the atmosphere . scattering is the redirection of electromagnetic energy by suspended particles in the atmosphere . The tyndall effect is light scattering by particles in a colloid or in a very fine suspension.
The type and amount of scattering that occurs depends on the size of particles and the wavelength of the energy. Rayleigh scatter occurs when radiation (light) interacts with molecules and particles in the atmosphere that are smaller in diameter than the wavelength of the incoming radiation. Shorter wavelength are more readily scattered than longer wavelengths.

(i) Which of the following will not show Tyndall effect?
(a) Milk
(b) Sugar solution
(c) Smoke
(d) Emulsion

(ii) Tyndall effect is due to
(a) refraction of light
(b) dispersion of light
(c) absorption of light
(d) scattering of light

(iii) Which of the following natural phenomena are not due to scattering of light in nature?
(A) blue colour of sky
(B) twinkling of stars
(C) formation of rainbow
(D) colour of water in deep sea

(a) both A and B
(b) both B and C
(c) both B and D
(d) both C and D

(iv) The table below lists the colour of scattered light for different sizes of scattering particles.
Select the row containing the correct information:

	Very fine particles	Larger particles	Large enough particles
a	blue	red	white
b	blue	white	red
c	red	blue	white
d	white	red	blue

(v) The blue colour of the sky is because :
(a) red colour is scattered more as compared to other colours.
(b) red colour is absorbed more as compared to other colours
(c) blue colour is scattered more as ccompared to other colours
(d) blue colour is absorbed more as compared to other colours

Passage 4.

Read the following passage and answer following the questions from (i) to (v).
Everyone enjoys the spectacle of a rainbow glimmering against a dark stormy sky . How does sunlight falling on clear drops of rain get broken into the rainbow of colours we see ? The same process causes white light to be broken into colours by a clear glass prism or a diamond. Sunlight considered to be white, actually appears to be a bit yellow because of its mixture of wavelengths, but it does contain all visible wavelengths.
The sequence of colors in rainbow is the same sequence as the colors plotted versus wavelength in figure below. What this implies is that white light is spread out according to wavelength in a rainbow.

(i) The phenomena that play a role in the formation of rainbow is:
(a) reflection and refraction of light
(b) refraction, absorption, dispersion and refraction of light
(c) dispersion, refraction and reflection of light
(d) Refraction, dispersion, reflection and refraction of light.

(ii) Select the colours in the correct ascending of wavelength:
(a) blue, green, red
(b) orange , green. Red
(c) blue , yellow, green
(d) orange , yellow, green

(iii) select the incorrect statements about rainbow:
(A) rainbow is caused by scattering of sunlight by tiny water droplets, present in the atmosphere.
(B) a rainbow is always formed in a direction opposite to that of the sun.
(C) the water droplets refract and scatter the incident sunlight, then reflect it internally and finally refract it again when it comes out of the raindrop.
(D) different colours reach the observer's eye due to the scattering and internal reflection

(a) both A and B
(b) both B and C
(c) A, C and D
(d) B,C and D

(iv) A spectrum of light is observed when white light is directed to a prism as :

(a) the different colours in the white light bend away from the normal line at different angles on entering prism.

(b) the different colours in the white light bend towards the normal line at different angles on entering prism.

(c) the different colours in the white light bend away from the normal at same speed to each other on entering the prism.

(d) the different colours in the white light bend towards the normal at same speed to each other on entering prism.

(v) the velocity of waves of all colours is same in :

(a) water

(b) oxygen

(c) vaccum

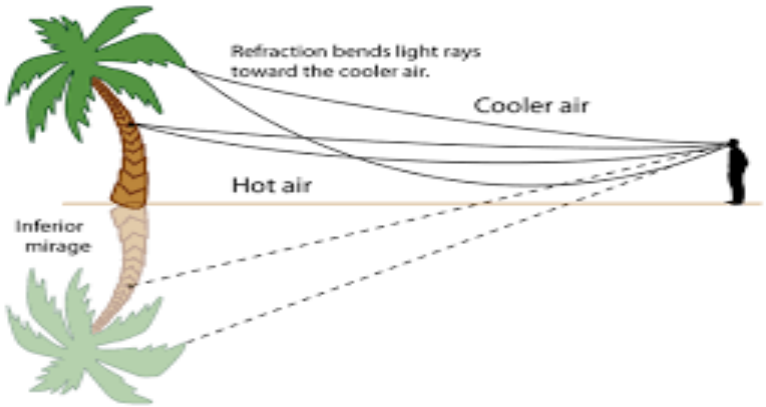
(d) glass

Passage 5

Read the following passage and answer following the questions from (i) to (v).

We ‘ve all seen that part in the movie where the weary desert wanderer has been walking for hours and is dying of thirst . Then he happens upon a vast body of water on the horizon . He runs towards the water , it grows closer and closer , until he springs himself into the air only to land back down in the sand and no water in sight. Well, that is due to an optical illusion called mirage.

Mirage is an optical phenomenon which creates an illusion of the presence of water and is a result of refraction of light from a non uniform medium. Mirage is observed mainly during sunny day when driving on a road way . Normally, light waves from the sun travel straight through the atmosphere to your eye . But, light travels at different speeds through hot air and cold air. Mirages happen when the ground is very hot and the air is cool and a ray of light gets refracted more and more away from the normal . At a particular angle when a ray of light exceeds critical angle , total internal reflection takes place and ray of light gets reflected in the same medium . when the reflected reaches our eye, it appears as coming from tree or sky and hence the inverted image of tree creates an impression from a pond water.



(i) Mirage is an example of :

(a) reflection of light and refraction of light

(b) dispersion of light

(c) total internal reflection

(d) refraction of light and total internal reflection

(ii) Mirages are common in :

(a) rainforests

(b) dry forests

(c) deserts

(d) highlands

(iii) Mirage is formed because:

(a) air above the ground is very hot and air above is cooler
(b) both a and d are correct
(c) light rays from a distant object bend towards the normal when coming towards the ground.
(d) light rays from a distant object bend away from the normal when coming towards the ground.

(iv) Atomspheric refraction occurs because :

(a) refractive index in medium is gradually changing
(b) of presence of dust particles in atmosphere
(c) large amount of moisture is present in atmosphere on a humid day
(d) sun's rays travel the most when sun is near the horizon

(v) when the starlight enters the earth's atmosphere:

(a) it bends away from the normal
(b) it bends towards the normal
(c) it first bends towards the normal and then away from the normal
(d) it first bends away from the normal and then towards the normal.

ANSWER KEYS:

CHAPTER 1

Answer Keys MCQ's

Q. No.	Ans.	Q. No.	Ans.	Q. No.	Ans.	Q. No.	Ans.	Q. No.	Ans.
1	A	11	D	21	D	31	D	41	C
2	D	12	B	22	D	32	A	42	B
3	B	13	D	23	A	33	B	43	REPEATED D
4	A	14	C	24	A	34	D	44	D
5	A	15	C	25	D	35	D	45	C
6	C	16	REPEATED C	26	C	36	B	46	D
7	D	17	D	27	D	37	D	47	REPEATED A
8	B	18	D	28	C	38	A	48	A
9	D	19	C	29	C	39	D	49	B
10	B	20	C	30	A	40	C	50	C

Assertion:

1. (a) Both A and R are true and R is the correct explanation of A.
2. (b) Both A and R are true but R is not the correct explanation of A.
3. (d) A is false but R is true.
4. (a) Both A and R are true and R is the correct explanation of A.
5. (a) Both A and R are true and R is the correct explanation of A.
6. (c) A is true but R is false.
7. (a) Both A and R are true and R is the correct explanation of A.
8. (c) A is true but R is false.
9. (b) Both A and R are true but R is not the correct explanation of A.
10. (a) Both A and R are true and R is the correct explanation of A.
11. (a) Both A and R are true and R is the correct explanation of A. This is due to the conservation of mass.
12. (a) Both A and R are true and R is the correct explanation of A.

13 (b) Both A and R are true but R is not the correct explanation of A.

14. (b) Both A and R are true but R is not the correct explanation of A. $CaCO_3$ on heating gives CO_2 and CaO.

15. (b) Both A and R are true but R is not the correct explanation of A. Decomposition reaction is a reaction in which a compound breaks down into two or more simpler substances
16. (c) A is true but R is false. Nitrogen being antioxidant prevents the chips from being oxidised.

17 (c) A is true but R is false.
18. Answer (c) A is true but R is false.
19. (a) Both A and R are true and R is the correct explanation of A. AgBr is a chemical compound. It is widely used in photography as photographic emulsions.
20. (a) Both A and R are true and R is the correct explanation of A.
21 (b) Both A and R are true but R is not the correct explanation of A.
22. (a) Both A and R are true and R is the correct explanation of A.
23. Both A and R are true and R is the correct explanation of A.
24. (a) Both A and R are true and R is the correct explanation of A.
25. (c) A is true but R is false.
26. (d) A is false but R is true
27. (a) Both A and R are true and R is correct explanation of A

PARAGRAPH BASED M.C.Q

PARAGRAPH - 1

1. c
2. c
3. c
4. d
5. b

PARAGRAPH -2

1. d
2. b
3. b
4. c
5. b

PARAGRAPH -3

1. c
2. a
3. b
4. b
5. d

PARAGRAPH-4

1. a
2. c
3. b
4. d
5. c

PARAGRAPH-5

1. c
2. b
3. d
4. a
5. d

CHAPTER 2
MCQ's ANSWER KEY

Q 1	b	Q 11	d	Q 21	b	Q 31	a	Q 41	c
Q 2	d	Q 12	c	Q 22	b	Q 32	a	Q 42	a
Q 3	a	Q13	d	Q 23	c	Q 33	b	Q 43	a
Q 4	c	Q14	b	Q 24	a	Q 34	d	Q 44	c
Q 5	d	Q15	b	Q 25	b	Q 35	b	Q 45	b
Q 6	d	Q16	d	Q 26	b	Q 36	b	Q 46	b
Q 7	a	Q17	c	Q 27	b	Q 37	b	Q 47	b
Q 8	b	Q18	a	Q 28	a	Q 38	b	Q 48	b
Q 9	c	Q19	d	Q 29	c	Q 39	c	Q 49	b
Q 10	a	Q 20	b	Q 30	a	Q 40	d	Q 50	d

ANSWER KEY ASSERTION

1. Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

2. Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). Because H_2SO_4 is a strong acid, it readily forms hydronium ions when dissolved in water which are responsible for its corrosive action.

3. Ans : (c) Assertion (A) is true but reason (R) is false.

4. Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

5. Ans: (c) Assertion (A) is true but reason (R) is false.

HCl produces H^+ ions in aqueous solution because in presence of water, acids give H^+ ions. As H^+ ions cannot exist alone so it combines with water molecules and form H_3O^+.

6. Ans : (d) Assertion (A) is false but reason (R) is true. H_2CO_3 carbonic acid is a weak acid.

Ans : (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

7. Sodium hydroxide being an strong base, reacts with active metal (zinc) to product H_2 gas. The reaction is given as follows:

$$Zn(s) + 2NaOH(aq) \text{-------} \rightarrow Na_2ZnO_2(aq) + H_2(g)$$

8. Ans : (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A)

9. Ans : (c) Assertion (A) is true but reason (R) is false. Ammonia gas, which is alkaline, turn the red litmus paper blue.

10. **Ans :** (c) Assertion (A) is true but reason (R) is false.

11. Ans : (d) Assertion (A) is false but reason (R) is true.Baking soda, being alkaline, neutralises the acidity

in the stomach and removes it.

12. Ans : (d) Assertion (A) is false but reason (R) is true.

13. Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion.

Water is never added to concentrated sulphuric acid as it is an exothermic reaction and releases a large amount of heat energy. It also results in spurting of the acid, which can burn your skin. Concentrated sulphuric acid is added to water in small amounts and that too with constant stirring and cooling

14. **Ans :** (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

15. . **Ans :** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

Magnesium chloride present in common salt is deliquescent i.e., it absorbs moisture from the air when kept in open.

16. **Ans :** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

17. Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

18. **Ans :** (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

The metal zinc readily reacts with hydrochloric acid to produce hydrogen gas H_2 and zinc chloride $ZnCl_2$.

19. **Ans :** (a) Both A and R are true and R is the correct explanation of A.

20. Ans : (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

21. **Ans :** (d) Assertion (A) is false but reason (R) is true. pH = 7 , signifies neutral solution.

22. **Ans :** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

23. **Ans :** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

24. **Ans :** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A). Plaster of Paris when mixed with water and applied around the fractured limbs, it sets in to a hard mass and keeps the bone joints in a fixed position. So, it is commonly used for setting fractured bones.

25. **Ans :** (d) Assertion (A) is false but reason (R) is true. HCl (Hydrochloric) is a strong acid.

$HCl \rightleftharpoons H^+ + Cl^-$

It donate proton in water.

ANSWERS- Paragraph Based MCQ's

Paragraph -1

1- ii
2- iii
3- i
4- iii
5- iv

Paragraph -2

1- iv
2- iv
3- ii
4- i
5- i

Paragraph -3

1- iii
2- iv
3- i
4- iii
5- i

Paragraph -4

1- iii
2- iii
3- iv
4- ii
5- iii

Paragraph -5

1- iii
2- i
3- i
4- iii
5- i

CHAPTER 3
Metals and non-metals

1) b: Aluminium
2) c: Copper
3) d: Lead
4) a: Potassium
5) b: Sodium
6) c: Diamond
7) c: Metalloid
8) b: Gold
9) a: lead
10) b: hydrogen
11) a: Na_2O
12) c: Amphoteric
13) c: Steam
14) a: Dullness
15) b: ductility
16) d: Fe
17) a: iodine
18) c : CO
19) b: base
20) d: Br
21) b: graphite
22) b: Mg
23) d: III AND IV
24) b: Ag
25) b: Has low melting point
26) d: $CuSO_4$+ Fe
27) d; B and D

28) b: 12
29) b: 18
30) a: Ca
31) b: Ag_2S
32) a: Mg Al Zn Fe
33) d: $AgNO_3$and Cu
34) b: H_2
35) c: HNO_3
36) b: Si
37) d: B is non-metal and C is metal
38) a : Zn
39) a : electrovalent bond
40) a) electropositive
41) a) green colour turns brown
42) c) Fe_3O_4
43) d) rough and granulated
44) a) $NaAlO_2$
45) b) 1 to 3
46) c) Zn is more reactive than tin
47) c) K
48) b) $MgCl_2$
49) c) Both of above
50) a) Al
51) c) Both of above

Assertion and Reasoning

1. (a): The metals placed at the top of the series are most reactive.
2. (a)
3. (c):Gold is a noble metal.
4. (d): The property of beating a metal into sheets is called malleability.
5. (a)
6. (b): Sulphur and phosphorus are non-metals. Non-metals form either acidic or neutral oxides.
7. (a)
8. (d): MgO exists in solid state.
9. (b): Calcium floats over water because the bubbles of hydrogen gas formed get stick to the surface of the water.
10. (b): Metals at the top of the series are very reactive and therefore, they do not occur free in nature. The metals at the bottom of the series are least reactive and therefore, they normally occur free in nature.
11. (c): Non-metals have a tendency to gain electrons.
12. (a)
13. (a)
14. (a)
15. (b): Metals have a strong tendency to lose electrons and hence they behave as reducing agents.
16. (b): Metals react with oxygen to form metal oxides which are basic in nature.
17. (a)
18. (c): Metals react with dilute HCl and dil. H_2SO_4 Non-metals do not react with dilute acids.
19. (a)
20. (d): Aluminum and zinc oxides are amphoteric in nature.
21. (c) Assertion is correct but Reason is false. HCl produces H^+ ions in aqueous solution because in presence of water, acids give H^+ ions. As H^+ ions cannot exist alone so it combines with water. molecules and form $H_3O^{+.}$

22. (b) Both Assertion and Reason are true but reason is not the correct explanation of assertion.
Sodium hydroxide being an strong base, reacts with active metal (zinc) to produce H_2 gas. The reaction is given as follows:

$Zn\ (s) + 2NaOH\ (aq) \text{----------} \rightarrow Na_2\ ZnO_2\ (aq) + H_2(g)$

23. (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion.
24. (c) Assertion is true but Reason is false. Phenolphthalein is a synthetic indicator.
25. (a) Tooth enamel is calcium phosphate, which gets affected when pH of our mouth falls below 5.5. It happens because the bacteria present in our mouth breakdown sugar and food particles into acids which damage our teeth by corroding them.

ANSWER – KEY

PARAGRAPH – 1
Q-1 a
Q-2 c
Q-3 a
Q-4 d
Q-5 a

PARAGRAPH – 2
Q-1 d
Q-2 b
Q-3 c
Q-4 c
Q-5 a

PARAGRAPH – 3
Q-1 d
Q-2 a
Q-3 c
Q-4 b
Q-5 d

PARAGRAPH – 4
Q-1 b
Q-2 d
Q-3 c
Q-4 b
Q-5 d

PARAGRAPH – 5
Q-1 c
Q-2 c
Q-3 b
Q-4 a
Q-5 c

CHAPTER 6: LIFE PROCESSES
ANSWER KEY MCQs

1 B	11 B	21 A	31 D	41 D
2 C	12 D	22 B	32 D	42 A
3 C	13 D	23 D	33 A	43 B
4 D	14 D	24 A	34 A	44 C
5 C	15 C	25 B	35 C	45 C
6 D	16 B	26 B	36 B	46 C
7 B	17 C	27 B	37 B	47 B
8 A	18 B	28 A	38 B	48 B
9 B	19 D	29 C	39 A	49 D
10 D	20 B	30 A	40 D	50 A

ASSERSION AND REASONING ANSWER KEY

1. c
2. d
3. b
4. a
5. b
6. a
7. c
8. b
9. c
10. b
11. a
12. c
13. a
14. a
15. a
16. d
17. c
18. a
19. c
20. c
21. a
22. a
23. a
24. d
25. d

PARAGRAPH BASED ANSWER KEY

PARAGRAPH 1		**Composition of blood**
1	(d)	WBC
2	(a)	sieve plate cells
3	(c)	haemoglobin
4	(a)	carbon dioxide

5	(b)	platelets
PARAGRAPH 2		**Human digestive system**
1	(d)	small intestine
2	(a)	bile juice
3	(b)	pepsin
4	(d)	mouth—oesophagus—stomach—small intestine—large intestine
5	(b)	mucus
PARAGRAPH 3		**Photosynthesis**
1	(d)	autotrophIc
2	(c)	oxidation of carbon to carbon dioxide
3	(b)	starch
4	(c)	6 CO_2 + 12 H_20 + chlorophyll + sunlight $C_6H_{12}O_6$ + 6 O_2 + 6 H_2O
5	(d)	Photosynthesis
PARAGRAPH 4		**human respiratory system**
1	(c)	rings of cartilage
2	(a)	nostrils—larynx—pharynx—trachea--lungs
3	(b)	alveoli of lungs
4	(a)	high affinity for oxygen
5	(b)	tissue repiration
PARAGRAPH 5		**Heart and blood pressure**
1	(b)	sphygmomanometer
2	(a)	valves in heart
3	(d)	cardiac cycle
4	(a)	120/80 mm Hg
5	(b)	high blood pressure

CHAPTER 10
LIGHT-REFLECTION AND REFRACTION
ANSWER KEY
(Main Points)

1. A
2. C
3. C
4. C
5. C
6. B
7. C
8. C
9. C
10. B

ANSWER KEY MCQs

1. (d) (all the above).
2. (a) (0)
3. (b) 55^o, 55^o
4. (d) can travel through perfect vacuum.
5. (d) (-6cm)
6. (c) convex lens of focal length 5 cm.
7. (a) + 5.0
8. Light waves are refracted by some materials.
9. (c) concave mirror (concave mirror forms a large erect image of tooth)
10. (d) 0 (the focal length of spherical mirror does not depends on the surrounding medium.)
11. (c) (since angle of incidence = 0 degree. According to the first law of reflection, the angle of incidence is equal to the angle of reflection).
12. (b). Virtual, behind the mirror and of the same size as the object.
13. (c). Between focus and pole
14. (c) i, ii and iii
15. (a) more dense than A
16. (a) is less than one
17. (b) very near to the focus of the reflector
18. (b) B
19. (b)Refraction
20. (a) converging lens
21. (d) Fig. D
22. (d) concave mirror, convex mirror, concave lens and convex lens
23. (a) a convex lens has 4 dioptre power having a focal length 0.25 m.
24. (a) a rectangular glass slab.
25. (d) convex mirror always formed virtual and diminished image.
26. (c) -10 cm.
27. (c) when object lies between C and F, the real, inverted and enlarged image is formed beyond C.
28. (d) when light ray travel from rarer to denser medium, its velocity and wavelength both decrease as $v = v\lambda$.
29. (a) a
30. (a) negative
31. (a) both concave
32. (c) beyond 2f
33. (b) bends towards the normal
34. (d) IV
35. (c) distance between object and image = 0.25 + 0.25 = 0.5 m
36. (c) Equal to 2f

37. (c) -50 cm
38. (d) behind the mirror
39. (d) real and inverted
40. (c). Diopter
41. (b). 10cm
42. (b) f = R/2
43. (b) $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$
44. (b) principal axis
45. (b) 100 cm
46. (c) Concave mirror
47. 3 x 10^8 m/s
48. (a) the angle of incidence and reflection are equal.
49. (c) between C and F
50. (b) 2 × 10^8 m/s

ANSWER KEY

ASSERTION AND REASONING

1. A
2. C
3. A
4. A
5. D
6. C
7. D
8. C
9. A
10. C
11. B
12. D
13. D
14. D
15. D
16. A
17. B
18. A
19. A
20. C
21. A
22. A
23. A
24. D
25. B
26. A
27. C
28. C
29. D
30. D

ANSWER KEY
PARAGRAPH BASED QUESTIONS

PARAGRAPH 1

1. (c)0.78m
   Radius of curvature R = 2 m
   As 1/f = 1/v = 1/u and R = 2f
   2/R = 1/v = 1/u
   2/2 = 1/v = 1/-3.5
   1/v = 1 + 1/3.5
   1/v = 4.5/3.5
   V = 3.5/4.5
   V = 0.78 m

2. (a) virtual and erect
3. (d) 0.22
   Magnification m = -v/u = (-0.78 m)/(-3.5 m) = 0.22
4. (b) 1m
   Focal length of mirror f = R/2 = 2/2 = 1m
5. (d) virtual, erect and diminished

PARAGRAPH 2

1. (b) convex lenses
2. (b) the image when passed through the lense was inverted and then it gets reflected on the mirror to be obtained on the screen
3. (a) because concave mirror can give real image
4. (d) f = -6cm
5. (a) positive, negative

PARAGRAPH 3

1. (c) virtual, erect and diminished
2. (b) focus
3. (d) it can never form real and inverted image
4. (a) between F and 2F
5. (d) at infinity

PARAGRAPH 4

1. (c) 60 cm
2. (a) -16cm
3. (d) R = -32 cm
4. (c) m = -4
5. (a) -24cm

PARAGRAPH 5

1. (c) 30 cm
2. (b) f= 15 cm
3. (c) at infinity
4. (b) the nature of the image formed will be virtual, erect and magnified
5. (d)

CHAPTER 11
HUMAN EYE AND COLOURFUL WORLD
ANSWER KEY (MCQs)

1. Answer: (c) Red ray
2.Answer: (b) The material of the prism
3. Answer: (c) Refraction of light
4. Answer: (d) Scattering of light
5. Answer: (ii)
6. Answer: (c) Refraction, dispersion and internal reflection
7. Answer: (b) refraction of light by different layers of varying refractive indices
8. answer: (c) violet and blue lights get scattered more than lights of all other colours by the atmosphere.
9. Answer: (c) All the colours of the white light move with the same speed.
10. Answer: (b) is scattered the least by smoke or fog.
11. Answer: (c) scattering of light
12. Answer: (d) always bends at an angle to the direction of incident ray.
13. answer: (a) towards the normal while entering into the prism and away from the normal while emerging out of the prism
14. Answer: (d) Y, Q and P
15. Answer: (c) dispersion
16. Answer: (a) atmospheric refraction
17.Answer:(d) all
18. (d) light is scattered by the droplets
19. Answer: (a) denser medium
20.Answer: (d)) Rainbow
21.Answer: (a)) Isaac Newton
22. (b) Short wavelength light
23. (b) Tyndall effect
24. (d) violet coloured ray undergoes maximum deviation
25.(c) temperature
26.(a) scattering of light
27)(b) Black
28) (b) Short wavelength light
29)(d) Black
30) b)Total internal reflection
31) (a) Hot air
32) (b)The material of the prism
33 (d) Red, Green, Blue
34. (c) Angle of incidence is greater than the critical angle
35. (c) 2 min.
36. (b) only green colour is reflected
37. (b) it moves away from the normal
38. (d) Twinkling of stars
39.(c) vacuum
40. (b).go straight without any refraction
41.(a) Water droplets scatters all wavelength
42. (d)Tyndall effect
43. (c) Refraction of light
44. (d) red light
45 : (a) A and D
46. (b) X: violet; Y: green; Z: red
47.(a)different refractive index for different wavelength of each colour

48. (d) atmospheric refraction
49. (a)closer planets are not point sources but due to long distance stars appear as point sources
50. (a)water particles

ANSWER KEY
ASSERTION AND REASONING- HUMAN EYE AND COLOURFUL WORLD

1. (a) Both A and R are true and R is the correct explanation of A.

2. (b) Both A and R are true but R is not the correct explanation of A.

3. (a) Both A and R are true and R is the correct explanation of A.

4. (a) Both A and R are true and R is the correct explanation of A.

5. (c) A is true but R is false.

6. (a) Both A and R are true and R is the correct explanation of A.

7. (b) Both A and R are true but R is not the correct explanation of A.

As planets are of larger size than stars and much closer to the earth, planets can be considered as a collection of large number of point sized sources of light. The total variation in the amount of light entering our eye from all these individual point sized sources will average out to zero which nullify the twinkling effect of each other. Therefore, planets do not twinkle.

8. (a) Both A and R are true and R is the correct explanation of A.

9. (a) Both A and R are true and R is the correct explanation of A.

Blue colour of sky is due to scattering of blue colour to the maximum extent by dust particles. Blue colour appears to be coming from the sky. Blue colour has the least wavelength .

10. (c) If Assertion is true, but Reason is false.

Tyndall effect is light scattering by particles in a colloid or particles in a fine suspension. So, a true solution does not show Tyndall effect due to scattering of light and scattering is directly proportional to size of sol particles.

11. **(d)** Assertion is incorrect but Reason is correct

The twinkling of a star is due to refraction of light from the star through the atmosphere of earth. As the conditions of the refracting medium are not stationary, star light has to travel through fluctuating masses of air in motion with changing conditions of temperature, temperature gradients etc. Therefore, the apparent position of the star fluctuates. This gives rise to the twinkling effect of star.

12.(a)) Both A and R are true and R is the correct explanation of A.

We know that the earth's atmosphere breaks sunlight into 7 colours at midday sunlight is white because sunlight travels a shorter distance through the atmosphere and the sunlight does not get scattered so we see sunlight as white light during the midday

13. (c)Assertion is true but reason is false.

The light for which prism has greater refractive index deviates or bends the most. We observe that violet deviates the most, but red deviates the least.

So, the refractive index is greatest for violet and least for red.

14. (a) .Both A and R are true and R is the correct explanation of A

the additional reflection, the colors in the secondary rainbow are reversed in order compared to the primary rainbow. Since some light is lost out of the raindrop with every reflection, the secondary rainbow is much fainter than the primary rainbow.

15. (a) .Both A and R are true and R is the correct explanation of A

Both Assertion and Reason are correct and Reason is the correct explanation of Assertion

Since, $\delta=i+i'-A$

So there exits two angles of incidence, the same magnitude of deviation except minimum deviation (where both i and i' are equal).

16 (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

17. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

18 (c) If assertion is true but reason is false

Rainbow is a phenomenon due to combined effect of dispersion, refraction and reflection of sunlight by spherical water droplets of rain.

19 (b) Both assertion (A) and reason (R) are true but reason (R) is not the correct explanation of assertion (A).

When the light from stars enters earth's atmosphere it goes through the phenomenon known as refraction as the earth's atmosphere has varying temperature and density. ... Hence, the stars twinkle due to the variation of the refractive index of earth's atmosphere.

20(c) Assertion (A) is true but reason (R) is false.

21**:** (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

In vacuum speed of light is independent of wavelength, Hence, no dispersion takes places in vacuum. Thus, vacuum is a non-dispersive medium in which all colours travel with the same speed.

22. (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

The rainbow is formed when light at the inner surface of the water drop gets internally reflected if the angle between the refracted ray and normal to the drop surface is greater than the critical angle.

23(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A).

24.(a) Both Assertion and Reason are correct and Reason is the correct explanation for Assertion

As sunrise and sunset are calculated from the leading and trailing edges of the Sun, and not the center, the duration of a day time is slightly longer than night time (by about 10 minutes, as seen from

temperate latitudes). Further, because the light from the Sun is refracted as it passes through the Earth's atmosphere, the Sun is still visible after it is geometrically below the horizon. Refraction also affects the apparent shape of the Sun when it is very close to the horizon. It makes things appear higher in the sky than they really are. Light from the bottom edge of the Sun's disk is refracted more than light from the top, since refraction increases as the angle of elevation decreases.
The bending of sunlight by the atmosphere causes the sun to rise about two minutes earlier, and set about two minutes later, than it would otherwise.

25.(b) Both Assertion and Reason are correct but Reason is not the correct explanation for Assertion.
After refraction at two parallel faces of a glass slab, a ray of light emerges in a direction parallel to the direction of incidence of white light on the slab. As rays of all colours emerge in the same direction (of incidence of white light), hence there is no dispersion, but only lateral displacement.

ANSWER KEY
PARAGRAPH BASED QUESTIONS

PASSAGE 1
ANS I - (b) Blue.
ANS II - (a) longest distance of atmosphere.
ANS III (c) scattering of light by air molecules
ANS IV - (a) Blue colour scattered and red colour reaches our eye.
ANS V - (c) both (a) and (b)
PASSAGE 2
ANS I - (a) increases.
ANS II -(a) atmospheric refraction.
ANS III - (c) atmospheric refraction
ANS IV -(c) atmospheric refraction
ANS V -(d) yellow
PASSAGE 3
ANS I - (b) sugar solution
ANS II - (d) scattering of light
ANS III - (b) both B and C
ANS IV - (a) Blue, red, white
ANS V - (c) blue colour is scattered more as compared to other colours
PASSAGE 4
ANS I - (d) refraction, dispersion, reflection and refraction of light.
ANS II - (a) blue, green , red
ANS III - (c) A , C and D
ANS IV - (a) the different colours in the white light bend away from the normal line at different angles on entering prism
ANS V - (c) Vacuum
PASSAGE 5
ANS I - (d) Refraction of light and total internal reflection
ANS II - (c) deserts
ANS III (b) both A and D
ANS IV -(a) refractive index in medium is gradually changing
ANS V - (b) it bends towards the normal

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