Name : .....

Std. : ..... Div.: ..... Roll No.: .....

Chemical Symbols

Ionic Symbols

Sr. No.	Subject	Date	Page No.	Remarks

Positive ions (Cations)

Hydrogen - H^+
Sodium - Na^+
Potassium - K^+
Lithium - Li^+
Barium - Ba^{2+}
Magnesium - Mg^{2+}
Calcium - Ca^{2+}
Zinc - Zn^{2+}
Aluminium - Al^{3+}
Lead - Pb^{2+}
Mercury - Hg^+
Iron - Fe^{2+} (ferrous.)
Fe^{3+} (ferric)
Copper - Cu^+ - Cuprous
Cu^{2+} - Cupric
Silver - Ag^+
Gold - Au^+
Ammonium ion - NH_4^+

Ammonia gas - NH_3

Negative ions (Anions)

Hydride - H^-
Chloride - Cl^-
Bromide - Br^-
Iodide - I^-
Oxide - O^{2-}
Hydroxide - OH^-
Phosphate - PO_4^{3-}
Carbonate - CO_3^{2-}
Hydrogen Carbonate or Bicarbonate - HCO_3^-
Sulphide - S^{2-}
Sulphate - SO_4^{2-}
Sulphite - SO_3^{2-}
Nitride - ~~N_3^-~~ N^{3-}
Nitrate - NO_3^-
Nitrite - NO_2^-
Acetate - CH_3COO^-

Chapter - 1.

"Chemical Reactions and Equations"

* **Physical change** :→ Processes in which no new chemical substances are formed.
* **Chemical change** :- Processes in which new substance with different properties are formed.

* **Chemical Reaction** :- The process involving a chemical change is called chemical reaction.

Reactant → Product

Reactant ↓ Substance that undergo chemical change.

Product ↓ new substance formed during the reaction.

ACTIVITY 1.1 Burning of Magnesium ribbon

$$2Mg + O_2 \longrightarrow 2MgO$$

Burns with dazzling white flame. — white powder.

Observation → white powder of MgO is formed.

ACTIVITY 1.2 Addition of lead nitrate solution in Potassium iodide.

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

(yellow ppt.)

Observation :- Yellow ppt. of PbI_2 is formed.

ACTIVITY 1.3 Reaction of Zinc granules with dil. HCl or dil. H_2SO_4

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

observation :- • Bubbles will formed near zinc granules.
• Temperature increases.

* Characteristics of chemical Reactions
or
Identification of chemical Reaction
or
Observations helps us to determine whether the chemical reaction has taken place :-

1. Change in state
2. Change in colour
3. Evolution of a gas
4. Change in temperature.
5. formation of Precipitate.

CHEMICAL EQUATIONS :→ The symbolic representation of a chemical change or reaction is called chemical equation.

There are two ways of representing a chemical reaction.

- In terms of words (word equation)
- In terms of Symbols and formulae. (chemical equation)

Eg. Magnesium + Oxygen → Magnesium Oxide

$Mg + O_2 \rightarrow MgO$

* **Unbalanced chemical equation**:- The equation in which total number of atoms of each element are not same on both reactant and product side. This equation is also known as Skeletal equation.

* **Balanced chemical equation**:- It is an equation in which the total number of atoms of each element are equal on both sides of the equation.

* Balancing of a chemical equation satisfies the "LAW OF CONSERVATION OF MASS"

It states that "mass can neither be created nor be destroyed in a chemical reaction."

* Information that we get from Balanced chemical equation:-

(i) Number of molecules of each of the reactants and products taking part in the reaction.
(ii) Mass - mass relationship.
(iii) Number of moles of each reactant and product taking part in chemical equation.
(iv) Volume - volume relationship in case of gaseous reactions.

* Making a chemical equation more informative :-

(i) Physical states of Reactants and Products :-

Solid - (s)

Liquid - (l)

Gas - (g) (upward ↑)

(Solution in water) Aqueous - (aq.)

(ii) The specific conditions of the reaction like temperature, pressure, catalyst* etc. are written above or below the arrow in the chemical equation.

$$CO_{2(g)} + 2H_{2(g)} \xrightarrow{340\,atm} CH_3OH_{(l)}$$

$$6CO_{2(aq.)} + 12H_2O_{(l)} \xrightarrow[\text{Sunlight}]{\text{Chlorophyll}} C_6H_{12}O_{6(aq.)} + 6O_{2(g)} + 6H_2O_{(l)}$$

Catalyst :- It is a substance that speeds up the chemical reaction, but itself do not undergo any reaction / change.

(iii) Evolution of heat or absorption of Heat can be indicated by writing (+ Heat) Δ.

$$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)} + \text{Heat}$$

INTEXT QUESTION :- Page No - 6

Ans:- It needs to be cleaned with sand paper to remove the protective layer of magnesium oxide on its surface which hinders the process of burning of Mg.

Ans 2. (i) $H_2 + Cl_2 \longrightarrow 2HCl$

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

(iii) $2Na + 2H_2O \longrightarrow 2NaOH + H_2$

Ans 3. (i) $BaCl_{2(aq.)} + Na_2SO_{4(aq.)} \longrightarrow BaSO_{4(s)} + 2NaCl_{(aq.)}$

(ii) $NaOH_{(aq.)} + HCl_{(aq.)} \longrightarrow NaCl_{(aq.)} + H_2O_{(\ell)}$

TYPES OF CHEMICAL REACTIONS :→

1. COMBINATION REACTION :- The reaction in which two or more elements or compounds combine together to form a single product.

ACTIVITY 1.4 $CaO_{(s)} + H_2O_{(\ell)} \longrightarrow Ca(OH)_{2(aq.)} + Heat$

(vigorous reaction) Calcium oxide or quick lime → Calcium hydroxide or Slaked lime

Observation :- Temperature increases.

NOTE :→ Solution of slaked lime is used for white washing.

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

Calcium carbonate (Shiny layer) of marble.

Slaked lime reacts slowly with CO_2 in air and form shiny layer.

* Burning of coal :-

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$

* formation of water from $H_2(g) + O_2(g)$

$2H_2(g) + O_2(g) \longrightarrow 2H_2O(\ell)$

EXOTHERMIC REACTION :- Reactions in which heat is released along with formation of products.

eg. (i) Burning of Natural gas.

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

(ii) Respiration :- oxidation of glucose done to produced energy.

$C_6H_{12}O_6(aq.) + 6O_2(aq.) \longrightarrow 6CO_2(aq.) + 6H_2O + \text{energy}$

(iii) Decomposition of vegetable matter into compost.

2. DECOMPOSITION REACTION :- A reaction in which single reactant breaks down to form two or more products.

ENDOTHERMIC REACTION :- Reactions in which heat is absorbed.

On the basis of the form of energy required for rxn., displacement reactions are of three types :-

- Thermal decomposition (involve the use of heat)
- Electrolysis (involve the use of electricity)
- Photolysis or Photochemical decomposition (involve the use of light)

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Page

(Heat)

(i) Thermal decomposition :- Example

(i) (ACTIVITY 1.5) :- Heating of green crystals of $FeSO_4$.

$FeSO_4 \cdot 7H_2O_{(s)} \xrightarrow{\Delta} FeSO_4 \xrightarrow{\Delta} Fe_2O_{3(s)} + SO_{2(g)} + SO_{3(g)}$

Green crystals → white (lose water) → ferric oxide (Dark Brown) → Smell of burning sulphur.

eg $CuSO_4 \cdot 7H_2O \xrightarrow{\Delta} CuSO_4 \xrightarrow{\Delta} CuO + 2SO_2 + 2SO_3 + O_2$

(Blue) → (Black)

observation :- • Dark brown residue is form.
• Smell of burning Sulphur produced.

(ii) Decomposition of $CaCO_3$

$CaCO_3 \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}$

quick lime (used in the manufacture of cement)

(iii) (ACTIVITY 1.6) Heating of lead nitrate.

$2Pb(NO_3)_{2(s)} \xrightarrow{\Delta} 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$

Lead nitrate (white powder) → Lead oxide (yellow) → Nitrogen dioxide (Brown fumes)

observation :- • Yellow residue of lead oxide is formed
• Brown fumes of NO_2 formed.

(ii) Electrolysis :- (Activity 1.7) electrolysis of water.

$2H_2O_{(l)} \xrightarrow{E.C.} 2H_{2(g)} + O_{2(g)}$

At cathode (Burns with popping sound) — At anode (Supports combustion)

Observation :- • Gaseous bubbles formed near electrodes.
• The volume of H_2 gas formed is double than that of O_2.

(iii) Photolysis/decomposition (Photochemical) :- (ACTIVITY 1.8) Photolysis of AgCl.

$$2AgCl_{(s)} \xrightarrow{\text{Sunlight}} 2Ag_{(s)} + Cl_{2(g)}$$

(white powder) → Grey.

Observation → white powder changes to grey.

$$2AgBr_{(s)} \xrightarrow{\text{Sunlight}} 2Ag_{(s)} + Br_{2(g)}$$

(Pale yellow) → Grey.

* Above reactions are used in black and white Photography.

* Reaction of Barium hydroxide and ammonium chloride is endothermic.

$$Ba(OH)_2 + NH_4Cl \longrightarrow BaCl_2 + NH_4OH$$

INTEXT QUESTIONS Page no. - 10.

Ans1. (i) X - Calcium oxide, formula - CaO.
(ii) $CaO_{(s)} + H_2O \longrightarrow Ca(OH)_{2(aq.)}$

Ans2. The composition of water ie the chemical formula H_2O suggests that the molar ratio of hydrogen and oxygen is 2:1. Therefore, when water is electrically decomposed, the gases

produced in the same molar ratio of 2:1.

3. DISPLACEMENT REACTION :- More reactive metal displaces the lesser reactive metal from its salt solution.

ACTIVITY 1.9 Iron nails dipped in $CuSO_4$ soln.

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

(Blue) (light green) Brown coating on fe.

Observation :→ · Blue colour of $CuSO_4$ fades away.
· Brown coating of Cu formed on fe.

Reactivity series :→

K	– Kedar	↓ Reactivity decreases
Na	– Nath	
Ca	– Ca	
Mg	– Madi	
Al	– Alloo	
Zn	– Zara	
Fe	– Feehar	
Pb	– Pkata	
H	– Hai	
Cu	– Copper	Call
Hg	– Mercury	Me
Ag	– Silver	Something
Au	– Gold	Good.

$$Zn_{(s)} + CuSO_{4(aq.)} \longrightarrow ZnSO_{4(aq.)} + Cu_{(s)}$$

Colourless.

$$Pb_{(s)} + CuCl_{2(aq.)} \longrightarrow PbCl_{2(aq.)} + Cu_{(s)}$$

(Blue-green) Colourless.

$$Cu_{(s)} + 2AgNO_{3(aq.)} \longrightarrow Cu(NO_3)_{2(aq.)} + 2Ag_{(s)}$$

4. DOUBLE DISPLACEMENT REACTION :-

The reactions in which there is an exchange of ions b/w the reactants are called double displacement reaction

Precipitate (ppt) → The insoluble solid substance formed as product is called precipitate.

Precipitation reaction :- Those reactions in which aqueous solutions of two compounds on mixing react to form an insoluble compound which

separates out as a solid (ppt) are called Precipitation reaction.

ACTIVITY 10 :- mixing of solutions of sodium sulphate and Barium chloride.

$Na_2SO_4(aq.) + BaCl_2(aq.) \longrightarrow BaSO_4\downarrow(s) + 2NaCl_{(aq.)}$

Colourless soln. + Colourless soln. → white ppt

Observation :- White ppt. of $BaSO_4$ is formed.

$Pb(NO_3)_2(aq.) + 2KI(aq.) \longrightarrow PbI_2(s)\downarrow + 2KNO_{3(aq.)}$

Colourless soln. + Colourless soln. → yellow ppt of lead iodide

$AgNO_3(aq.) + NaBr(aq.) \longrightarrow AgBr\downarrow(s) + NaNO_{3(aq.)}$

Colourless soln. + Colourless soln. → yellow ppt of silver Bromide

5. Oxidation and Reduction :-

Oxidation :- It is defined as a process which involves
(i) gain of Oxygen
(ii) loss of hydrogen
(iii) loss of electrons.

$2Cu + O_2 \xrightarrow{\Delta} 2CuO$

$4Na + O_2 \longrightarrow 2Na_2O$

$2Mg + O_2 \longrightarrow 2MgO$

Reduction :- It is defined as a process which involves
(i) loss of oxygen
(ii) gain of hydrogen
(iii) gain of electrons.

$2Na + H_2 \longrightarrow 2NaH$

$CuO + H_2 \longrightarrow Cu + H_2O$

Redox Reactions :→ Those reactions in which oxidation and reduction reactions takes place simultaneously are called redox reactions.

ACTIVITY 1.11 :→ Heating of Cu powder.

$2Cu + O_2 \xrightarrow{Heat} 2CuO$

(Black coloured)
Copper oxide.

Observation :- Black coloured coating of copper oxide formed on Cu.

* On passing H_2 gas over CuO, the black coating turns brown (reverse reaction)

Reduction

$CuO + H_2 \xrightarrow{A} Cu + H_2O$

oxidation

Oxidised - H_2

Reduced - CuO

* **Oxidised** → If a substance gains oxygen during a reaction, it is said to be oxidised.
* **Reduced** → If a substance loses oxygen during a reaction, it is said to be reduced.
* **Oxidising agent** → A substance which undergoes reduction and helps in oxidation of other reactant acts as an oxidising agent.
* **Reducing agent** → A substance which undergoes oxidation and helps in reduction of other reactant acts as Reducing agent

$ZnO + C \longrightarrow Zn + CO$

oxidised - C
oxidising agent - ZnO
Reduced - ZnO
Reducing agent - C

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

oxidised - HCl
oxidising agent - MnO_2
Reduced - MnO_2
Reducing agent - HCl

* for more Practice

$SO_2 + 2H_2S \longrightarrow 2H_2O + 3S$

$Fe_2O_3 + 3C \longrightarrow 3Fe + 3CO$

$2PbO + C \longrightarrow 2Pb + CO_2$

$Fe_2O_3 + 3CO \longrightarrow 2Fe + 3CO_2$

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

* Effects of oxidation Reactions in everyday life

1. CORROSION :→

It is the slow eating up of the metals by the action of air and moisture on their surfaces. It is also called weeping of metals

Examples :- (i) formation of oxide layer on the surface of aluminium. (Advantage :- prevents the underneath metal from further damage) Due to this reason, aluminium utensils are used for cooking purposes.)

(ii) Rusting of Iron

$2Fe_{(s)} + 3/2\ O_{2(g)} + xH_2O_{(l)} \longrightarrow Fe_2O_3 \cdot xH_2O_{(s)}$

Hydrated ferric oxide (Rust) (Brown)

(ii) formation of green coating of basic copper carbonate.

$$2Cu_{(s)} + \underbrace{CO_{2(g)} + O_{2(g)} + H_2O_{(e)}}_{\text{from moist air}} \longrightarrow CuCO_3 \cdot Cu(OH)_2$$

Basic copper carbonate (green).

(iv) Tarnishing of Silver articles :-

$$2Ag_{(s)} + H_2S_{(g)} \longrightarrow Ag_2S_{(s)} + H_{2(g)}$$

Hydrogen Sulphide (from air) → Silver Sulphide (Black)

* Gold and Silver do not corrode (Noble metals) Platinum.

* Conditions necessary for rusting :-

(i) Exposed metal surface
(ii) The metal surface must come in contact with air or oxygen.
(iii) The air must contain moisture.

* Methods to prevent corrosion :- (i) By painting
(ii) By greasing and oiling.
(iii) By galvanisation. (is the process of applying a protective zinc coating to steel or iron).
(iv) By coating with nickel or chromium electrolytically.
(v) By forming alloys.

2. RANCIDITY :→ The oxidation of oils or fats in a food resulting into a bad smell and bad taste is called Rancidity

* Methods to prevent Rancidity :-

1. By adding anti-oxidants.
2. Vacuum Packing
3. Flushing the food containers with nitrogen
4. Refrigeration of the food stuff.
5. By storing food in air tight containers.

INTEXT QUESTIONS Page No-13

Ans1 → Being the iron more reactive than that of copper, displaces copper from copper sulphate solution.

$$Fe_{(s)} + CuSO_{4\,(aq.)} \longrightarrow FeSO_{4\,(aq.)} + Cu$$

Blue → (light green)

Ans2. → $Pb(NO_3)_{2\,(aq.)} + 2KI_{(aq.)} \longrightarrow PbI_{2\,(s)}\downarrow + 2KNO_3$

Colourless lead nitrate + Colourless pot. iodide → yellow ppt. lead iodide

Ans3 → (i) oxidised - Na
Reduced - O_2

(ii) oxidised - H_2
Reduced - CuO

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Ans1 → (i) (a) and (b)
Ans2 → (d) displacement reaction.
Ans3 → (a) Hydrogen gas and iron chloride are produced

Ans 4. → When the number of atoms of different elements on reactant and product side are equal, then the chemical equation is called a balanced chemical equation.

It is important to balance a chemical equation to justify the "Law of conservation of mass" which states that mass can neither be created nor be destroyed in a chemical reaction. This law hold true only if the equation is balanced.

Ans 5 → (i) $3H_2(g) + N_2(g) \longrightarrow 2NH_3(g)$

(ii) $2H_2S(g) + 3O_2(g) \longrightarrow 2H_2O(\ell) + 2SO_2(g)$

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

(iv) $2K(s) + 2H_2O(\ell) \longrightarrow 2KOH(aq.) + H_2(g)$

Ans (6) → (i) $2HNO_3 + Ca(OH)_2 \longrightarrow Ca(NO_3)_2 + 2H_2O$

(ii) $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + 2H_2O$

(iii) $NaCl + AgNO_3 \longrightarrow AgCl + NaNO_3$

(iv) $BaCl_2 + H_2SO_4 \longrightarrow BaSO_4 + 2HCl$

Ans 7. → (i) $Ca(OH)_2 + CO_2 \longrightarrow CaCO_3 + H_2O$

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

(iii) $2Al + 3CuCl_2 \longrightarrow 2AlCl_3 + 3Cu$

(iv) $BaCl_2 + K_2SO_4 \longrightarrow BaSO_4 + 2KCl$

Ans 8 → (i) $2KBr_{(aq)} + BaI_{2(aq.)} \longrightarrow 2KI_{(aq.)} + BaBr_{2(s)}$
Double displacement

(ii) $ZnCO_{3(s)} \xrightarrow{\Delta} ZnO_{(s)} + CO_{2(g)}$
Thermal decomposition

(iii) $H_{2(g)} + Cl_{2(g)} \longrightarrow 2HCl_{(g)}$
Combination

(iv) $Mg_{(s)} + 2HCl_{(aq.)} \longrightarrow MgCl_{2(aq.)} + H_{2(g)}$
Displacement

Ans 9 →

Exothermic Reaction	Endothermic Reaction
Reactions in which heat is released along with the formation of products.	These reactions involve the absorption of heat or energy.
$CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq.)} + \Delta$	$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_{2(g)}$

Ans 10 → The food taken by the living beings is ultimately broken down to glucose by the digestive system. Respiration involves the oxidation of glucose to produce energy. Thus it is an exothermic process.

$C_6H_{12}O_{6(aq.)} + 6O_{2(g)} \longrightarrow 6CO_{2(g)} + 6H_2O_{(l)} + \text{energy}$

Glucose

Ans 11 →

Combination reaction	Decomposition reaction
1. The reaction in which two or more reactants combine to form one single product.	1. The reaction in which one single reactant breaks into two or more products.
2. Some combination reactions are exothermic.	2. These are endothermic reactions.
Eg. $C + O_2 \longrightarrow CO_2$	Eg. $2FeSO_{4(s)} \xrightarrow{\Delta} Fe_2O_{3(s)} + SO_2\uparrow + SO_3\uparrow$

From the above discussion we can conclude that these two reactions are opposite to each other.

Ans 12 → (i) Heat → $CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(s)} + CO_2\uparrow$

(ii) Light → $2AgCl_{(s)} \xrightarrow{Light} 2Ag_{(s)} + Cl_2\uparrow$

(iii) Electricity → $2H_2O_{(l)} \xrightarrow{Electricity} 2H_2\uparrow + O_2\uparrow$

Ans 13 →

Displacement reaction	Double displacement reaction
1. In this reaction, more reactive metal displaces lesser reactive metal from its salt soln.	1. The reaction in which exchange of ions take place between two aqueous salt solutions.
Eg. $Fe_{(s)} + CuSO_{4(aq.)} \longrightarrow FeSO_{4(aq.)} + Cu_{(s)}$	Eg. $Na_2SO_{4(aq.)} + BaCl_{2(aq.)} \rightarrow BaSO_{4(s)} + 2NaCl_{(aq.)}$

Ans 14 → Reaction involved is

$2AgNO_{3(aq.)} + Cu_{(s)} \longrightarrow Cu(NO_3)_{2(aq.)} + 2Ag_{(s)}$

Copper nitrate.

Ans15 → The reaction in which insoluble substance (precipitate) is formed is called precipitation reaction.

Eg → $Na_2SO_{4(aq.)} + BaCl_{2(aq.)} \longrightarrow BaSO_{4(s)} + 2NaCl_{(aq.)}$

Ans16 → (i) Oxidation → It is a process in which a substance gains oxygen.

Eg. $4Na + O_2 \longrightarrow 2Na_2O$

$2Mg + O_2 \longrightarrow 2MgO$

(ii) Reduction → It is a process in which a substance loses oxygen.

$CuO + H_2 \longrightarrow Cu + H_2O$

Ans17 → Element 'x' - Copper

Black coloured compound formed - Copper oxide

$2Cu_{(s)} + O_{2(g)} \xrightarrow{Heat} 2CuO_{(s)}$

Ans18 → Paint does not allow oxygen and moisture to come in contact with the surface of iron and so prevent rusting of iron.

Ans19 → In the presence of oxygen of the air, the fats present in the fatty food are oxidised to compounds which have a bad smell ie the food becomes rancid. Flushing with nitrogen cuts off oxygen and protects the food from rancidity.

Ans20 Definition of corrosion and Rancidity.

Ch-2.
ACIDS, BASES AND SALTS

The two main sources of most of the chemical substances are :-

(i) Animals and Plants
(ii) Minerals and rocks

The chemical substances obtained from animals and plants are called **organic compounds**.

Those chemical substances obtained from minerals and rocks are called **inorganic compounds**.

Earliest classification of inorganic compounds was on the basis of their taste.

ACIDS **BASES** **SALTS**

ACIDS :- are the substances which have sour taste.

Acid word derived from latin word 'ACIDUS' → Sour.

Arrhenius definition → are the substances which contain hydrogen and which when dissolved in water give hydrogen ions (H^+) in the solution

Example → Lemon juice, tomatoes, vinegar etc.
HCl, H_2SO_4, HNO_3 etc.

BASES → are the substances which have bitter taste and soapy in touch.

Arrhenius definition :- is a substance which when dissolved in water gives hydroxide (OH^-) ions in the solution.

Example. Washing soda, Baking soda etc.
NaOH, $Ca(OH)_2$ etc.

INDICATORS :- The chemical substances that shows different colour in acidic and Basic medium.

Types of Indicators

Natural

Litmus → Litmus solution is a purple dye, extracted from lichen, belongs to division Thallophyta.
- Red cabbage leaves
- turmeric
- Coloured petals of some flowers such as Hydrangea, Petunia, Geranium

Synthetic

Methyl orange
Phenolphthalein

Olfactory indicators

are substances whose odour changes in acidic or basic media.
example - Onion
clove
Vanilla.

	Red Litmus	Blue Litmus	Turmeric	Methyl orange	Phenolphthalein
Acid	Red	Red	yellow	Red	Colourless
Base	Blue	Blue	Reddish Brown	Yellow	Pink
Neutral	Red	Blue	yellow	Orange	Colourless

INTEXT QUESTION :— Page No – 18.

Ans: Dip the given red litmus paper in each of the three test tubes. The tube in which the red litmus turns blue contains basic solution. Dip the blue litmus paper now in the remaining test tubes. The tube in which blue litmus again changes back into red contains acidic solution. The tube in which neither red litmus turns blue nor blue litmus turns red contains distilled water.

HOW DO ACIDS AND BASES REACT WITH METALS ?

Activity 2.3 → To study the reaction of acids with metals.

Observation → Bubbles are formed in the soap solution indicating that some gas is evolved during the reaction b/w the metal and acid. The gas burns with popping sound showing that gas evolved is hydrogen.

Conclusion → The active metal like zinc displaces hydrogen from all the acids and the remaining part of the acid combines with metal to form corresponding salt.

metal + Acid → salt + H_2

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

$$Mg_{(s)} + H_2SO_{4\,(aq.)} \longrightarrow MgSO_{4\,(aq.)} + H_{2\,(g)}$$

$$HCl_{(aq.)} + Cu_{(s)} \longrightarrow \text{No reaction}$$

(Cu is less reactive than hydrogen)

* Some bases like NaOH and KOH react with active metals like Zn and Al to form salt and liberate H_2.

$$2NaOH + Zn \longrightarrow \underset{\text{Sodium zincate}\ (Na^+\ ZnO_2^{2-})}{Na_2ZnO_2} + H_2$$

$$2NaOH + 2Al + 2H_2O \longrightarrow \underset{\text{Sodium aluminate}\ (Na^+\ AlO_2^-)}{2\,NaAlO_2} + H_2$$

(ii) How do Metal Carbonates and metal Hydrogen Carbonates react with acids?

Activity → To study reaction of metal carbonates and metal hydrogen carbonates with acids.

Observation → It is observed that CO_2 gas is evolved in each case which turns lime water milky.

Conclusion → All metal carbonates and metal hydrogencarbonates react with acids to give a corresponding salt, carbon dioxide and water.

metal carbonate / metal Hydrogencarbonate + Acid → Salt + water + CO_2

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

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

$$ZnCO_{3(s)} + H_2SO_{4(aq.)} \longrightarrow ZnSO_{4(aq.)} + H_2O_{(\ell)} + CO_{2(g)}$$

Test for Presence of CO_2 gas :- CO_2 turns lime water milky

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

Lime water — White ppt. (due to which milkiness appears)

On passing excess CO_2 milkiness disappears :-

$$CaCO_{3(s)} + H_2O_{(\ell)} + CO_{2(g)} \longrightarrow Ca(HCO_3)_{2(aq)}$$

Calciumhydrogencarbonate (Soluble in H_2O, so milkiness disappears)

(iii) How do Acids and Bases react with each other ?

Activity 2.6 → To study the reaction b/w acids and bases ie neutralisation rxn

observation → On adding phenolphthalein to NaOH soln., the colour becomes pink. On adding dilute HCl solution dropwise, finally the pink colour disappears and the solution again becomes colourless. On adding NaOH, pink colour reappears because the medium becomes basic again.

Conclusion → Acid + Base → Salt + H_2O

Neutralisation reaction → The rxn b/w acid and base to form salt and H_2O.

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

$$Mg(OH)_{2(aq.)} + H_2SO_{4(aq.)} \rightarrow MgSO_{4(aq.)} + H_2O_{(\ell)}$$

(iv) Reaction of Metallic oxides with Acids :-

Activity 2.7 → To study the reaction of metal oxides with acids.

observation → It is observed that the colour of the solution becomes blue-green and Copper oxide dissolves. The blue green colour of the solution is due to the

formation of Copper (II) chloride in the solution.

Conclusion → Metal oxide + Acid → Salt + H_2O

$CuO + 2HCl \rightarrow CuCl_2 + H_2O$

Copper (II) oxide — Copper (II) chloride (Blue-green)

This reaction shows that metal oxides are basic in nature as they react with acid to form salt and water.

(v) Reaction of Non-metallic Oxide with Base

$Ca(OH)_{2(aq.)} + CO_{2(g)} \rightarrow CaCO_{3(s)} + H_2O$

This reaction shows that non-metallic oxides are acidic in nature as they react with base to form salt and water.

$NaOH_{(aq.)} + CO_{2(g)} \rightarrow Na_2CO_{3(aq.)} + H_2O$ (e)

$NaOH_{(aq.)} + SO_{3(g)} \rightarrow Na_2SO_{4(aq)} + H_2O$

INTEXT QUESTIONS Page No – 22

Ans1 → Curd and sour substances are acidic in nature. When these acidic substances kept in glass or copper vessels, they react to form toxic compounds and make the food stuff unfit for consumption

Ans 2 → Hydrogen gas is liberated.

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

When we bring burning splinter of matchstick near the soap bubbles, the gas in it burns with popping sound.

Ans 3 → $CaCO_{3(s)} + HCl_{(aq.)} \rightarrow CaCl_{2(aq.)} + H_2O_{(\ell)} + CO_{2(g)}$

What do all acids and all bases Have in Common ?

Activity 2.8 → To study the conduction of electricity by aqueous solutions of acids and bases.

Observation → The bulb is found to glow in case of acids but not in case of glucose and alcohol solutions.

Conclusion → As electric current is carried through the solution by ions, this shows that acids dissociate in the solution to produce $H^+(aq)$ ions but substances like glucose and alcohol do not dissociate to give H^+ ions and hence are not acidic. Thus, H^+ ions are responsible for the acidic properties.

What happens to an Acid or a Base in a water solution?

Activity 2.9 :— To test that dry HCl gas is not acidic but its aqueous solution is acidic.

$$NaCl + H_2SO_4 \rightarrow NaHSO_4 + HCl_{(g)}$$

observation → Dry blue litmus paper does not change colour but wet blue litmus paper changes its colour to Red.

Conclusion → Dry HCl gas is not acidic but HCl solution is acidic. This is because in the presence of water, HCl dissociates to give H^+ ions.

$$HCl_{(g)} + H_2O_{(l)} \rightarrow \underset{\text{hydronium ion}}{H_3O^+ / H^+_{(aq)}} + \underset{\text{chloride ion}}{Cl^-_{(aq)}}$$

Role of guard tube containing Calcium chloride →

to absorb the moisture to dry the gas.

What happens when a base dissolved in H_2O —

$$NaOH_{(s)} \xrightarrow{H_2O} Na^+_{(aq)} + OH^-_{(aq)}$$

$$KOH_{(s)} \xrightarrow{H_2O} K^+_{(aq)} + OH^-_{(aq)}$$

$$Mg(OH)_{2(s)} \xrightarrow{H_2O} Mg^{2+}_{(aq)} + 2OH^-_{(aq)}$$

* Bases which are soluble in H_2O are called alkalis.

Examples — NaOH, KOH, $Ca(OH)_2$

Alkalis are soapy in touch, bitter and corrosive

Dilution :— It is the addition of solvent, which decreases the concentration of solute in the solution.

→ dilution of an acid or a base is highly exothermic

→ Always add acid to water with constant stirring.

→ If water is added to a concentrated acid, the heat generated may cause the mixture to splash out and cause burns.
— the glass container may also break.

* Mixing an acid or base with water results in decrease in concentration of ions (H_3O^+ / OH^-) per unit volume.

Intext Questions Page No-25

Ans → Done in activity 2.8

Ans2 → An acid in the aqueous solution ionizes to produce $H^+_{(aq)}$ ions and the corresponding negative ions. Due to presence of ions in the solution, it conducts electricity.

Ans3 → Dry HCl gas does not ionize to produce $H^+_{(aq)}$ ions. Hence, it does not show acidic properties. and therefore does not change the colour of the dry litmus paper.

Ans4 → Done in dilution.

Ans5 → On dilution of an acid solution, the concentration of H_3O^+ per unit volume increases.

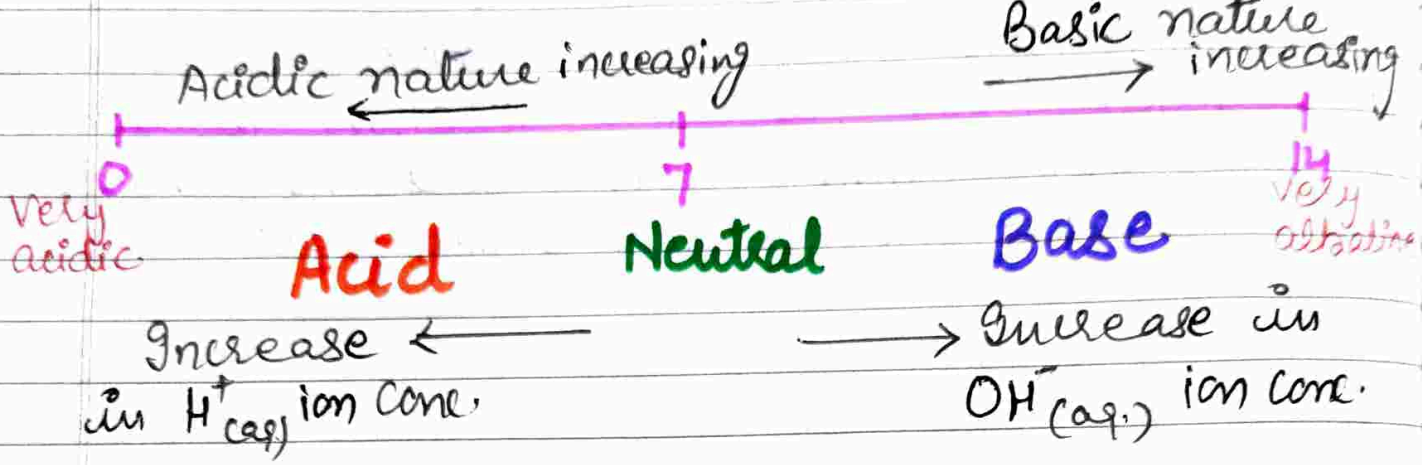
Ans6 → On dissolving excess base in a solution of NaOH, concentration of OH^- ions per unit volume in the solution increases.

HOW STRONG ARE ACID OR BASE SOLUTIONS ?

pH → In German 'p' stands for potenz. meaning power.

pH scale → Scale used for measuring hydrogen ion concentration.

Universal Indicator :- It is a mixture of several indicators, that shows different colours at different concentrations of hydrogen ion in a solution.



pH of some Common Substances :-

Gastric juic	-	about 1.2
Lemon juic	-	about 2.2
Pure blood	-	7.4
water	-	7.4
($Mg(OH)_2$) Milk of magnesia	-	10
NaOH solution	-	about 14

Strong acid	Weak acid
- Acids that get dissociate completely in solutions	- Acids that do not get dissociate completely in solutions. (Partially dissociate)
- Large no. of ions are produced.	- small (less) no. of ions are produced
- Eg HCl, HNO_3, H_2SO_4	Eg CH_3COOH, H_3PO_4, H_2CO_3, acetic acid, citric acid, Lactic acid.

Strong Base	Weak Base
– Bases that get dissociate completely in solutions.	– Bases that do not get dissociate completely or partially dissociate in solutions.
– Large no of ions are produced.	– Less no. of ions are produced.
– eg – NaOH, KOH, $Ca(OH)_2$, $Ba(OH)_2$	eg NH_4OH, $Zn(OH)_2$, $Mg(OH)_2$

Importance of pH in Everyday life :-

① Are plants and animals pH sensitive :-

* Human body works within pH range – 7.0 to 7.8

* When pH of rain water is less than 5.6 it is called acid rain.

Effect of acid rain → rain flows into the rivers, and lowers the pH of river water. That affects life of aquatic plants and animals.

② What is the pH of the soil in your backyard ?

Plants require a specific pH range for their healthy growth.

(3) pH in Digestive System :- HCl produced in stomach maintains pH.

Acidity :- During indigestion the stomach produces too much acid, that situation is called acidity.

Effect of acidity → Causes pain and irritation.

Remedy → use of antacids. (mild bases used against acidity)

eg → Baking Soda, $Mg(OH)_2$ milk of magnesia.

(4) pH change as the cause of Tooth Decay :→

* Tooth decay starts when the pH of the mouth is lower than 5.5.

* Cause of lowering pH → Bacteria present in the mouth produce acids by degradation of sugar and food particles remaining in the mouth after eating food.

* Effect of lowered pH → The acid produced corrode the tooth enamel (hardest substance of body) made up of Calcium hydroxyapatite (a crystalline form of Calcium phosphate)

* Remedy → (i) clean the mouth after eating food.
(ii) Using basic toothpaste.

⑤ Self defence by animals and plants through chemical warfare :-

Bee sting leaves — Methanoic acid
Remedy — Baking soda

Stinging hair of nettle leaves inject — Methanoic acid or formic acid ($HCOOH$)
Remedy — Dock plant leaves

* Some naturally occuring acids :-

Natural source	acid
Vinegar	Acetic acid
Orange	Citric acid
Tamarind	Tartaric acid
Tomato	Oxalic acid
Sour milk (curd)	Lactic acid
Lemon	Citric acid.

INTEXT QUESTIONS Page No - 28

Ans1 → 'A' solution has more hydrogen ion conc.
Solution A is acidic
Solution B is Basic

Ans2 → More of H^+(aq.) ions concentration, more acidic is the solution.
Less of H^+(aq.) ions concentration, less acidic is the solution.

Ans3 → Basic solutions also have H^+ ions in addition to OH^- ions. They are basic because in these solutions, more of OH^- ions are there as compared to H^+ ions.

Ans4 → As quic lime, or slaked lime or chalk are alkaline substances. and these are used by farmer when the soil is highly acidic.

MORE ABOUT SALTS :-

Salts are formed by the following processes when -

(i) Acid + Base → salt + H_2O

(ii) Acid + metal → salt + H_2

(iii) Base + metal → salt + H_2

(iv) Acid + metal carbonate / metal Bicarbonate → salt + CO_2 + H_2O

(v) metal oxides + Acids → Salt + H_2O

(vi) non-metallic oxides + Base → salt + H_2O

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

Na^+ — Positive ion, Cation (from Base)

Cl^- — Negative ion, anion (from acid)

Family of salts :— On the basis of Cations, Salts are of following types :—

Sodium Salts → $NaCl$, Na_2SO_4, $NaNO_3$
Potassium Salts → KCl, K_2SO_4, KNO_3
Calcium Salts → $CaCl_2$, $CaSO_4$, $Ca(NO_3)_2$
Magnesium Salts → $MgCl_2$, $MgSO_4$, $Mg(NO_3)_2$
Copper Salts → $CuCl_2$, $CuSO_4$, $Cu(NO_3)_2$
Zinc Salts → $ZnCl_2$, $ZnSO_4$, $Zn(NO_3)_2$
Aluminium Salts → $AlCl_3$, $Al_2(SO_4)_3$, $Al(NO_3)_3$

On the basis of Anions, salts are following types.

Sulphate Salts → Na_2SO_4, K_2SO_4, $CaSO_4$
Chloride Salts → $NaCl$, KCl, $CaCl_2$
Nitrate salts → $NaNO_3$, KNO_3, $Ca(NO_3)_2$
Carbonate Salts → Na_2CO_3, K_2CO_3, $CaCO_3$
acetate salts → CH_3COONa, CH_3COOK
Hydrogencarbonate salts → $NaHCO_3$, $KHCO_3$, $Ca(HCO_3)_2$

Types of Salts

Neutral Salts

Salt formed by Strong Acid and Strong Base or weak acid and weak Base

pH = 7

Acidic Salt

Salt formed by strong acid and weak Base

pH < 7

Basic salt

Salt formed by weak acid and strong base

pH > 7

Salt	Acid	Base
K_2SO_4 (N.S.)	H_2SO_4 (S.A.)	KOH (S.B.)
Na_2SO_4 (N.S.)	H_2SO_4 (S.A.)	NaOH (S.B.)
$CaSO_4$ (N.S.)	H_2SO_4 (S.A.)	$Ca(OH)_2$ (S.B.)
$MgSO_4$ (A.S.)	H_2SO_4 (S.A.)	$Mg(OH)_2$ (W.B.)
$CuSO_4$ (A.S.)	H_2SO_4 (S.A.)	$Cu(OH)_2$ (W.B.)
NaCl (N.S.)	HCl (S.A.)	NaOH (S.B.)
$NaNO_3$ (N.S.)	HNO_3 (S.A.)	NaOH (S.B.)
Na_2CO_3 (B.S.)	H_2CO_3 (W.A.)	NaOH (S.B.)
NH_4Cl (A.S.)	HCl (S.A.)	NH_4OH (W.B.)

Common Salt (NaCl) :- NaCl is obtained from sea water.

* Deposits of solid salts are found in several parts of the earth called Rock salt.

These large crystals are often brown due to impurities.

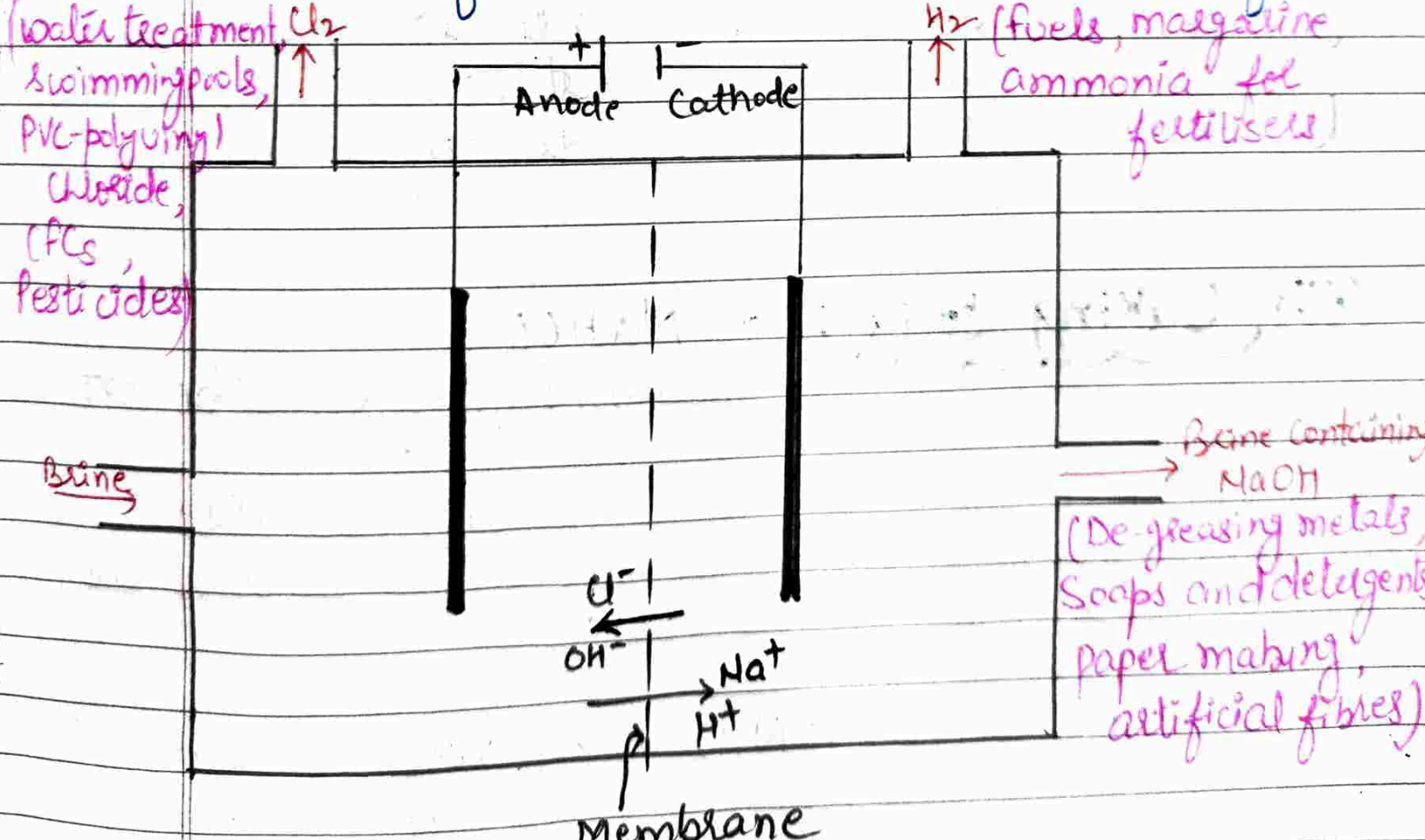
Chemicals from Common Salt:-

(i) NaOH :- Caustic soda or Sodium hydroxide

$$2NaCl_{(aq.)} + 2H_2O_{(l)} \xrightarrow{\text{Electricity}} 2NaOH_{(aq.)} + Cl_{2(g)} + H_{2(g)}$$

- $2NaCl_{(aq.)} + 2H_2O_{(l)}$: Aqueous solution of NaCl is called Brine.
- $2NaOH_{(aq.)}$: near cathode
- $Cl_{2(g)}$: anode
- $H_{2(g)}$: cathode

* Name of process is → Chlor-Alkali process.
Because of products formed chlor for chlorine and alkali for NaOH



(ii) Bleaching powder :- $CaOCl_2$
Calcium Oxychloride

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

Dry slaked lime — Chlorine gas passed.

* When exposed to air, it gives smell of Cl_2

$$CaOCl_2 + CO_2 \longrightarrow CaCO_3 + Cl_2$$

Uses :— (i) for bleaching cotton and Linen in the textile industry, for bleaching wood pulp in paper factories and for bleaching washed clothes in laundry.
(ii) It is used as an oxidising agent in many chemical industries.
(iii) It is used to make drinking water free from germs.

(iii) Baking Soda :— $NaHCO_3$
Sodium hydrogen carbonate
or
Sodium Bicarbonate.

→ Used in Kitchen for making crispy pakoras etc. and for faster cooking.

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

Ammonia — Baking Soda — Ammonium Chloride

This process of formation of Baking Soda is known as Solvay process or ammonia-soda process.

On heating :-

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

(Sodium carbonate)

Uses :- (i) for making Baking powder (mixture of Baking soda and mild base such as Tartaric acid $C_4H_6O_6$.

on heating or dissolving in water →

$$\underbrace{NaHCO_3 + H^+}_{\text{Baking powder.}} \xrightarrow{\Delta} CO_2 + H_2O + \text{Sodium salt of acid.}$$

↓

make bread or cake soft and spongy.

(ii) It is also an ingredients in antacids. Being alkaline, it neutralises the excess acid in the stomach and provides relief.

$$NaHCO_3 + HCl \longrightarrow NaCl + H_2O + CO_2$$

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

$$NaHCO_3 + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O + CO_2$$

↓ extinguish fire.

(iv) Washing Soda :- $Na_2CO_3 \cdot 10H_2O$

Sodium carbonate decahydrate

On recrystallisation of Na_2CO_3 formed on heating baking soda, we obtain Washing soda.

$$Na_2CO_3 + 10H_2O \longrightarrow \underbrace{Na_2CO_3 \cdot 10H_2O}_{\text{Washing Soda.}} \text{ (Basic salt)}$$

Anhydrous Na_2CO_3 is called Soda ash.

Uses :- (i) It is used in glass, soap and paper industries.
(ii) It is used in manufacture of sodium compounds such as borax.
(iii) It is used as an cleaning agent for domestic purposes.
(iv) It is used for removing permanent hardness of water.

Activity :- To test the presence of water of crystallisation in copper sulphate crystals.

Observation :- Blue coloured copper sulphate crystals on heating leave behind white anhydrous copper sulphate and water droplets are seen in the upper cooler parts of the boiling tube. On adding 2-3 drops of water to the white residue, blue colour reappears.

Conclusion → Crystals of copper sulphate has water that loses on heating.

Efflorescence :- loss of water when salts exposed to air.

$$Na_2CO_3 \cdot 10H_2O \xrightarrow{\text{In air}} Na_2CO_3 \cdot H_2O + 9H_2O$$

Crystals. Powder.

* **Water of crystallisation** :- It is the fixed number of water molecules present in one formula unit of salt.

Examples →

$CuSO_4 \cdot 5H_2O$ (Blue vitriol) – Copper sulphate pentahydrate
$FeSO_4 \cdot 7H_2O$ (Green vitriol) – Ferrous sulphate heptahydrate
$CaSO_4 \cdot 2H_2O$ (Gypsum) – Calcium sulphate dihydrate
$CaSO_4 \cdot \frac{1}{2}H_2O$ (Plaster of Paris) – Calcium sulphate hemihydrate

(v) Plaster of Paris :-

On heating gypsum at 373K., we get POP.

$$CaSO_4 \cdot 2H_2O \xrightarrow{373\,K} \underbrace{CaSO_4 \cdot \frac{1}{2}H_2O}_{POP} + 1\frac{1}{2}H_2O$$

Calcium sulphate hemihydrate.

* If gypsum is heated above 373 K, then half molecule of water will be lost, and the salt formed loses the property to set again on mixing with water. That salt is called dead plaster.

* On adding water in POP, it becomes hard. and forming gypsum.

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

* In POP, actually one molecule of water is shared by two molecules of $CaSO_4$.

Uses → (i) It is used for making toys, Statues, decorative materials.
(ii) It is used for making surfaces smooth.
(iii) It is used for setting fractured bones.
(iv) It is used for making designs on ceilings.

INTEXT QUESTIONS :- Page No. 33.

Ans1 → Bleaching powder.

Ans2 → Dry slaked lime (Calcium hydroxide)

Ans3 → Washing soda.

Ans4 → $2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$

Ans5 → $CaSO_4 \cdot \frac{1}{2}H_2O + 1\frac{1}{2}H_2O \longrightarrow CaSO_4 \cdot 2H_2O$

BACK EXERCISE Page No - 34.

Ans1 → (a) 10

Ans2 → (b) HCl

Ans3 → (d) 16 ml

Ans4 → (c) Antacid.

Ans5 → (a) $H_2SO_{4(aq.)} + Zn_{(s)} \rightarrow ZnSO_{4(aq.)} + H_{2(g)}$

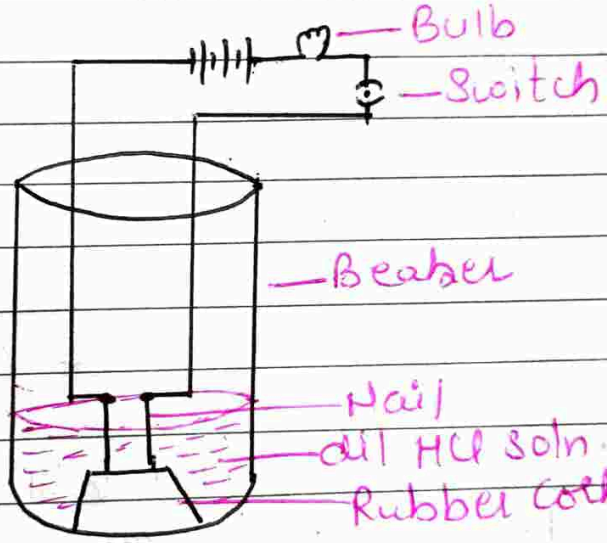
(b) $2HCl_{(aq.)} + Mg_{(s)} \rightarrow MgCl_{2(aq.)} + H_{2(g)}$

(c) $3H_2SO_{4(aq.)} + 2Al_{(s)} \rightarrow Al_2(SO_4)_{3(aq.)} + 3H_{2(g)}$

(d) $2HCl_{(aq.)} + Fe_{(s)} \rightarrow FeCl_{2(aq.)} + H_{2(g)}$

Ans6 → Alcohols and glucose contain hydrogen but are not categorised as acids because they do no ionise in the solution to produce $H^+_{(aq.)}$ ions and hence can't conduct electricity.

Activity →



Observation :→ (i) The bulb glows when dil. HCl was added to beaker.

(ii) The bulb did not glow when alcohol and glucose solution was added to the beaker.

Conclusion :- (i) Alcohol and glucose cannot form ions in solution and hence can't conduct electricity.

(ii) Dil. HCl solution forms $(aq.)$ H^+ ions and hence can conduct electricity suggesting

that electric current is carried through the solution by ions formed by them.

Ans7 → Distilled water does not contain any ions and have no electrolytes. Hence, it does not conduct electricity. But rain acids are there that get ionised and conduct electricity.

Ans8 → Ions are produced only in aqueous medium and presence $H^+_{(aq.)}$ ions are responsible for the acidic properties.

Ans9 →
(a) D pH-7
(b) C pH-11
(c) B pH-1
(d) A pH-4
(e) E pH-9

Increasing order - C, D, E, A, B.

Ans10 → More vigorous fizzing will occur in test tube A containing HCl. This is because HCl is stronger acid than acetic acid and dissociate completely. Whereas acetic acid dissociate partially.

Ans11 → When milk changes into curd, pH will decrease due to the formation of lactic acid.

Ans12 → (a) Fresh milk is acidic and it turns sour easily to become more acidic. In presence of baking soda, milk becomes alkaline and does not turn sour easily. Or curdles easily.

(b) When milk is set to curd, the presence of alkali does not allow it to become acidic easily. Hence, this milk take a longer time to set as a curd.

Ans13→ Because when it comes in contact with water, it sets into a hard solid mass called gypsum.

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

To prevent this, POP must be stored in moisture proof containers.

Ans14→ The reaction b/w an acid and base to form salt and water is called neutralisation rxn.

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

$HNO_{3(aq.)} + KOH_{(aq.)} \longrightarrow KNO_{3(aq.)} + H_2O_{(l)}$

Ans15. Already done.
Uses of Washing Soda
Baking Soda.

Ch-3
METALS AND NON-METALS

Matter (made up of particles) (Anything that has mass and occupy space)

- **Pure substance** (made up of same kind of particles)
  - **Element** (pure substance made up of same kind of atoms) In nature 118 elements are there
    eg Ag, Au, Zn, Cu, U, C etc.
    - **Metals** (Those elements which form positive ions by losing electrons) eg Cu, Fe, Al, Na etc
    - **Non-metals** (Those elements which form negative ions by gaining electrons) eg C, U, F, Ne etc
    - **Metalloids** (Elements that show some properties of metals as well as non-metals) eg B, Si, Ge, As, Te, Po
  - **Compound** (Pure substance made up of atoms of two or more different elements combined in fixed ratio)
    eg H_2O, CO_2, HCl, $C_6H_{12}O_6$ etc.
- **Mixture** (made up of one or two diff. kinds of particles in any ratio.
  - Homogeneous
  - Heterogeneous

Allotropes :- are different form of an element, that are having different physical properties, but have same chemical properties.

eg Allotropic form of C
- Diamond
- Graphite
- fullerenes.

Physical properties of Metals and Non-Metals

Physical Property	Metals	Non-metals
1. Physical state	Metals are solids Except - Mercury (Hg) liquid at room temp.	Non-metals may be solids, liquids or gases at room temp. C, S, P, I → Solid Br → Liquid H, O, N, Cl → gases.
2. Melting and Boiling points	Have generally High melting and Boiling points. eg M.pt of Fe - 1536°C B.pt of Fe - 3000°C Except → Gallium and Caesium M.pt of Ga = 29.76°C " " Cs = 28.7°C	Generally low melting and Boiling points. eg Melting point of S = 119°C Except → Diamond and graphite (form of C) M.pt of diamond = 3723°C

Physical Property	Metals	Non-metals
3. Lustre (Shining surface)	Metals are lustrous	Non-metals are non-lustrous Except → Iodine
4. Hardness	Metals are generally hard Except → Li, Na, K (Soft metals) Can be cut with knife	Soft and brittle Except → Diamond (hardest substance)
5. Malleability (Property due to which metals can be beaten into thin sheets)	Malleable Gold and Silver are highly malleable Gold is most malleable	Non-malleable
6. Ductility (Property due to which metals can be drawn into wires)	Ductile Gold is the most ductile metals. 2 Km long wire can be drawn from only 1 gm of Au.	Non-Ductile
7. Conductivity (ability of a material to transfer heat energy or electrical current from one point to another)	Metals are good conductors of heat [Ag + Cu] → Best conductor	Poor conductors of heat

Physical Property	Metals	Non-metals
1. Conductivity Thermal conductivity Electrical Conductivity	(Pb and Hg) Poor conductors of heat Metals are good conductors of electricity. Ag → Best conductor Hg → Poor conductor	Poor conductors of heat Poor conductors of electricity Except → (Graphite (form of C)) used in making electrodes
2. Density	High density (atoms are closely packed) Except → Li, Na, K. Low densities	Low densities (atoms are not closely packed)
3. Sonorosity When a piece of metal is struck with something hard, a ringing sound is produced. This property is known as sonorosity.	Sonorous	Non-sonorous
4. Tensile strength It is property due to which a substance can bear a lot of stain without breaking	High tensile strength	Low tensile strength

chemical properties of metals and non-metals :-

(i) Reaction of Metals with oxygen :-

Metal + Oxygen → Metal oxide

(i) Reaction of K and Na

$4Na + O_2 \rightarrow 2Na_2O$

$4K + O_2 \rightarrow 2K_2O$

Vigorously these metals react with air even at room temp and catches fire. That is why they are always kept under kerosene.

(ii) Reaction of Mg

$2Mg + O_2 \rightarrow 2MgO$

(Burns with dazzling white flame) (white powder)

(iii) Reaction of Al (slow reaction)

$4Al + 3O_2 \rightarrow 2Al_2O_3$

Aluminium oxide (Protective coating)

(iv) Reaction of Fe

does not burn in air even on strong heating but begins to glow with bright light.

Iron filings burn vigorously when sprinkled in the flame of burner.

(v) Reaction of Cu (does not burn in air)

$2Cu + O_2 \longrightarrow 2CuO$

Copper (II) oxide
or
Cupric oxide (Black coating)

(vi) Ag, Au, Pt → do not react with O_2

* Characteristic properties of metal oxides :-

(i) **Basic / Amphoteric oxides** :- Most of the metal oxides are basic in nature ie they dissolve in H_2O to give and alkaline solution or they react with acids to form salt + water.

eg $Na_2O_{(s)} + H_2O_{(l)} \longrightarrow 2NaOH_{(aq.)}$

Amphoteric oxides :- are those metal oxides that react with acids as well as bases to form salt and water.

eg → Al_2O_3 and ZnO

$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$
(Base)

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$
(acid) (Sodium aluminate)

$ZnO + 2HCl \rightarrow ZnCl_2 + H_2O$
(Base)

$ZnO + NaOH \rightarrow Na_2ZnO_2 + H_2O$
(acid) (Sodium zincate)

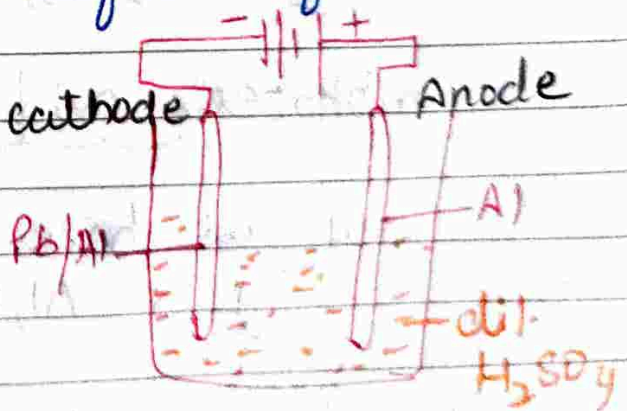
(ii) Solubility in water :— Most of metals oxides are insoluble in water. However, some metal oxides dissolve in water to form alkali.

Eg Na_2O, K_2O

$Na_2O_{(s)} + H_2O(\ell) \rightarrow 2NaOH(aq.)$

$K_2O(s) + H_2O(\ell) \rightarrow 2KOH(aq.)$

Anodising :— is the process of coating a thick layer of aluminium oxide on the surface of aluminium articles.



— Oxygen gas evolved at anode reacts with Al to make a thicker protective oxide layer.

— This oxide layer can be dyed easily to give beautiful looks to the Article.

Reaction of non-metals with Oxygen :-

Non-metal + O_2 → Non-metal oxide

(i) **Acidic oxides :-** non-metallic oxides which dissolve in water to form acids are called acidic oxides. or react with base to form salt and H_2O

(a) When C burns in excess of air :-

$C_{(s)} + O_{2(g)} \rightarrow CO_2$ (acidic oxide)

CO_2 dissolves in water to form acidic oxides which turns blue litmus red.

$CO_{2(g)} + H_2O_{(e)} \rightarrow H_2CO_{3(aq.)}$

Carbonic acid.

(b) When sulphur is burnt in air :-

$S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$

Sulphur dioxide

SO_2 dissolves in water to form sulphurous acid.

$SO_{2(g)} + H_2O_{(e)} \rightarrow H_2SO_{3(aq.)}$

sulphurous acid.

(c) N is burnt in air :-

$N_{(s)} + O_{2(g)} \rightarrow NO_{2(g)}$

Nitrogen dioxide

NO_2 dissolves in water form nitric acid.

$NO_2 + H_2O \rightarrow HNO_3$

(nitric acid)

(ii) Neutral oxides :— Those non-metal oxides which neither react with acids nor with bases.
eg - CO, H_2O, nitric oxide (NO), nitrous oxide (N_2O)

(ii) Reaction of metals with H_2O :—

$$\text{Metal} + H_2O \rightarrow \underset{\text{oxide}}{\text{Metal}} + H_2$$

Metal oxides soluble in H_2O, dissolve in it and form metal hydroxide.

$$\text{Metal oxide} + H_2O \rightarrow \text{Metal Hydroxide}$$

(i) Reaction of K and Na (violently react with cold H_2O)

$$2K + 2H_2O \rightarrow 2KOH + \underset{\text{Catches fire.}}{H_2} + \Delta \text{ (exothermic)}$$

$$2Na + 2H_2O \rightarrow 2NaOH + \underset{\text{catches fire}}{H_2} + \Delta \text{ (exothermic)}$$

(ii) Reaction of Ca with cold water

$$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$$

Hydrogen bubbles stick to Ca surface, so Ca starts floating in water.

(iii) Reaction of Mg with Hot water

$$Mg + 2H_2O \longrightarrow Mg(OH)_2 + H_2$$

Magnesium starts floating in water as gaseous bubbles stick to the surface of Metal.

(iv) Reaction of Al, Zn, Fe with steam.

$$2\,Al + 3H_2O \xrightarrow{\text{steam}} Al_2O_3 + 3H_2$$

$$Zn + H_2O \longrightarrow ZnO + H_2$$

$$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$$

$(Fe_2O_3 + FeO)$

(Iron (II, III) oxide)

(v) Pb, Cu, Ag, Au do not react with H_2O

* Non-metals do not react with H_2O

(iii) Reaction of metals with acids :-

Metal + acid → Salt + H_2

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

$$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$$

* Hydrogen gas is not evolved when a metal reacts with nitric acid!-
  - Because HNO_3 is a strong oxidising agent.
  - It oxides H_2 produced to H_2O
  - itself gets reduced to any of the nitrogen oxides (N_2O, NO, NO_2)

Mg and Mn reacts with very dilute HNO_3 and to evolve H_2 gas.

* Cu, Ag, Au, Pt do not react with acids.

* Non-metals do not react with acids.

Aqua Regia :- (Royal water)

It is a freshly prepared mixture of conc. HCl and conc. HNO_3 in the ratio 3:1

- It can dissolve gold and platinum.
- It is highly corrosive and fuming liquid.

(iv) Reaction of metals with other metal salt solutions :—

Displacement Reaction :— The reaction in which highly reactive metal displaces lesser reactive metal from its salt solution.

$$Fe + CuSO_4 \longrightarrow Cu + FeSO_4$$

(Blue Soln.) (Light green Soln.)

Reactivity Series :— List of metals arranged in the order of their decreasing activities.

* Series done in ch-1.

* How do metals and non-metals React ?

- Metals lose $\bar{e}$s and form positive ion
- Non-metals gain $\bar{e}$s and form negative ion.

Ionic Bond / Electrovalent Bond :— The bonds formed by transfer of $\bar{e}$s from a metal to a non-metal are called ionic bonds.

Ionic Compounds / Electrovalent Compounds :—

The compounds formed by transfer of $\bar{e}$s from a metal to a non-metal.

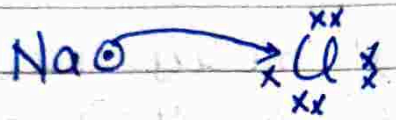
(i) formation of Sodium chloride :-

$Na = 11$ (2, 8, 1)

$Na \longrightarrow \bar{e} + Na^+$ (2, 8) Sodium cation

$Cl = 17$ (2, 8, 7)

$Cl + \bar{e} \longrightarrow Cl^-$ (2, 8, 8) chloride anion



$(Na^+)[:\ddot{Cl}:^-] = NaCl$

(ii) formation of magnesium chloride :-

$Mg = 12$ (2, 8, 2)

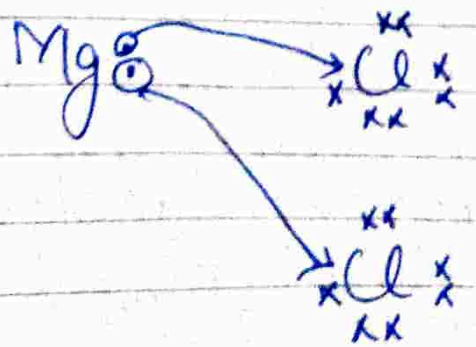
$Mg \longrightarrow Mg^{2+} + 2\bar{e}$

(2, 8) (magnesium cation)

$Cl = 17$ (2, 8, 7)

$Cl + \bar{e} \longrightarrow Cl^-$ chloride anion

(2, 8, 8)



$(Mg^{2+})[:\ddot{Cl}:^{-}]_2$

$MgCl_2$

(iii) **formation of Aluminium oxide :—**

Al = 13 (2,8,3)

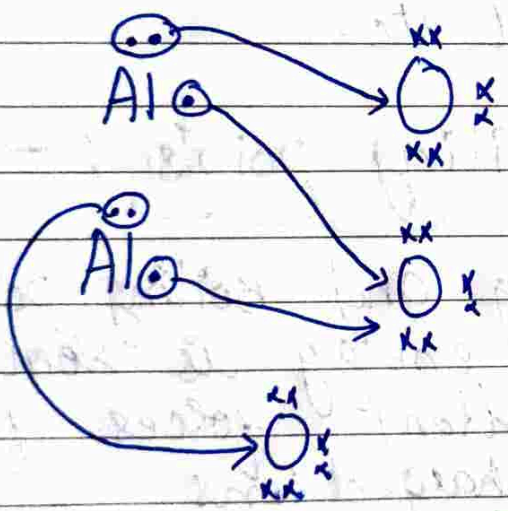
$Al \longrightarrow Al^{3+} + 3\bar{e}$

(2,8) aluminium cation

O = 8 (2,6)

$O + 2\bar{e} \longrightarrow O^{2-}$ oxide anion

(2,8)



$(Al^{3+})[:\ddot{O}:^{2-}]_3$

Al_2O_3

Home work :→ Show the formation of following compounds by transfer of $\bar{e}$s

1. Magnesium oxide
2. Sodium oxide
3. Aluminium chloride
4. Potassium oxide
5. Potassium chloride
6. Calcium oxide
7. Calcium chloride
8. Lithium chloride
9. Beryllium oxide
10. Beryllium chloride

Properties of ionic Compounds :—

(i) **Physical state** :— Ionic compounds are solids and are some what hard.
- due to strong forces of attractions b/w oppositely charged ions.
- They are brittle and breaks into pieces on applying force

(ii) **Solubility** :— Ionic compounds are generally soluble in water and insoluble in solvents such as kerosene, petrol etc.

(iii) **Melting and Boiling points** :—
- Have high melting and Boiling points.
- a large amount of energy is required to break the strong forces of attractions b/w oppositely charged ions.

(iv) **Conduction of electricity** :— . Ionic or electrovalent compounds are good conductors of electricity, either in molten form or in their aqueous solutions.
. A solution of ionic compound in water contain ions, which move to the oppositely charged electrodes when electricity is passed through it.

- In molten form, the electrostatic forces of attraction between oppositely charged ions are overcome due to heat.
  Due to this, ions are free to move and conduct electricity.
- In solid form, do not conduct electricity because movement of ions in the solid state is not possible due to their rigid structure.

INTEXT QUESTIONS Page No - 40

Ans 1 → (i) Hg
(ii) Li, Na, K
(iii) Silver
(iv) Lead.

Ans 2 → Already done meaning of malleable and ductile

INTEXT QUESTIONS Page No-46

Ans 1 → Sodium is a very reactive metal. It vigorously react with oxygen and water and catches fire. Therefore to protect it from accidental fires, sodium is kept immersed in kerosene oil.

Ans2 → Already done

Ans3 → (i) B is the most active metal as it displaces iron from its salt solution.
(ii) B will displace Cu from $CuSO_4$ solution because B is more reactive than Cu
(iii) B > A > C > D

Ans4 → Hydrogen gas is produced when dilute hydrochloric acid is added to a reactive metal.

$$Fe_{(s)} + H_2SO_{4(aq.)} \longrightarrow FeSO_{4(aq.)} + H_{2(g)}$$

Ans5 → Zinc being more reactive than iron displaces iron from iron(II) sulphate solution. Thus, the green colour of the solution fades and iron metal get deposited on Zn.

$$Zn_{(s)} + \underset{\text{(Green)}}{FeSO_{4(aq.)}} \longrightarrow \underset{\text{(Colourless)}}{ZnSO_{4(aq.)}} + Fe_{(s)}$$

INTEXT QUESTIONS Page No - 49

Ans1 → (i) (i) Na = 11 (2,8,1) Na·

(ii) O = 8 (2,6) ·ö:

(iii) Mg = 12 (2,8,2) Mg

(ii) & (iii) Already done.

Ans 2 → Already done.

BACK EXERCISE :- Page No-56

Ans 1 → (d) $AgNO_3$ solution and Copper metal

Ans 3 → (a) Calcium

Ans 4 → (c) Zinc is more reactive than tin.

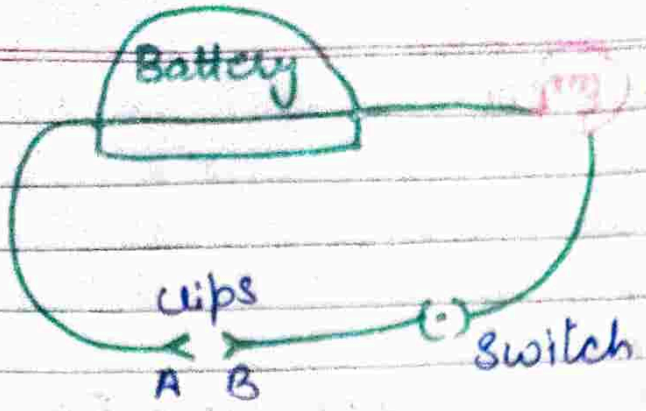
Ans 5 → (i) (a) Take the given sample of metals and non-metals and strike them with the hammer. If it converts into a sheet, it is metal and if not, it is non-metal. Metals are malleable, non-metals are non-malleable.

(b) If it produces sound when struck with the hammer, it is a metal. But it it does not produce a sound, it is a non-metals.

(c) If the sample breaks, this means that it is brittle and hence it is non metal.

(d) Now arranging the given objects to form an electric circuit.

Insert any one sample between clips A and B. If the bulb glows, it is a metal, If the bulb does not glows, it is a non-metal.



(ii) From the above tests, it is clear that metals are generally hard, malleable, sonorous and good conductor of electricity. While non-metals are generally non-malleable, brittle, non-sonorous and poor conductors of electricity.

Ans6 → Already done amphoteric oxides.

Ans7 → Zinc and Mg displace Hydrogen from acids. Cu and Ag do not displace.

Ans9 → (a) (i) No change in colour.
(ii) moist litmus papers will change its colour.

(b) $S_{(s)} + O_{2(g)} \rightarrow SO_{2(g)}$

$SO_{2(g)} + H_2O_{(l)} \rightarrow H_2SO_{3(aq.)}$
Sulphurous acid.

Ans11 → Non-metals react with oxygen to form oxides which are acidic in nature. Non-metals also form neutral oxides with Oxygen.

Ans12 → (a) These metals are highly malleable, lustrous, and least reactive. So they are not corroded by air and water easily.

(b) Already done

(c) A thin layer of aluminium oxide formed on the surface of aluminium prevents it from corrosion. Thus, aluminium vessels do not react with any ingredient of food and are suitable for cooking.

Ans14 → Property	Metals	Non-metals
(i) Nature of ions	Metals lose $\bar{e}$s and form positive ions.	Non-metals gain $\bar{e}$s and form negative ions.
(ii) Nature of oxides	Metal oxides are basic in nature.	Non-metal oxides are acidic and neural in nature.
(iii) Reaction with water / steam	Metals liberate H_2 gas on reacting with water / steam	Non-metals generally do not react with water.
(iv) Reaction with dilute acids	Active metals react with dil. acids to yield H_2 gas and salts	Non-metals do not react with acids.

Ans 15 → The man used aqua-regia, a mixture of conc. HCl and conc HNO_3 in the ratio 3:1. This is the only solution, that can dissolve gold. As the gold from bangles was dissolved in aqua-regia, their weight was reduced drastically.

Ch-4
Carbon and its compounds

→ Carbon is a non-metal.
→ The name Carbon is derived from the Latin word → 'Carbo' which means coal.
→ The earth crust has only 0.02% carbon present in the form of minerals (like carbonates, hydrogen-carbonates, coal and petroleum).
→ The atmosphere has 0.03% of CO_2.
→ Fuels (like wood, kerosene, coal, LPG, CNG, Petrol etc) clothing material (like cotton, nylon, polyester), paper, rubber, plastics, leather, drugs and dyes are all made up of carbon.

COVALENT BONDING IN CARBON COMPOUNDS :-

Atomic no. of C = 6
K L
2, 4

There are 4 electrons in its outermost shell and its octet can be completed by the following two ways :-

(i) It could gain 4 electrons and form C^{4-} anion. But for a nucleus having 6 protons, it would be difficult to hold on 10 electrons ie. 4 extra electrons.
Moreover the repulsion b/w electrons will increase that make the anion unstable.

(ii) It could lose 4 electrons and form C^{4+} cation But a large amount of energy is required to remove 4 electrons leaving behind a carbon cation with 6 protons in its nucleus holding on just two electrons, which is not possible.

Therefore, in order to overcome this problem, carbon shares it valence electrons with other atoms of carbon or with atoms of other elements.

Covalent Bonding :-

A chemical bond formed between two atoms by mutual sharing of valence es b/w two atoms so that each atom acquires the stable electronic configuration of the nearest noble gas.

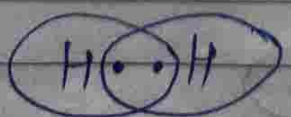
Covalency :- The no of electrons shared b/w two atoms to complete their octet is known as covalency.

Covalent Compounds :-

Compounds formed by sharing of electrons are called covalent compounds.

(i) **formation of Hydrogen molecule :-**

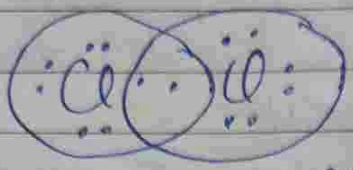
H = 1
K = 1



H-H H_2 molecule

(ii) formation of chlorine molecule :-

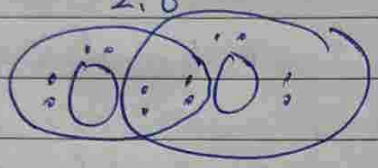
Cl = 17 K L M
2, 8, 7



Cl-Cl or Cl_2

(iii) formation of oxygen molecule :-

O = 8 K L
2, 6

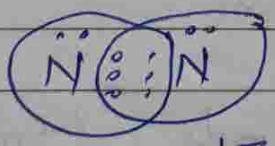


O=O or O_2

↑ double Bonding.

(iv) formation of nitrogen molecule :-

N = 7
K, L
2 5



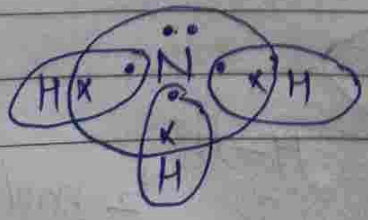
N≡N or N_2

↑ Triple Bonding

(v) formation of ammonia :-

N = 7 K L
2, 5

H = 1 K
1

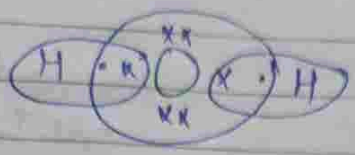


or NH_3

(vi) formation of water molecule :-

H = 1
K
1

O = 8
K L
2, 6

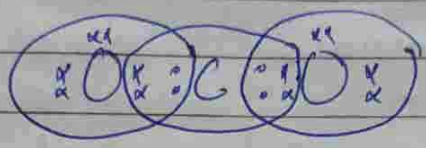


H-O-H or H_2O

(vii) formation of Carbon dioxide :-

C = 6
K L
2, 4

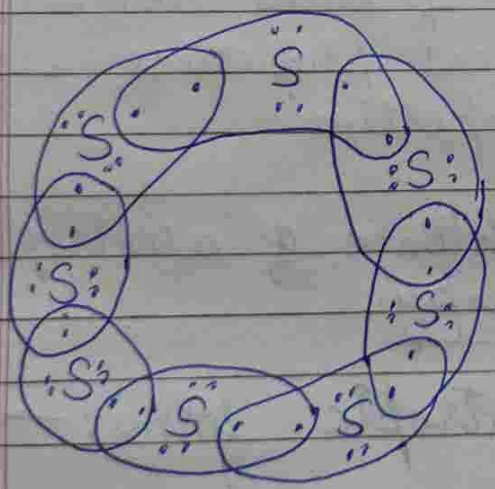
O = 8
K, L
2, 6



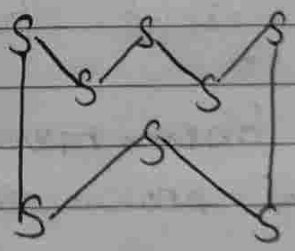
O=C=O or CO_2

(viii) formation of Sulphur molecule :- (S_8)

S = 16
K L M
2, 8, 6



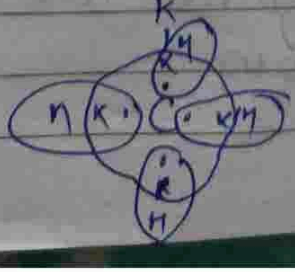
Crown shaped (S_8) molecule

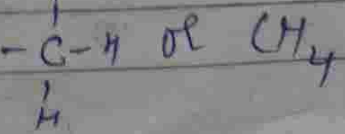


(ix) formation of methane (CH_4) :-

C = 6
K 2
2, 4

H = 1
K





Difference b/w ionic and covalent compounds

Ionic Compounds	Covalent compounds
(i) formed by transfer of es.	(i) formed by sharing of electrons.
(ii) generally solid	(ii) may be solid, liquid or gas
(iii) High melting and boiling points.	(iii) Low melting and boiling points.
(iv) Soluble in water Insoluble in organic solvents.	(iv) Insoluble in water and soluble in organic solvents.
(v) Conduct electricity in molten or solution form.	(v) do not contain ions so do not conduct electricity.

Allotropes :-

Different forms of same element having same chemical properties, but different physical properties.

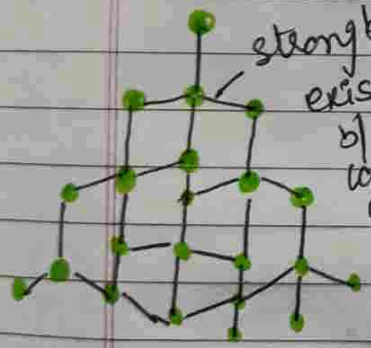
* The phenomenon of existence of allotropes is known as allotropy.

* Carbon has three allotropic forms :-
  (i) Diamond
  (ii) Graphite
  (iii) fullerenes.
  — All these forms are purest forms of carbon.

* The physical properties of these three allotropes of carbon are different due to different arrangement of carbon atoms in them.

Diamond (extremely hard)

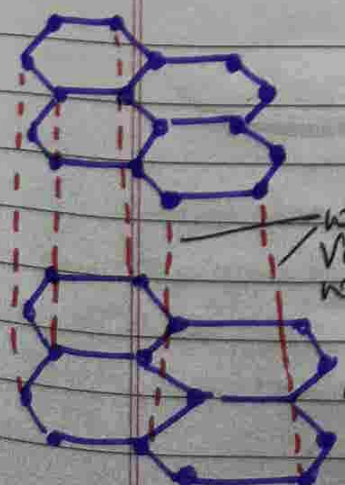
- Occur in nature (South Africa, Zaire, Australia, Russia)
- Synthetic diamond formed by subjecting pure carbon to very high pressure and temp.
- In this each carbon atom is bonded to four other carbon atoms forming a rigid 3-d str.



Diamond

Graphite (Soft)

- greyish black substance
- Occur in nature (China, South Korea, Russia, India).
- In this each carbon atom is bonded to three other carbon atoms in the same plane giving a hexagonal array.
- fourth electron of each carbon is utilised in forming double bond and is responsible for Conduction of electricity.
- The various layers of carbon atoms are held together by weak Vander waal's forces. So these can slide over one another and therefore, graphite is slippery to touch.



Graphite

Fullerenes (neither very hard nor very soft)

- Spherical in shape.
- contain even no. of carbon atoms ranging from 60-350 or above.
- C_{60} is the most stable fullerene and first to be identified.
- looks like dome shaped halls designed by US architect Buckminster Fuller, that's why called Buckminster fullerenes. or fullerenes.

Difference b/w diamond and graphite.

Diamond	graphite
(i) It has a three-dimensional network structure.	(i) Graphite has a two dimensional sheet like structure consisting of a no. of hexagonal rings fused togethers.
(ii) Hardest natural substance.	(ii) Soft and greasy and is used as solid lubricant for heavy machines.
(iii) Bad conductor of electricity.	(iii) good conductor of electricity thats why used for making electrodes of battery.
(iv) It is transparent substance with high refractive index thats why used for making gemstones and jewellery.	(iv) It is an opaque greyish black substance.

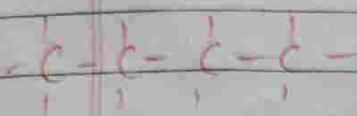
Intext questions Page no. 61

Ans1 → Already done

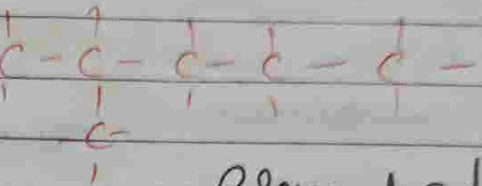
Ans2 → Already done.

Versatile nature of Carbon :-

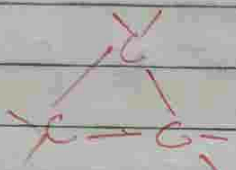
(i) **Catenation** :- Self linking property of carbon atoms through covalent bonds to form long straight or branched chains and rings of different sizes is called catenation.



long chains.



Branched chains.



rings.

(ii) **Tetra covalency** :- Carbon has valency four. So it is capable of bonding or pairing with four other carbon atoms or with atoms of some other monovalent elements like hydrogen, halogen, chlorine, Bromine etc

(iii) **Tendency to form multiple bonds** :- Due to small size, carbon also forms multiple bonds with other carbon atoms, oxygen, sulphur and nitrogen. This multiplicity of carbon-carbon, carbon-oxygen and carbon-nitrogen bonds further increases the number of carbon compounds.

Q Compounds formed by carbon are exceptionally stable. Why ?

Because carbon forms strong bonds due to its small size. This enables the nucleus to hold on to the shared pair of electrons strongly.

Organic Compounds :- Compounds isolated directly or indirectly from living organisms such as plants and animals.

organic chemistry :- Branch of chemistry deals with the study of these compounds called organic chemistry.

Inorganic Compounds :- Compounds isolated from non-living sources such as rocks and minerals.

Inorganic chemistry :- Branch of chemistry deals with study of these compounds.

Vital force theory :-

Proposed by Berzelius.

Acc to this theory, organic compounds are produced only under the influence of some mysterious force existing in the living organisms. This mysterious force was called the Vital force.

So organic compounds do not synthesize in the laboratory.

Wohler's Synthesis :-

In 1828, Friedrich Wohler prepared organic compound urea from ammonium cyanate (NH_4CNO)

Urea = $H_2N-\overset{\overset{O}{\|}}{C}-NH_2$

Modern definition of organic compounds :-

Compounds of carbon containing usually hydrogen and one and more other elements such as oxygen, nitrogen, sulphur, halogen, phosphorus etc. are called organic compounds.

* Oxides of carbon, Carbonates, Bicarbonates, cyanides etc. are not organic compounds.

Hydrocarbons :-

organic compounds of carbon and Hydrogen are called Hydrocarbons.

Saturated (less reactive)

Compounds of carbon which have only single covalent bonds b/w the carbon atoms.

$>C-C<$ (Alkanes)

Unsaturated (more reactive)

Compounds of carbon which contain one or more double or triple bonds b/w carbon atoms.

$>C=C<$ (Alkenes)

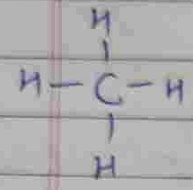
$-C\equiv C-$ (Alkynes)

Alkanes

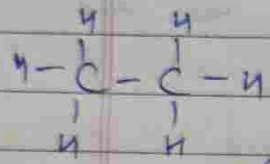
General formula -

C_nH_{2n+2}

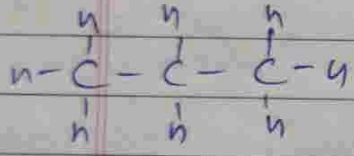
Suffix - -ane



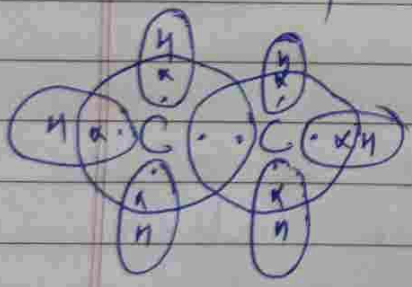
CH_4
methane



C_2H_6
Ethane



C_3H_8
Propane

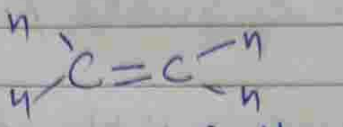


Ethane

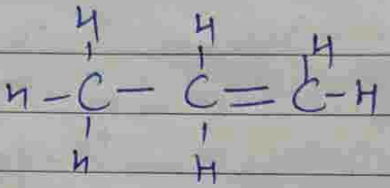
Alkenes

C_nH_{2n}

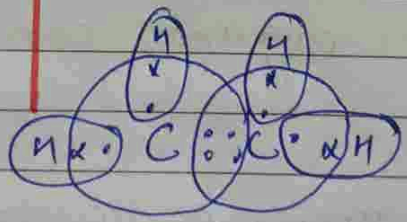
-ene



C_2H_4
Ethene



Propene

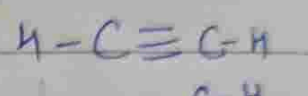


Ethene

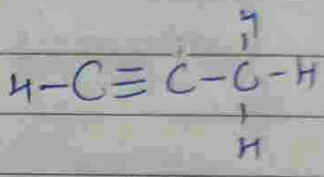
Alkynes

C_nH_{2n-2}

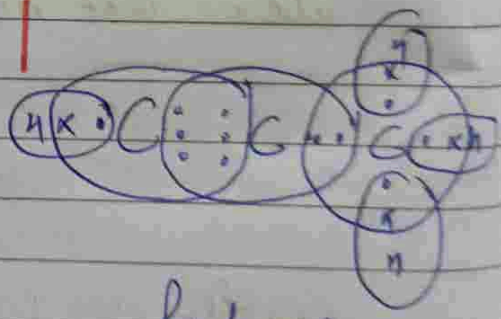
-yne



C_2H_2
Ethyne



C_3H_4
Propyne



Propyne

Word root (Based on no. of C atoms)

1 - Meth	6 - Hex
2 - Eth	7 - Hept
3 - Prop	8 - Oct
4 - But	9 - Non
5 - Pent	10 - Dec

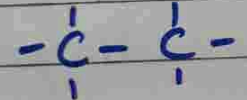
Chains, Branches and Rings:- Carbon can form long chains, Branches and cyclic structures.

Isomers:- Compound having same molecular formula but different structures are called Isomers or structural isomers.

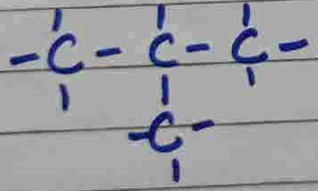
Phenomenon of exhibiting isomers is called **isomerism**.

* Propane has longest chain of 3 carbons only, so it can not show isomerism.

Isomers of Butane:- C_4H_{10}

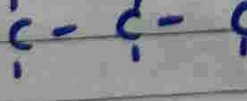


n-butane

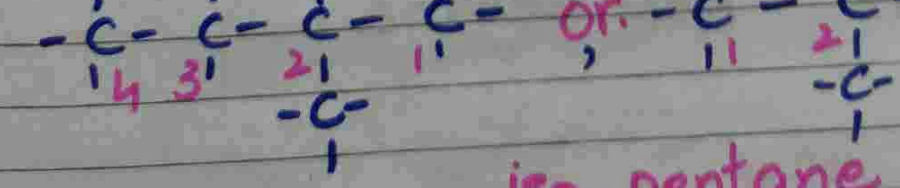


iso-butane

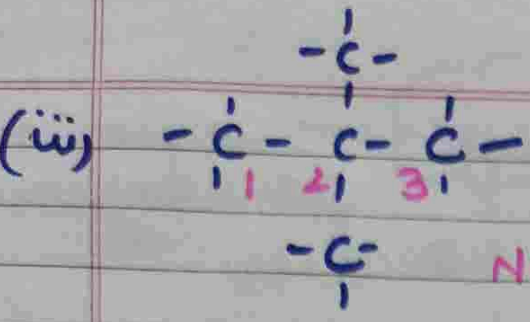
Isomers of Pentane:- C_5H_{12}

(i) 

n-pentane

(ii) 

iso-pentane

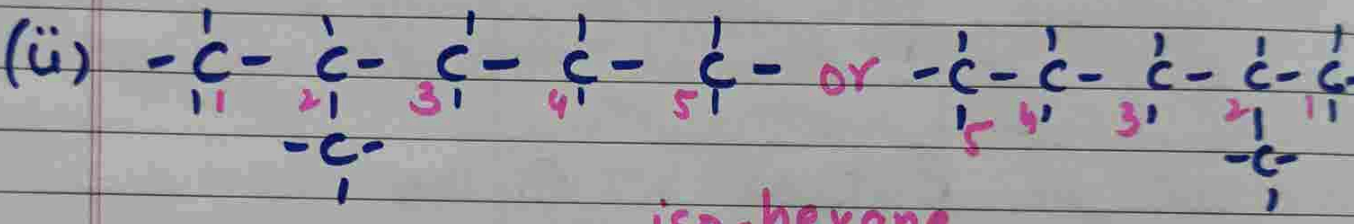
(iii) 

Neo-pentane

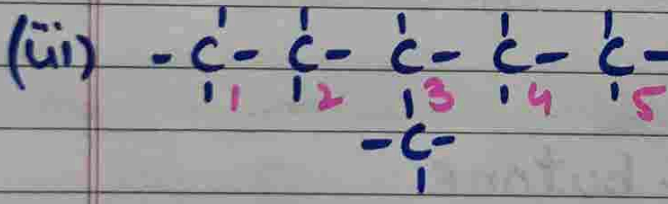
Isomers of Hexane C_6H_{14}.

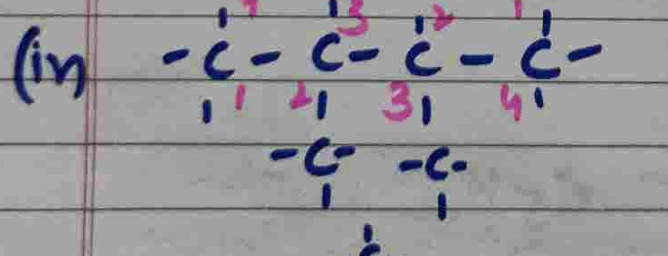
(i) 

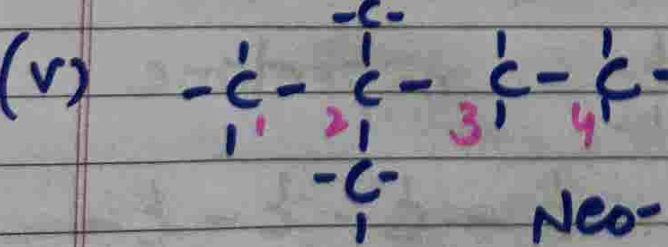
n-hexane

(ii) 

iso-hexane

(iii) 

(iv) 

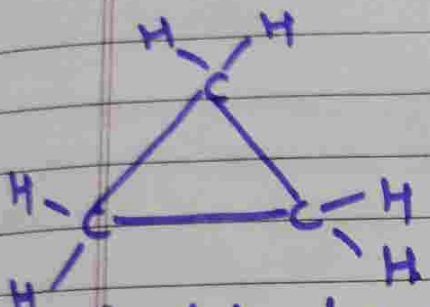
(v) 

Neo-hexane

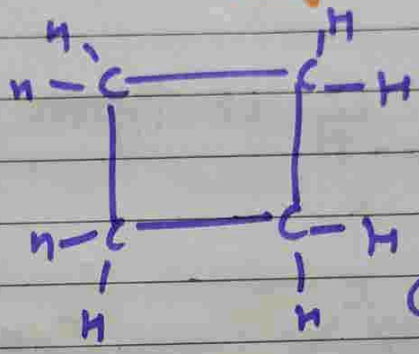
Cyclic compounds :— Compounds of carbon in which atoms of carbon are arranged in a ring are called cyclic compounds.

(i) Saturated Cyclic Carbon compounds :—

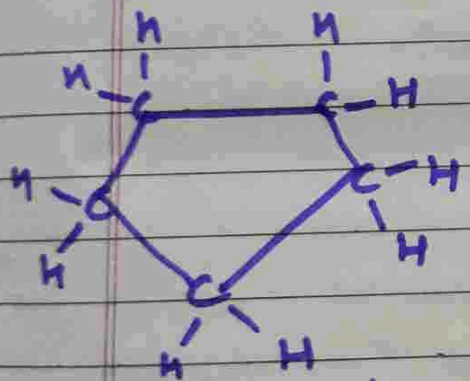
Cycloalkanes : C_nH_{2n}



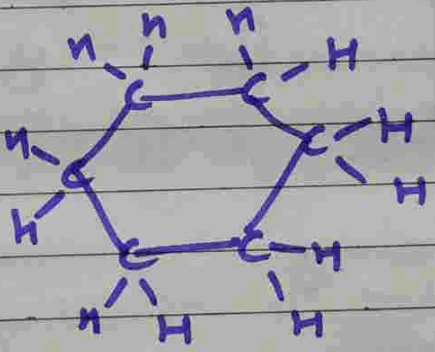
Cyclopropane
C_3H_6



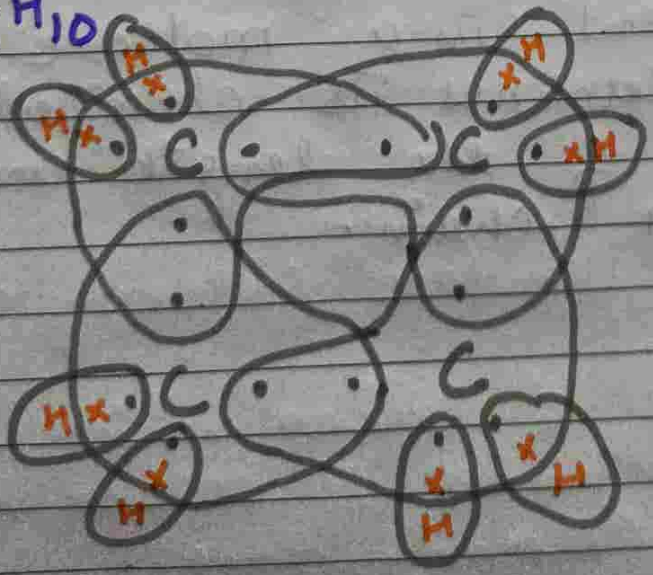
Cyclobutane
C_4H_8



Cyclopentane
C_5H_{10}



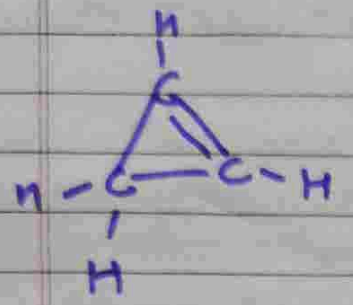
Cyclohexane
C_6H_{12}



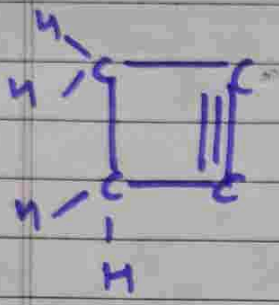
Electron dot str. of cyclobutane

(ii) Unsaturated Cyclic compounds :-

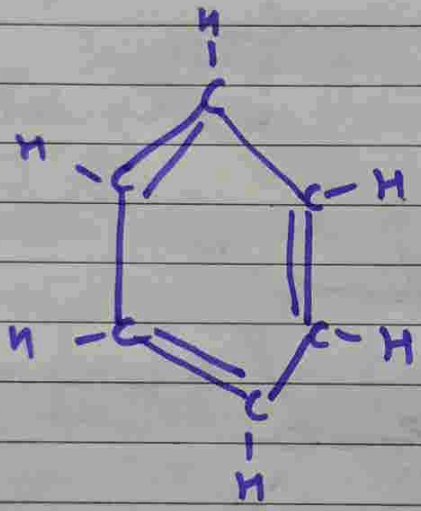
- Cycloalkenes
- Cycloalkynes.



Cyclopropene



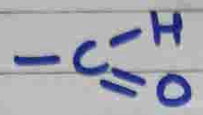
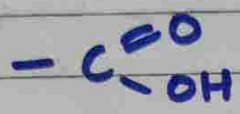
Cyclobotyne



C_6H_6.

Benzene

functional group :- may be defined as an atom or group of atoms present in a molecule which largely determines its chemical properties regardless of the length and nature of carbon chain.

functional group	formula	Position in C-chain
Halo → chloro / Bromo	-Cl / -Br	anywhere in chain
Alcohol	-OH	anywhere
Aldehyde		Terminal
Carboxylic acid		Terminal
Ketone		(B/w two catoms)

Homologous Series :— may be defined as a family of organic compounds having the same functional group. Similar chemical properties and successive members of which differs by CH_2 unit and mass of 14u.

— The individual members of homologous series are called homologue. and the phenomenon is called homology.

Characteristics :— (i) All the members of a homologous series can be represented by a general formula.

(ii) The molecular formula of any two successive members of a homologous series differ by unit CH_2

CH_4 C_2H_6 C_3H_8 C_4H_{10} C_5H_{12}

(CH_2 between each pair)

(iii) The molecular masses of any two successive members of a homologous series differ by 14u.

(iv) All the members of a given homologous series have the same functional group.

(v) All the members of a homologous series show similar chemical properties.

(vi) The members of a homologous series show a gradation (gradual change) in physical properties as the molecular mass increases.
(melting and boiling points increases as molecular mass increases)

Intext questions Page No- 68

Ans1 → Isomers of pentane (already done)

Ans2 → Properties of carbon which lead to huge number of carbon compounds. (Already done)

Ans3 → electron dot structure of cyclopentane. (done)

Back exercise Page No- 77.

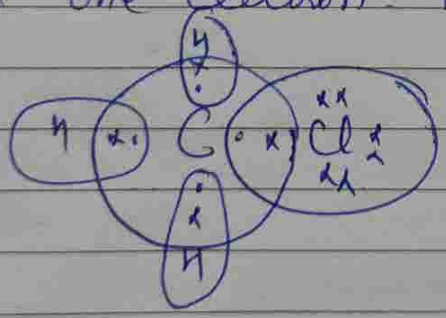
Ans1 → (b) 7 covalent bonds.

Ans4 → Atomic no of C = 6
2, 4

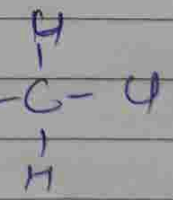
Atomic no. of H = 1
K
1

Atomic no. of Cl = 17
2, 8, 7

Since Carbon needs 4 electrons to complete its octet, hydrogen needs one electron to complete its duplet and chlorine needs one electron to complete its octet, therefore Carbon shares its four electrons, one electron with each three hydrogen, and one electron with the chlorine atom.

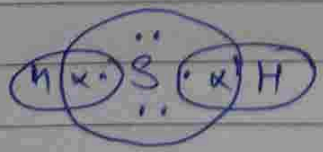


or



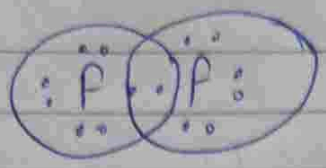
Ans5 → (b) H_2S

H = 1 , S = 16
2, 8, 6



H–S–H.

(d) F_2 $F = \begin{matrix} 9 \\ 2,7 \end{matrix}$



F–F.

Ans 6 → Already done.

Ans 9 → Carbon burns in oxygen (air) to form carbon dioxide and water. During this reaction, a large amount of heat and light is released. Further once ignited, carbon and its compounds keep on burning without the requirement of additional energy. Hence they are used as fuels.

$$C + O_2 \longrightarrow CO_2 + \text{Heat} + \text{Light}.$$

Ch-8
HOW DO ORGANISMS REPRODUCE?

Reproduction:- may be defined as the production of new generation of individuals of the same species.

OR

the process of production of young ones of their own kind.

Species :- The group of individuals that can interbreed under natural conditions to produce fertile offsprings.

fertile - able to make babies or able to reproduce
Sterile - not able to make babies or not able to Reproduce.

Significance of Reproduction :-

(i) It is important for continuation of life on earth.
(ii) for addition of new species (evolution)
(iii) Replacement of dead organisms.
(iv) Transfer of variations from one generation to another.
(v) to increase in number of same species.

* The basic event in Reproduction is creation of DNA Copy and additional cellular apparatus by the cell involved in this process.

Basic Event in Reproduction

- Creation of DNA Copy (replication)
  - ↓
  - Division of nucleus. (KaryoKinesis ~~Karyokinesis~~)
- Division of cytoplasm (cytoKinesis)

Fundamentals of Reproduction:-

1. DNA is a blueprint of basic body design.
2. It is present in the nucleus in condensed form called chromosomes.
3. With the help of biochemical reaction cell makes the copy of DNA (Replication)
4. DNA is the source of making specific proteins and that particular protein influence the body design.

- DNA (Blueprint of Body design) ⟶ Makes specific Proteins ⟶ Body design
- Alteration in DNA (Due to errors in DNA Copying) ⟶ Change in protein ⟶ Change in Body design (Variations)

Variation :- is the differences between individuals within a species.

Importance / Advantage / Significance of variation.

1. It leads to evolution.
2. It helps the organism to survive in different habitat.

Niche :- well-defined place occupied by population of organisms in an ecosystem.

INTEXT QUESTIONS :- Page No- 128

Ans1 :→ 1. It is responsible for transmission of parental characteristics to offsprings.
2. During DNA copying in reproduction there are some chances of error that leads to variations. These leads to evolution.

Ans2 :- Variations allow organisms to exist in diverse habitat. In their absence, species may remain restricted to a particular area. If this area gets drastically altered due to various natural or man-made causes, the species may wiped out.

However, if some variations were present in few individuals, this would help them to survive in other habitat.

If variations are present in single organism only there would be very little chance of their survival.

ASEXUAL REPRODUCTION

- It is a type of reproduction that involves single parent (Uniparental reproduction)
- No gametes are formed.
- Fertilisation do not take place.
- Transfer of genetic material will not takes place individuals.
- few chances of variation.

Types of Asexual Reproduction :—

(i) **fission** :→ It is the splitting of a parent cell into two or more than two separate daughter cells.

Types of fission

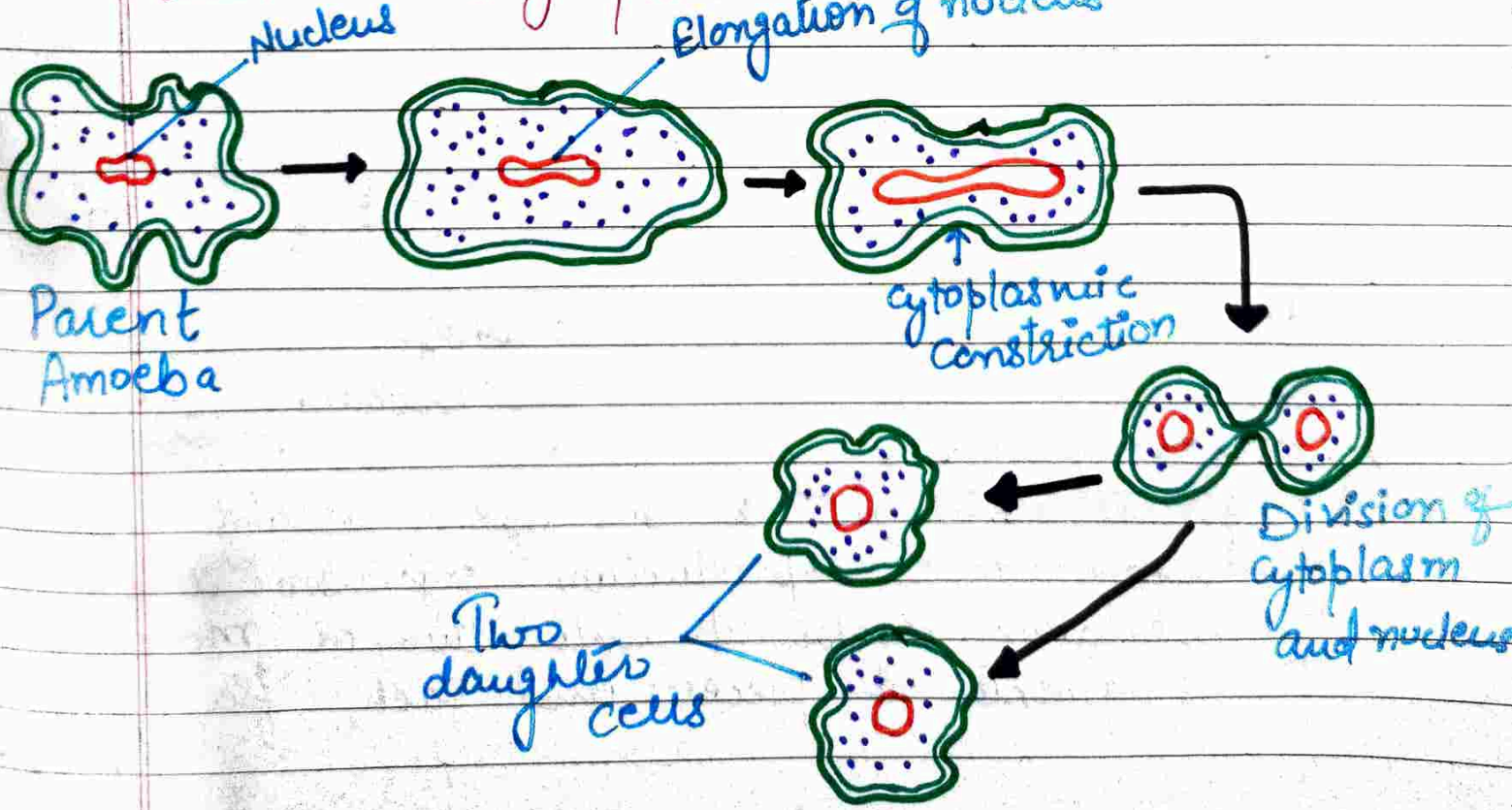
Binary fission	Multiple fission
• This is the division of parent cell into two small, nearly equal sized identical daughter cells.	• This is the division of parent cell into several small, nearly equal sized daughter individuals.

- Karyokinesis followed by Cytokinesis.

• Nucleus of the parent cell divides only once to form two nuclei	• Nucleus of parent cell undergoes repeated divisions to form a number of daughter nuclei.
• Cytoplasm divides after nuclear division.	• Cytoplasm does not divide after each nuclear division.
• It occurs under favourable conditions.	• It occurs both under favourable and unfavourable conditions.
• No part of parent body is left unused.	• A part of the body (covering and residual cytoplasm) is left unused.
Example → Amoeba, Bacteria, Paramecium, Leishmania, Euglena.	Example → Plasmodium (malarial parasite)

BINARY FISSION IN AMOEBA :-

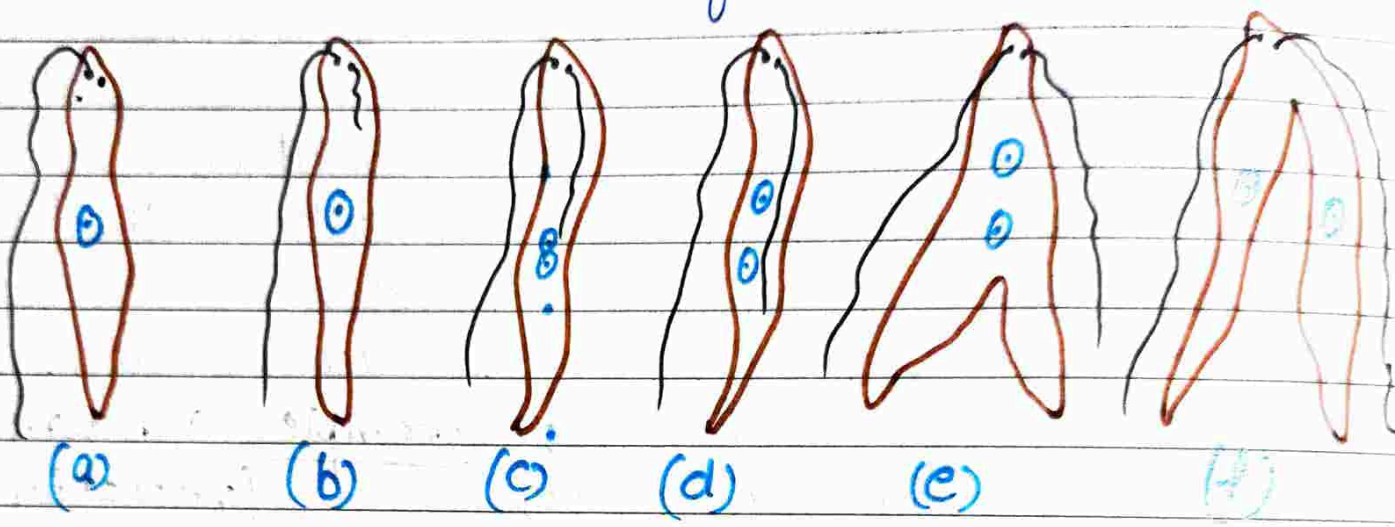
Due to irregular shape, division can occur in any plane.



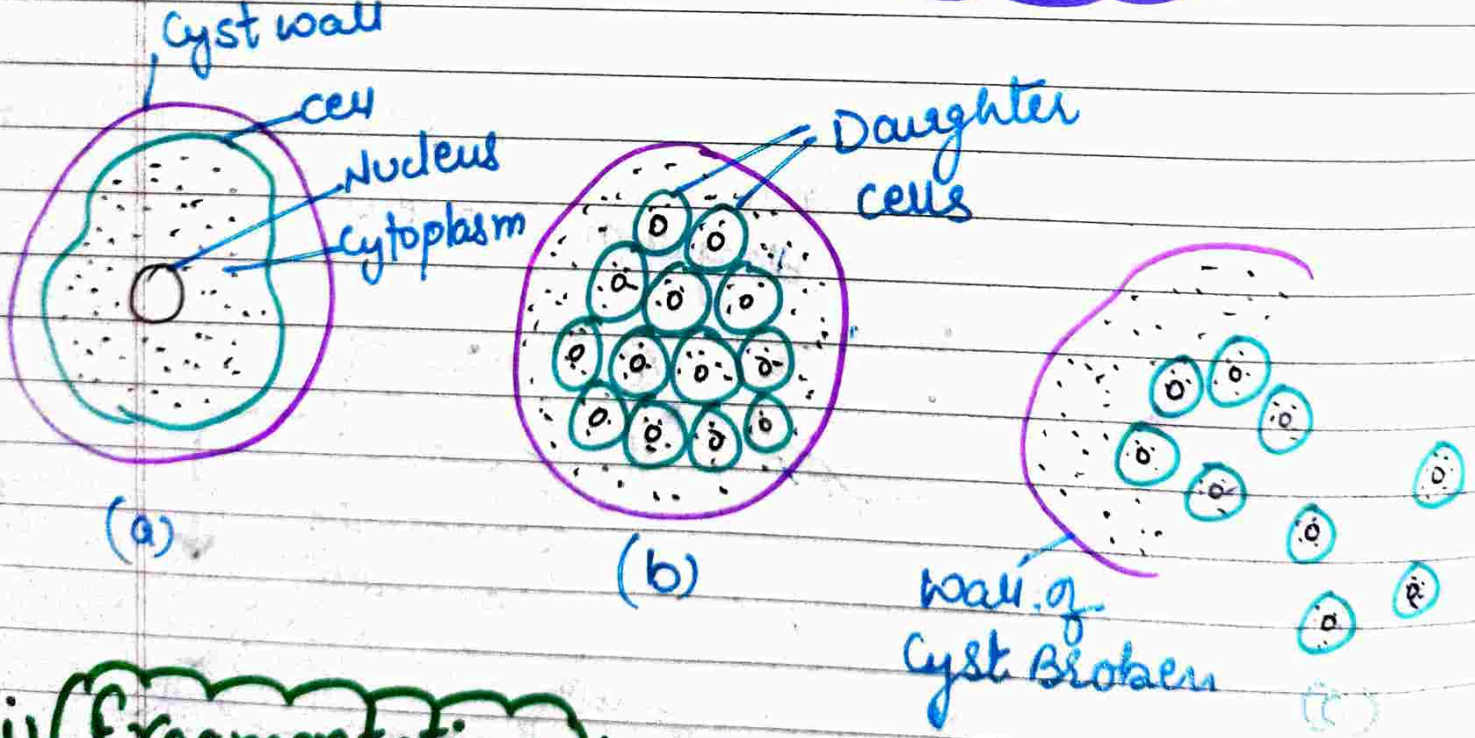
BINARY FISSION IN LEISHMANIA :-

Leishmania cause Kala-azar

They have whip like structure (flagella) so the division occur in definite orientation.

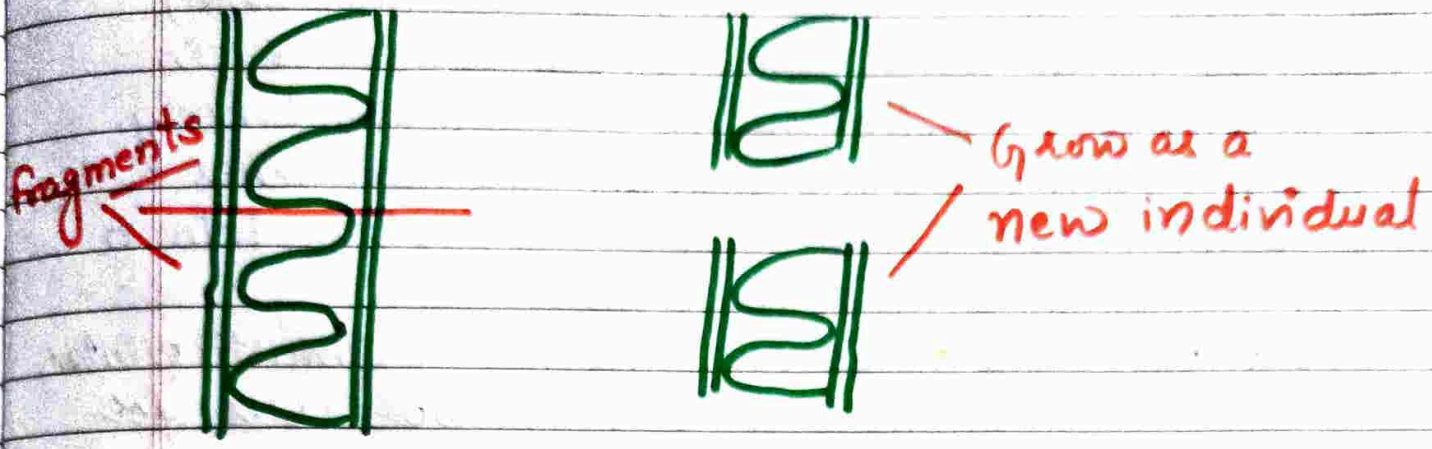


MULTIPLE FISSION IN PLASMODIUM :-



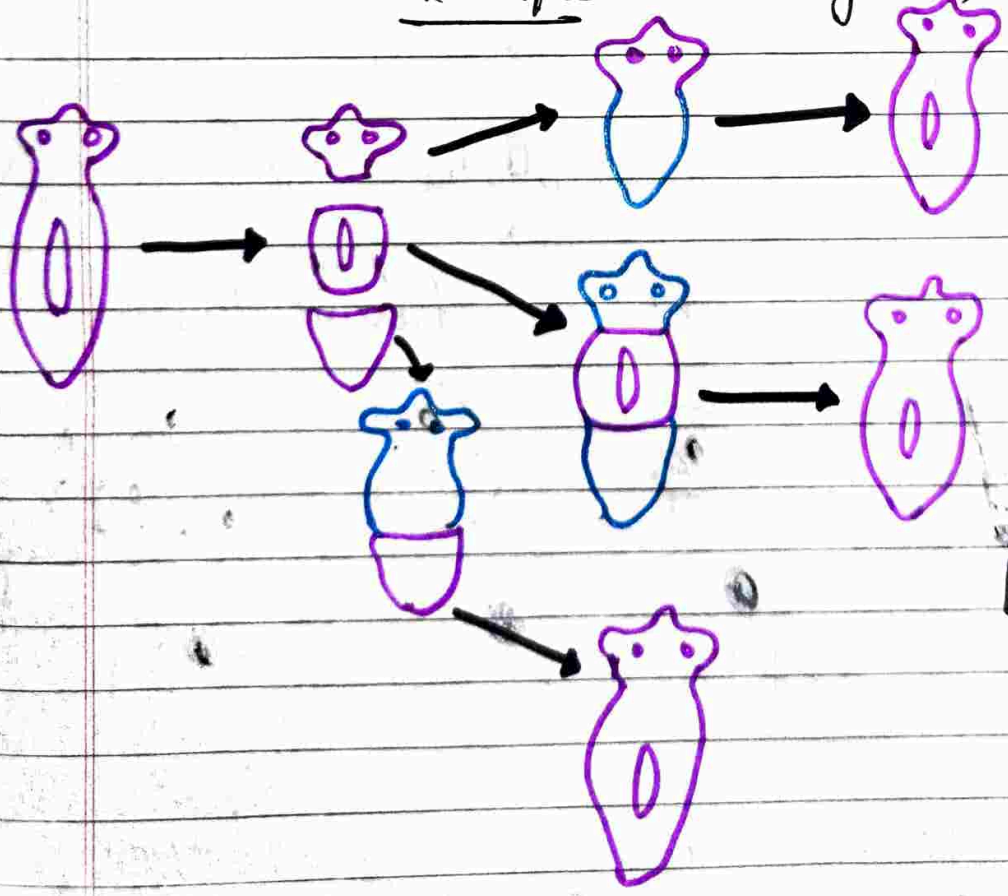
(ii) **Fragmentation** :- In this type of asexual reproduction organism upon maturation breaks up into two or more fragments or pieces and each fragment

grows to form complete new organism.
for eg. — Spirogyra.



(iii) **Regeneration** :— It is a type of asexual reproduction in which organism has the ability to regenerate their lost body parts from the broken pieces with the help of specialised cells.

Example → Hydra, Planaria.



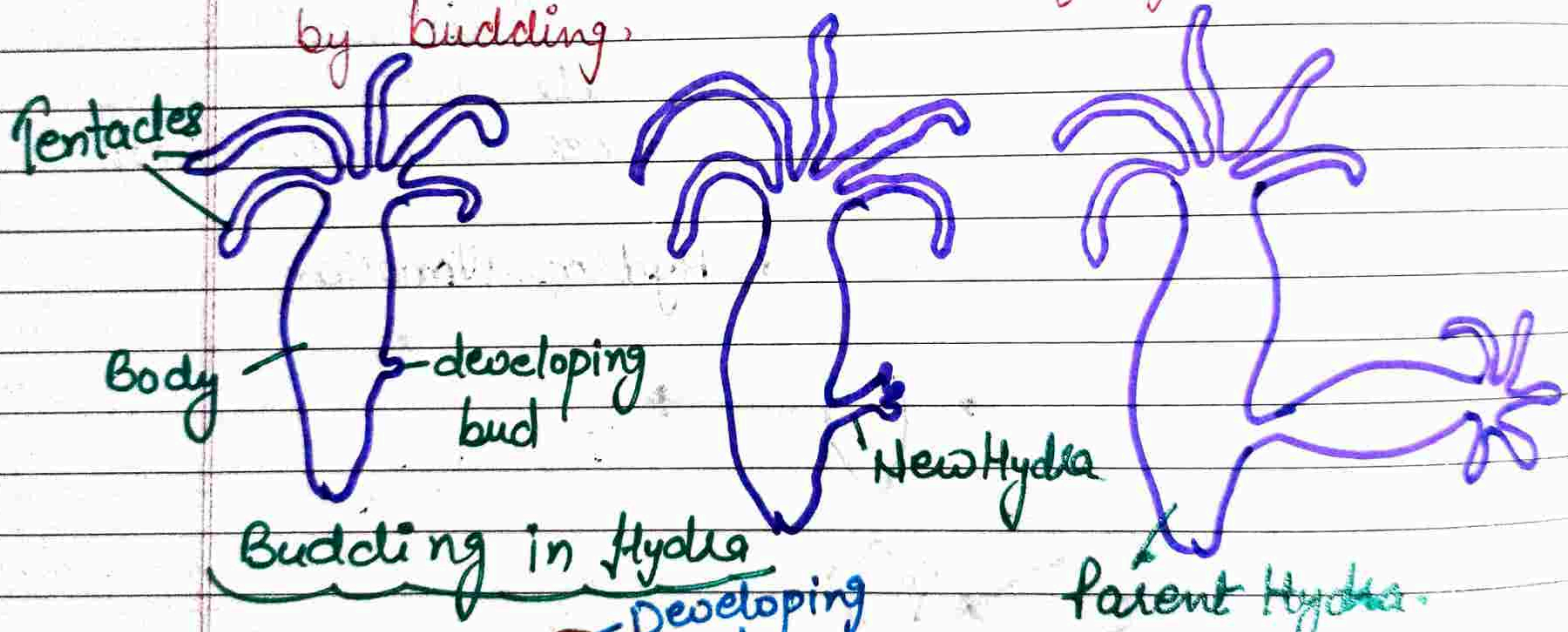
Regeneration in Planaria.

(iv) **Budding**:— • In this type of asexual reproduction daughter cell is formed from a protuberance (outgrowth) known as bud, which develops due to repeated cell division on the parent body.

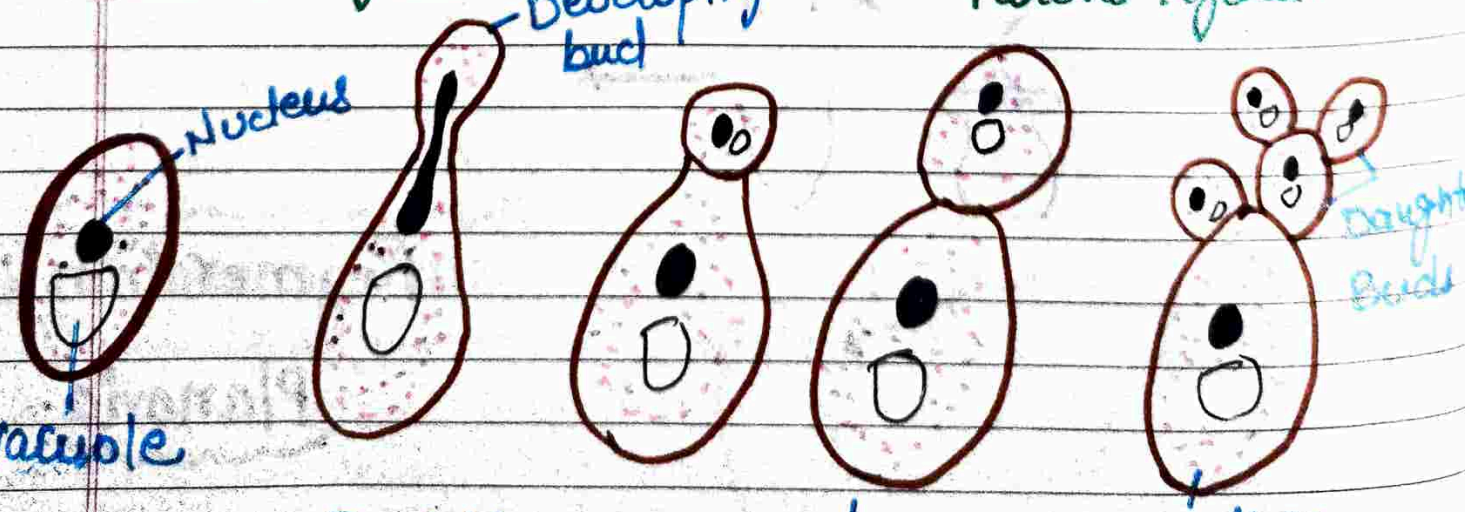
• When fully grown this bud detaches from the parent body to grow into a new independent individual.

Example. Hydra is an example of multicellular organism use regenerative cells for reproduction in budding.

Yeast is an unicellular fungus reproduce by budding.



Budding in Hydra



Budding in yeast.

(v) Vegetative Propagation :- In this type of asexual reproduction new plants are obtained from vegetative parts (root, stem, leaf) of the plant.

Types

Natural
Under favourable conditions the vegetative parts of the plant grows into new organisms.

(i) Root → eg- Sweet potato
Dahlia

(ii) Stem → eg →
(a) Tuber of potato
(b) Bulb of Garlic, Onion
(c) Rhizome of Ginger, Turmeric
(d) Corm of colocasia

(iii) Leaf → eg Bryophyllum

Artificial
methods are man-made and developed by plant growers.

(i) Cutting → Rose, grapes, Banana, Sugarcane, Cactus

(ii) Layering → Jasmine Grass

(iii) Grafting → Apple, Pear, Peach, Mango.

Advantages :- (i) It is a quick method.
(ii) It is easier and cheaper than collecting seeds.
(iii) Plants produced by this method are genetically similar to the parent plant.

(iv) Plants raised by this method can bear flowers and fruits earlier than those produced by seeds.

(v) It also makes the propagation of plants such as banana, orange, jasmine which has less capacity or do not produce seeds.

Disadvantages:- (i) There is no genetic variation so there is less adaptability to the environment.

(ii) They can easily get damaged during storage.

(iii) The plantlets obtained by this method are difficult to transport than seeds.

(iv) They are more likely to carry disease from their diseased parent.

(v) Seeds of desired quality may not be formed in asexually propagating plants.

(vi) These methods can be used to produce plants which cannot produce seeds or produce non-viable seeds.

(vi) Tissue Culture :-

New plants are grown by removing tissues or separating cells from growing tip of plant → placed in artificial medium →

where they grow rapidly to form a small group of cells of Callus.

Callus is transferred to another medium containing hormones

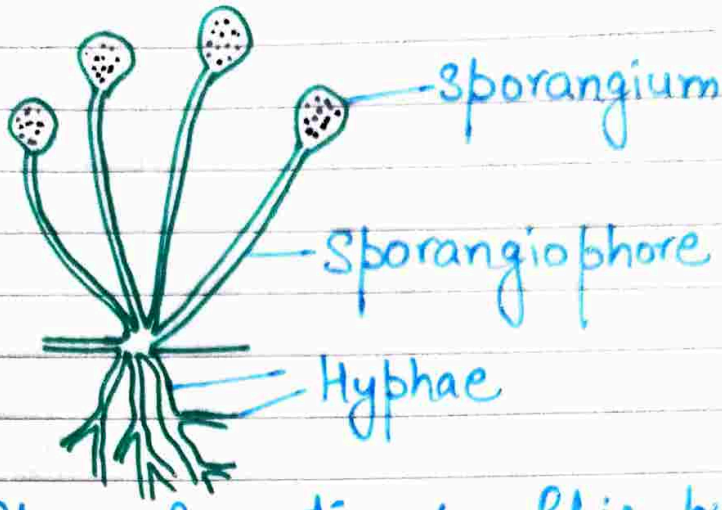
Plantlets placed in soil, so that they can grow into mature plants.

Advantages:— (i) new plants can be grown from one parent in disease free conditions.
- This method is commonly used for ornamental plants. like Orchids, Dahlia, chrysanthemum.

(vii) Spore formation:— Spores are usually produced in blob-like structure called **Sporangia** (Sing. **Sporangium**)

- Spore is a single or several celled reproductive str. that detaches from the parent and gives rise to new individual.

- The **spores are covered by thick walls** that protect them until they come into contact with another moist surface and can begin to grow.



Spore formation in Rhizopus.

Eg - Rhizopus, Mucor, Aspergillus, Penicillium

INTEXT QUESTIONS Page NO-133.

Ans1 → Done difference b/w binary fission and multiple fission.

Ans2 → Spores are special reproductive bodies which are produced inside the sporangia. They are covered by thick walls that enables them to survive in unfavourable conditions. They are mostly dispersed by wind.

Ans3 → Complex organisms have several kinds of complex organs and organ systems. It is probably not easy to develop such an organism through regeneration.

Ans4 → Advantages of vegetative propagation.

Haploid → (n) single set of chromosomes
Diploid. (2n) → two sets of chromosomes.

Ans 5 → The process of reproduction results in the production of offsprings which as exactly similar to parents. The exact blue prints of body design is inherited in the offspring due to DNA replication in parent cell.

SEXUAL REPRODUCTION :-

- two sexes are involved (male and female)
- gametes are formed.
- fusion of gametes called fertilisation takes place.
- lead to variations (evolution)

Types of gametes

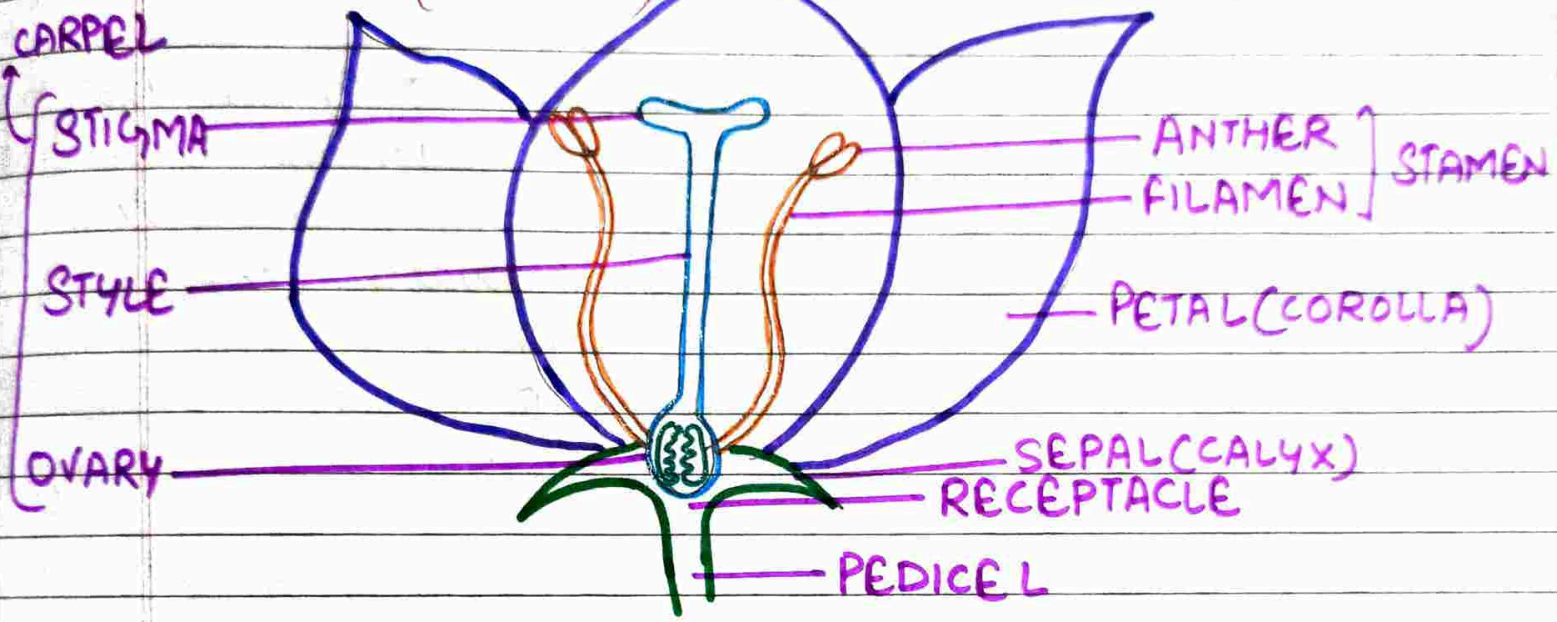
Male gamete	female gamete
• small in size	• larger in size
• motile	• non-motile
• do not have any reserved food.	• stored food is present.

SEXUAL REPRODUCTION IN FLOWERING PLANTS

flowering plants are also known as "Angiosperms"

PARTS OF FLOWER :- A typical angiospermous flower consists of four whorls of floral appendages attached on the Receptacle.

The Receptacle is the top of the flower stalk (Pedicel)



1. **CALYX** :→ It is the outermost whorl of floral leaves called Sepals. Sepals are generally green in colour and protect the flower in bud stage.

2. **COROLLA** :→ It is the collection of petals. Petals are generally large, showy and brightly coloured to attract the insect pollinators.

3. **ANDROECIUM** :→ It is the collection of stamens the male reproductive part. Each stamen consist of anther and filament.

Anther – is a bilobed structure containing four pollen sacs (microsporangia). These produce pollen grains that are yellowish in colour.

filament – is a long stalk that bears an anther at the top.

4. **GYNOECIUM OR PISTIL**:– It is the collection of carpels, the female reproductive part. Each carpel has swollen ovary, long style and a terminal stigma.

(a) **Stigma**.– It is the sticky part which helps in receiving the pollen grains during pollination.

(b) **Style** – It bears stigma in a suitable position to receive pollen and also provides passage for the entry of pollen tube.

(c) **ovary** – It is the swollen and hollow basal part that contains ovules. Each ovule has an embryo sac that bears a haploid egg the female gamete.

TYPES OF FLOWER

Unisexual	Bisexual
• Flowers that contain either stamen or pistil.	• flowers that contain both stamen and pistil

- In these flowers cross pollination takes place.

eg Papaya, Watermelon

- In this flowers self and cross pollination both may take place

eg Mustard Hibiscus or china rose.

POLLINATION :-

The transfer of pollen grains from the anther of the stamen to stigma of a flower is termed as pollination.

Pollinating agents →

Abiotic
- Wind
- Water

Biotic
- Insects
- animals
- Bats

Types of Pollination

Self pollination

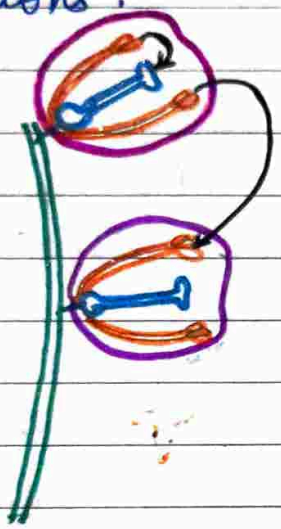
- Transfer of pollen grains from the anther of a flower to the stigma of same flower or to the stigma of another flower borne on the same plant.

Cross-pollination

- Transfer of pollen grains from anther of one flower to the stigma of flower on another plant of same species.

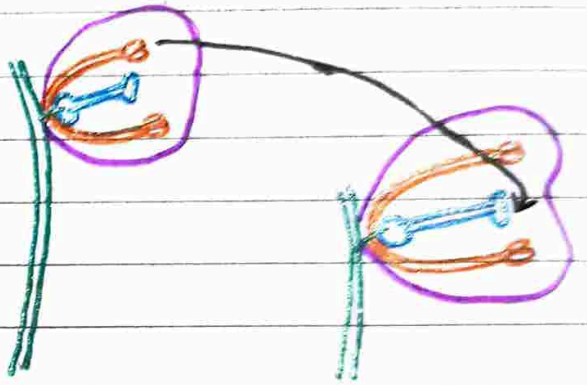
Self pollination

- It does not require an external agency for the transfer of pollen grains.
- It does not bring variations.



Cross pollination

- It requires an external agency for the transfer of pollen grains.
- It brings about large number of variations.



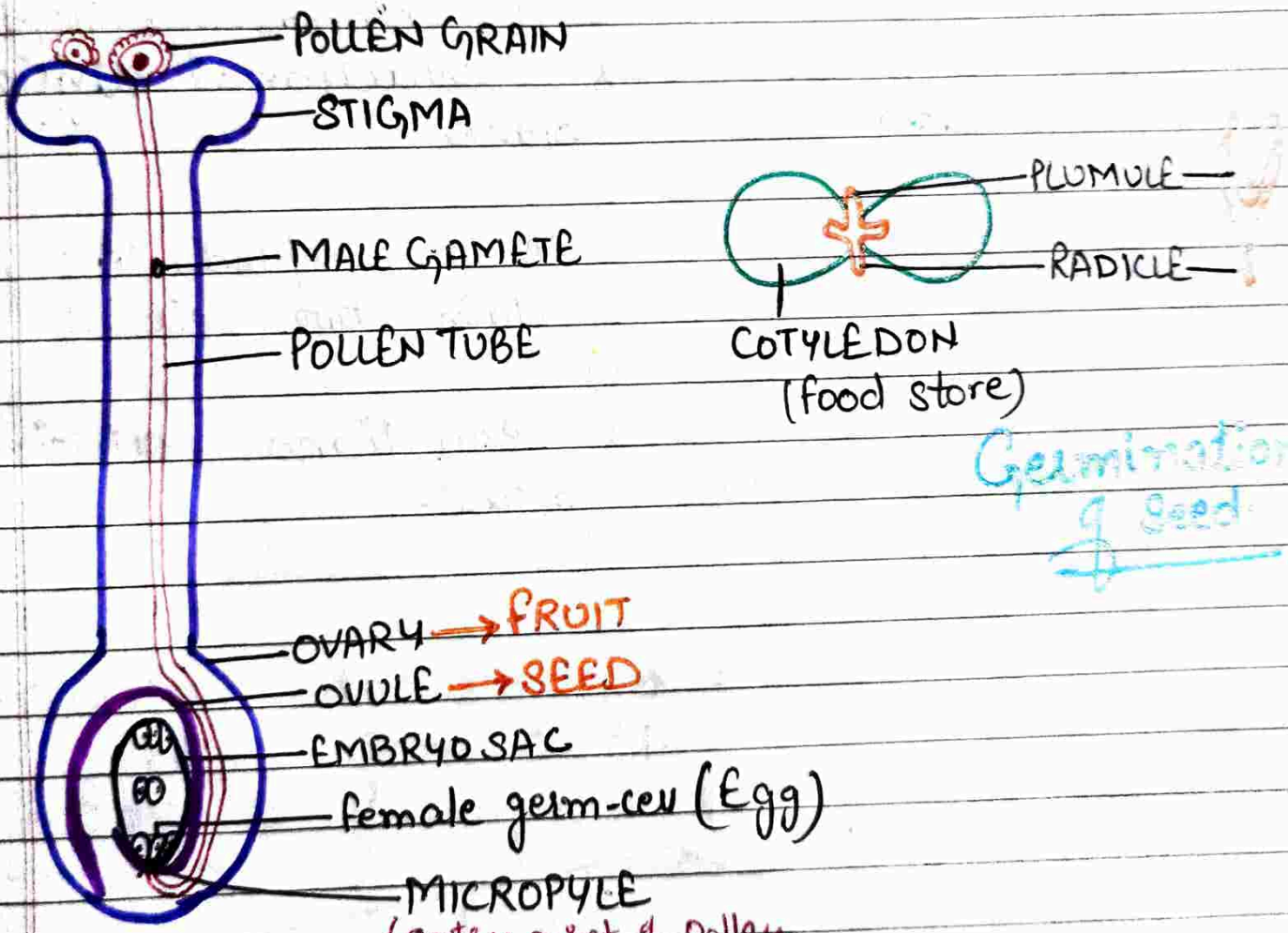
fertilisation — • when pollen grains reaches the stigma, they produce pollen tube to ovule.

- In pollen grain, male gamete is present that through pollen tube reaches the egg in ovule.
- Their male gamete fuses with female gamete to form zygote. This fusion process is called **fertilisation**.
- The zygote divides several times to form an embryo within the ovule.
- The ovule develops a tough / hard coat and gets converted into a seed.
- The ovary grows rapidly and ripens to form fruit.

- In the mean time sepals, petals, stamen, style, stigma may shed off.
- The seed contains the embryo which develops into a seedling under suitable conditions and this process is called germination.
- Embryo has two parts

Radicle forms future root

Plumule forms future shoot



Germination of seed

Germination of Pollen on stigma.

REPRODUCTION IN HUMAN BEINGS:-

There are two types of cells in human beings :-

1. Germ cell
2. Somatic cell.

1. **Germ cell** :- These are special reproductive cells which produce gametes that have half number of chromosomes (Haploid). In these cells Reductional division (meiosis) takes place.

2. **Somatic cell** :- These are non-reproductive cells that contain two sets of chromosomes (Diploid). In these cells equational division (mitosis) takes place.

* The reproductive systems of males and females consist of primary and secondary sex organs.

- Primary sex organs (Gonads)
  - Testes in males
    - Produce
      - sperm
      - Testosterone
  - ovaries in females
    - Produce
      - egg
      - estrogen
      - Progesterone
- secondary sex organs.
  - include genital ducts and glands which help in transportation of gametes.

Primary and Secondary Sexual Characters :-

Primary sexual characters are those present at birth.

Secondary sexual characters are those that develop at puberty.

PUBERTY :- is the age of human males and females at which the reproductive organs become functional.

Boys → 13-14 yrs.
Girls → 10-12 yrs.

Common changes in both Boys and girls :-

- Thick hair growth in armpits and genital area between the thighs.
- Thinner hair appear on legs, arms and face.
- Oily skin and appearance of pimples.

Specific changes in Boys and girls :-

In Boys :-
- Thick facial hair growth.
- Voice begins to crack or hoarse.
- Enlargement of penis and scrotum.

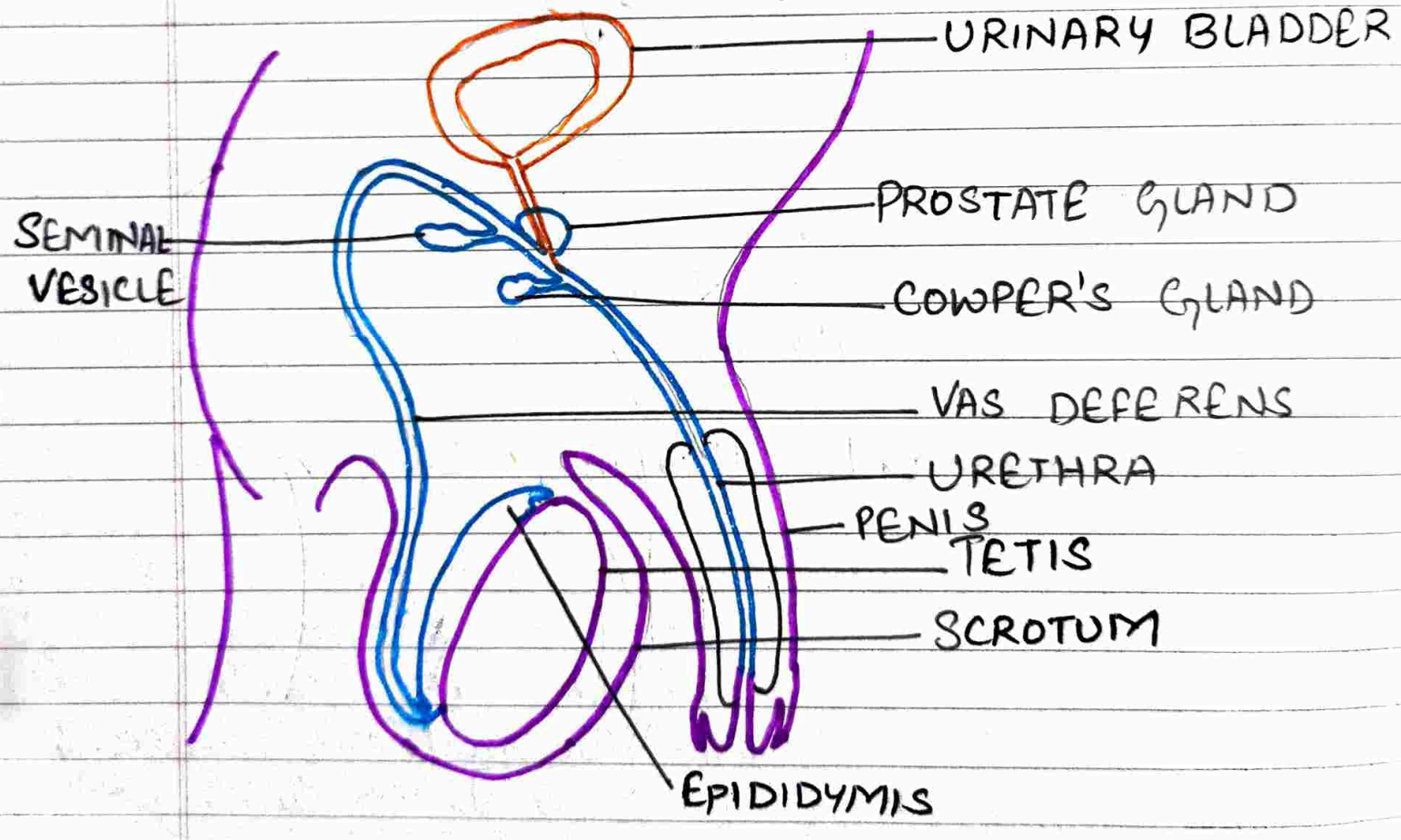
In Girls :-
- Growth of Breasts and external genitalia (Vulva)
- Initiation of menstruation and ovulation (release of egg or ovum)
- Darkening of nipple skin.

MALE REPRODUCTIVE SYSTEM :-

The male reproductive system consists of portions which produce the germ-cells and other portions that deliver the germ-cells to the site of fertilisation.

Consist of following organs :-

Testes, Scrotum, Vas deferens, Urethra, Penis.



MALE REPRODUCTIVE SYSTEM

(i) **Testes (Sing. Testis) :-**

- Paired, oval-shaped male sex organs.
- Produce sperms.
- Produce male sex hormone called testosterone, which bring about changes in appearance of boys at puberty.

(ii) **Scrotum :-**

- Small pouch that contains testis.
- present outside the abdominal cavity.
- It requires optimal temperature for the formation sperms i.e 1-3°c lower than the normal body temperature.

(iii) **Vas deferens :-**

Tube-like structure which connects testis to urethra in order to allow the passage of semen. (fluid and nutrients combine with sperm to form semen)

(iv) **Urethra :-**

- Common passage for both the sperms and urine. It never carries both of them at the same time.

(v) **Penis :-**

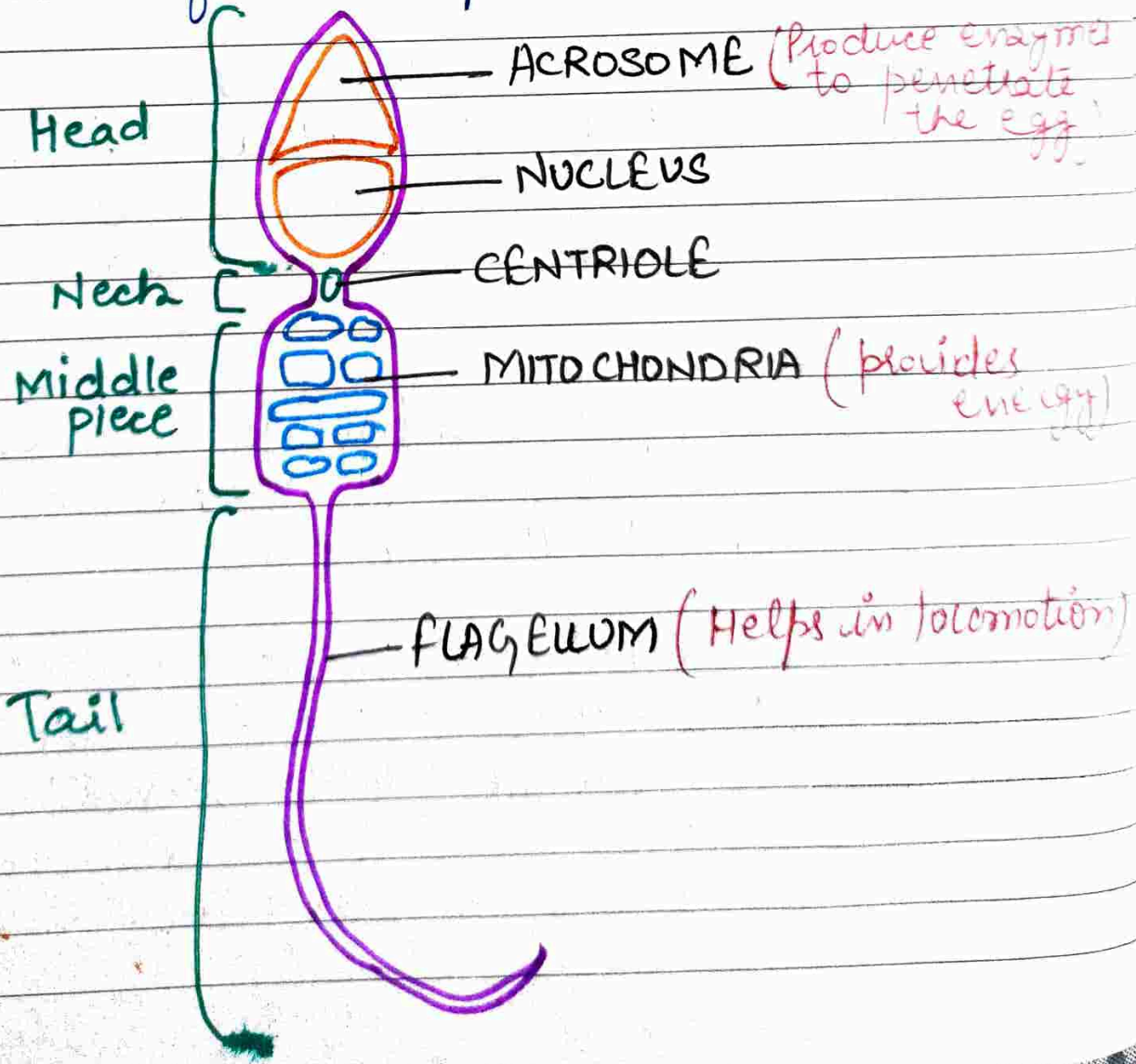
- External male genital organ.
- Transfers sperms into the vagina of the female during sexual intercourse.

Accessory glands (Prostate gland and seminal vesicles.)

Secrete milky, viscous fluid contains fructose and other chemicals for nourishing and stimulating sperms.

Seminal vesicles also store sperms temporarily and add secretions with sperms.

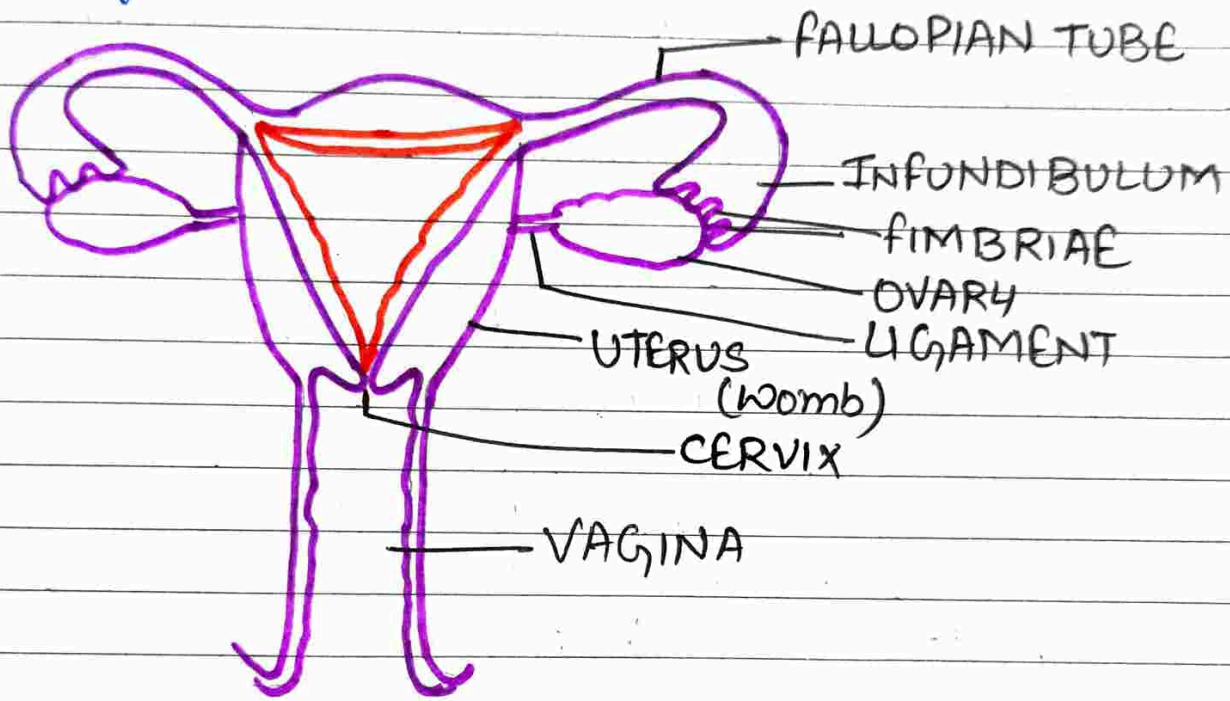
Sperm :- Tiny and motile bodies that use their long tail to move through the female reproductive tract.



Female Reproductive System :-

female reproductive system consists of the following organs :-

(i) ovaries
(ii) fallopian tubes (oviducts)
(iii) uterus
(iv) cervix
(v) vagina



(i) **Ovaries** :- . Paired oval shaped organs located in abdominal cavity near the Kidney.
. Each ovary is connected by ligament to the uterus.
. Produce female gamete (egg)
. Secrete female sex hormones like estrogen and progesterone.

(ii) **fallopian tubes (oviducts)** :- . It has funnel shaped opening nearby the ovary (Infundibulum)

- Carries egg or ovum from ovary to uterus.
- Site of fertilisation.
- open into the uterus from both the sides.

(iii) **Uterus** :- . Hollow, inverted, pear-shaped, muscular structure.
- Here, the growth and development of foetus takes place.
- Site of implantation

(iv) **Cervix** :- It is the lower and narrower portion of uterus which opens into the vagina.

(v) **Vagina** :- . Receives the Sperms from the male partner.
- Serves as birth canal.

SEXUAL CYCLE IN FEMALES :-

The fertility period of human female begins at the age of puberty (about 10-12 yrs. of age) when one of two ovaries starts releasing ovum.

MENSTRUATION :-

Menstruation is the time of uterine bleeding which an unfertilised egg and the thick uterine lining comes out through vagina as blood and mucus.

* Life span of egg - 1 day
sperm in female reproductive tract - 5 days

- It lasts for 2-8 days.
- All these events occur in every 28 days. So this cycle of events of menstruation is termed as 'Menstrual Cycle'.

Menarche	Menopause
• It is the stage of initiation of menstruation in the life of female(girl)	• It is the stage at which menstruation stops in the life of a woman.
• It generally occurs at an age of 11-13 years.	• It occurs in woman at an age between 45-50 years.
• It refers to the beginning of the reproductive phase in girls.	• It refers to the end of the reproductive phase in the woman.

fertilisation and Post-fertilisation changes:-

The fusion of nucleus of the sperm and ovum is known as fertilisation.
This process takes place in the following ways:-

(i) The male gamete enters into the female genital tract (vagina) by the process of copulation or mating.

(ii) The sperms are highly active and motile.

They swim into the uterus through cervix and then pass into the oviduct.

(iii) fertilisation only occurs, if an egg is present in the oviduct.

(iv) When a sperm reaches the egg. It penetrates inside the ovum and fusion of male and female nuclei occurs to form zygote.

(v) The zygote undergoes various mitotic divisions to form an embryo.

(vi) The embryo sinks down and reaches into the soft and thick lining of the uterus. The embedding of the embryo in the thick lining of the uterus is known as implantation.

PLACENTA :- Disc like structure embedded in uterine wall.

Structure :- . It contains villi on the embryo's side of the tissue.
. On the mother side blood spaces, surrounds the villi.
(This provides large surface area for glucose and oxygen to pass from mother to embryo)

function :- (i) It helps the embryo to get nutrition and oxygen from mother's blood.
(ii) It also helps in removal of waste material from embryo to mother's blood.

Gestation :- (Pregnancy)

The complete development of foetus, from the initial stage of conception till the birth of young one.
Completed in 9 months (280 days)

Parturition :- is the act of expelling the full-term young one from mother's uterus at the end of gestation.
This occurs as a result of rhythmic contractions of the muscles in the uterus.

REPRODUCTIVE HEALTH :-

It can be defined as the state of physical, mental and social fitness to lead a healthy reproductive life.

December 1 is celebrated every year as the "World AIDS DAY."

Sexually Transmitted Diseases

STD's :-

The infectious diseases, which are spread from an infected person to a healthy person by sexual contact. are called STD's

These are caused by Bacteria and Virus

Bacterial diseases
- Gonorrhoea
- Syphilis

Viral diseases
- HIV-AIDS (Acquired Immuno deficiency Syndrome)
- Warts

Sex Ratio :-

- It is the ratio of number of females to the no. of males in a population.
- The female-male sex ratio should be maintained in order to have a healthy society.

Population Size :-

The ratio of birth rate (natality) and death rate (mortality) in a given population determines its size.

The population size increase if birth rate is higher than the death rate and vice-versa.

BIRTH CONTROL / CONTRACEPTION :-

The prevention of pregnancy is called as Birth control or contraception.

Contraceptive methods :-

The methods used to prevent occurance of pregnancy are called Contraceptive methods.

(i) **Barrier Method** → (Use of condoms)
- It stops sperms from entering vagina.
- It also prevents the transmission of STD's
- It has no side effects.

(ii) **Chemical method** :- Foam tablets, jellies, pastes, creams and spermicides are some common chemicals used by females. These are placed in vagina and kill the sperms.
- Oral pills are also used to check ovulation. These prevent development of egg and ovulation. It disturbs the hormonal balance of body.

(iii) Intrauterine Contraceptive Device (IUCD):

- These are contraceptive devices made of Copper, plastic or stainless steel.
- Copper - T is inserted into uterus
- It prevents implantation in the uterus.
- This device can cause side effects due to irritation in uterus.

(iv) Surgical method :- (i) Vasectomy in males.

- A small portion of vas deferens are cut and tied properly.
- This prevents the passage of sperm from testis to urethra.

(ii) Tubectomy in females :-

- A small portion of oviduct is cut or tied properly.
- The egg will not be able to reach further and thus fertilisation does not occur.

* These are irreversible process. These method can cause infections and other problems if not performed properly.

INTEXT QUESTIONS :- Page No- 140

Ans1 →

Pollination	Fertilisation
• The transfer of pollen grains from anther to stigma of a flower.	• The fusion of male and female gametes to form zygote.
• Takes place only in plants.	• Takes place in both plants and animals.
• Pollinating agents are required.	• No agents are required.
• It involves only male gamete.	• Both male and female gametes are involved in this process.

Ans2 → Already done Role of accessory glands.

Ans3 → Already done changes seen in girls during puberty.

Ans4 → write functions of placenta.

Ans5 → No, Copper-T will not protect her from STD's. Only barrier method can be used to protect her from STD's

BACK EXERCISE Page No - 141

Ans1 :→ (b) yeast

Ans2 :→ (c) vas deferens

Ans3 :→ (d) Pollen grains

Ans4 :→ In sexual reproduction, fusion of gametes takes place that leads to variations but in asexual reproduction only the single parent is involved that do not leads to any variations. Moreover variation is important for the survival of species.

Ans5 :→ Testes produce sperms (male gamete) and male sex hormone ie Testosterone.

Ans6 :→ Menstruation occur only when the egg is not fertilised.

Ans7 → Already done diagram of flower.

Ans8 → Already done contraceptive methods.

Ans9 → Unicellular organisms generally reproduce asexually by fission, budding and spore formation. They have only one celled body and can multiply easily by simple cell division. The multicellular organisms are more complex and reproduce mainly by sexual reproduction.

Ans10 → Living organisms reproduce for the continuation of particular species. It helps in providing stability to the population of species by producing a new individual that resemble the parents. This is the reason why cats give birth to only cats and dogs give birth to only dogs. Thus reproduction provides stability to population dogs or cats or any other species.

Ans11 → - To prevent unwanted pregnancies.
- To control population size or birth rate.
- To prevent the transfer of STD's.
- To maintain the gap between siblings.
- Frequent pregnancies have an adverse effect on the health of a women. These can be avoided by using contraceptive methods.

Significance of Sexual Reproduction :-

1. This mode of reproduction involves the process of combining DNA from two different individuals. It does not disturb the control of DNA over cellular apparatus.
2. It result in restablishment of the number of chromosomes and DNA content in new generation. It leads to a new combination of genes in gametes due to this genetic variation occurs.
3. It promotes diversity of characters in generation.

Ch-9

"Heredity and Evolution"

Important Terms :-

(i) **Heredity** :- It refers to the transmission of characters or traits from the parents to their offspring.

(ii) **Genetics** :- It is the branch of biology which deals with heredity and variation.

(iii) **Genes** :- A functional segment of DNA is called gene.

(iv) **Gametes** :- Reproductive cells are called gametes.

(v) **Alleles** :- One of the different forms of a particular gene

(vi) **Recessive allele** :- It is the allele whose phenotypic expression is masked (suppressed) by dominant allele of that gene.

(vii) **Dominant allele** :- An allele whose phenotype will be expressed in the presence of other allele of that gene.

(viii) **Genotype** :- Genetic composition of an individual.

(ix) **Phenotype** :- Expression of genotype which is an observable and measurable characteristic.

(x) **Hybrid** :- An individual having two different alleles for the same trait.

(xi) **Homozygous** :- When both alleles of a particular genes are the same eg TT, tt

(xii) **Heterozygous** :- When both alleles of a particular gene are different eg Tt.

(xiii) **Punnett square** :- Probability diagram, illustrating the possible offspring of mating.

(xiv) **Variations** :- The difference in the characters (traits) among the individuals of a species are called variations. Variations are produced due to inaccuracies in copying of DNA and get accumulated generation after generation that leads to evolution.

(xv) **Progeny** :- A descendant or offspring as a daughter organism.

(xvi) **Trait** :- A trait or character is a feature of an organism.

* Traits or characteristics, which are passed on from parents to their offspring generation are controlled by genes.

(xvii) **Contrasting characters** :- The characters which always appear in two opposing conditions are called contrasting characters.

(xviii) **Monohybrid cross** :- A breeding experiment dealing with a single character.

(xix) **Dihybrid cross** :- A breeding experiment dealing with two characters at the same time.

(xx) **Dominance** :- The phenomenon of appearance of only one of two contrasting traits

is f_1 generation.

(xxi) **Sex determination** :- The mechanism by which the sex of an individual is determined as it begins life.

MENDLE'S Contribution towards the inheritance of traits :-

Gregor Johann Mendel (1822-1884)
father of genetics.

* He selected garden pea plant for his experiments because -

(i) these grow quickly and are easier to study.

(ii) Pea plants can crossed or self pollinated and have a flower structure that limits accidental contact.

(iii) Garden ~~to~~ pea has clear cut contrasting traits which are easy to observe like round / wrinkled seeds, tall/short plant, white / voilet flowers and so on.

(iv) They produce large no. of seeds, so large no. of plants can be studied.

(v) In these bisexual plants, artificial cross fertilisation could easily be achieved.

Seven contrasting characters noted by Mendel in garden pea plant :-

Sr. No.	Character	Contrasting traits	
		Dominant	Recessive
1.	Plant size or height	Tall	Dwarf
2.	Position of flowers on the stem	Axial	Terminal
3.	Colour of unripe pod	Green	Yellow
4.	Shape of pod	Inflated	Constricted
5.	Shape of seed	Round	Wrinkled
6.	Colour of the seed	Yellow	Green
7.	Colour of flower	Violet	White.

INHERITANCE OF Traits for one contrasting character → (MONOHYBRID CROSS)

Eg → Tall plants TT (Homozygous) × short plants tt (Homozygous)

Gametes → T T × t t

fertilisation → Tt Tt

f_1 hybrid. all (Tall)

Heterozygous.

f_1 will be self pollinated :-

Gametes : Tt × Tt

T t × T t

fertilisation

f_2 generation

♀ \ ♂	T	t
T	TT	Tt
t	Tt	tt

Genotype	Phenotype
TT	Tall
Tt	Tall
tt	Short
1:2:1	3:1

* **LAW OF DOMINANCE** :- when parent plants are pure for constrasting traits, only one form of the trait will appear in the next generation ie known as dominant trait.

* **LAW OF SAGREGATION** :- In f_1 hybrid, the dominant and recessive trait though remain together for long time but do not mix with each other and separate or sagregate at the time of gamete formation.

INHERITANCE of Traits for two visible contrasting characters → (DIHYBRID CROSS)

Eg. Round and green seed RRyy × wrinkled and yellow seed rryy

Gametes → Ry, Ry × ry, ry

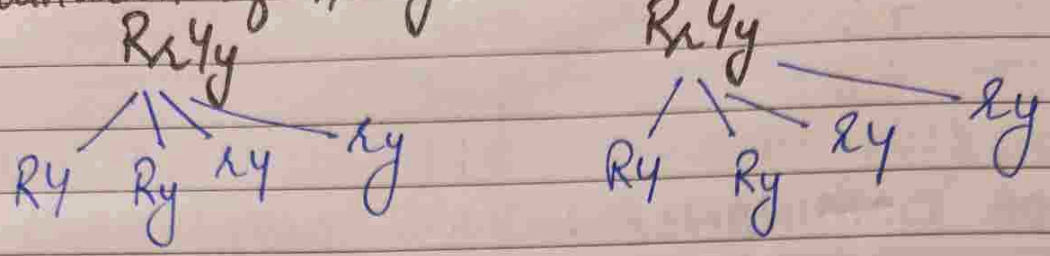
fertilisation

f_1 generation: Rry, Rry, Rry, Rry

(All are round and yellow)

Self pollination of f_1 hybrid :-

Gametes:



f_2 generation →

♀ / ♂	RY	Ry	rY	ry
RY	RRYY Round yellow	RRYy Round yellow	RrYY Round yellow	RrYy Round yellow
Ry	RRYy Round yellow	RRyy Round green	RrYy Round yellow	Rryy Round green
rY	RrYY Round yellow	RrYy Round yellow	rrYy wrinkled yellow	rrYy wrinkled yellow
ry	RrYy Round yellow	Rryy Round green	rrYy wrinkled yellow	rryy wrinkled green

Phenotype Round yellow Round green wrinkled yellow wrinkled green

9 : 3 : 3 : 1

LAW OF INDEPENDENT ASSORTMENT :- The inheritance of one character is always independent to the inheritance of other character within the same individual.

As in above cross, round, yellow, green, wrinkled all four phenotypes inherited in dependently with respect to each other.

HOW DO THESE TRAITS GET EXPRESSED ?

* As we all know that cellular DNA is the information source for making proteins in the cell.
* A section of DNA that provides information for one protein is called the gene for that protein.

Eg → DNA has gene for making
↓
Protein / enzyme
↓
that regulates the formation of plant hormone
↓
Auxin (growth hormone)
↓
more Auxin, Plant Tall.

Alteration in gene
↓
alteration in protein / enzyme
↓
efficiently not formed hormone
↓
Auxin
↓
less Auxin, Short Plant

MECHANISM OF INHERITANCE :-

- If both parents help to determine the trait in the progeny, then both parents must be contributing a copy of the same gene
- So each germ cell have only one gene set.
- Each cell will have two copies of chromosome one inherited from each parent.
- When two germ cells combine they will restore normal number of chromosomes ensuring the stability of DNA of species.

SEX DETERMINATION :-

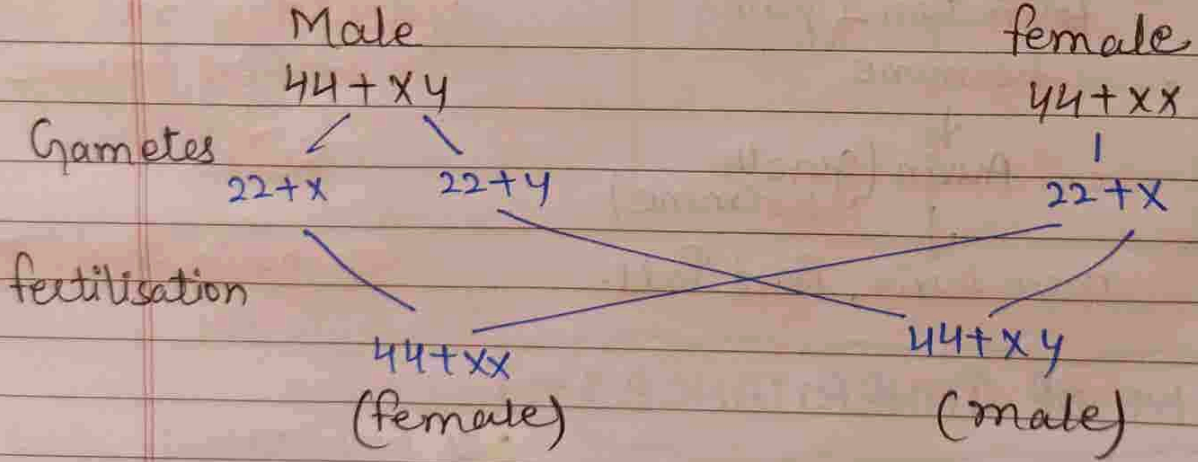
In most of the species, sex is determined genetically. But in some species, environmental factors are important in determining the sex of the developing individual. eg :—

(i) In reptiles, the temperature at which the fertilised eggs are kept, determines the sex of the offspring.

(ii) In turtles, at high temperature more females are formed, while in lizards, it gives rise to more males.

(iii) In snails, individuals can change sex in different conditions.

Sex determination in Human beings :- (Sex determined genetically)



"Ch-15"
"OUR ENVIRONMENT"

* Our environment includes all those things and set of conditions which influences the life of an organism like their growth, survival, development and reproduction.

→ It is composed of physical surroundings, living organisms and climatic conditions of a region in which an organism live.

ECOSYSTEM :→

* This term was coined by A. G. Tansley in 1935.
* It is the structural and functional unit of biosphere.
* All the interacting organisms in an area together with a non-living components of the environment form an ecosystem.

Types of Ecosystem

Natural

- The naturally occuring ecosystem without any human support is called as Natural ecosystem.

Man-made or Artificial

- An ecosystem which is created and maintained by human is called as artificial or man made ecosystem.

- It possess self-regulating mechanism.
  - Terrestrial: Desert, grassland, forests etc.
  - Aquatic: Ponds, lakes, oceans, seas etc.

- It does not possess any self-regulating mechanism.
  ex. Aquarium, Parks, crop fields, nursery, Botanical gardens etc.

COMPONENTS of ECOSYSTEM

BIOTIC

- These components include all the living organisms present in the ecosystem.
  ex plants, animals.
- The living organisms are interconnected with one-another by various mechanisms and show inter-dependence on each other.

On the basis of food they consume
- Producers - green plants or blue green algae
- Consumers - Herbivore, carnivores, omnivores.
- Decomposers

ABIOTIC

- These are the non-living components on which living organisms are dependent.
  eg light, air, temperature, wind, water, soil, precipitation

Decomposers – These are micro-organisms which feed on dead and decaying matter.

- Help in recycling of nutrients.

FOOD CHAIN

It is the linear arrangement which shows who eats whom.

OR

It is the linear network of living organism in community through which energy is transferred in the form of food.

Types of food chain

Terrestrial

Plants → Goat → Lion

Aquatic

Phytoplankton → Zooplankton → fish → shark.

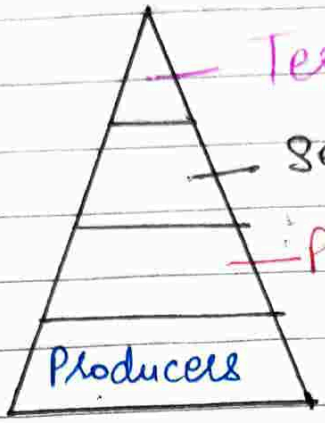
plankton means microscopic
Phyto means plants
Zoo means animals

TROPHIC LEVELS

– The transfer of food or energy takes place through various steps or levels in the food chain known as trophic levels.

OR

Each level of or step of a food chain forms a trophic level.



Significance of food chain:- 1. It involves the transfer of energy, material and nutrients.

2. The knowledge of food chain helps in understanding the feeding relationship as well as interaction b/w animals and ecosystem.

3. It also helps to understand the movement of toxic substances and the problems associated with biological magnification in the ecosystem.

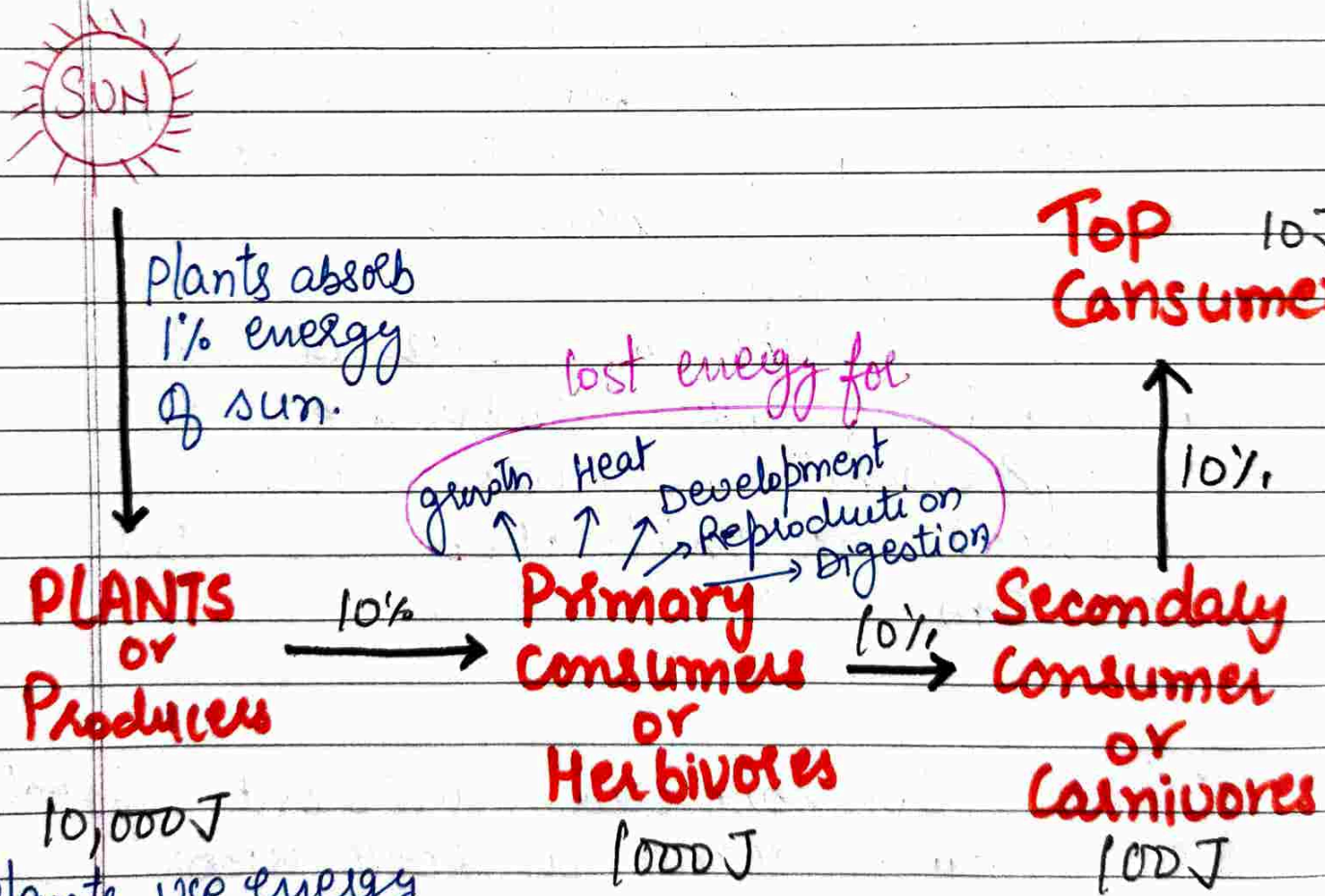
FOOD WEB:- Interconnected different food chains makes a food web.

Characteristics - 1. A food web provides alternative pathways of food availability.

2. Greater alternatives available in a food web make the ecosystem more stable.
3. food webs also help in checking the overpopulation of ~~tightly~~ plants and animals.

ENERGY FLOW :-

The energy accumulated by producers transfer to various trophic levels through a food chain. This phenomenon is called energy flow.



Plants use energy for evaporation or released in the form of Heat.

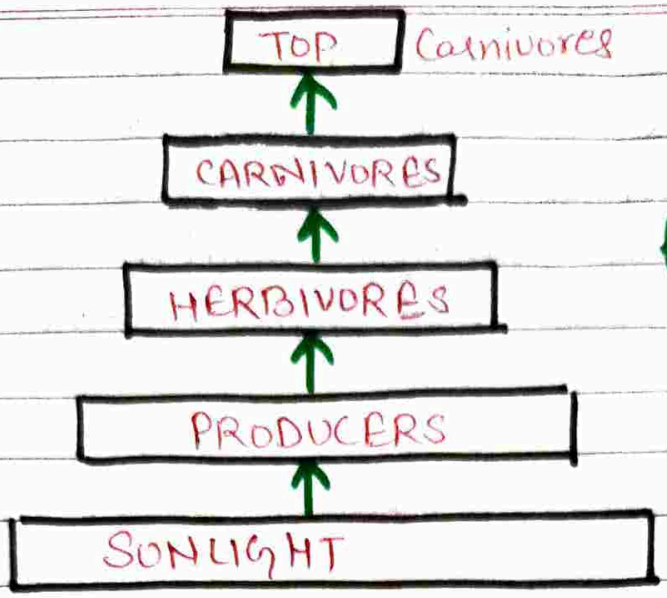


Diagram showing flow of energy in an ecosystem

Characteristics of Energy flow :—

- The producers capture about 1% of the energy of sunlight and convert it into food (chemical energy)
- These plants are eaten by primary consumers. A great amount of energy is lost by them as heat and some amount of energy is used in digestion, growth, reproduction.
- An average of 10% of energy of food eaten by the organism is turned back into its body that is available to the next trophic level.
- Generally food chains consist of three or four trophic level only as a little amount of energy is available for the next level of consumers. (only 10% of absorbed energy is available for next trophic level)

The flow of energy is unidirectional that means energy captured by autotrophs does not revert back into solar input and energy which passes to herbivores does not come back to autotrophs.

Ten percent law / 10% law

States by Lindeman in 1942

This law states that during transfer of energy from one trophic level to the next level, only about 10% energy is available to the higher trophic level and the remaining 90% is lost in respiration and heat.

BIOLOGICAL MAGNIFICATION OR BIO-MAGNIFICATION

It is the phenomenon of progressive increase in the concentration of toxicants in organisms at each successive trophic level.

Cause of Bio-magnification:-

As the chemical (pesticides, fertilisers, DDT, insecticides) are non-biodegradable so they get accumulated in organisms and their concentration goes on increasing at each trophic level.

(for extra Knowledge)

EUTROPHICATION: — from Greek eutrophos mean "well nourished"

is when a body of water becomes overly enriched with minerals and nutrients which induce excessive growth of algae.

* This process may result in oxygen depletion of the water body.
* That leads to decreased population of aquatic animals.

INTEXT QUESTIONS Page No - 260:

Ans1. Already done

Ans2. Organisms that feed on dead plants and animals are called decomposers, eg bacteria, fungi etc. They breakdown the complex organic compounds present in the dead remains into simpler substances and obtain nutrition from them. These substances are released into the soil and the atmosphere.

Thus, they play the following roles.

(i) They help in recycling of materials, replenishment of the soil's nutrients etc.

(ii) They clean our environment by decomposing dead organisms and organic wastes.

OZONE :→ . O_3 is the triatomic molecule of oxygen.

- It is found in stratosphere ie 20-30 km above the earth.
- It is a deadly poison. However at the higher levels of the atmosphere it performs an essential function.

* **formation of ozone :-** $O_2 \xrightarrow{UV} O + O$

(O_2: oxygen molecule; $O + O$: Monoatomic oxygen (Free atoms) (Highly unstable))

$O_2 + O \rightarrow O_3$ (ozone)

* **Importance of ozone :-**
  - It protects the surface of earth from harmful UV radiations of the sun.
  - These UV radiations can cause skin cancer in human beings, damage eyes (cataract), decrease crop yield, disturb global rainfall etc.

* **Depletion of ozone layer :-**
  - Depletion of ozone layer was mainly caused due to increased used of chemicals like CFCs.
  - CFCs are used in refrigerants as coolants and in fire extinguishers.
  - CFC's are very stable so they do not degrade easily and rise high up in the atmosphere.
  - In upper atmosphere UV radiations breaks down CFC molecule and release chlorine atom.
  - This chlorine atom dissociate O_3 into Oxygen.

* You will be surprised to know that a single 'active chlorine' converts one lakh molecules of ozone into oxygen.

* In 1987, United Nations Environment Programme (UNEP), signed an agreement to freeze the production of CFCs.
* In place of CFC, we can use HFCs (hydrofluorocarbon)

WASTE SUBSTANCES —

The useless leftover or discarded substances are called waste substances. Generally they are of three types :-

Waste substances

- SOLID — Agricultural waste, Industrial waste, Household waste
- LIQUID — Chemical waste
- GASEOUS — Smoke from chimneys and automobiles etc.

These waste substances can be divided into two main groups :-

Biodegradable
Non-biodegradable

(i) Biodegradable substances :- The substances which can be disposed off naturally by the action of microorganisms like bacteria, fungi etc. are called biodegradable substances.
- These organisms secrete enzyme which causes breakdown of biodegradable substances into simple forms.

Eg :- Vegetable peels, Kitchen waste, Agricultural waste, waste paper etc.

Harmful Effects of Biodegradable Substances :-

They act as pollutants when their quantity becomes large.

1. Degradation of biodegradable waste leads to foul smell.
2. Dumping of industrial wastes reduces the fertility of soil and leads to reduction in crop yields.
3. Breeding of flies in huge quantity on these waste carries germs and spread diseases.
4. Dumping of waste into water bodies leads to water pollution and is responsible for spreading of various water borne diseases.

(ii) Non-Biodegradable substances :-

Substances that cannot be converted into harmless simples forms by the action of micro-organisms are called non-biodegradable substances.

Eg :- Radio active waste, plastic, insecticides, heavy metals like lead, aluminium, arsenic etc.

Harmful Effects of Non-Biodegradable Substances :-

1. Long term exposure of pesticides / chemicals to soil may allow them to enter the food chain and harm the organisms.
2. Substances like radioactive waste, lead, mercury etc. accumulate in the environment and causes life threatening diseases in humans and other living beings.
3. They pollute water and harm the aquatic plants and animals.

INTEXT QUESTIONS Page No- 262.

Ans1 → Already done (definitions)

Ans2 → Already done (effects of biodegradable substances)

Ans3 → Already done (effects of non-biodegradable substances)

GARBAGE :-

The household waste is called garbage.

* Methods of garbage/waste disposal :-

1. Recycling :- It is the processing of waste materials to form new products. Materials like tin cans, metallic articles, polythene, glass etc. are recycled.

2. Composting :- Biodegradable domestic waste such as left over fruit, vegetable peels etc. can be burried in a pit, dug into ground. They are converted into compost and used as manures.

3. Sewage Treatment :- Sewage is carried over to sewage treatment plant. Here the sewage is filtered. Organic material in the sewage is allowed to settle down and decompose in large tanks. The water from these tanks is cleaned and is released into water bodies.

4. Biogas production :- In some places, sewage is decomposed anaerobically to yield biogas and manure.

5. Incineration :- It is the burning of substance at high temperature to form ash. It reduces the volume of waste considerably. It is commonly used to dispose hospital waste.

6. Landfills :- Solid waste is dumped into a low lying area and covered with soil. A big landfill site can be used to dispose waste material for a considerable time.

INTEXT QUESTIONS :- Page No- 264

Ans1 → Already done (ozone and absorb UV radiations)

Ans2 → Already done (methods of waste disposal)

BACK EXERCISE Page No- 264

Ans1. (a) cake, wood and grass.

Ans2 → (b) grass, goat, human.

Ans3 → (d) All of the above.

Ans4 → If we will kill all the organisms in one trophic level; the lower trophic level will grow more in number and the higher trophic level will not survive. Hence, the flow of energy from one trophic level to another will not take place.

Extra eg. [Suppose, all herbivores in an ecosystem are killed. There will be no food available for carnivores of that area. in return that affect their population. Also, population of producers will go on increasing.]

Ans5 → Yes, the impact of removing all the organisms in a trophic level will be different for different trophic levels. The lower trophic level of an ecosystem has a greater number of individuals than the higher trophic levels.

Removal of producers will affect all the organisms of successive trophic levels and it will threat their survival. The removal of higher trophic level will lead to increase in organisms of lower trophic level and the organisms of higher trophic level will die due to the shortage of food.

(ii) No, removal of all organisms of a trophic level will disturb the ecosystem. Killing of higher trophic level organisms will cause explosion in the population of lower level of organisms. This will adversely affect the ecosystem.

Ans6 → Biological magnification (definition already done)

Yes, the level of magnification will be different at different levels of ecosystem because chemicals do not degrade and get accumulated progressively at each trophic level which leads to bio magnification. Biomagnification is more in organisms of higher trophic level.

Ans7 → Already done (Harmful effects of non-biodegradable waste)

Ans8 → If all the waste is biodegradable, then there will be no accumulation of waste and Earth would be a cleaner place to live. But, if this biodegradable waste is too large in amount then its slow degradation may lead to

air pollution. as well as water and land pollution.

Ans 9→ Thinning of ozone layer present in stratosphere is called depletion of ozone layer.

Due to depletion of ozone layer, harmful ultraviolet radiations can reach the surface of earth, which may lead to skin diseases, cancer etc.

* To reduce the depletion of ozone layer, use of CFC's has been minimised. In 1987, UNEP has passed an agreement to freeze CFC production.