Light: Reflection & Refraction

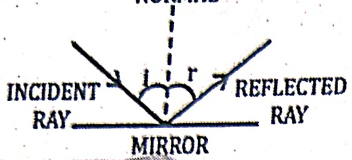
REFLECTION OF LIGHT

The Bouncing back of light when it hits a polished surface like mirror.

Laws of Reflection :-

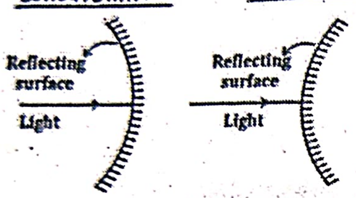
(i) $\angle i = \angle r$
Angle of incidence = Angle of Reflection

(ii) The incident ray, reflected ray, and the normal, all lie in the same plane.

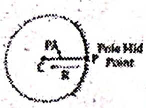


Spherical Mirrors :-

concave mirror — convex mirror

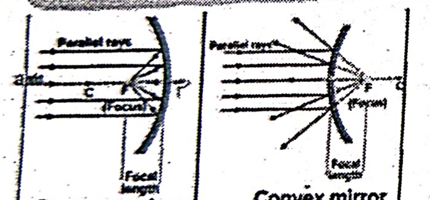


Pole :- Centre of reflecting surface of spherical mirror.
Centre of Curvature - Centre of the sphere of which the mirror is part of



Principal Axis - line joining P and C
Radius of Curvature - Distance PC
* Principal Axis is normal to mirror at Pole.

Principle Focus (F) and Focal length (f) :-



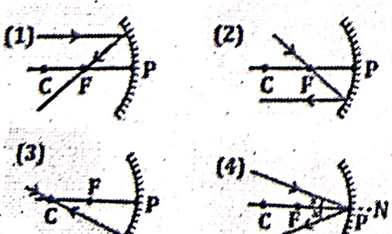
Concave mirror — converging mirror
Convex mirror — Diverging mirror

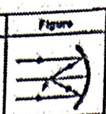
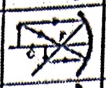
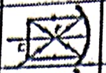
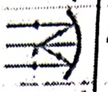
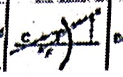
In our syllabus
$R = 2f$

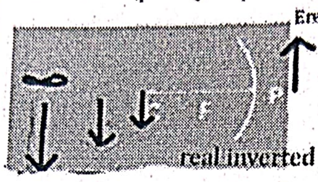
Image formation and characteristics

* If rays of light actually meet → Real
* If rays of light appear to meet → Virtual

Image formation - Concave mirror



Position of object	Figure	Position of image	Nature of image
1. At infinity		At the principal focus or in the focal plane	Real, inverted, extremely diminished in size
2. Beyond the centre of curvature		Between the principal focus and centre of curvature	Real, inverted and diminished
3. At the centre of curvature		At the centre of curvature	Real, inverted and equal to object
4. Between focus and centre of curvature		Beyond centre of curvature	Real, inverted and bigger than object
5. At the principal focus		At infinity	Extremely magnified
6. Between the pole and principal focus		Behind the mirror	Virtual, erect and magnified



	object	Image
1)	∞	F
2)	∞ C	F C
3)	C	C
4)	C F	C ∞
5)	F	∞
6)	F P	

Uses of Concave Mirror

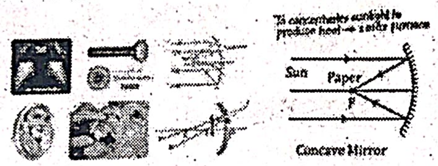
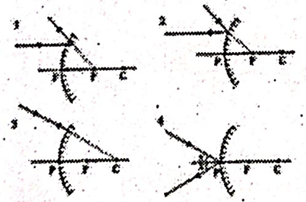
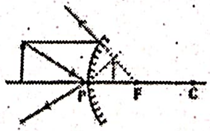


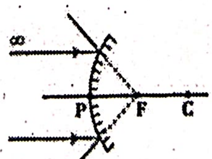
Image Formation: convex Mirror



Object at finite distance :-
(anywhere except ∞)
characteristics
Image between F and P,
virtual, Erect, Diminished
upright



object at ∞ :-
Characteristics
Image at F
Virtual, Erect, Highly Diminished point-size



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

Use of Convex Mirror :-

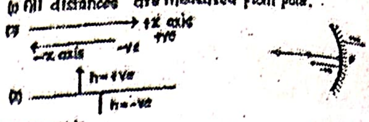
* Rear-View mirrors -
  * upright/Erect Image
  * wider field of view

summary - convex and concave

* Concave Mirror
  * Inverted
  * Erect/Virtual upright, Enlarged (Gandhi + Badi Image)
* Convex Mirror
  * only Erect, Virtual Diminished (Gandhi or chotti image)

Sign Convention

(i) All distances are measured from pole.



Mirror formula

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

u = object distance
v = Image distance

Note: u → -ve Always
f → +ve convex
concave → -

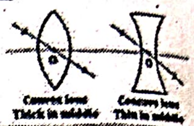
Magnification (m)

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

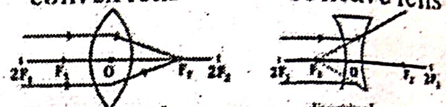
$h_i = m h_o$

Spherical lenses :-

* Principal axis
* Optical Centre (O)

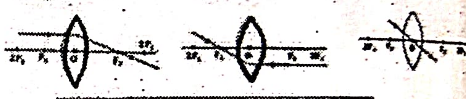


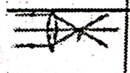
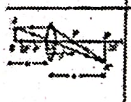
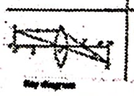
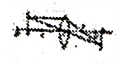
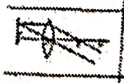
Principle Focus (F) and Focal length (f)

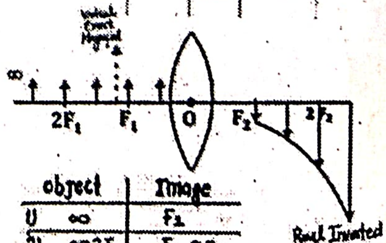


Note: They have two F
F_1 and F_2 due to two curved surfaces

image formation → Convex lens

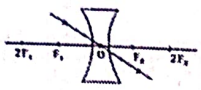


Ray diagram	Position of object	Position of image	Nature of image
	At infinity	At F	Real, inverted and highly diminished
	Between infinity and 2F	Between F and 2F	Real, inverted and diminished
	At 2F	At 2F	Real, inverted and same sized
	Between F and 2F	Beyond 2F	Real, inverted and enlarged
	At F	At infinity	Real, inverted and enlarged
	Between F and O	On the same side of the lens	Virtual, erect and enlarged



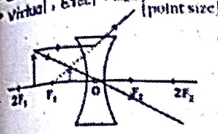
	object	Image
1)	∞	F_2
2)	∞ $2F_1$	F_2 $2F_2$
3)	$2F_1$	$2F_2$
4)	$2F_1 F_1$	$2F_2$ ∞
5)	F_1	∞
6)	F_1 O	

Image Formation → Concave lens



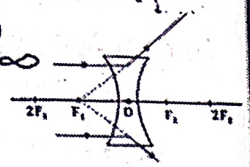
object at finite distance (anywhere except ∞)

characteristics of image
- Image between F_1 & O
- Virtual, Erect, highly diminished (point size)



object at ∞

characteristics of image
- Image at F_1
- Virtual, Erect, Highly Diminished



summary of convex and concave lens

convex lens → Inverted
convex lens → Erect/upright magnified
Concave lens → Erect/Upright Diminished (seedhi + chatti)

Sign convention, Lens formula & Magnification

1) Here all distances are measured from O (optical centre)
2) Rest all same rule for sign.

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

$$m = \frac{h_i}{h_o} \qquad m = \frac{v}{u}$$

u → −ve
f → +ve
convex → +ve

Power of a lens

- Ability of a lens to converge or Diverge Rays of light.
- it is defined as Reciprocal of focal length.

convex lens → +ve, $f \to +ve$, $P \to +ve$

$P = \frac{1}{f}$ (always in metre)

Dioptre (D)

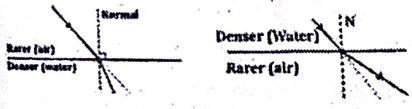
$\frac{cm}{100}$

power of combination: $P = P_1 + P_2 + \dots$, $P = \frac{1}{f_1} + \frac{1}{f_2} + \dots$

f_1, f_2 → in metres

Refraction of light :–

The Bending of light ray when its travels from one medium to another.



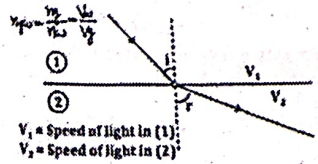
Rarer to Denser Medium (Bends towards the normal) | Denser to Rarer Medium (Bends away from the normal)

No change in medium No Bending

$$n_{21} = \frac{n_2}{n_1} = \frac{V_1}{V_2}$$

Refractive Index (R·I)

Measure of How dense a medium is



R·I of 2 w·r·t 1

$$n_{21} = \frac{n_2}{n_1} = \frac{V_1}{V_2}, \quad n_{aw} = \frac{n_a}{n_w} = \frac{V_w}{V_a}$$

Absolute Refractive index

When first medium is air and second medium is any medium.

R·I of water w·r·t Air

$$n_{wa} = \frac{n_w}{n_a} = \frac{V_a}{V_w}$$

$n = 1$, $V_a = c$

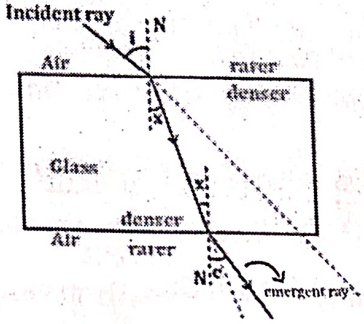
$$n_w = \frac{c}{V_w}$$

$$n_x = \frac{c}{V_x}$$

✓ R·I of glass is 1.5
✓ R·I of water is 1.33

✲ Which is more dense? Glass
✲ In which light travels faster → water

Refraction Through A Glass Slab



To remember
① emergent ray is parallel to incident ray.
② $\angle e = \angle i$

Laws of Refraction :–

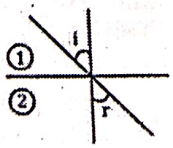
(i) The incident ray, Normal & the refracted ray lies on the same plane.
(ii) The ratio of sine of Angle of incidence to the sine of angle of refraction remains constant for a given pair of media.

Snell's law :–

$$\frac{\sin i_1}{\sin r_1} = \frac{\sin i_2}{\sin r_2}$$

$$\frac{\sin i}{\sin r} = \text{constant}$$

$i \to$ change $\quad i_1\ r_1$
$r \to$ change $\quad i_2\ r_2$

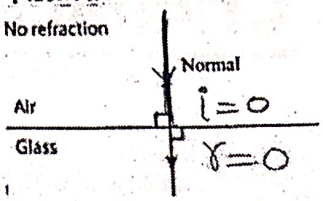


$$n_1 \sin i = n_2 \sin r$$

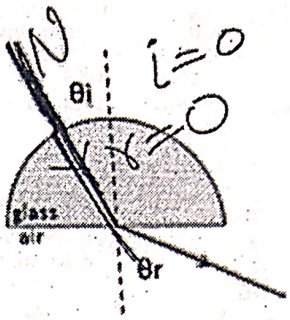
$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1} = n_{12}$$

Case of NO Bending

1) Normal incidence



2) No medium change or no change in refractive index



Chemical Reaction & Equations

CHEMICAL REACTION:- A process in which new chemicals are formed.

CHEMICAL EQUATIONS:- chemical Reaction with symbol and formula.

$H_2(g) + O_2(g) \longrightarrow 2H_2O(l)$
(Reactant) (product)

(aq) - Soluble in water
(PPt)↓ - insoluble in water
(s) - Solid
↑ - Gas

✲ BALANCED CHEMICAL REACTION :-

- Number of Atoms of each element in chemical Equation should be same LHS = RHS.

LHS RHS
$A_2 + B_2 \longrightarrow 2AB$

- **Why Balance?**

Conservation of mass - Total mass of Reactant should be equal to total mass of product.

Trick:- • First Balance Metals Zn, Fe, Na, Al, Mg, Mn, Cu, Ca, Pb, Ba
• Second Balance Non-Metals Cl, Br, S, N, C
• Third Balance oxygen then 'H'

$Zn + 2HCl \longrightarrow ZnCl_2 + H_2$
$2Pb(NO_3)_2 \longrightarrow 2PbO + 4NO_2 + O_2$

✲ TYPES OF CHEMICAL REACTION :-

(A) COMBINATION REACTION

Two or More Reactants combine to form a single product.

(i) $2Mg(s) + O_2(g) \longrightarrow 2MgO(s)$
(ribbon) (White powder)

✓Dazzling white light (Very bright light) is emitted.
✓Heat Evolved - Exothermic Reaction.

(ii) $CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq)$
(Quicklime) (slaked lime)

✓Quicklime reacts vigorously with water.
✓Rise in temperature (exothermic Reaction
✓Example of combination and Exothermic reaction.

(iii) $C(s) + O_2(g) \longrightarrow CO_2(g)$
(Burning of coal)

(B) DECOMPOSITION REACTION

One Reactants breaks into two or more products.

(1) Thermal Decomposition

Thermolysis - breaks due to heat.

$CaCO_3(s) \xrightarrow[\Delta]{Heat} CaO(s) + CO_2(g)$
(limestone) (Quicklime)

$2FeSO_4(s) \xrightarrow[\Delta]{Heat} Fe_2O_3(s) + SO_2 + SO_3\ (g)$
(Green) (Red/Brown)

$2Pb(NO_3)_2(s) \xrightarrow[\Delta]{Heat} 2PbO(s) + 4NO_2(g) + O_2(g)$
(White) (yellow) (Brown gas)

✓All 3 are Thermal Decomposition and Endothermic Reaction.
✓$SO_2(g) + SO_3(g)$ are air pollutant.

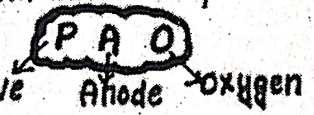
(2) Electrolytic Decomposition

Electrolysis - break due to electric current

$2H_2O(l) \xrightarrow{Electrolysis} 2H_2(g) + O_2(g)$

✓Volume of gas $H_2 : O_2 = 2:1$

✓Pure water is poor conductor of electricity so a few drop of acids is added, which acts as electrolyte and conduct electricity.



(3) Photochemical Decomposition

Photolysis - Breaks due to light

- $2AgCl \xrightarrow{sunlight} 2Ag(s) + Cl_2(g)$
(White) (Grey)
- $2AgBr \xrightarrow{sunlight} 2Ag(s) + Br_2(g)$
(yellow) (Grey)

✓Used in Black and White photography

(C) DISPLACEMENT REACTION

- More reactive element Replace a less Reactive element from its salt solution

$A + BC \longrightarrow AC + B$
displace

✲ Reactivity series:-

Potassium kudi (K)	↑ most reactive
Sodium Naal (Na)	
Calcium car (Ca)	
Magnesium Mango (Mg)	
Aluminium Alto (Al)	
Zinc Zisko (Zn)	
Iron Fir (Fe)	
Lead lekar (Pb)	
Hydrogen Hum (H)	
Copper chale (Cu)	
Mercury Mathura (Hg)	
Silver sath (Ag)	less reactive
Gold Ghumne (Au)	

- $Fe(s) + CuSO_4(aq) \longrightarrow FeSO_4(aq) + Cu(s)$
(Blue) (Green) (Red/Brown)

- $Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4 + Cu$
(Blue) (Colourless)
- $Zn(s) + H_2SO_4(aq) \longrightarrow ZnSO_4 + H_2\uparrow + Heat$

✓H_2 gas is colourless and odorless, burn with pop sound and extinguishes burning candle.
✓Temperature increases, reaction is highly Exothermic.

(D) DOUBLE DISPLACEMENT REACTION :-

- Exchange of ions between Reactants.

$A^+B^- + C^+D^- \longrightarrow AD + CB$

- $Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s)\downarrow + 2NaCl$
(Colourless) (Colourless) White ppt
- $Pb(NO_3)_2 + 2KI(aq) \longrightarrow PbI_2\downarrow + 2KNO_3$
lead nitrate (colourless) Potassium iodide (colourless) (yellow ppt)

✓Example of double displacement and precipitation reaction.

HEAT IN REACTIONS :-

(A) Exothermic Reaction

$A + B \longrightarrow C + \text{Heat}$

(1) Respiration

- $\text{Glucose} + O_2 \longrightarrow CO_2(g) + H_2O(l) + \text{Energy}$

(2) Burning of natural gas

- $CH_4(g) + O_2(g) \longrightarrow CO_2(g) + H_2O(g) + \text{Heat}$

(3) Decomposition of vegetables into compost.

(B) Endothermic Reaction

$A + B \xrightarrow{\text{Heat}} C$

- All examples of Decomposition Reaction
- $2\,FeSO_4 \xrightarrow{\text{Heat}} Fe_2O_3(s) + SO_2(g) + SO_3(g)$
- $CaCO_3(s) \xrightarrow{\text{Heat}} CaO + CO_2(g)$ reaction.

REDOX REACTION The Reaction in which oxidation and Reduction occure.

Oxidation

If a chemical (A) → loss of electron / Gains of oxygen / loss of Hydrogen

it is called oxidation of A and 'A' is said to be oxidised.

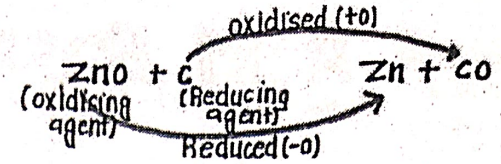
$Cu(s) + O_2(g) \xrightarrow{\text{Heat}} CuO(s)$

Reduction

If chemical (B) → Gain of e^- / loss of O_2 (oxygen) / Gains of Hydrogen

it is called Reduction of B and 'B' is said to be Reduced.

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



CORROSION :- When a metal is attacked by substances around it such as moisture (water vapour + oxygen), acid etc. it is said to be corrode and this process is called corrosion.

Examples of corrosion :-

(1) Rusting of iron – Hydrated Reddish Brown iron oxide (rust)

(2) Tarnishing of copper - Green

(3) Tarnishing of silver - Black

RANCIDITY :- • The taste or smell of food material containing fat/oil changes when it is left exposed to air for a long time.

✓ oxidation of fat/oil present in food material causes Rancidity.

Prevention :- (1) Antioxidants
(2) Air tight Container
(3) Bags of chips (Flushed with N_2 gas)

PHYSICAL CHANGE AND CHEMICAL CHANGE

• No chemical Reaction happens. • No new chemical is formed.	• A chemical reaction happens. • shape, size, colour, etc may also change
Examples	Examples
• Boiling water from the evaporating dish. • Melting of ice to give water. • Melting of wax. • crushing a paper cup. • Crystallisation.	• Burning of paper. • fermentation of grapes. • sousing of milk. • curd from milk is left in a room during summer • Rusting of iron. • Food digestion. • Food cooking. • chemical Battery usage.

Acid, Bases & Salts

Acid :- A substance that gives $H^+(aq)$ as only +ve ion in aqueous solution.

Example:- HCl, H_2SO_4, HNO_3
CH_3COOH (acetic acid)

(i) Acids are sour (khatte) in taste
(ii) Acids turns blue litmus red.

BASE :- A substance which increase Hydroxyl ions $OH^-(aq)$ in aqueous solution.

Example- NaOH, KOH, NH_4OH

(i) Bitter in taste.
(ii) Soapy to touch.
(iii) Base turns red litmus blue.

INDICATORS:- Tells wheater a substance is acid or base.

Indicators	Base	Acids
Litmus	Blue	Red
Turmeric	Red	yellow
Phenolphthalein (Colorless)	Pink	colourless
Methyl Orange Range	yellow	Red

Trick -> LaBouR TRY PoPCorn with MaYoR

(i) Litmus solution is originally purple in colour where no acid or base is added.
(ii) Pure water has no effect on colour of litmus.

OLFACTORY INDICATORS:- substance whose smell odour changes in acidic or basic medium.

Example:- Onion, vanilla essence, clove oil

Acid Retains smell — Base loses smell

ACID AND BASE IN WATER

Acids produce H^+ ions in aqueous Solution:-

$H_2SO_4 \xrightarrow{H_2O} 2H^+(aq) + SO_4^{2-}$

$HCl \xrightarrow{H_2O} H^+(aq) + Cl^-$

$H^+ + H_2O \longrightarrow H_3O^+$ (Hydronium ion)

$H^+(aq) = H_3O^+$ gives common properties to all acids.

Preparation of HCl gas:-

$2NaCl(aq) + H_2SO_4(conc) \downarrow \rightarrow Na_2SO_4(aq) + 2HCl(g)$

$HCl(g) \xrightarrow{\text{dry blue litmus}}$ No change

$HCl(g) \xrightarrow{\text{moist blue litmus}}$ Red colour

Alkalis - Some bases are water soluble, these are called Alkalies.

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

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

Example:- NaOH, KOH, $NH_4(OH)$

- All Bases are not water soluble.
- Bases but not alkali - $Zn(OH)_2$, $Fe(OH)_2$, $Cu(OH)_2$

Acid + water is a highly Exothermic.

Always add acid slowly 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 also break due to heat given out.

Trick

AaThuW
Acid to water

Acid and Alkali - Electric current ?

- Electric current through the solution is carried by ions.
- Solution of Acids:- HCl, H_2SO_4, HNO_3 and CH_3COOH generates ions and hence they conduct electricity.
- Alkalis also generate ions - NaOH, KOH, $Mg(OH)_2$, NH_4OH and hence conduct electricity.
- Glycose, Alcohol do not generate ions and hence do not conduct electricity.

REACTION with METAL

Metal + Acid(dil) ⟶ Salt + H

Most Reactive

K (Potassium)	katrin
Na (Sodium)	Ne
Ca (Calcium)	Cas
Mg (Magnesium	Mang
Al (Aluminium)	Alu
Zn (Zinc)	Zen
Fe (iron)	Ferra
Pb (lead)	Firbl
H (Hydrogen)	Hath
Cu (Copper)	kyu
Hg (Mercury)	Mili
Ag (silver)	Silver
Au (Gold)	Audi

less Reactive

Preparation of Hydrogen gas

$H_2SO_4 + Zn \longrightarrow ZnSO_4 + H_2\uparrow$ (White Vitriol)

- $ZnSO_4$ is white coloured salt called White vitriol.
- H_2 gas burns with pop sound and Extinguishes a candle.
- Combustible but not supporter of Combustion.

✡ Metal + Base ⟶ Salt + H_2

$2NaOH(aq) + Zn(s) \longrightarrow Na_2ZnO_2(s) + H$ (sodium zinca

- Does not happen with all metals.

NEUTRALISATION :-

Acid + Base ⟶ salt + water

- $HCl(aq) + NaOH(aq) \longrightarrow NaCl + H_2$
- $H_2SO_4 + Ca(OH)_2 \longrightarrow CaSO_4 + H$

Metal oxide + Acid ⟶ Salt + wa
(ZnO/CuO/MgO/CaO)

$CuO(s) + 2HCl(dil) \longrightarrow CuCl_2(aq) + H$
(Black solid) (Blue-green)

- Generally Metaloxide are basic in n because they react with Acid to salt and water.

Non Metal oxide + Base ⟶ salt + water
($SO_2/SO_3/CO_2/NO_2$)

$CO_2 + Ca(OH)_{2(aq)} \longrightarrow CaCO_3 + H_2O$

- Generally Non-metal oxide are acidic in nature because they react with base to give salt and water.

Acid + Metal carbonate (CO_3^{2-})
OR
Metal Hydrogen carbonate HCO_3^- (Bicarbonate)

↓

salt + CO_2 + H_2O↑

CO_2 turns lime water Milky

- $CO_{2(g)} + Ca(OH)_2$ (lime water) ⟶ H_2O + $CaCO_{3(s)}$↓ (White ppt) (Calcium Carbonate)

Test:-
on passing excess of CO_2, milkiness disappear.

- $CaCO_3 + H_2O + CO_2 \longrightarrow Ca(HCO_3)_{2(aq)}$

$Na_2CO_3 + 2HCl \longrightarrow 2NaCl + H_2O + CO_2$

Strength of Acid and Base

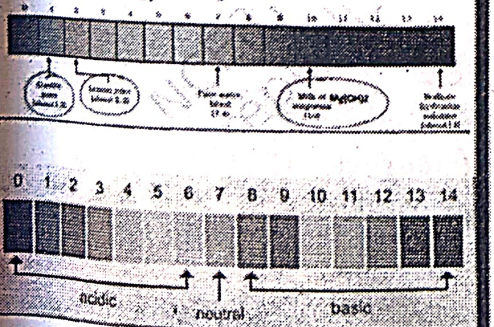
pH: P(Potenz → Power)
H → Hydrogen

- Measure $H^+(aq)$ ions concentration in a solution.
- pH ranges from 0 (very acidic) to 14 (Very basic)
- pH↓ → $H^+(aq)$↑ → Acidic↑

pH < 7 Acidic
pH = 7 Neutral
pH > 7 Base

Universal Indicator:-

Substance which detect nature of chemical as acid or base and also measure strength of it. eg- pH paper



Strong Acid:- H_2SO_4, HCl, HNO_3
- Gives more concentration of $H^+(aq)$ ions.

Weak Acid:- CH_3COOH (Acetic acid), citric acid, lactic acid, H_2CO_3 (carbonic acid).
(generally organic acids-natural sources)
- Gives less concentration of $H^+(aq)$ ions.

Strong Base:- NaOH, KOH, $Ca(OH)_2$
- Gives more concentration of OH^- ions.

Weak Base:- NH_4OH, $Zn(OH)_2$, $Cu(OH)_2$, $Fe(OH)_2$.
- Gives less concentration of OH^- ions.

pH of salts?

Acid + Base ⟶ salt + Water

✓ Strong Acid (HCl) + Strong Base (NaOH) ⟶ Neutral salt (NaCl) + Water (pH=7)

✓ Weak Acid (H_2CO_3) + strong Base (NaOH) ⟶ Basic salt (Na_2CO_3) + Water (pH>7)

✓ strong acid (HCl) + Weak Base (NH_4OH) ⟶ Acidic salt (NH_4Cl) + Water (pH<7)

Naturally Occurring Acids

Natural Source	Acid	Trick
Vinegar	Acetic Acid	sirka pillar acting kannelage.
Orange	citric Acid	Orange cheela andar silyaikli
Tamarind	Tartaric Acid	Imlee ko tar se bandha.
Tomato	Oxalic Acid	Tamatar Ox ne khaya
sour milk (curd)	lactic acid	Dahi ko lake me feka.
lemon	Citric Acid	lemon cheela andar silyaikli
Ant sting	Methanoic acid	Ant ne khaya Methi ka paratha.
Nettle sting	Methanoic acid	Net me fasa Methi ka paratha

Common salt (NaCl) [Rock salt]:-

(1) Sodium Hydroxide / Caustic soda (NaOH)

- Chlor - Alkali process

$2NaCl_{(aq)} + 2H_2O_{(l)} \xrightarrow{\text{electric current}} 2NaOH_{(aq)}$ (near cathode) + $Cl_{2(g)}$ (at anode) + $H_{2(g)}$ (at cathode)
Brine

Chor Khali

PArCl → Positive Anode chlorine
CHiNa → Cathode Hydrogen NaOH

- found in deposits in rock bed.
- Raw material for various chemical.

(2) Bleaching powder ($CaOCl_2$)

$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$
(Slaked lime) (Bleaching powder)

Uses:-
(i) Bleaching cotton and linen, wood pulp in paper factories, Bleaching washed clothes.
(ii) oxidising agent.
(iii) Make drinking water free form germs.

(3) Baking Soda ($NaHCO_3$)

$NaCl + H_2O + CO_2 + NH_3$
↓
$NaHCO_3 + NH_4Cl$
(sodium Hydrogen carbonate baking soda)

Uses:-
(i) for making tasty crispy pakora.
(ii) for faster cooking
(iii) Neutralise Acidity Antacid.
(iv) Soda-Acid fire extinguisher
(v) Delay curdling of milk.

Baking powder:-
Baking powder = Baking soda + Tartic Acid

$NaHCO_3 + H^+ \longrightarrow CO_2 + H_2O$ + salt

Uses:-
- cause bread or cake to rise making them soft or spongy.

(4) Washing Soda ($Na_2CO_3 \cdot 10H_2O$)

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

$Na_2CO_3 + 10H_2O \longrightarrow Na_2CO_3 \cdot 10H_2O$

Uses:-
(i) Glass, soap and paper industry.
(ii) Removing permanent hardness.

WATER OF CRYSTALLIZATION:-

- Fixed number of water molecules present in one formula unit of salt.
- $CuSO_4 \cdot 5H_2O$ (copper sulphate Crystals)
- $FeSO_4 \cdot 7H_2O$ (Ferrous sulphate Crystals)
- $CaSO_4 \cdot 2H_2O$ (Gypsum)
- $Na_2CO_3 \cdot 10H_2O$ (Washing soda) Sodium carbonate decahydrate)

✲ $CuSO_4 \cdot 5H_2O$ (Blue) $\xrightarrow{\text{Heat}}$ $CuSO_4$ (white) + $5H_2O$

✲ $FeSO_4 \cdot 7H_2O$ (Green) $\xrightarrow{\text{Heat}}$ $FeSO_4$ (White) $\xrightarrow{\text{Heat}}$ Fe_2O_3 (Brown)

Plaster of Paris:- (POP)

$CaSO_4 \cdot \frac{1}{2}H_2O$ ⟶ White powder

▲ $CaSO_4 \cdot 2H_2O$ (Gypsum) $\xrightarrow{373K}$ $\frac{3}{2}H_2O$ + $CaSO_4 \cdot \frac{1}{2}H_2O$ (POP)

✲ Plaster of paris is used for making toys, making surface smooth and materials of decoration.

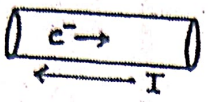
Electricity

CHARGE (Q) :-

(i) Two types of charge ⊕ & ⊖
(ii) SI unit of charge Coulomb (C)
(iii) smallest independent charge Electron (e^-)

$1e^- = 1.6 \times 10^{-19} C$

⊕ → ← ⊖ Attract
← ⊕ ⊕ → Repel
← ⊖ ⊖ → Repel

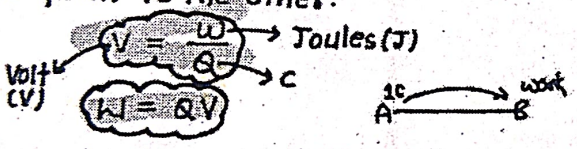


CURRENT (I) :-

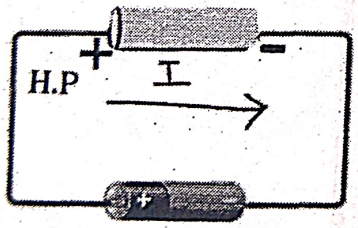
* current is Rate of flow of charge. (flow of +ve charge)
* Direction of current :- opposite to direction of flow of electron.
* SI unit of current :- Ampere (A)

POTENTIAL DIFFERENCE (P.D) [V] :-

Potential Difference between two points is amount of work done in moving a unit charge (1C) from one point to the other.



- Potential difference measured by an instrument voltmeter
- Electric current (A) is measured by Ammeter.

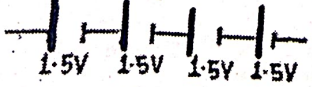


* Electron flows from lower potential to higher potential.

* current (I) flows from Higher potential to lower potential.

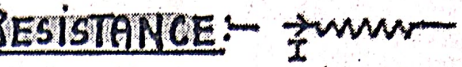
symbol :- —|+ |— (cell)
1.5V

combination of cell
↓
Battery

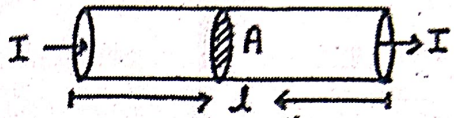


= 6V

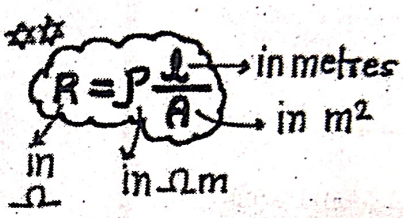
RESISTANCE :-



obstruction offered to the flow of charges (current)
OR
property of conductor to obstruct flow of charges.



l = length
A = Area of cross section



Factors on which Resistance of (Conductor) Depends :-

(i) l — R ∝ l
(ii) A — R ∝ 1/A
R = ρ l/A → m, m²
ohm Ω

(iii) Material resistivity) property of material.
(iv) Temperature Temperature ↑ Resistance

SI unit of R :- ohm (Ω)

Resistivity (ρ) :- unit = Ωm

(i) ρ is a property of the material.
(2) Metals and Alloys have low ρ → Good conductor of electricity.
copper and Aluminium are used for transmission lines.
(3) Insulators like Rubber and Glass have high ρ

OHM'S LAW :-

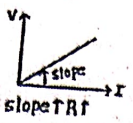
The potential difference(V) across the ends of a metallic conductor is directly proportional to the current flowing through it provided its temperature remains the same.

$V \propto I$ *Temperature constant

$V = IR$

volt — Ampere — ohm

$I \uparrow \Rightarrow R \downarrow$ (V constant)



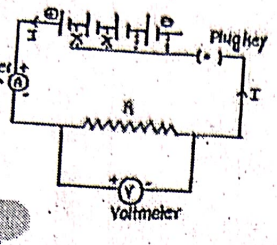
slope ↑ R ↑

V v/s I straight line pass origin

trick- VIRal

V=IR

Experimental setup-

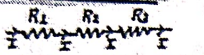


Combination of Resistors:-

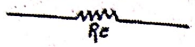
[1] SERIES

I → same

V → Different



$V = IR_1$ $V = IR_2$ $V = IR_3$

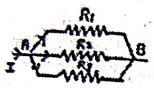


$R_e = R_1 + R_2 + R_3$

[2] Parallel :-

I → Different

V → same



$\frac{1}{R_e} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$

Disadvantage of series combination

(1) If one device fails, all others devices in that series will not work.

(2) Devices of different types need different current. for e.g a bulb and heater needs different current and cannot be connected in series. this can be done with parallel combination.

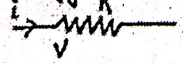
CIRCUIT DIAGRAM

CIRCUIT → Continuous & closed path of electric current

S.No.	Components	Symbols
1.	An electric cell	
2.	A battery or a combination of cells	
3.	Plug key or switch (open)	
4.	Plug key or switch (closed)	
5.	A wire joint	
6.	Wires crossing without joining	
7.	Electric bulb	
8.	A resistor of resistance R	
9.	Variable resistance or rheostat	
10.	Ammeter	A
11.	Voltmeter	V

Electric Power:-

- Rate at which electrical energy is consumed.



① $P = VI$ → Ampere

watt ← Volt

② $P = I^2R$ ③ $P = \frac{V^2}{R}$

✲ $V = IR$

✲ $I = \frac{V}{R}$

Electrical Energy(E) :-

supplied by cell

Generally E → S.Unit → Joules

$1 Kwh = 3.6 \times 10^6 J$ but, generally E is measured in KWh

$E = P \times t$ → in hour

Kwh (electrical energy) — in kw

watt = 1000

Bijli ka Bill Banao :-

Energy ka Paisa

Electric Meter ⇒ 1 unit of energy

1 unit = 1 kwh

Bill = no. of units × price of unit

Energy in kwh

(kitni energy use ki kwh mein)

Heating Effect of Electric current:-

When an electric current passes through a conductor or an electric device, the conductor becomes hot after some time and produce heat. This is called Heating effect of electric current.

Practical Application of Heating Effect of electric current

ex- bulb, toaster, mobilephone, fan

Alloys → High resistivity ⇒ Heat ↑

→ High Melting point

→ Do not oxide

$R = \frac{\rho l}{A}$ $H = i^2Rt$

Joule's law of Heating :-

$H \propto i^2$

$H \propto R$

$H \propto t$

$H = i^2Rt$ — Heat(H) produced in a Resister

J — A — Ω

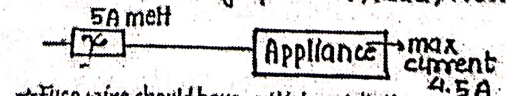
R — (i) Pure Resister — $V = IR$

Electric Bulb :-

- Filament Tungsten (High melting point) is Heated and it emits light. Most of energy consumed appears as heat, only small part as light tungsten has very high melting point.

Electric Fuse - Safety Device:-

- Electrical fuse is used to prevent short circuit. fuse has low melting point.
  So, when high current passes through it melts and stop the flow of current.
- Fuse wire in series with the appliance.
- Fuse wire - Alloy of Al, Cu, lead, iron



✲ Fuse wire should have → High resistivity

High Temperature melt — low melting point — Resistance ↑

- If high current flows (more than required) fuse wire gets heated and melts.
  Rating of fuse - 1A, 2A, 3A, 4A, 5A, 10A etc
- Rating of fuse wire → maximum current

Life processes

1. Life process are the basic processes in living organisms which are necessary for maintaining their life.

2. The basic life processes are - nutrition, respiration, transportation and excretion.

3. Life process require energy which is provided by nutrition.

A. Nutrition - It is the process of taking food by an organism and its utilization by the body for life processes.

I. MODES OF NUTRITION -

(i) Autotrophic - It is a type of nutrition in which organisms can synthesize their own food.
E.g. - Green Plants.

(ii) Heterotrophic - It is a type of nutrition in which organisms do not possess the ability to synthesize their own food. They depend on autotrophs for their food supply directly or indirectly.
Eg. Animals, Fungi.

(iii) Types of Heterotrophic nutrition:

There are the main types of heterotrophic nutrition. They are saprophytic, parasitic and holozoic nutrition.

a) Saprophytic Nutrition: In this type of nutrition organisms secrete some digestive enzymes to digest the dead organic food and get nourishment from organic remains like excreta, dead organisms, etc.
Eg. Fungi, yeast and Mushrooms.

(b) Parasitic Nutrition - In this type of nutrition, one organism resides on or inside the body of another organism and derives its food without killing other organisms. Parasites are those organisms which obtain shelter & food from another organism.
e.g. Cuscuta, orchids, ticks, lice, leeches, roundworms, tapeworms, plasmodium etc.

(c) Holozoic Nutrition - In this mode of nutrition, the organism involves the intake of solid pieces of food. This food is subsequently digested and absorbed.
e.g. Amoeba, Paramecium, birds, fishes, humans etc.

It involves the following steps: ingestion, digestion, absorption and egestion.

II. NUTRITION IN PLANTS-

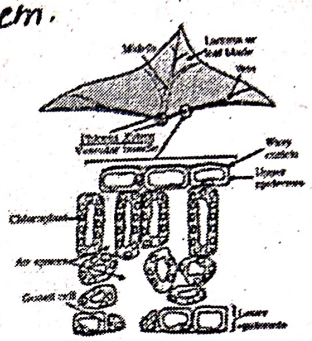
(a) Photosynthesis - It is the process by which plants prepare food by using carbon-dioxide and water in the presence of sunlight and chlorophyll. The food prepared is carbohydrate which is stored in the form of starch. Oxygen is released in the process.

(b) Equation of Photosynthesis

$$6CO_2 + 12H_2O \xrightarrow[\text{sunlight}]{\text{chlorophyll}} C_6H_{12}O_6 + 6O_2 + 6H_2O$$
(Glucose)

(c) Raw Materials required in photosynthesis -
(1) Carbohydrate.
(2) Photosynthetic Pigment
(3) Sunlight
(4) Water.

(d) Site of Photosynthesis - Photosynthesis occurs in the chloroplast or kitchen of the cell in green tissues inside and young stem.



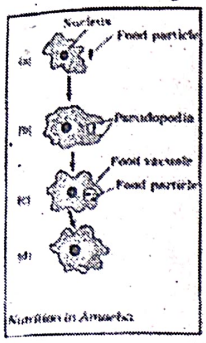
(e) Mechanisms of Photosynth
Photosynthesis takes place three main steps.
(i) Absorption of light ene by chlorophyll.
(ii) Conversion of light ener into chemical energy and splitting up of water molecules into hydrogen and oxygen.
(iii) Reduction of carbon dioxide by hydrogen to form carbohydrates.

(f) Importance of Photosynth
Photosynthesis is an anabolic process which provides food to the living organisms.
It purifies the atmospheric air by consuming CO_2, and evolving oxygen. It transforms light energy into chemical energy.

III. NUTRITION IN ANIMALS

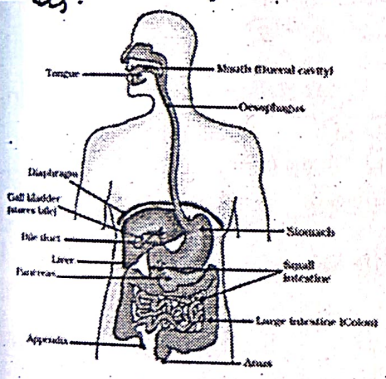
(a) Nutrition in Amoeba -

Amoeba is a unicellular animal living in water. It takes in food by forming finger-like projections called pseudopodia and forms a food vacuole. Inside the food vacuole, the food is digested and absorbed. The undigested foods is then sent out through the surface of the cell.



NUTRITION IN HUMANS

The human digestive system comprises of alimentary canal and associated digestive glands.



1. Mouth Salivary glands Secrete → Secrete Salaiva [Salivary amylase] → (change starch in sugar)
   - Teeth (Chewing / grading of food)
   - Tongue (Rolling, tasting of food)

(2) Oesophagus
Takes food from mouth to oesophagus by peristatic movements. (Contraction and expansion of alimentary canal)

(3) Stomach Gastric Juices
- Pepsin (Breaks down Protein)
- HCl (Makes Medium acidic)
- Mucus (Protects inner lining of stomach)

(4) Small Intestine
Liver → Secretes bile
Pancreas → Secrete pancreatic juice.

Intestinal Enzyme
- Carbohydrate → Glucose.
- Fats → Fatty acid + Glycerol
- Protein → Amino Acids

Pancreatic Juice
- Trypsin → Protein → Peptones
- Lipase → Emulsified fats → Glycerol + Fatty acids

Large fat globules —Bile Juice (emulsification)→ Small fat globules

(5) Large Intestine (Absorbs excess water)

(6) Rectum (Temporary collection of water)

(7) Anus (helps in egestion)

- As shown in the flow chart, digestion begins from the mouth. In the mouth, it is broken down by salivary amylase.
- The food moves to the stomach through the oesophagus which performs peristaltic movement.
- Enzymes and various digestion juices from the liver, gall bladder and pancreas act on the chunks from the stomach in the small intestine.
- In the large intestine, the remaining nutrients are absorbed and the leftover is removed from the body through the rectum and anus.

B. Respiration –

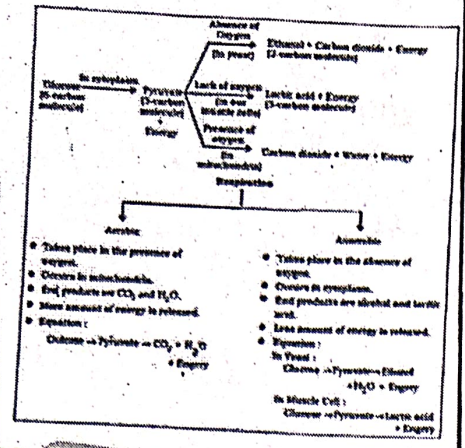
It is a process in living organisms involving the production of energy, typically with the intake of oxygen and the release of carbon dioxide from the oxidation of complex organic substances.

(a) Respiration Involves –

(i) Gaseous Exchange (Breathe): Intake of oxygen from the atmosphere and release of CO_2.

(ii) Cellular Respiration: Breakdown of simple food in order to release energy inside the cell.

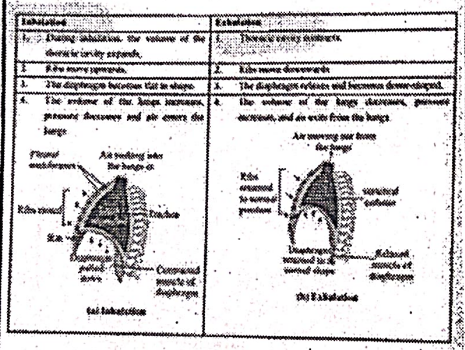
(b) Breakdown of Glucose by various pathways -



(c) Passage of air through the respiratory system :

- Nostril : Air is taken into the body.
- Nasal Passage : It is a channel for airflow through the nose.
- Nasal Cavity - It is lined with hairs and mucus membranes. It warms, moistwrizes and filters air as it reaches the lungs.
- Pharynx - It contains rings of cartilage which ensure that the air passage does not collapse.
- Larynx - It houses the vocal cords and manipulates pitch and volume, which is essential for phonation. It is also known as the voice box.
- Trachea - Thy pharynx splits into the trachea and esophagus - It connects the larynx (or voice box) to the bronchi of the lungs. It provides airflow to and from the lungs for respiration.
- Bronchi - They are the main passageway into the lungs. They are extensions of the windpipe that shuttle air to and from the lungs. The oxygen goes to the lungs and carbon dioxide leaves the lungs through them.
- Bronchioles - Bronchi get smaller when they reach closer to lungs tissues and are called Bronchioles. They are passageways by which air passes through the nose or mouth to the alveoli of the lungs.
- Alveoli - They are smaller tubes that finally terminate in balloon-like structures which are called alveoli. They allow oxygen and carbon dioxide to move between the lungs and the bloodstream.
- Blood Capillaries - These are the sites of transferring oxygen and other nutrients from the bloodstream to other tissues in the body. They also collect carbon-dioxide and waste materials and return it to the veins.

(iv) MECHANISM OF BREATHING



(v) Exchange of Gases Between alveolus, blood and tissue

1) Air (rich in O_2) (in alveolus) → Blood (through blood vessel) (capillaries)

→ O_2 Bind Wind Haemoglobin in RBC → O_2 is released in tissues.

2) CO_2 (from tissue) → CO_2 released into Blood → CO_2 dissolved in Blood → Blood Vessels (capillaries) (in alveoli) → CO_2 Released in alveolus Sac

→ CO_2 (Sent out through nostrils)

Terrestrial Organisms - use atmospheric oxygen for respiration.

Aquatic Organisms - Use oxygen dissolved in water.

(vi) RESPIRATION IN PLANTS -

Respiration in plants is simpler than the respiration in animals. Gaseous exchange occurs through.

1. Stomata in leaves.
2. Lenticles in stem.
3. The general surface of the roots.

C. TRANSPORTATION :

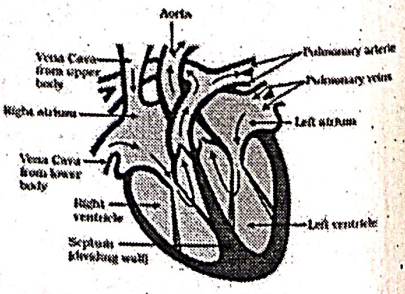
I. Transportation in Human Beings :

Human beings like other multicellular organisms need a regular supply of food, oxygen etc. This function is performed by the circulatory system.

The circulatory system in humans consists of -

(i) The Heart (Pumping organ)
(ii) Arteries and Veins (Blood Vessels)
(iii) Blood and lymph.

II. The Circulatory System in Humans -



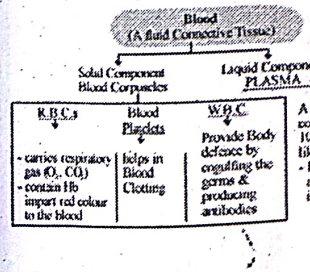
III. HEART:
is a muscular organ which pumps blood to all parts of the body.
- It has four chambers. The upper chambers are called atria and the lower chambers are called ventricles.
- Since the ventricles pumps the blood the different organs, their walls are thicker than the atria.
- The right and left chambers are separated by a septum. It prevents the mixing of oxygenated and deoxygenated blood.
- The atria and ventricles have valves between them to prevent blood from flowing backward.

IV. ARTERIES:
carry pure blood from the heart to all parts of the body. They are thick-walled and do not have valves.

V. VEINS:
Carry impure blood from all parts of the body to the heart. They are thin-walled and have valves.

VI. CAPILLARIES:
are very narrow blood vessels which connect arteries and veins together. The exchange of food, water, oxygen, carbon dioxide etc. between the blood and cells takes place through the capillaries.

VII. BLOOD:
transports food, oxygen and waste products. It consists of plasma, red blood cells (RBC), white blood cells (WBC) and platelets. Plasma transports food, water, carbon dioxide, nitrogenous waste, etc. Red blood cells transport oxygen. White blood cells kill harmful microbes and protect the body. Platelets help in the clotting of blood and prevent loss of blood during injury.



VIII. LYMPH:
- It is a yellowish fluid which escapes from the blood capillaries into the intercellular spaces. It contains fewer proteins than blood.
- It carries digested and absorbed fat from the intestine and drains excess fluid from extracellular space back into the blood.

IX. DOUBLE CIRCULATION:
Blood travels twice through the heart in one complete cycle of the body.
- Pulmonary circulation - blood moves from the heart to the lungs and back to the heart.
- Systemic circulation - blood moves from the heart to the rest of the body & to the heart back.

X. TRANSPORTATION IN PLANTS-
There are two main conducting tissues in a plants.
(a) Xylem (b) Phloem

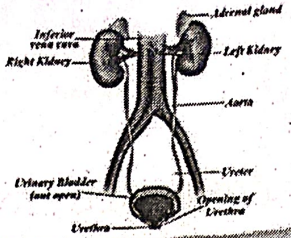
Conducting Tissue

Xylem	Phloem
1. Carries water & minerals from the roots to other part of the plant	1. Carries product of photosynthesis from leaves to the other part of the plant.
2. No energy is used.	2. Energy is used from ATP

- Transpiration is the process by which plants lose water in the form of vapours.
- Role of Transpiration.
1. Absorption and upward movement of water and minerals by creating PULL.
2. Helps in temperature regulation in plants.

XI. TRANSLOCATION -
The transport of food from leaves (food factory) to different parts of the plants is called translocation.

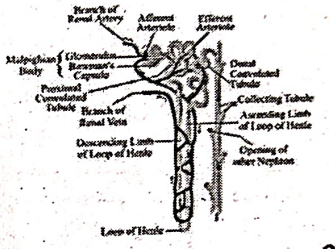
D. EXCRETION SYSTEM IN HUMAN BEINGS-
The excreatory system consists of:
1. A pair of Kidneys.
2. A urinary bladder.
3. A pair of ureters.
4. A urethra.



I. PROCESS OF EXCRETION-
1) The renal artery brings in blood containing waste substances to the kidneys. The kidneys filters blood.
2) Urine produced in the kidney passes through the ureters into the urinary bladder where it is stored until it is released through the urethra.

II. FUNCTIONS OF KIDNEY-
It removes the waste products from the blood i.e. urea which is produced in the liver.

III. NEPHRON -
Each kidney has a large no. of filtration units called nephrons.
The nephron is the structural & functional units of the kidney.



IV. The mechanism of Urine formation involves three steps:
1) Glomerular Filtration - Blood is filtered from the glomerular into the Bowman Capsule of the nephron. This filtrate passes through the tubules of the nephron.
2) Tubular re-absorption - Now, useful substances from the filtrate like Na^+, K^+, glucose, amino acids are reabsorbed by the capillaries surrounding the nephron into the blood.
3) Secretion - Urea, extra water, & salts are secreted into the tubule which opens up into the collecting duct & then into the ureter.

V. ARTIFICIAL KIDNEY -
Hemodialysis - The process of purifying blood by an artificial kidney. It is meant for kidney failure patients.

VI. EXCRETION IN PLANTS-

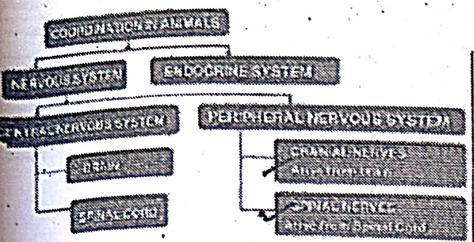
1) Oxygen is released during photosynthesis.
2) H_2O by transpiration.
3) Wastes may be stored in leaves, bark, etc. which fall off from the plants.
4) Waste products stored as gums and resin in old xylem.
5) Plants excreate some waste into the soil around them.

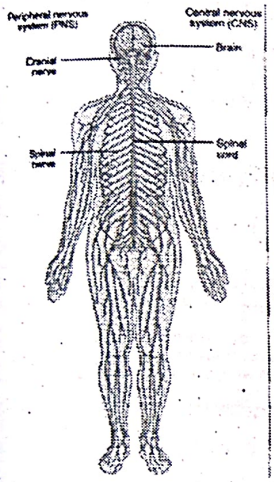
Control & Coordination

Stimuli:- change in the environment to which an organism responds.

Response:- Reaction of an organism to a stimulus.

Working together of various parts of body to respond to a stimuli is called Coordination.





Nervous Tissues:- • made up of a organized network of nerve cells.
• Bundle of neurons.

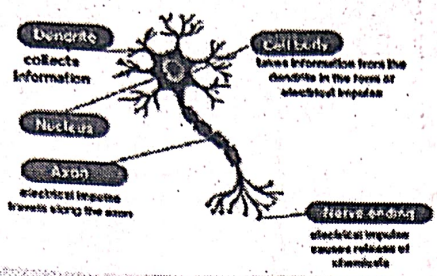
Receptors:- cells, tissue or organs that receive the stimulus.

Effectors:- muscles/tissues/glands which act in response to a stimuli.

Receptor	Sense Organ	Stimuli
Photo receptors	Eyes	Light
Olfactory receptors	Nose	Smell
Gustatory receptors	Tongue	Taste
Phono receptors	Ear	Sound
Thermoreceptors	Skin	Heat/ Cold
Nociceptors	Skin	Pain

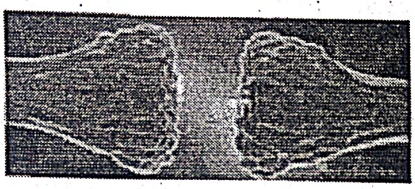
NEURON:-

- Structural and functional unit of nervous system.
- largest cell in Body.
- Carry messages in the form of electrical impulses.



TRANSMISSION OF IMPULSE BETWEEN 2 NEURONS

Receptors receive the stimulus
↓
Information is collected at the end of dendritic tip.
↓
chemical Reaction creates an electrical impulse
↓
Impulse travel from dendrite to cell body
↓
Impulse travels through the axon.
↓
Reaches nerve endings
↓
Release of chemicals at the synapse



SYNAPSE:- Microscopic junction between two neurons.

- There is a release of chemical substances at the synapse between two neurons which help in the transmission of electrical impulse.

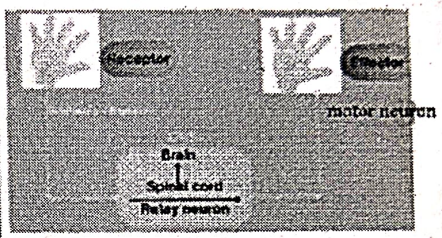
Neurotransmitters:- chemical substances that help in the transmission of nerve impulse.

NEUROMUSCULAR JUNCTION:-
- Junction between nerve ending of a motor neuron and a muscle.

presence of stimulus
↓
Receptors receive the stimulus
↓
Impulse taken by sensory neurons
↓
conduction of impulse through the neurons
↓
Information reaches to CNS
↓
Relay neurons present in CNS transfers impulse from sensory to motor neurons
↓
Motor neurons carry information from CNS to effectors
↓
Effectors (muscles/glands) respond to stimuli.

TYPES OF NEURONS

- **Sensory Neurons** — Transmit impulse from Receptor to CNS.
- **Motor Neurons** — Transmit impulse from CNS to effectors (muscle or gland)
- **Relay Neurons** — Connects sensory and Motor neurons.



REFLEX ACTIONS (Reflex Movement)

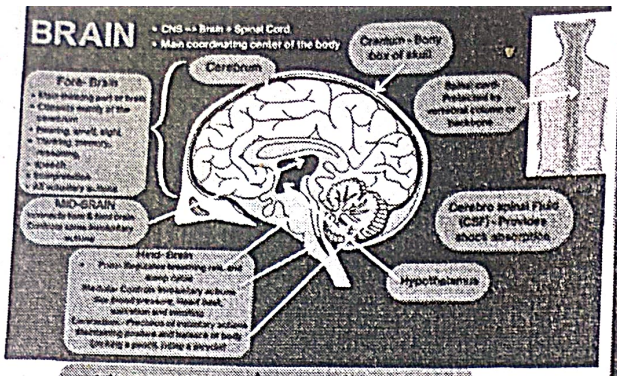
- sudden and Quick movement.
- Involuntary movement.
- Brain not involved (directly not involved)
- Reflex actions are controlled by spinal cord.

Type of Action	Description	Examples
Voluntary Actions	- Controlled by will- Thinking and brain involved	Walking, Writing, Dancing
Involuntary Actions	- Uncontrolled- No thinking- Brain involved	Blood pumping, Peristalsis
Reflex Actions	- Uncontrolled- No thinking- No brain involved	Hand withdrawal, Sneezing

Reflex Arc:- Path followed by nerve impulse during reflex action.

BRAIN:-

- CNS → Brain + spinal cord
- Main coordinating center of the body.



HORMONES IN ANIMALS

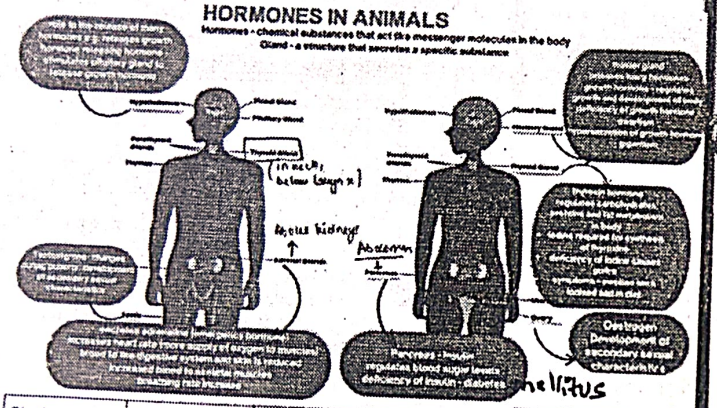
Hormones - chemical substances that act like messenger molecules in the body.

Gland - a structure that secretes a specific substance.

Types of Glands

(1) Endocrine - ductless glands, secrete products directly into the bloodstream

(2) Exocrine - have ducts.



Gland	Hormone	Function	Related disease
Hypothalamus	Releasing hormones	Stimulates pituitary gland to release hormones	
Pituitary gland	Growth hormone	Body growth, development of bones & muscles	Excess - Gigantism Deficiency - Dwarfism
Thyroid gland	Thyroxine	Regulates carbohydrate, protein, fat metabolism	deficiency of iodine - Goitre
Pancreas	Insulin	Control blood sugar levels	diabetes
Adrenal gland	Adrenaline	Prepare body to cope with emergency situations	
Testes in males	Testosterone	Development of secondary male characters like deep voice, beard, and sex organs	
Ovaries in females	Oestrogen	Development of secondary female characters like mammary glands, menstrual cycle and sex organs.	

- feedback mechanism - the timing and amount of hormone released are regulated by feedback mechanism.

e.g.

- Blood sugar levels increase - pancreas produces more insulin.
- Blood sugar levels decrease - insulin secretion is reduced.

COORDINATION IN PLANTS :-

Movement in Plants

TROPIC MOVEMENT

NASTIC MOVEMENT

TROPIC MOVEMENT :-

- Tropic Movement - growth dependent growth movement of a plant part in response to external stimuli is called tropism.
- direction of stimulus determines the direction of response.
- Growth of plants towards stimulus → positive tropism.
- Growth of plants away from stimulus → Negative tropism

Phototropism	Growth of plant part towards or away from Light	• POSITIVE PHOTOTROPISM - movement towards light • eg. stem of a growing plant bends towards light	• NEGATIVE PHOTOTROPISM - movement away fr • eg. roots of a plant moves away from light
Geotropism	Growth of plant part towards or away from Gravity	• POSITIVE GEOTROPISM - movement towards gravity • eg. roots of a plant moves downward towards gravity	• NEGATIVE GEOTROPISM - movement against gr • eg. stems of a plants moves upwards against gr
Hydrotropism	Growth of plant part towards or away from water	• POSITIVE HYDROTROPISM - movement towards water • eg. roots of a plant grow towards water	• NEGATIVE HYDROTROPISM - movement away f water
Chemotropism	Growth of plant part towards or away from chemicals	• POSITIVE CHEMOTROPISM - movement towards chemical • eg. growth of pollen tube towards ovule during fertilisation	• NEGATIVE CHEMOTROPISM - movement away f chemical
Thigmotropism	Growth of plant part towards or away from touch	the direction of growth movement of a plant part in response to the touch of an object e.g. climbing parts of a plant such as tendrils grow towards support and wind around them	

NASTIC MOVEMENT :-

- Non-directional movement in plant in response to stimuli.
- Growth independent movement.

e.g. When we touch the leaves of a sensitive plant like Mimosa pudica, they fold.

Difference between tropic & nastic movement

Characteristic	Tropic Movements	Nastic Movements
Response to Stimulus	Unidirectional Response to Stimulus	Non-directional Response to Stimulus
Dependency on Growth	Growth-dependent movements	Growth-independent movements
Nature of Movement	Permanent and irreversible	Temporary and reversible
Occurrence in Plants	Found in all plants	Found only in a few specialized plants
Speed of Movement	Slow action	Immediate action

Difference between plants &

ANIMALS	PLANTS
Specialised tissues for conduction of information	No specialised tissues for conduction of information
They change shape because of specialised proteins in muscles	They change shape because of change in amount of wa in cells (resulting in swelling/shrinking)

HORMONES IN PLANTS

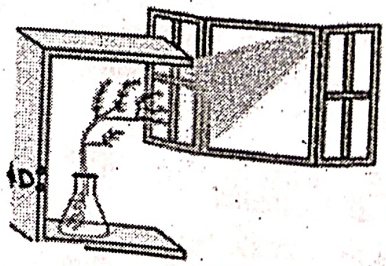
AUXINS :- promotes cell enlargement and cell differentiation.
promotes fruit growth.
Auxin is made by cells at the tip of stems and roots.
moves away from light and moves towards gravity.

CYTOKININS :- promotes cell division.
present in greater concentration in areas of rapid cell division (such as fruits and seeds)

GIBBERELLINS :- help in growth of the stem.

Abscisic acid

- growth inhibitor
- falling of leaves.
- stress hormone



BENDING OF PLANT :-

light comes on one side of plant.

- Auxin diffuses toward shady side of shoot.
- Cells grow longer on the side of shoot away from light.
- Thus plant appears to bend towards light.

Human Eyes & The Colourful world

(i) Eyeball :- Approximately spherical, Diameter 2.3cm

(ii) Cornea :- • Thin transparent bulging membrane
• Most of the refraction happens
• Protects from dust, germs

(iii) Iris :- Controls the size of pupil.

(iv) Pupil :- Regulates and controls the amount of light entering the eye.

(v) Crystalline lens :- convex lens; flexible focal length; forms Real and Inverted image

(vi) Ciliary Muscles :- Adjust the focal length of eye lens.

(vii) Retina :- Screen

• Real Inverted Image is formed on Retina.
• has lots of light sensitive cells.
• Rods - vision in low light (Light Intensity)
• Cones - vision in high light + colour vision.
• Cells get activated when light falls on them and generates electrical signal.

(viii) optical nerve :- sends electrical signal to the brain.
Light → Nerve impulse

(ix) Aqueous Humour
• water like fluid.
• it is present between lens and Cornea.
• Nutrition.

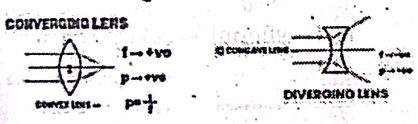
Vitreous Humour
• Gel like substance.
• present between lens and Retina.
• Support and strength helps the eye to keep its shape.

Power of Accomodation

The ability of eyelens to adjust/change its focal length.

NEAR POINT :- The minimum distance from eye at which an object can be seen clearly and distinctly. it is also called least Distance of Distinct vision.
For normal vision (young adults) - 25cm

FAR POINT :- The farthest (sabse door) point upto which the eyes can see objects clearly.
For normal eyes → Infinity.



To View closer objects

Ciliary muscle Contract

lens become thick (Curvature increases) θ → F

focal Length decreases PT

To View distant (far) objects.

Ciliary muscle relaxes $P = \frac{1}{f}$

lens becomes thin (curvature decreases) θ → F

focal length Increases FT PL

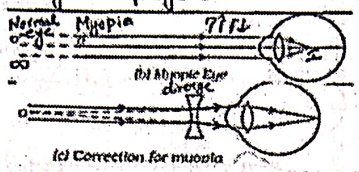
DEFECTS in HUMAN EYE And Corrections

(1) Myopia :- (Near Sightedness)

• can see nearby objects clearly.
• cannot see distant objects distinctly (clearly)
• far point is less than infinity.

✲ Image of distant object is formed in front (before) of Retina.

Reasons :-
(i) Excessive curvature of eyelens.
(ii) lens thick → focal length decreases
(iii) Elongation of eye ball.



Negative power lens — CORRECTION → CONCAVE LENS

trick-

MyoNi makes Elon Thick, wont CAVE

Myopia → Near Sightedness; Elongation of eyeball; (Fat) Lens Thick fat; Concave lens f → -ve, P → -ve

(2) Hypermetropia :- (far-Sightedness)

• can see distant (far) objects clearly.
• cannot see nearby objects distinctly (clearly)
• Near point is more than 25cm.

✲ Image of nearby object is formed at a point behind retina.

Reason
Focal length of eyelens is too long (lens cannot get thick enough)
Eyeball has become too small.

CORRECTION — CONVEX LENS
+ve power lens

trick-

Fast Metro makes eye small, Face Large like Wax

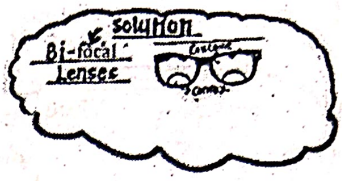
Fast → for Sightedness; Metro → Eyeball Small shrink; Face Large like → Focal length Large thin; Wax → convex lens

(3) Presbyopia :-

With ageing people find it difficult to see nearby objects distinctly (clearly). Generally they also have trouble to view far objects.

Reasons :- (i) Weakening of ciliary muscle.
(ii) less flexibility of eye lens.

(4) Cataract :- (lens becomes opaque)
• Sometimes at old ages Crystalline lens becomes milky and cloudy
↓
Partial or complete loss of vision
Correction → CATARACT SURGERY

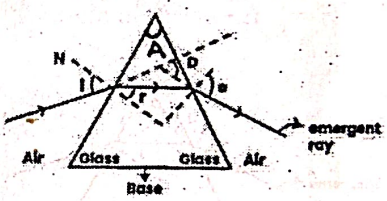


REFRACTION OF LIGHT & DEVIATION THROUGH A PRISM

Monochromatic light

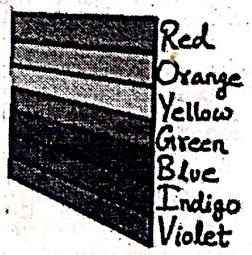
∠i → incidence
∠r → Refraction
∠e → emergence
∠D → Deviation

angle of prism - A



✲ A prism bends a ray of light towards Base.

• We know that white light is made up of seven colours.
• A prism bends a ray of light
↓
Angle of Deviation (∠D)
• ∠D is different for different colours of light → some colours bends more than other



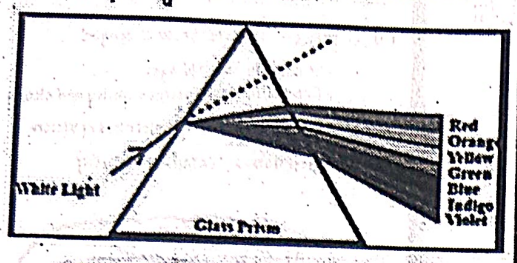
Refraction of white light (sunlight) through a PRISM.

Dispersion :–

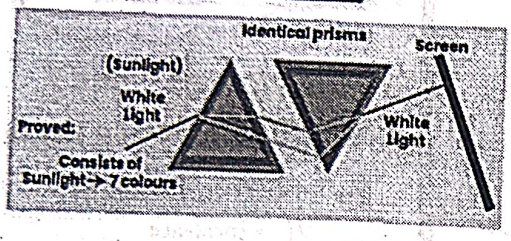
The splitting of white light into its component colours (7 colours).

Spectrum :–

The band of colour components of light (obtained on screen)

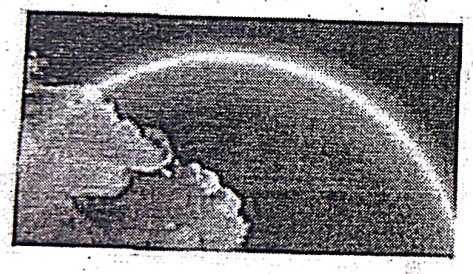


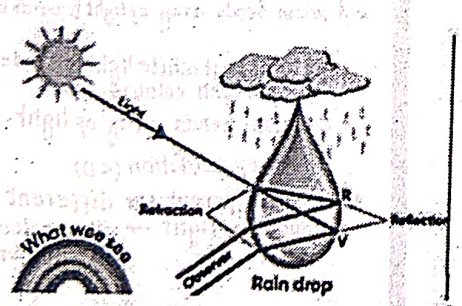
NEWTON'S PRISM EXPERIMENT (INVERTED PRISMS)



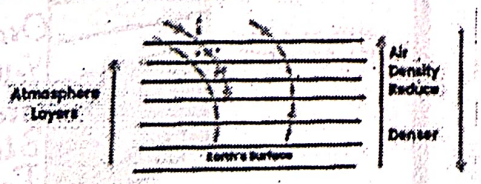
RAINBOW FORMATION

Dispersion + Refraction + Reflection

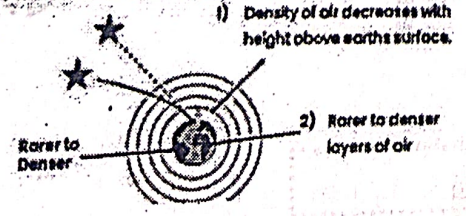




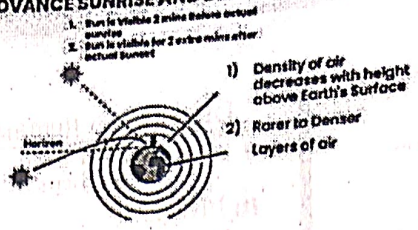
ATMOSPHERIC REFRACTION



APPARENT POSITION OF STARS



ADVANCE SUNRISE AND DELAY SUNSET



Twinkling of stars

(1) The physical conditions like temperature, pressure of earth's atmosphere keeps on varying.
(2) Due to this density of layers also keep changings.
(3) Stars are very far so they behave like point source of light.
(4) The path of ray of light coming from star keep's changing and Amount of starlight entering eyes flickers

Why Planets Do not twinkle

- Planets are near to Earth as compared to stars.
- Planets behave as extended source of light.
- Extended source can be imagined as collection of millions of point source of light.
- Now, the total varitions in the amount of light entering our eye from all the individual point-sized sources Averages out to zero and intensity of light entering eye remains almost same.

TYNDALL EFFECT

- The phenomenon of scattering of light by the colloidal particles.
- A colloid is a heterogenous mixture. The size of particles of a colloid is too small to be individually seen with naked eyes.
  Example – Milk, smoke, Dust in air
- The path of a beam of light passing through a true solution is not visible. But in colloidal passing through a true solutions colloidal solutions, colloids are big enough to scatter a beam of light passing through it and make its path visible.
- The colour of the scattered light depends on the size of the scattering particles.
  (1) very small particles scatter mainly blue light (smallest wave length)
  (2) Very large particles scatter all colour of light equally.

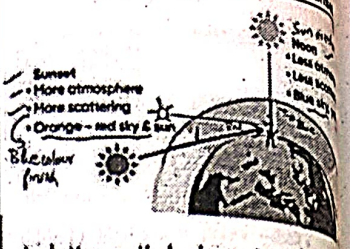
✡ Beam of sunlight enters a smoke filled room through a small hole.

✡ Sunlight passes through a canopy of a dense forest. Tiny water droplets in the mist scatter light.

Blue colour of sky

(1) The molecules of air and other fine particles in the atmosphere have a size smaller than the wavelength of visible light.
(2) scattering is more for light of short wavelength hence Blue colour is more strongly than Red colour.
(3) Thus, scatters more strongly than Red colour.
Thus, scattered blue light enters our eyes and sky appears blue.

Reddening of the Sun at Sunrise & Sunset



(4) If the earth had no atmosphere there would not have been scattering. Then the sky would look dark.
Astronauts – Dark

(5) The sky appears dark to pass flying at very high altitudes at high altitudes due to the abs of atmosphere, scattering do not take place and hence appears dark to passeng flying at high altitudes.

(6) Danger signal lights are re colour. Explain.
Red light is least scattered fog or smoke. Therefore, be seen in the same colo at a distance.

Metals & Non - Metals

PHYSICAL PROPERTIES :-

METALS :-

(i) Lustrous: have shining surface (pure state). Metallic Lustre.
(ii) Generally Hard.
(iii) Malleability: property of substance that it can be beaten into thin sheets. (Gold and silver Most Malleable)
(iv) Ductility: Ability of metals to be drawn into thin wire (1g of Gold metal → 2km length of wire)
(v) Good Conductor of electricity (Best conductor are silver, copper, Gold)
(vi) Good conductor of Heat: (Best conductor are silver, copper)
(vii) Have High Melting point.
(viii) Sonorous: Metals that produce a sound on striking a hard surface.
(ix) Physical state: All metals except mercury exist as solids at room temperature.

Non-Metals :-

(i) Non-Lustrous
(ii) Generally soft
(iii) Non-malleable
(iv) Non-ductile
(v) Poor conductor of electricity
(vi) Poor conductor of Heat.
(vii) Low melting point.
(viii) Non-sonorous
(ix) solid → carbon sulphur
liquid → Bromine
Gases → Nitrogen, N_2
oxygen, F_2

Important point (Exception)

METALS :-

(1) Alkali Metals- Li, Na, K are so soft that they can be cut with a knife. (also Rb and Cs)
(2) Gallium (Ga) and cesium (Cs) very soft and have very low Melting point. They melt if you keep them on your palm
(3) Mercury is poor conductor of Heat. (exist at liquid)
(4) lead (Pb) is a poor conductor of electricity.

NON-METALS

(1) Iodine and Graphite are lustrous.
(2) Diamond (form of carbon) is Hardest Natural substance, it has high Melting and Boiling point.
(3) Graphite (form of carbon) is Lustrous, conducts electricity.

(1) copper and Aluminium are used for making cooking vessels. They are good conductor of heat & they do not melt (have high Melting point).
(2) Carbon is a non-metal that can exist in different forms. Each form is called an allotrope.
Eg- Graphite, Diamond, Coal

CHEMICAL PROPERTIES :-

$4K + O_2 \longrightarrow 2K_2O$ (s)

$4Na + O_2 \longrightarrow 2Na_2O$ (s)

- K and Na react so vigorously with oxygen that they catch fire (Burns in air) even if kept in the open.
- They are kept inside kerosene oil to (i) Protect them from burning in air. (ii) Prevents accidental fires.

Metal + Oxygen ⟶ Metal Oxide (Generally Basic in nature)

✡ $2Mg + O_2 \xrightarrow{Heat} MgO$ (Ribbon) (White powder)

- Mg ribbon burns with dazzling white light.

✡ $4Al + 3O_2 \xrightarrow{Heat} 2Al_2O_3$

- Aluminium burns with a brilliant white flame.

✡ $2Cu + O_2 \xrightarrow{Heat} 2CuO$ (Black layer)

- Cu does' not burn. (takes long time).

Gold and silver do not react with oxygen even at high temperature.

Flame Test

Trick-

YELLOW SUN GREEN COP LIQOUR BLACK BIKE CAR ORANGE

Element	Ion	Flame test colour
Lithium	Li^+	Crimson
Sodium	Na^+	Yellow
Potassium	K^+	Lilac
Calcium	Ca^{2+}	Orange-red
Copper	Cu^{2+}	Green

Aqua Regia
freshly prepared mixture (3:1) (Conc) HCl + (Conc) HNO_3
- Dissolves gold
- Highly corrosive & fuming liquid

Amphoteric oxide

Metal oxides are generally basic in nature. Turns moist red litmus blue.
Eg- MgO, CuO, Na_2O, K_2O, Fe_2O_3

But some metal oxides show both acidic and basic nature, called Amphoteric oxide.
Eg- oxides of Al and Zn

Base + Acid ⟶ salt + water
$Al_2O_3 + 6HCl \longrightarrow 2AlCl_3 + 3H_2O$

Acid + Base ⟶ salt + water
$Al_2O_3 + 2NaOH \longrightarrow 2NaAlO_2 + H_2O$

Metal + water ⟶ Metal hydroxide/oxide + H_2

$2K + 2H_2O \longrightarrow 2KOH + H_2\uparrow$
$2Na + 2H_2O \longrightarrow 2NaOH + H_2\uparrow$
$Ca + 2H_2O \longrightarrow Ca(OH)_2 + H_2\uparrow$
$Mg + 2H_2O \longrightarrow Mg(OH)_2 + H_2\uparrow$
$2Al + 3H_2O \longrightarrow Al_2O_3 + 3H_2\uparrow$
$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$

- Na reacts violently with cold water. Reaction is highly exothermic. H_2(g) evolved catches fire.
- less violent react do not catch fire.
- Ca and Mg floats in water as Bubbles of H_2(g) sticks to surface of metal.

Reaction with acids :-

Metal + Dil Acid ⟶ Salt + $H_2\uparrow$

$Mg + 2HCl \longrightarrow MgCl_2 + H_2$
$2Al + 6HCl \longrightarrow 2AlCl_3 + 3H_2$
$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$
$Cu + H_2SO_4 \not\longrightarrow$ No reaction

More reactive metals = more heat evolved & more is rate of formation of H_2 gas

Special Case of Nitric Acid :-

Metal + Dil Acid ⟶ salt + H_2

H_2(g) not evolved when a metal reacts with dil HNO_3 (nitric acid). HNO_3 is strong oxidising agent - it oxidises the H_2(g) produced to

$H_2 \xrightarrow{HNO_3} H_2O$
[O]

and itself gets reduced to (NO, NO_2, N_2O) only Magnesium (Mg) and Manganese (Mn) reacts with very dil. HNO_3 to give H_2(g)

Displacement Reaction :-

$A + BC \longrightarrow AC + B$

A is more reactive than B

$Fe(s) + CuSO_4(aq) \longrightarrow FeSO_4 + Cu(s)$
(Blue) (Green) Brown

$Zn(s) + CuSO_4(aq) \longrightarrow ZnSO_4(aq) + Cu(s)$
(Blue) (colourless) (Brown)

$Cu(s) + FeSO_4(aq) \longrightarrow$ No reaction

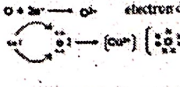
This reaction can be used to identify more reactive metal.

Metals and Non-Metals React → Ionic compound / Electrovalent compounds

Element	Atomic No.	Electronic Configuration
Sodium (Na)	11	2,8,1
Magnesium (Mg)	12	2,8,2
Calcium (Ca)	20	2,8,8,2
Chlorine (Cl)	17	2,8,7
Oxygen (O)	8	2,6

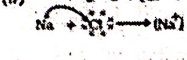
Formation of Calcium Oxide (CaO)

Ca (20) ⟶ 2,8,8,2
O(8) ⟶ 2,6
Ca ⟶ $Ca^{2+} + 2e^-$
$O + 2e^- \longrightarrow O^{2-}$ electron dot structure



Formation of Sodium Chloride (NaCl)

Na(11) ⟶ 2 8 1 { Na ⟶ $Na^+ + e^-$
Cl(17) ⟶ 2 8 7 { Cl + e^- ⟶ Cl^-



* Na^+ and Cl^- ions (oppositely charged) attract each other.
* Na^+ and Cl^- are held together by strong electrostatic forces of attraction.
* Sodium chloride (NaCl) do not exist as molecule but as combination of oppositely charged ions → ionic compound / Electrovalent compound.

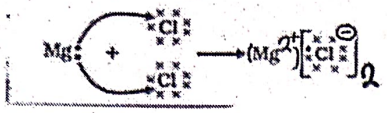
Formation of Magnesium chloride ($MgCl_2$)

$Mg(12) \longrightarrow 2,8,2$

$Cl(17) \longrightarrow 2,8,7$

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

$Cl + e^- \longrightarrow Cl^-$



Ionic / Electrovalent Compounds Properties

(1) Hard, solid compounds because of strong force of attraction between +ve and -ve ions. Brittle in nature, Breaks into pieces if pressure is applied.

(2) Have High Melting and Boiling point Because large amount of energy is required to break strong interionic attraction.

(3) Generally soluble in water but insoluble in solvents like kerosene, petrol, alcohol etc.

(4) In solid state do not conduct electricity as ions cannot move because of strong electrostatic force of attraction.

(5) In Molten state, Heat Energy weakens the strong electrostatic forces of attraction and ions can move freely, hence in molten state, conduct electricity.

(6) In aqueous solution, conducts electricity as solution of Ionic Compound in water contains ions.

ions move to opposite electrodes.

(water weakens the strong electrostatic forces of attraction between ions).

Extraction of Metals

(1) Minerals :- elements or compounds which occur naturally in earth's crust.

(2) Ores :- Those minerals which contain a very high % of a particular metal and metal can be profitably extracted from it, are called ores.

Top in Activity Series

5 — K, Na, Ca, Mg, Al — very reactive, so never found in free state as free metal

3 — Zn, Fe, Pb, H — Middle of Activity Series — moderately reactive found in earth's crust in form of oxides, sulphides and carbonates.

5 — Cu, Hg, Ag, Au, Pt — least reactive, hence found in free state as free metals as well as sulphides form. — Low in Activity series

Extracting Metal → Middle of Activity Series

Present as oxides, sulphides or carbonates in nature.

Sulphides / carbonates converted to oxide as its easy to extract metal from oxide

Roasting :- Heating sulphide ores strongly in presence of excess air.

$2ZnS + 3O_2 \xrightarrow{Heat} 2ZnO + 2SO_2$

Calcination :- Heating carbonate ores strongly in limited air or in absence of air.

$ZnCO_3 \xrightarrow{Heat} ZnO + CO_2$

Now, metal oxide is reduced (removal of oxygen) with help of Reducing agent Carbon (coke).

$ZnO + C \longrightarrow Zn + CO$

Extracting Metals → Top of Activity series

carbon cannot reduce their oxides, these metals are very reactive and have More affinity (likeness) for oxygen than carbon.

- Such Metals are obtained by Electrolytic Reduction (Reduction with help of electric current).
- Na, Ca, Mg → electrolysis of molten chlorides

At cathode $2Na^+ + 2e^- \longrightarrow 2Na$ At Anode $2Cl^- \longrightarrow 2e^- + Cl_2$

$2NaCl_{(molten)} \xrightarrow{\text{electric current}} 2Na_{(s)} + Cl_{2(g)}$

Refining of Metals

- Metal obtained after carbon reduction or electrolytic reduction is not very pure.
- The most common method for refining metal is Electrolytic refining.

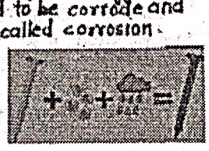
At Anode : Pure copper dissolves in solution.

At Cathode : Equivalent amount of pure copper from solution deposits at cathode.

Corrosion :- When a metals is attacked by substance around it such as moisture (water vapour + oxygen), acid etc. it is said to be corrode and this process is called corrosion.

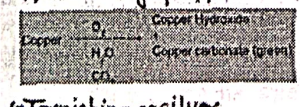
Examples :-

(1) Rusting of iron

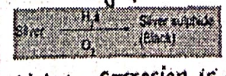


$2Fe + \frac{3}{2}O_2 \cdot xH_2O \longrightarrow 2Fe_2O_3 \cdot xH_2O$

(2) Tarnishing of copper



(3) Tarnishing of silver



Note :- Corrosion is an example of oxidation.

$2Cu(s) + H_2O(g) + CO_2(g) \longrightarrow CuCO_3(s) + Cu(OH)$

Prevention of corrosion :-

- Painting
- Oiling
- Greasing
- Galvanishing
- Anodising

Galvanisation :-

- Steel and iron are coated with thin layer of zinc.
- It is done through electrolysis.
- it does not change property of metal

Anodising :- process of forming a thick oxide layer of Al. This layer prevents corrosion of Al metal. The oxide layer also give Al articles attractive finish.

Alloy :- A homogenous mixture of two or more metals, or a metal and non metal.

step-1 Melting primary metal.

step-2 Dissolving other elements in fixed proportions.

step-3 Cooling to room temperature.

The properties of An Alloy is different from the metals from which it obtained.

(1) Pure iron is very soft and stretch easily when hot pure iron + carbon (0.05%) → Hard and strong iron carbon Alloy.

(2) stainless steel → Alloy of Fe + C

(3) Amalgam → Alloy in which one metal is mercury (Hg)

(4) Brass ($BCoZ$) → Alloy of Zn + Cu

(5) Bronze ($CoaT$) → Alloy of copper + tin ($Cu + Sn$)

(6) solder ($SoTeLa$) → Alloy of lead + tin ($Pb + Sn$)

Thermit Reaction / Welding

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

(s) (s) (s) (l)

The above reaction is so highly exothermic that heat given out procluces metal in molten state. This molten metal is used to Join railway tracks or cracked machine parts. This reaction is known as thermit reaction.

How do Organisms reproduce

Reproduction:

Process by which organisms produce new individuals of the same species

Significance — Reproduction ensures species continuity and drives evolution by passing favourable variations across generations.

Body Design & Importance of Variation: Reproduction creates DNA copies that maintain body design, but slight variations always occur. These variations help organisms adapt to changing environments ensuring survival of species. Thus, variation is essential for evolution and continuity of life. There are two types of reproduction.

① Asexual Reproduction:

Involves single parent, offspring genetically identical to parent.

a) Fission: Division of unicellular organism into two or more individuals.

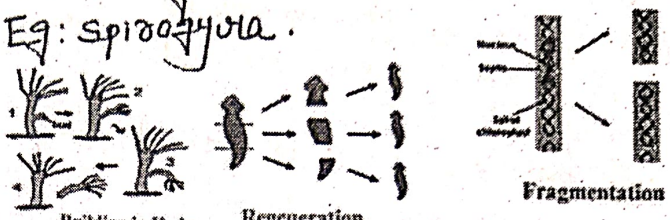
(i) Binary Fission: An organism divides & forms two individuals.
Eg: Amoeba, Leishmania.

(ii) Multiple Fission: One organism divides into many daughter cells.
Eg: Plasmodium (Malarial Parasite)

b) Budding: A small bud arises on the parent body, grows, and detaches to form a new individual.
Eg: Hydra, Yeast.

c) Regeneration: Ability to fully differentiated organisms to regrow lost body parts into complete individuals
Eg: Planaria, Hydra, starfish.

d) Fragmentation: Body of a simple unicellular organism breaks into fragments, each fragment grows into a new organism.
Eg: Spirogyra.



e) Spore Formation: Special structures called sporangia produce spores; Spores germinate on moist surfaces to form new individuals.
Eg: Rhizopus (bread Mould), Mucor, Penicillium.

f) Vegetative Propagation: Vegetative Propagation allows new plants to grow from roots, stems or leaves, enabling faster reproduction. It helps propagate seedless plants and ensures offspring retain all parental characteristics.
Eg: Bud produced in the notches along the leaf margin of Bryophyllum.

g) Tissue Culture: Tissue culture involves growing new plants from small tissues or cells placed in an artificial medium, forming a callus that develops into plantlets. It enables mass production of disease-free plants & is widely used for ornamental species.

Advantage: Asexual Reproduction enables faster growth and helps propagate seedless or dormant plants while preserving parental traits.

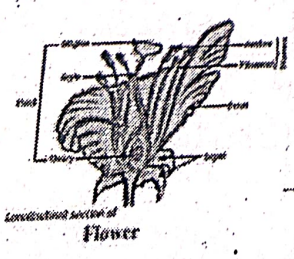
Disadvantage: It lacks genetic variation, making offspring less adaptable and prone to inheriting parental disease.

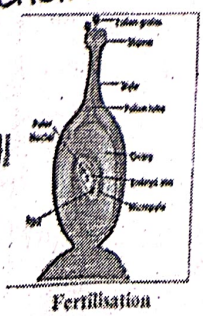
② Sexual Reproduction:

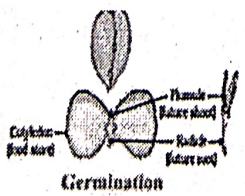
Two parents are involved, Gamete fusion leads to zygote formation.

Significance: It promotes variation and diversity of characters in the offspring.

In Plants: In Angiosperms, the flower is the reproductive organ containing stamen (male, pollen grains) and pistil (female, ovary with ovules). Flowers may be unisexual (papaya, watermelon) or bisexual (hibiscus, mustard). The transfer of pollen grains from the anther to the stigma of a flower is called pollination. Pollination can be self or cross. This transfer of pollen from one flower to another is achieved by agents like wind, water, or animals. **Fertilization** occurs when pollen from stamen reaches stigma, grow a tube through style, and fuses with the egg in the ovule to form a zygote. The ovule develops into a seed and the ovary into a fruit, while other floral parts usually fall off. Seeds ensure survival of the plant by germinating into new seedlings under suitable conditions.

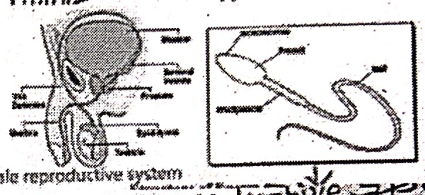

Flower


Fertilisation

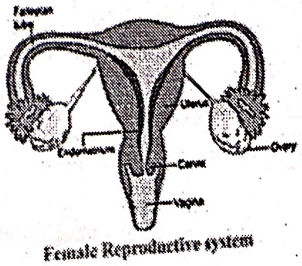

Germination

In Humans: Sexual maturity (puberty) brings common changes in boys & girls such as hair growth in armpits/genital areas, thinner body hair, oily skin, and pimples. In Girls, puberty causes breast enlargement, nipple darkening, and onset of menstruation; in boys facial hair growth voice cracking, and occasional erections occur. Puberty is the stage when sex hormones becomes active and gametes start being produced.

The Male Reproductive System:
It includes testes (sperm and testosterone production), epididymis (sperm storage/maturation), vas deferens, urethra, and penis, supported by accessory gland (seminal vesicles, prostate, bulbo-urethral). Semen is a mix of seminal fluid and sperm, providing nutrition, lubrication, and protection, sperm count ranges 20-200 million/ml, with a lifespan of 24-40 hours in the female genital tract.


Male reproductive system

The Female Reproductive System:
The Female Reproductive system consists of ovaries (produce ova and hormones), fallopian tubes (carry egg), uterus (embryo development), and vagina (birth canal). During copulation, sperm enters the vagina, travel through cervix and uterus, and fertilizes the ovum in the fallopian tube. Fertilisation forms a zygote which develops into a embryo; implantation occurs in the uterus liniry. The placenta forms between mother and foetus for exchange of nutrients, oxygen and waste; Pregnancy lasts about 9 months (Gestation), ending with birth (Parturition). The Menstrual cycle begins with Menstruation, first menstruation is called menarche (11-12 yrs) and last is menopause (~45 yrs)


Female Reproductive system

Magnetic Effects of Electric Current

* magnetic effect of electric current

• magent is an object that attracts obejects made of iron, cobalt and nickle magnet comes to rest in the nort-south direction, when suspended freely

properties of magnet

• a freelysuspended magnet always points towards the north and south direction.

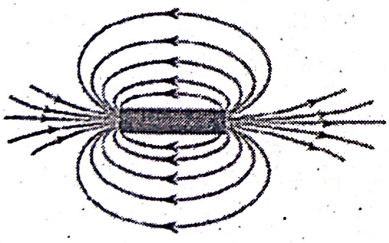
• The pole of a magnet which points towards north direction is called north pole or north-seeking.

• The pole of a magent which points towards south direction is called south pole or south-seeking.

• like poles of magnets repel each other while unlike poles of magnets attract each other

magnetic field

• The area around a magnet where magnetic force is experienced is called the magnetic field. It is quantity that has both direction and magnitude (i.e vector quantity)



• The imaginary lines of magnetic field around a magnet are called field line or field line of magnet when iron fillings are allowed to settle around a bar magnet, they get arranged in a pattern which mimicks the magnetic field lines

uniform magnetic field

• Field is the same everywhere. field lines are parallel and at equal distances

non-uniform field

• Field is different at different places. Field lines are not parallel and are at unequal distances

properties of magnetic field

• The magnitude of magnetic field increase with increase in electric current and decreases with decrease in electric current

• The magnitude of magnetic field produced by electric current decreases with increase in distance and vice-verse. The size of concentric circle of magnetic field line increases with distance from the conducter, which showes that magnetic field decreases with distance

• magnetic field lines always **form closed loop.**

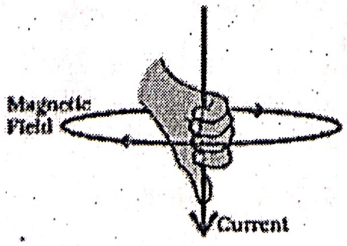
• no two field lines cross each other

oersted's discovery

• Hans christan oersted discovered that a current-carrying wire produces a magnetic field around it, which causes a magnetic compass needle placed nearby to deflect

Right-hand thumb rule

• if a current carrying conductor is held by the right hand, keeping the thumb straight and if the directing of electric current is in the direction of thumb, then the direction of wrapping of other fingers will show the direction of the magnetic field.



magnetic field due to current carrying straight conducter

• A current carrying straight conducter produces a magnetic field consisting of concentric circles around wire, with the right-hand rule.

Force on a current carrying conducter in a magnetic field

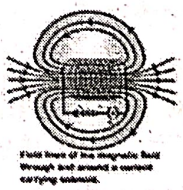
• a current-carrying conducter exerts a force when a magnet is placed in its vicinity. similarly, a magnet also exerts equal and opposite force on current carrying conducter.

magnetic field lines due to current through circular loop

• a current-carrying circular loop produces a magnetic field where the field lines are concentric circles near the wire, becoming progressively larger and straighter towards the centre, where they appear as parallel straight lines.

magenetic field due to a current in a solenoid

• solenoid is the coil with many circular turns of insulated copper wire wrapped closely in the shape of a cylinder. A current carrying solenoid produces a similar pattern of magnetic field as a bar magnet. one end of solenoid behaves as the north pole and another end behave as the south pole.



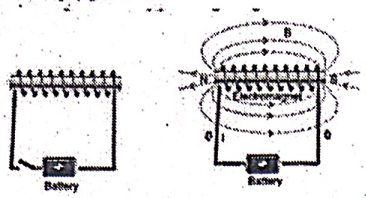
• Factors affecting strength:

1. no of turns : larger turns - stronger field
2. Current : larger current - stronger field
3. nature of core : using soft iron rod as the core produces a much stronger field.

electromagnet

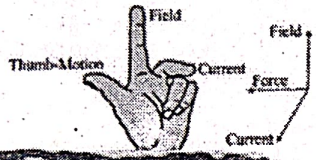
• an electromagnet consist of a long coil of insulated copper wire wrapped on a

soft iron. magnet formed by producing a magnetic field inside a solenoid is called electro-magnet



* Fleming's left hand rule

- according to this rule, "if the thumb, forefinger and middlefinger of the left hand are stretched perpendicular to each other and if the fore finger gives the direction of magnetic field, middle finger gives the direction of current, then the thumb will give the direction of motion or the force acting on the current-carrying conducter.



* domestic electric circuits

- 3 kinds of wires are used in domestic electric circuits
- live wire red in colour
- neutral wire with black insulation cover.
- earth wire with green insulation cover.
- the potential difference between live and neutral wire in india is 220v

* electric fuse

- it is a safety device to limit the current in an electric circuit.
- it prevents the electric appliences from damage
- it is made up of material which has high resistivity and low melting point

* overloading

- it occurs due to a hike in voltage or by connecting too many appliences to a single socket
- short-circuiting occurs when the live wire and neutral come into direct contact, causing the current to abruptly increase heavily.

* earthing

- earthing is a crucial safety device for appliances with metallic bodies (like, refrigerator, iron, etc)
- the metallic body is connected to the earth wire
- if current leaks onto the metal body (due to damaged insulation) the earth wire provides a low-resistance
- path for the current to flow to the ground.
- This prevents the user from getting a serious electric shock and protects the appliances from damage.

* short circuit

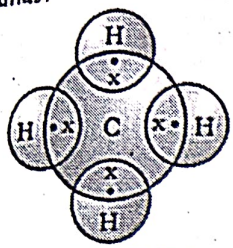
- occurs when the live wire and neutral wire come into direct contact (eg. due to damaged insulation). drastically reduces the circuit's resistance, causing a huge, sudden flow of current this excessive current produces a lot of heat, which can cause a fire.

Carbon and its compounds

Carbon :-

- Atomic No. → 6 4e⁻
  C(6) → 2, 4 → 4e⁻ octet 8e⁻
- To attain Noble gas configuration.
- Carbon has to
  - C^{4+} lose 4e⁻ — Requires lot of energy as 6 protons in nucleus will pull e⁻ strongly.
  - C^{4-} Gain 4e⁻ — Difficult to hold 10e⁻ with 6 protons in nucleus

*So carbon shares 4e⁻ and always form covalent bonds and covalent compounds.

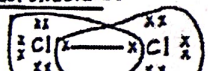


Properties of Covalent Compounds

i) Generally Poor conductor of electricity.
- Absence of ions.

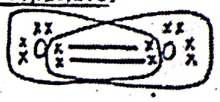
ii) Generally low melting and Boiling points.
- Because they have weak Intermolecular forces.

- Formation of Cl_2 :-
  Cl (17) = 2,8,7 → valence shell
  e⁻ dot structure :-



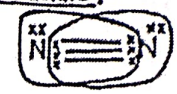
Cl — Cl
single covalent Bond

- Formation of O_2 :-
  O (8) = 2,6 To attain stability O needs 8e⁻ in last/Valence shell.
  e⁻ dot structure :-



O = O
Double covalent Bond

- Formation of N_2 :-
  N(7) = 2,5
  e⁻ dot structure :-



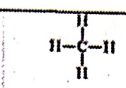
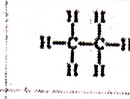
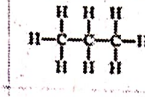
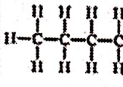
N ≡ N
Triple bond

Naming *learn

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

Carbon Carbon single bond – ane

Alkanes

Methane	CH_4	
Ethane	C_2H_6	
Propane	C_3H_8	
Butane	C_4H_{10}	

Formula :- C_nH_{2n+2}

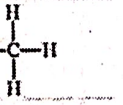
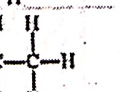
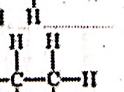
Carbon Carbon double bond = ene

Alkene

ETHENE	C_2H_4	 Methene C=?
PROPENE	C_3H_6	
BUTENE	C_4H_8	
PENTENE	C_5H_{10}	

Formula :- C_nH_{2n}

Carbon Carbon triple Bond ≡ yne

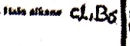
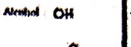
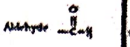
Ethyne	
Propyne	
Butyne	
Pentyne	

C_4H_6

Formula :- C_nH_{2n-2}

Functional Group :-

Atoms or groups of atoms which gives chemical properties to compound.

Class of compounds	Prefix/Suffix	Example
1. Halo alkane $C_nH_{2n}X$	Prefix-chloro, bromo, etc.	 Chloropropane  Bromopropane
2. Alcohol –OH	suffix 'ol'	 ethanol
3. Aldehyde –CHO	suffix 'al'	 propanal
4. Ketone >C=O	suffix 'one'	 propanone
5. Carboxylic acid –COOH	suffix 'oic acid'	 Ethanoic acid

Homologous Series :-

A series of compound with same functional Group, same General formula and similar chemical properties where each consecutive member differs by $-CH_2$.

Eg :- Alkane = C_nH_{2n+2}
Alkene = C_nH_{2n}

CH_4 —14amu→ C_2H_6 —14amu→ C_3H_8
C_2H_4 C_3H_6

C = 12 amu
H = 1 amu
O = 16 amu
N = 14 amu

(1) Molecular mass increase moving up homologous series.
$CH_4 \xrightarrow{+CH_2} C_2H_6$ (14amu)

(2) Melting and boiling point up the series.
Reason – They increase with molecular mass Gradation in other physical properties like solubility.

(3) chemical properties are same for a homologous series.
Reason – chemical properties are same because of functional group which remains same in HS.

Isomers :- compounds with same molecular formula but different structure and this phenomenon is called isomerism.

(1) Butane (4C)
e.g. C_4H_{10} 4c chain
(a) $H_3C-H_2C-H_2C-CH_3$ straight chain
3c chain
(b) $H_3C-CH(CH_3)-CH_3$ Branched chain — Isomers

C_3H_6O
(a) $H_3C-HC(=O)-H$ → propanal, Aldehyde
(b) $H_3C-C(=O)-CH_3$ → propanone, Ketone

Saturated Compounds :-

✓ Which has carbon-carbon singles bonds only.

C–C C–C–C

✓ C_nH_{2n+2}

✓ Stable

✓ less Reactive

Unsaturated Compounds

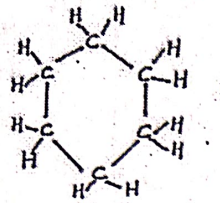
✓ Which has carbon-carbon Double or triple Bond.

✓ C=C → C_nH_{2n} C≡C → C_nH_{2n-2}

✓ Reactive unstable.

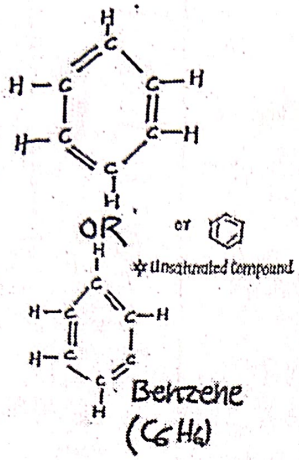
✓ More Reactive

Ring of Carbon



Cyclohexane (C_6H_{12})

✲ Saturated Compound



or

✲ Unsaturated compound

Benzene (C_6H_6)

Allotropy :-

- The phenomenon of existence of an element in two or more forms which have different physical properties but identical chemical properties.
- carbon exist in different forms in nature like Diamond and Graphite.

This phenomenon is called allotrophy and these different forms are called allotropes.

- Graphite is smooth and slippery.
- Diamond is hardest substance.

Catenation :- C–C–C–C

- property of carbon to self link and form long chains of carbon atoms, branched chain of carbon atoms or ring of carbon atoms.
- This is the biggest reason that Carbon forms millions of compounds. food, paper, clothes, Human body all contains carbon compounds.

Tetravalency :-

carbon forms four covalent bonds. due to small size of carbon, it's compounds are highly stable.

ETHANOL [CH_3-CH_2-OH] ✲✲✲✲

(1) $2CH_3-CH_2-OH + 2Na$ (Acid) → $2CH_3-CH_2-ONa + H_2$ ↑ Burns with a pop sound

(sodium ethoxide)

(2) $CH_3-CH_2-OH \xrightarrow[\text{Excess conc. } H_2SO_4]{443K} CH_2=CH_2 + H_2O$ (ethene)

Conc. H_2SO_4 Dehydrating agent hai (pani nikalne wala). This reaction is called Dehydration of ethanol.

(3) CH_3-CH_2-OH (ethanol) $\xrightarrow{\text{(1) Alkaline KMnO}_4\text{ + Heat. (Alkaline potassium permanganate) OR}}$ CH_3-COOH ethanoic acid (colourless)

(2) Acidified $K_2Cr_2O_7$ + Heat ← (Acidified potassium dichromate) OR O_2

1, and 2 are oxidising agent. This is oxidation of ethanol. Addition of oxygen to ethanol happens. Purple colour of Alkaline $KMnO_4$ disappears.

ETHANOIC ACID (CH_3-COOH)

Reaction of Acid ⟶ H^+ ions release

(1) $CH_3-COOH + NaOH \longrightarrow CH_3COONa + H_2O$ (water)
(Acid) (Base) (sodium ethanoate) (sodium salt)

(2) $2CH_3-COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + CO_2 + H_2O$
(Acid) (Metal Carbonate) (salt)

$CH_3-COOH + NaHCO_3 \longrightarrow CH_3COONa + CO_2 + H_2O$
(Acid) (Metal Bicarbonate) (salt)

Test for CO_2 gas → Turns lime water milky and milkiness disappear in passing excess of gas.

(3) Esterfication :- Ethanoic acid + Ethanol

CH_3-COOH (Acid) + CH_3-CH_2-OH (Base) ⇌ (acid-catalyst, reversible reaction)

$CH_3COO-CH_2-CH_3 + H_2O$
(Ester)

✲ Ester are sweet smelling substances, used in making perfumes and flavouring agents.

(4) Saponification – Ester + NaOH

$CH_3-COOCH_2-CH_3$ (ester) + $NaOH$ → CH_3-CH_2-OH (ethanol) + CH_3COONa (soap/salt) (soap industry)

Addition Reaction :-

- Unsaturated compounds Alkene, Alkynes

$CH_2=CH_2$ (ethene) + H_2 —Nickel catalyst / Platinum / Palladium catalyst→ CH_3-CH_3 (ethane) (saturated)

- Hydrogenation - Addition of Hydrogen
- Reaction is used in Hydrogenation of Vegetable oil.

Substitution Reaction :-

For saturated compounds

$CH_4 + Cl_2$ (methane) —sunlight→ CH_3Cl (chloro...)

saturated Compound. are le...

Combustion :-

(1) Complete combustion (in ...) ↓

$CO_2 + H_2O$ + Heat

$CH_4 + O_2 \longrightarrow CO_2 + H_2O$

$CH_3CH_2OH + 3O_2 \longrightarrow$ acet...

Saturated Hydrocarbon → clea...

Unsaturated Hydrocarbon → ...
with lot ...

(2) Incomplete Combustion → ...

• product are H_2O, CO and C ...

Soaps :-

- Molecules of soaps are so... potassium salts of long... carboxylic acids.

(Tail) Hydrophobic पानी से डर

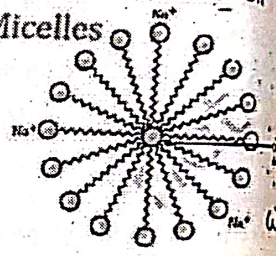
(He... Hy... पा...

- most of the dirt is oil.

Head – Towards water

Tail – Towards oil

Micelles



Hard water :-

- water that contains of calcium and Mg salts, bicarbonates, chlorides, sulphates.

Soap

(i) They are sodium salts of long chain fatty acids.

(ii) Soaps cannot be used with hard water.

(iii) Do not give foam with hard water.

(iv) They form precipatate with salts present in Hard water.

Detergents

(i) These are sodium or potassium s... of sulphonic acids of hydrocarb...

(ii) Detergents work well with hard and soft water both.

(iii) Give foam with hard water.

(iv) Do not form precipate with hard water.

Heredity

Genetics: The Study of heredity and variations.

Heredity: Heredity refers to the transmission of characters from one generation to the next generation.

Variations: The differences in characters of parents and offspring.

There are two types of variations.

Somatic variations	Gametic Variations.
They occur in the somatic cell of the body. They are not inherited or transmitted to the next Generation.	They occur in germ cells of the body. They are inherited to the next Generation.

Importance of variations:

1. It is the basis of Heredity.
2. It forms the basis of evolution.
3. It increases the chances of the survival of the organism according to the changing environment.

S.No	Characters	Contrasting Twait.
1.	Stem Height	Tall / Dwarf
2.	Flower colour	Violet/White
3.	Flower Position	Axial/Terminal
4.	Pod shape	Inflated/constricted
5.	Pod colour	Green/Yellow.
6.	Seed shape	Round/Wrinkled
7.	Seed colour	Yellow/Green.

Contribution of Mendel in Genetics:

- G.J Mendel started his work on Pisum sativum (Garden Pea).
- He was known as the father of Genetics.
- He had chosen seven pairs of contrasting characters.

The Reason for choosing Garden Pea for the experiment were as follows:

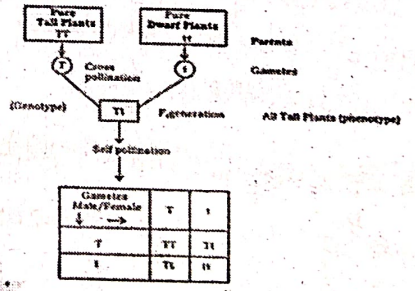
- Short Life cycle.
- A large number of seeds produced.
- Self - Pollination
- Several contrasting characters can be found in the Pea Plant

Mendel's Law Of Inheritance:

- **Law of Dominance**: If the two alleles for at a locus differ, then one, the dominant allele, determines the organism's appearance.
- **Law of Segregation**: The two alleles for a heritable character separate (segregate) during gamete formation and end up in different gametes.
- **Law of Independent Assortment**: Each pair of alleles segregates independently of other pairs of alleles during gamete formation.

MONOHYBRID CROSS:

When one pair of contrasting characters is taken to cross two Pea Plants, it is known as a monohybrid cross.

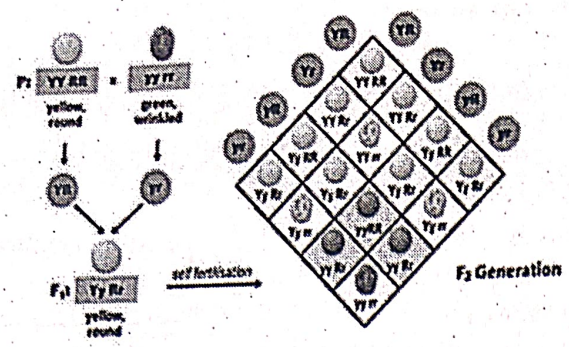


conclusion:

- Phenotypic Ratio: Tall : Dwarf (3:1)
- Genotypic Ratio: Pure tall : Hybrid Tall : Pure Dwarf (1:2:1)

Dihybrid cross:

When two pairs of contrasting characters are taken to cross two plants, it is known as a dihybrid cross.



Conclusion:

- The Phenotypic Ratio was found to be 9:3:3:1
- 9 : Round Yellow
- 3 : Round Green.
- 3 : Wrinkled Yellow
- 1 : Wrinkled Green.
- But the genotypic ratio was found to be 1:2:1:2:4:2:1:2:1

Sex Determination.

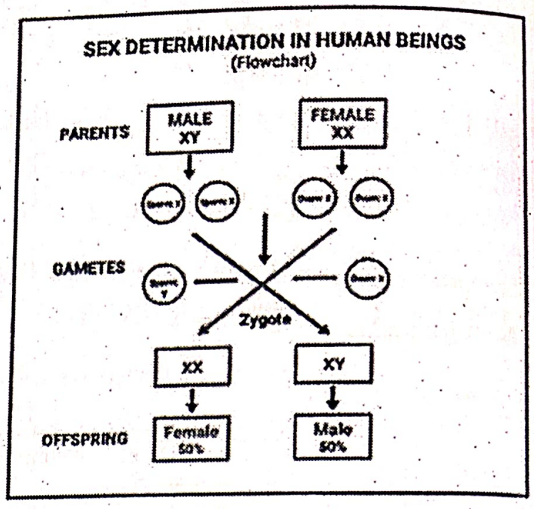
- Sex determination is used to determine the sex of the offspring.
- Environmental and genetic factors determine the sex of the offspring.
- In turtles, gender is determined by environmental factors such as temperature.

Types of Sex Determination:

Different types of sex determination are as follows:

- XX-XY type (Human)

Genetic factors include the presence of sex chromosomes. For example, in Humans the presence of two 'X' chromosome forms the female offspring whereas the presence of one 'X' and one 'Y' chromosome forms male offspring.



Our Environment

Ecosystem:- Ecological system

components of ecosystem

(Abiotic) Non-living component of Ecosystem

Physical or climatic factor
- Soil
- Water
- Air
- Light
- Temperature
- Rainfall
- pH

Biotic (living component of Ecosystem)

Producer (Autotrophic)
- Green plants
- cyanobacteria

→ Synthesize own food

Consumer
- Herbivores → Primary Consumer
- Carnivores → Secondary Consumer
- Omnivores → Tertiary Consumer
→ Quaternary Consumer

Decomposer (Saprotrophic)
- Microorganisms (bacteria and fungi)

Types of Ecosystem

Natural:-

1) Terrestial Ecosystem (land-based ecosystem)

Ex- Desert, Grassland, forest, Mountain

2) Aquatic Ecosystem (water-based Ecosystem)

Ex- River, pond, lakes (fresh water ecosystem), sea ocean (Marine-water Ecosystem).

Artificial / Man made Ecosystem:-

✓ made by human beings

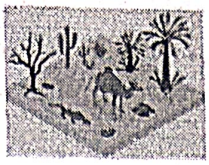
✓ Efforts require to maintain these type of ecosystem

Ex- cropfield (Agriculture land), Garden, Aquarium, poultary farms, zoo

Natural Ecosystem

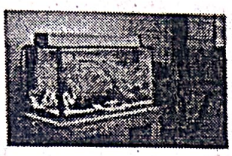
Pond Ecosystem

Desert Ecosystem

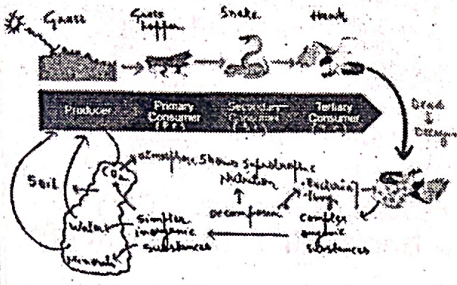


Manmade / Artificial Ecosystem

Aquarium



Garden



Decomposers:-

✓ organisms which feed on dead and decay matter.

✓ Convert complex organic material into simpler inorganic forms.

✓ Help in nutrient cycling.

✓ Help in cleaning of environment by decompositing biodegradable waste.

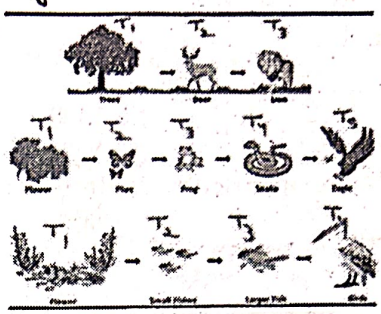
Functioning of Ecosystem

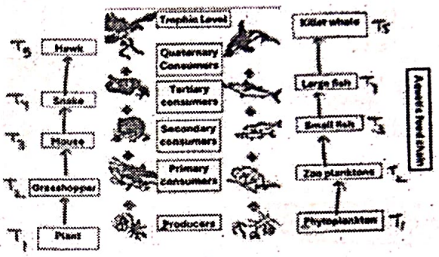
1. The producers, synthesise complex food with the help of solar energy, carbon dioxide sunlight and minerals (soil).
2. The consumers eat up plants and other animals as food, so energy is tranferred to next organism.
3. When plants and animals die, then decomposers act/feed on dead remains of their body and decompose them into simple materials like CO_2, Water and minerals

foodchain:-

The sequence of living organisms in which one organisms consume another organism to transfer food energy.

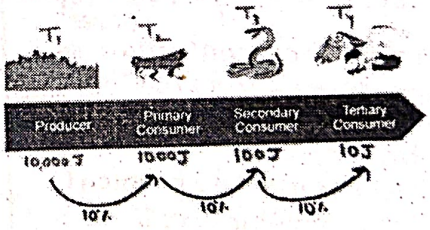
Trophic level:- position of an organism in a food chain.



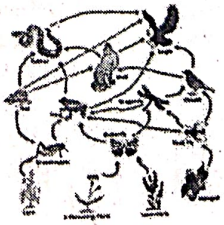


10% (Ten percent) law of Energy Transfer

According to this law only 10% of energy is transferred from one trophic level to next successive trophic level



Food web:- The network of interlinked food chains

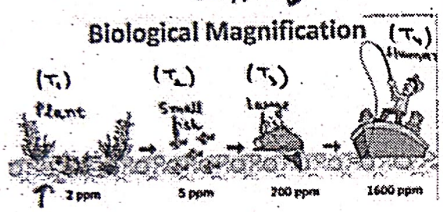


Food Chain	Food web
A food chain is a linear sequence of organisms through which nutrients and energy flows from one organism to another.	A network of different food chains is called food web.
It consists of only one straight chain.	It consists of many interconnected food chains.
If one group of an organism disturbs, the whole chain will become unstable.	The food web does not become unstable by the removal of one group of organisms.

Biomagnification :— it is the increase in the concentration of toxins or non biodegradable substances in the body tissues of organisms as it moves from one trophic level to the next.

Non biodegradable and toxic chemicals such as —
- insecticides
- Pesticides
- Heavy metals, etc

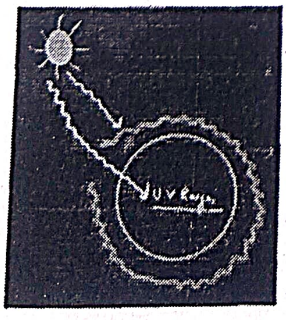
Toxin/chemical enter into water ↓



Please Note:—

Grass → Grass hopper → Frog → Snake → Eagle

- Flow of energy in a food chain is always unidirectional.
- Generally consist of only four or five steps.
- In a food chain:
  Highest energy – first Trophic level
  lowest energy – last trophic level
  Highest concentration of biomagnified chemical – last trophic level.
  lowest concentration of biomagnified chemical – first trophic level.



→ stratosphere ↓ ozone layer (Protect from harmful U.V rays) ↓ made up of oxygen gas (O_3)

Ozone formation in stratosphere

$O_2 \xrightarrow{\text{ultraViolet Rays}} O + O$

$O_2 + O \longrightarrow O_3$ (ozone layer)

Environmental problem and its management

Ozone layer depletion

Step 1: Chlorofluorocarbon (CFC) emissions reach the ozone layer.

Step 2: CFCs are broken down by the Sun's ultraviolet (UV) rays, releasing chlorine atoms into the ozone layer.

Step 3: Active chlorine atoms break down the ozone molecules, causing ozone layer depletion.

Step 4: More ultraviolet rays reach the Earth, threatening human health.

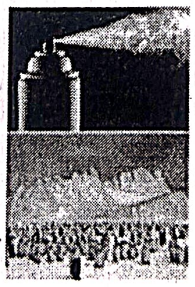
Causes of ozone layer depletion

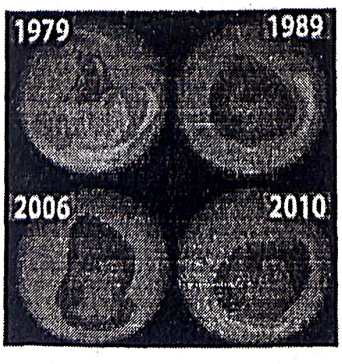
- chlorofluorocarbon (CFC)
- Hydrochlorofluorocarbon
- Methyl bromide
- Methyl chloroform

Effects of ozone layer Depletion

- skin cancer, cataract,
- DNA damage, sunburns,
- Reduced immunity
- low crop productivity
- Destruction of marine life

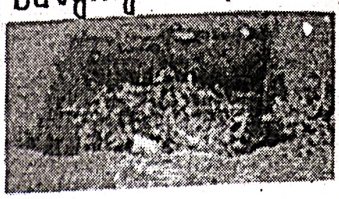
In 1987, an agreement was formulated by the united Nations environment programme (UNEP) to freeze the production of "CFCs" to prevent depletion of "OZONE LAYER".



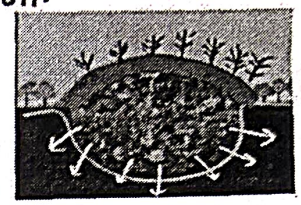


Waste Management

preparation of compost:—
Biodegradable wastes can converted into compost by burying in a pit.



Landfills:—
Disposal of wastes by putting it in low lying area of ground and covering it with soil.



Incineration:—
Burning of waste substances at high temperature to form ash.

Sewage treatment:—
- When sewage water is treated, it becomes clean water that can be discharg in river.
- it also produce manure and sewage gas (biogas).

Recycling:—
solid wastes like paper and metals can be recycled