Way to Success

10th- SCIENCE

STUDY MATERIAL-Quarterly syllabus

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- **Tips and Tricks –** Scientists-discoveries, Important Formula, Points to remember, Important Diagrams

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SCIENTISTS – INVENTIONS & DISCOVERIES

Father of various fields		Discoveries	
Leonardo da Vinci	Paleontology	Marie curie	Radium
Kaspar Maria Von Sternberg	Paleobotany	Martin Klaproth	Uranium
Birbal Sahani	Indian Paleobotany	Henry Bequerel	Natural radioactivity
Thomas Addison	Endocrinology	Irene Curie	Artificial radioactivity
Nehemiah Grew	Plant Anatomy.	Robin Hill	Light reaction.
William Harvey **[SEP-20]**	Modern physiology	Landsteiner & Wiener	Rh factor
Gregor Johann Mendel	Genetics	W.F. Libby **[PTA-5]**	Radio carbon dating
Dr. Norman E. Borlaug	Green Revolution.	Johann Lippershey	First Telescope

Introduced/ First coined the term	
Kogl & Haagen- Smith	Auxin.
W.M.Bayliss & E.H.Starling	Hormone.
Waldeyer	Chromosome **[MAY-22]**
J.W. Harshberger	Ethnobotany **[APR-23, MAY-22]**
Karl Landsteiner	Concept of Blood group **[SEP-21]**
Decastello and Steini	Identified AB Blood group
Fredrick Banting, Charles Best & MacLeod	Human insulin

Others	
Dr.Homi Jahangir Bhaba	First chairman of Indian Atomic Energy Commission.
Frits Warmolt Went	Demonstrated the existence and effect of auxin in plants.
James Watson & Francis Crick.	Proposed Three-dimensional model of DNA.
Erwin Chargaff	Proportion of Adenine = Thymine & Guanine = Cytosine
Kurosawa	Observed Bakanae disease or foolish seedling disease in rice crops
Dr. Suniti Solomon	Pioneered HIV research and treatment in India
Jean Baptiste Lamarck	Theories of Evolution (Use and Disuse Theory)
Charles Darwin **[PTA-6]**	Theory of Natural Selection
Oparin & Haldane	Chemical evolution of life
Ernst Haeckel	Biogenetic law / Recapitulation theory
Louis Pasteur **[SEP-21]**	Speculated biogenesis - Life originates from pre-existing life

IMPORTANT DAYS

World Cancer Day	February 4th	Menstrual Hygiene day	May 28th
National Cancer awareness day	November 7th	National Forest Policy	1952 & 1988
AIDS Day	December 1st	Forest conservation Act	1980
Anti Tobacco Act	May 1st 2004	Chipko movement victory	1980
World Anti / No Tobacco Day	May 31st **[JUN-23]**	Wildlife protection Act	1972
International day against drug abuse	June 26th	Child helpline number	1098

PHYSICS - IMPORTANT FORMULAE & VALUES

UNIT- 1

Force	$F = m \times a$	Momentum of a couple	$M = F \times S$
Linear Momentum	$p = m \times v$	Change in momentum	$\Delta p = m(v - u)$
Torque	$\tau = F \times d$	Impulse	$J = F \times t = \Delta p$
Gravitational Force	$F = \frac{Gm_1m_2}{r^2}$	Acceleration due to gravity	$g = \frac{GM}{R^2}$
Weight	$W = m \times g$	Kinetic Energy	$E_k = \frac{1}{2}mv^2 = \frac{p^2}{2m}$

Important Values: Acceleration due to gravity on Earth: 9.8 ms^{-2} & on Moon: 1.625 ms^{-2}
Radius of Earth (R) = 6400km ; Gravitational constant(G) = 6.674×10^{-11} $Nm^2 kg^{-2}$
Mass of Earth (M) = 5.972×10^{24}kg

UNIT- 2

Velocity of light	$c = \nu\lambda$	Snell's law	$\frac{\sin i}{\sin r} = \frac{\mu_2}{\mu_1}$	Rayleigh's law	$S \alpha \frac{1}{\lambda^4}$
Magnification	$\frac{v}{u} = \frac{h'}{h}$	Power	$P = \frac{1}{f}$	Lens Formula	$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

Focal length of corrective lens for Myopia : $f = \frac{xy}{x-y}$ (concave lens)& Hypermetropia : $f = \frac{dD}{d-D}$ (convex lens)

UNIT- 3

Linear expansion	$\frac{\Delta L}{L_0} = \alpha_L \Delta T$	Boyle's law	$P \alpha \frac{1}{V}$	**Important Values:**
Cubical expansion	$\frac{\Delta V}{V_0} = \alpha_V \Delta T$	Charles's law	$V \alpha T$	$N_A = 6.023 \times 10^{23}$ /mol
Superficial expansion	$\frac{\Delta A}{A_0} = \alpha_A \Delta T$	Avogadro's law	$V \alpha n$	$k_B = 1.38 \times 10^{-23}$ JK^{-1}
		Ideal gas equation	$PV = RT$	$R = 8.31$ J $mol^{-1}K^{-1}$

UNIT- 4

Current	$I = \frac{Q}{t}$	Resistance	$R = \frac{V}{I}$	Resistivity	$\rho = \frac{RA}{L}$
Ohm's law	$V = IR / I = \frac{V}{R} / R = \frac{V}{I}$	Conductance	$G = \frac{1}{R}$	Conductivity	$\sigma = \frac{1}{\rho}$

Resistors in Series $R_s = R_1 + R_2 + R_3 + \ldots\ldots$ (for equal resistance $R_s = n R$)
Resistors in Parallel $\frac{1}{R_P} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \ldots\ldots$ (for equal resistance $R_P = \frac{R}{n}$)

Potential difference(V)	$\frac{\text{Work done (W)}}{\text{Charge (Q)}}$	Electric Power	$P = \frac{\text{Work}}{\text{Time}} = VI = \frac{V^2}{R}$
Electrical energy	$E = P \times t$	Joule's law of heating	$H = I^2 R t$

UNIT- 5

Wave velocity	$V = \frac{\lambda}{T} = n\lambda$	Velocity of sound in air is 340 ms^{-1}	Hearing range 20 to 20,000 Hz
Effect of density	$V \alpha \sqrt{\frac{1}{d}}$	Speed of Echo $\frac{2d}{t}$	Minimum distance to hear echo is 17.2 m
Effect of Temperature	$V \alpha \sqrt{T}$; $V_T = (V_0 + 0.61T)ms^{-1}$	Doppler Frequency	$n' = \left(\frac{V+V_L}{V-V_S}\right) n$

UNIT- 6

Permitted range of radiation 100 mR per week (or) 20 milli Sievert per year = Safe limit
100 R →leukemia (or) cancer & 600 R → death

POINTS TO REMEMBER FOR ALL UNITS

1. LAWS OF MOTION

- **Newton's 1st Law (or) Law of Inertia :** *Every body continues to be in its state of rest or in uniform motion along a straight line unless it is acted upon by some external force.*
- **Newton's 2nd Law (or) Law of Force :** *Force acting on a body is directly proportional to the rate of change of linear momentum. The change in momentum takes place in the direction of force.* ***F = ma (or)*** $F \propto \frac{\Delta p}{t}$
- **Newton's 3rd Law :** *For every action, there is an equal and opposite reaction.*
- **Law of Conservation of Linear Momentum :** *There is no change in linear momentum of a system of bodies as long as no net external force acts on them.*
- **Newton's universal law of gravitation :** *Gravitational force between any two bodies in the universe is directly proportional to the product of their masses and inversely proportional to the square of the distance between the centers of these masses. The direction of force acts along the line joining them.*

2. OPTICS

- **First law of refraction :** *Incident ray, refracted ray and the normal all lie in same plane.*
- **Second law of refraction (or) Snell's law :** *Ratio of sine of angle of incidence and sine of angle of refraction is equal to the ratio of refractive indices of two media.*

Types of Inelastic scattering

i) **Rayleigh scattering:** *Scattering of sunlight by atoms/molecules of gases in earth's atmosphere.* ***Eg.*** *Sun is red at sunrise and sunset.*

ii) **Mie scattering:** *Occurs when diameter of scatterer is similar/larger than wavelength of incident light.* ***Eg.*** *White appearance of clouds.*

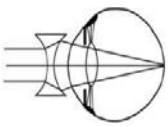
iii) **Tyndall Scattering:** *Scattering of light by colloidal particles in colloidal solution.*

iv) **Raman scattering:** *Light ray interacts with particles of pure liquids or transparent solids, leading wavelength / frequency change.*

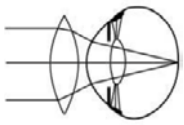
Defects of Eye

- **Myopia :** *Short sightedness, inability to see distant objects.*
- **Hypermetropia :** *Long sightedness, inability to see nearby objects.*
- **Presbyopia / Old age Hypermetropia :** *Ageing, weaken ciliary muscles & eye-lens become rigid. So eye loses its power of accommodation.*
- **Astigmatism :** *Inability to see parallel and horizontal lines clearly.*

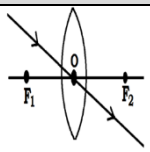
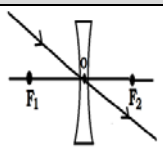
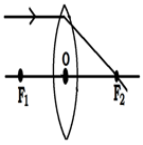
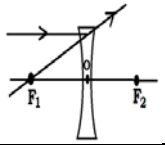
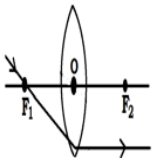
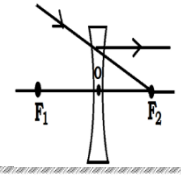
Corrected Myopia



Corrected Hypermetropia

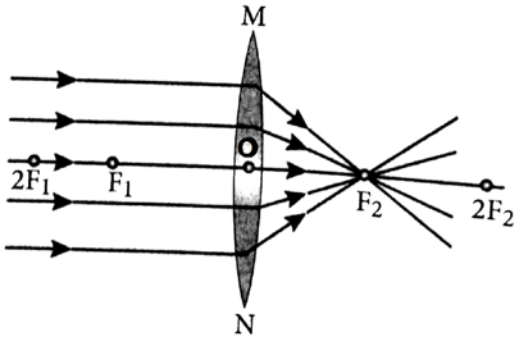


Rules for Images formed due to refraction through a convex & concave lens

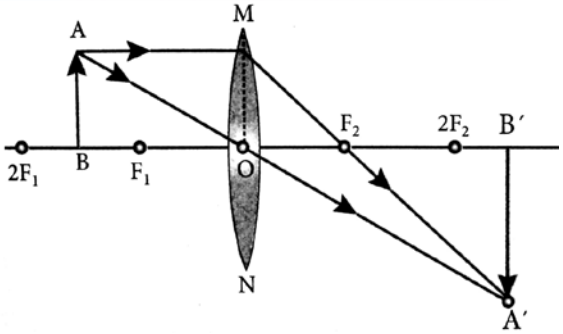
Convex lens	Concave lens
Rule 1: When light strikes obliquely at **optical centre**, it continuous to follow its path **without deviation.** 	When light strikes at **optical centre**, it continuous to follow its path **without deviation.** 
Rule 2: When rays strikes **parallel to principal axis**, refracted rays are **converged to principal focus.** 	When rays strikes **parallel to principal axis**, refracted rays are **diverged from principal focus.** 
Rule 3: When ray **passes through** principal focus, refracted ray will be **parallel to principal axis**. 	When ray **directed towards** principal focus, refracted ray will be **parallel to principal axis**. 

REFRACTION THROUGH A CONVEX LENS

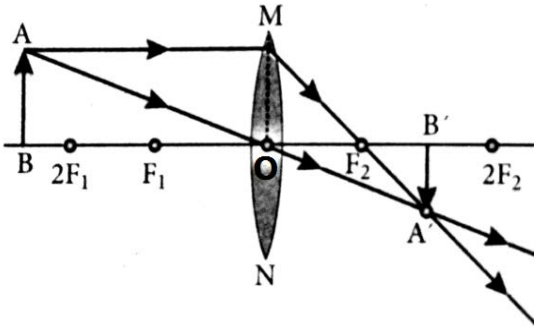
Object position : Infinity Image position : At F	Image size << Object size, **Real image**



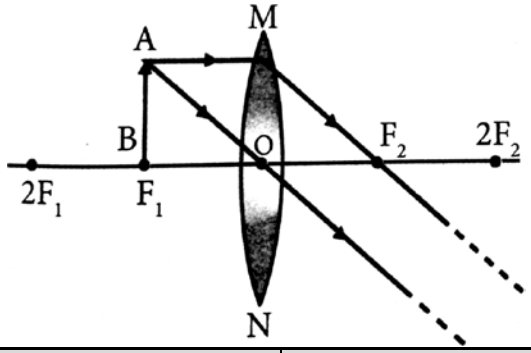
Object position : between F & 2F Image position : beyond C/2F	Image size > Object size, **Real & inverted image**



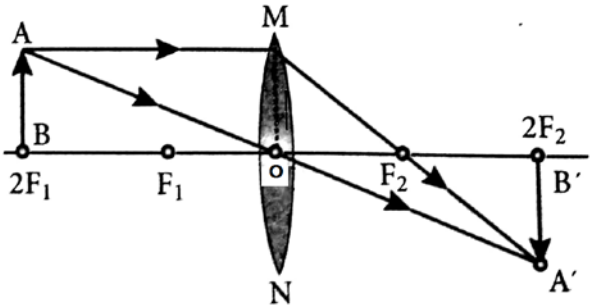
Object position : beyond C / 2F Image position : between F & 2F	Image size < Object size, **Real & inverted image**



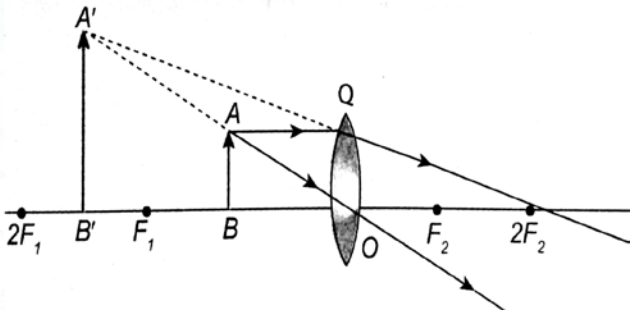
Object position : At F Image position : Infinity	Image size >> Object size, **Real & inverted image**



Object position : At C / 2F Image position : At 2F	Image size = Object size, **Real & inverted image**

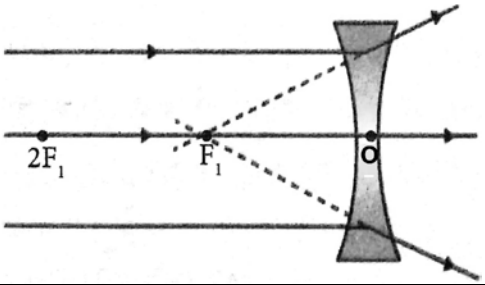


Object position : F & O Image position : At F	Image size > Object size, **Virtual & Erect image**

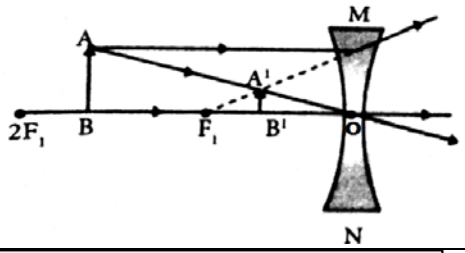


REFRACTION THROUGH A CONCAVE LENS

Object position : Infinity Image position : At F	Image size << Object size, **Virtual image**



Object position : Any finite distance from the lens Image position : Between F & O
Image size < Object size, **Virtual image**



Distance between the object & lens decreased,	Distance between the image & lens decreases

Note: Here AB is the Object and A'B' is the Image

3. THERMAL PHYSICS

	Expansion type	Definition	Co-efficient Value
Solids	Linear/Longitudinal	Length changes due to temperature change.	Ratio of increase in length per degree rise in temperature to its unit length.
	Superficial/areal	Area changes due to temperature change.	Ratio of increase in area of per degree rise in temperature to its unit area.
	Cubical/volumetric	Volume changes due to temperature change.	Ratio of increase in volume per degree rise in temperature to its unit volume.
Gas	Real expansion	Liquid is heated directly without container.	Ratio of true rise in volume per degree rise in temperature to its unit volume.
	Apparent expansion	Without considering expansion of container.	Ratio of apparent rise in volume per degree rise in temperature to its unit volume

- **Boyle's law :** When temperature is kept constant, volume is inversely proportional to pressure.
- **Charles's law :** When pressure is kept constant, volume is directly proportional to temperature.
- **Avogadro's law :** At constant pressure & temperature, volume is directly proportional to No. of atoms/molecules.
- **Real gases** Atoms/molecules interact with each other with intermolecular/interatomic force of attraction.
- **Ideal gas (or) Perfect gas** Atoms/molecules do not interact with each other.

4. ELECTRICITY

- **Ohm's law:** At a constant temperature, current 'I' through a conductor is directly proportional to potential difference 'V' between the two ends of the conductor. V = IR
- **Joule's law :** Heat produced in resistor is directly proportional to,
  - Square of current
  - Resistance
  - Time for which current passes through resistor.
- **Overloading:** When current through a wire exceeds the maximum limit, it gets heated to an extent of fire.
- **Short circuiting:** When a live wire meets neutral wire, it causes a short circuit.
- **Horse Power:** It is used to express the electric power. It is equal to 746 watt.

5. ACOUSTICS

- **Velocity of sound wave:** ***Affecting Factors:*** Temperature, Density, Relative humidity, Elasticity(Only solids)
  - ✓ ***Particle velocity:*** Velocity with which particles of medium vibrate to transfer energy as wave.
  - ✓ ***Wave velocity :*** Velocity with which wave travels through the medium.
- **Reflection Applications:** Megaphone, Sound board, Ear trumpet, Whispering hall (or) gallery
- **Doppler effect** : Frequency of sound heard by listener is different from the original frequency emitted by source, whenever there is a relative motion between source and listener.
- **RADAR(*Radio Detection And Ranging*)**: Used to track speed & location of aircrafts, etc,. by radio waves.
- **SONAR*(Sound Navigation and Ranging):*** Speed of marine animals & submarines are determined.

6. NUCLEAR PHYSICS

- **Radioactive displacement law (or) Soddy and Fajan's law :**
  - i) *When a radioactive element emits an alpha particle, a daughter nucleus is formed whose mass number is less by 4 units and atomic number is less by 2 units, than that of the parent nucleus.*
  - ii) *When a radioactive element emits a beta particle, a daughter nucleus is formed whose mass number is the same and atomic number is more by 1 unit, than that of the parent nucleus.*

Alpha decay : $_{Z}Y^{A} \rightarrow {}_{Z-2}Y^{A-4} + {}_{2}He^{4}$	**Beta decay :** $_{Z}Y^{A} \rightarrow {}_{Z+1}Y^{A} + {}_{-1}e^{0}$

- **Nuclear fission:** Breaking of heavier nucleus into two smaller nuclei with energy release.
  Eg: $_{92}U^{235} + {}_{0}n^{1} \rightarrow {}_{56}Ba^{141} + {}_{36}Kr^{92} + 3\ {}_{0}n^{1} + Q$ (energy) **Atom bomb**
- **Nuclear reactor:** Nuclear fission takes place in self-sustained & controlled manner to produce electricity.
- **Critical mass (m_c):** minimum mass of fissile material necessary to sustain chain reaction.
- **Nuclear fusion:** Two lighter nuclei combine to form heavier nucleus. only at high temperature & pressure.
  Eg : $_{1}H^{2} + {}_{1}H^{2} \rightarrow {}_{2}He^{4} + Q$ (energy) **Hydrogen bomb**

7. ATOMS AND MOLECULES

✱ **Isotopes :** Atoms of same elements having different atomic masses. ***E.g:*** $_{17}Cl^{35}$, $_{17}Cl^{37}$

✱ **Isobar :** Atoms of different elements having same atomic masses. ***E.g:*** $_{18}Ar^{40}$, $_{20}Ca^{40}$

✱ **Isotones :** Atoms of different elements having same number of neutrons. ***E.g:*** $_{6}C^{13}$, $_{7}N^{14}$

✱ **Atomicity:** It is the number of atoms present in the molecule.

Atomic Mass Unit (AMU) Mass of atom. It is $\frac{1}{12}^{th}$ of mass of Carbon 12 atom.	**Average atomic mass (AAM)** Weighted average of masses of its natural isotopes.
Gram Atomic Mass (GAM) Atomic mass of an element expressed in grams.	**Gram Molecular Mass (GMM)** Molecular mass of compound expressed in grams.
Relative Atomic Mass (RAM) / standard atomic weight It is the ratio between average mass of its isotopes to $\frac{1}{12}^{th}$ of mass of a Carbon 12 atom.	**Relative Molecular Mass (RMM)** It is the ratio between mass of one molecule of substance to $\frac{1}{12}^{th}$ of mass of a Carbon 12 atom.

$^{12}_{6}C$ — Mass Number(A); Atomic Number(Z)	*Mass number = No. of protons + No. of neutrons* *Atomic number = No. of protons / No. of electrons*

Atomic Masses of commonly used elements

Hydrogen (H)	**1**	*Nitrogen (N)*	**14**	*Phosphorus (P)*	**30**	*Chlorine (Cl)*	**35.5**
Carbon(C)	**12**	*Oxygen (O)*	**16**	*Sulphur (S)*	**32**	*Calcium (Ca)*	**40**

8. PERIODIC CLASSIFICATION OF ELEMENTS

✱ ***Modern periodic law*** physical and chemical properties of elements are periodic functions of their atomic numbers.

Periodic property	Left to Right in a period	Top to Bottom in a group
Atomic radius : Distance between nucleus centre and valence electron.	***Decreases*** With same valence shell, proton number increases, increasing attraction. Thus atom shrinks.	***Increases.*** Due to increase in valence shell number
Ionic radius : Distance from nucleus centre of ion upto where it exerts its influence.		
Ionisation Energy : Minimum energy required to remove an electron from atom.	***Increases*** Atomic radius decreases	***Decreases*** Loosely bound valence electrons.
Electron Affinity : Amount of energy released when atom gains an electron	***Increases*** Atomic radius decreases	***Decreases*** Loosely bound valence electrons.
Electronegativity : Tendency to attract electrons towards itself in covalent bond.	***Increases*** Increase in nuclear charge	***Decreases*** Increased valence shell number

Metallurgy

Aluminium	Copper	Iron
Ores of Aluminium : Bauxite $Al_2O_3.2H_2O$ Cryolite Na_3AlF_6 Corundum Al_2O_3	**Ores of Copper :** Copper pyrites $CuFeS_2$ Cuprite or ruby copper Cu_2O Copper glance Cu_2S	**Ores of Iron :** Haematite Fe_2O_3 Magnetite Fe_3O_4 Iron pyrite FeS_2
• It is a silvery white metal.	• It is a reddish brown metal.	• Lustrous metal, greyish white in colour.

9. SOLUTIONS

Solute + **Solvent** ⟶ **Solution**

(present in lesser amount) *(present in larger amount)* *(a homogeneous mixture of two or more substances)*

Types of solution based on .....

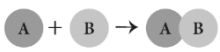
1. **Number of components :** • ***Binary solution :*** 2 components. •***Ternary solution :*** 3 components.
2. **Physical state of solute and solvent :**
   - ***i) Solid solution :*** (a) Solid – solid ***E.g :*** alloys (b) Liquid – solid ***E.g :*** amalgam
   - ***ii) liquid solution :*** (a) Solid – liquid ***E.g :*** NaCl in water
     (b) Liquid – liquid ***E.g :*** alcohol in water (c) Gas – liquid ***E.g :*** sodawater
   - ***iii) gaseous solution :*** (a) Liquid – gas ***E.g :*** cloud (b) Gas – gas ***E.g :*** He-O_2 gas mixture
3. **Type of solvent :** • ***Aqueous solution*** (Water)
   •***Non aqueous solution*** (Any liquid other than water)
4. **Amount of solute :**
   - ***Saturated :*** No more solute can be dissolved.
   - ***Unsaturated :*** Contains less solute than saturated solution.
   - ***Super saturated :*** Contains more solute than saturated solution.

Hydrated Salts	
Blue Vitriol	$CuSO_4.\ 5\ H_2O$
Green Vitriol	$FeSO_4.\ 7\ H_2O$
White Vitriol	$ZnSO_4.\ 7\ H_2O$
Epsom Salt	$MgSO_4.7\ H_2O$
Gypsum	$CaSO_4.\ 2\ H_2O$

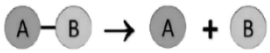
10. TYPES OF CHEMICAL REACTIONS

Classification based on nature of rearrangement of atoms:

❖ **Combination / synthesis / composition reaction :** (Exothermic in nature, they release heat.)

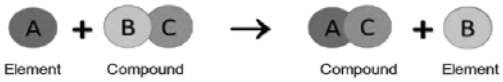
- ✓ Element + Element → Compound ***E.g:*** $H_{2\,(g)} + Cl_{2\,(g)} \rightarrow 2HCl_{(g)}$ 
- ✓ Compound + Element → Compound ***E.g:*** $PCl_{3\,(l)} + Cl_{2\,(g)} \rightarrow PCl_{5\,(s)}$
- ✓ Compound + Compound → Compound. ***E.g:*** $SiO_{2\,(s)} + CaO_{(s)} \rightarrow CaSiO_{3\,(s)}$

❖ **Decomposition reactions :** (Endothermic in nature, by providing energy.)

- ✓ Thermal decomposition / Thermolysis : $2HgO_{(s)} \xrightarrow{heat} 2Hg_{(l)} + O_{2(g)}$
- ✓ Electrolytic decomposition : $2NaCl_{(aq)} \xrightarrow{electricity} 2Na_{(s)} + Cl_{2(g)}$ 
- ✓ Photo decomposition/photolysis : $2AgBr_{(s)} \xrightarrow{light} 2Ag_{(s)} + Br_{2(g)}$

❖ **Single displacement Reactions :**

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



❖ **Double displacement reactions / Metathesis :**

- ✓ ***Precipitation reaction :*** $Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \longrightarrow PbI_{2(s)} \downarrow + 2KNO_{3(aq)}$
- ✓ ***Neutralisation reaction:*** $NaOH_{(aq)} + HCl_{(aq)} \longrightarrow NaCl_{(aq)} + H_2O_{(l)}$

❖ **Combustion reaction :** ***E.g:*** $C_3H_{8(g)} + 5O_{2(g)} \longrightarrow 3CO_{2(g)} + 4H_2O_{(g)} + Heat$

Classification based on direction of reaction

❖ **Reversible reaction:** ***Types:*** • Forward • Backward

$$PCl_{5\,(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

❖ **Irreversible reaction :** Only in forward direction

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

pH	
$pH = -\log_{10}[H^+]$	$pH < 7 \Rightarrow$ ***Acid*** $pH > 7 \Rightarrow$ ***Base*** $pH = 7 \Rightarrow$ ***Neutral***
Ionic product of water $K_W = [H^+]\,[OH^-]$	

12. PLANT ANATOMY AND PLANT PHYSIOLOGY

✱ **Vascular bundles :** Xylem (conducts water & minerals) & Phloem (conducts food).

✱ ***Endarch:*** Protoxylem towards centre; metaxylem towards periphery. ***Eg:*** *Stem*.

✱ ***Exarch :*** Protoxylem towards periphery; metaxylem towards centre. ***Eg:*** *Roots.*

★ **Dicot Root** – Radial, Xylem is Exarch and Tetrach. ***Eg :*** *Bean*

★ **Monocot Root** – Radial, Xylem is Exarch and Polyarch. ***Eg :*** *Maize*

★ **Dicot stem** – Conjoint - Collateral, Endarch and Open. ***Eg :*** *Sunflower*

★ **Monocot Stem** – Conjoint – Collateral, Endarch and Closed. ***Eg :*** *Maize*

★ **Monocot***(Grass)* & **Dicot Leaf***(Mango)* – Conjoint - Collateral and Closed

✱ **Types of plastids :**
1) Chloroplast - Green coloured plastids (green pigment – chlorophyll).
2) Chromoplast - Yellow, red, orange coloured plastids.
3) Leucoplast - Colourless plastids

✱ **Photosynthesis :** $6CO_2 + 6H_2O \xrightarrow[\text{Chlorophyll}]{\text{Light}} \underset{\textit{Glucose}}{C_6H_{12}O_6} + \underset{\textit{Oxygen}}{6O_2}\uparrow$

1) Light dependent photosynthesis (Hill reaction / Light reaction)

2) Light independent reactions (Calvin cycle / Dark reaction / Biosynthetic phase)

✱ **Mitochondria :** Power house of the cell

✱ **Respiration:** **1) Aerobic respiration :** $C_6H_{12}O_6 + 6O_2 \longrightarrow 6CO_2 + 6H_2O + ATP$

i) ***Glycolysis (Glucose splitting):*** In Cytoplasm. Glucose → Pyruvic acid

ii) ***Krebs Cycle/Tricarboxylic Acid Cycle (TCA):*** In mitochondria matrix. Pyruvic acid→CO_2 & H_2O

iii) ***Electron Transport Chain:*** Through electron carrier complex $NADH_2$ & $FADH_2$ → NAD^+ & FAD^+

2) Anaerobic respiration : $C_6H_{12}O_6 \longrightarrow 2\,CO_2 + 2C_2H_5OH + \text{Energy (ATP)}$

✱ **Respiratory Quotient (R.Q) :** $RQ = \frac{\text{Volume of } CO_2 \text{ liberated}}{\text{Volume of } O_2 \text{ consumed}}$

13. STRUCTURAL ORGANISATION OF ANIMALS

Indian cattle Leech (Invertebrate)

✱ **Locomotion :** (i) looping or crawling movement (ii) Swimming movement.

✱ **Food Flow :** Mouth→Buccal cavity→Pharynx→ Crop→Stomach→Intestine →rectum →Anus

✱ **Hirudin :** It prevents coagulation of blood by secreting a protein.

✱ **Circulatory system :** It has haemocoelic system.

✱ **Four channels:** One above, one below and two on either side of the alimentary canal acts as heart

✱ **Medicinal uses:**
- Used to treat cardiovascular diseases.
- Saliva is used for preparing pharmaceutical drugs to treat hypertension.

Common Rabbit (Vertebrate)

✱ **Food Flow:** Mouth→Buccal cavity→ Pharynx→ Oesophagus → Small Intestine →Caecum →large intestine →Anus

✱ **Diphyodont dentition / Heterodont :** Incisors(I), canines(C), premolars(PM) & molars(M)

Dental formula $\left(I\frac{2}{1}, C\frac{0}{0}, PM\frac{3}{2}, M\frac{3}{3}\right)\frac{2033}{1023}$ Canines are absent.

✱ **Diastema** – gap between incisors and premolars.

✱ **Reproductive system :** Sexual dimorphism

- ***Male :*** It has consists of a pair of testes, seminiferous tubules, epididymis, **vas deferens**. (sperm duct).
  Accessory glands : prostate gland, cowper's gland and perineal gland.
- ***Female :*** Ovary→Oviducts→fallopian tube → uterus→ vagina→ vestibules → vulva
  Accessory glands : Cowper's gland and perineal gland.

14. TRANSPORTATION IN PLANTS AND CIRCULATION IN ANIMALS

- **Diffusion :** Movement of molecules from higher to lower concentration region without energy.
- **Osmosis :** Movement from higher to lower concentration region through semi-permeable membrane.
  - ✓ **Plasmolysis:** When plant cell is placed in hypertonic solution, water moves out & protoplasm shrinks.
  - ✓ **Imbibition:** Solid plant material absorbs water & swells up. ***Eg :*** absorption of water by dry grapes.
- **Apoplast pathway :** Water travels through intercellular spaces & cell walls.
- **Symplast pathway :** Water travels through plasma membrane, cytoplasm & plasmodesmata.
- **Transpiration :** Evaporation of water from aerial parts of plants especially through stomata.
- **Transpiration pull:** As water is lost, pressure is created to pull more water from xylem to mesophyll cells.
- **Ascent of sap :** Upward movement of water and minerals from roots to different plant parts.
- **Types of blood cells :** *a) Red blood cells/ Erythrocytes : Red in colour due to haemoglobin.*

  b) White blood cells /Leucocytes :
  - **1) Granulocytes**
    - ***(i) Neutrophils*** - 60% - 65% of total leucocytes
    - ***(ii) Eosinophils*** - 2% - 3% of total leucocytes
    - ***(iii) Basophils*** - 0.5-1.0% of total leucocytes
  - **2) Agranulocytes**
    - ***(i) Lymphocytes*** - 20-25% of total leucocytes
    - ***(ii) Monocytes*** - 5-6% of total leucocytes

  c) Blood platelets /Thrombocytes : form Blood clot.
- **Hypertension :** High blood pressure. **Hypotension :** Low blood pressure.

  Systolic pressure : Pressure rises to peak as ventricle contract

  Diastolic pressure : Pressure falls to lowest as ventricle relaxes.
- **Stethoscope :** Detects the sound by internal organs.
- **Sphygmomanometer :** Measure blood pressure
- **Important Values**:
  - ➢ Each cardiac cycle lasts about 0.8 sec.
  - ➢ Normal pulse rate 70 – 90 / min.
  - ➢ Normal heart beat 72 – 75 times per minute.
  - ➢ Normal Blood pressure: 120mm / 80mm Hg.

Blood Group	Can donate to	Can receive from
A	A and AB	A and O
B	B and AB	B and O
AB	AB	A, B, AB, O (Universal recipient)
O	A, B, AB, O (Universal Donor)	O

15. NERVOUS SYSTEM

- **Types of neurons based on structure :** Unipolar, Bipolar and Multipolar neurons.
- **Types of neurons based on function :** Sensory/afferent, Motor/efferent and Association neurons.
- **Transmission of nerve impulse :** Stimulus →Receptors in sense organ → Electrical impulse →Dendrite→Cell body or cyton → Axon →Axon end→Neuro transmitter →Synapse → Dentrites of next neuron. This process repeats and impulse reaches brain or spinal cord.

Human nervous system

1) Central Nervous System (Brain + Spinal cord) :

- ***Brain :*** Controlling centre of all body activities.
  - Connective tissue – ***Duramater, Arachnoid membrane, Piamater.***
  - Main parts : ***a) Forebrain*** (Cerebrum & Diencephalon) ***b) Midbrain*** (Corpora quadrigemina) ***c) Hindbrain*** (Cerebellum, Pons & Medulla oblongata)
- ***Spinal cord :*** Conducts sensory & motor impulses to & from brain. Controls reflex actions of body.

2) Peripheral Nervous System :

- ***Cranial nerves :*** 12 pairs of Nerves from brain. Types: **Sensory nerve, Motor nerve**
- ***Spinal nerves :*** 31 pairs of nerves from spinal cord. Each has **Dorsal Sensory & Ventral Motor root**

3) Autonomic/Visceral Nervous System : Regulates involuntary functions of visceral organs through **sympathetic & parasympathetic nerves**.

Reflex Action - Any response that occurs automatically without consciousness.

- ***Simple or basic :*** Inbuilt and unlearned responses. ***Eg:*** winking of eyes when any dust particles enters
- ***Acquired/Conditional:*** Result of practice & learning. ***Eg:*** Playing harmonium on seeing music note.

16. PLANT AND ANIMAL HORMONES

Plant Hormones

1. Auxins	2. Cytokinins	3. Gibberellins	4. Abscisic acid (ABA)	5. Ethylene
• Stem elongation • Apical dominance • Induce root formation • Parthenocarpy • Prevent abscission	• Cell division • Cell enlargement • Morphogenesis • Growth of lateral buds. • Richmond lang effect	• Elongation of internode • Bolting • Produce male flowers • Break dormancy. • Parthenocarpic fruits	• Promotes abscission • Causes stomatal closure • Senescence in leaves • Induces bud dormancy • Inhibits lateral bud growth	• Ripening of fruits. • Inhibits elongation, • Hastens senescence • Stimulates abscission • Breaks dormancy

Human Endocrine Glands / Ductless glands

Pituitary gland - *Master gland*

Hormones by anterior lobe (Adenohypophysis)

1. ***Growth hormone (GH):*** Development & enlargement of tissues.
2. ***Thyroid stimulating hormone (TSH):*** Controls thyroid gland.
3. ***Adrenocorticotropic hormone(ACTH):*** Protein synthesis in adrenal cortex.
4. ***Gonadotropic hormones (GTH):*** For development of gonads.
   i)Follicle stimulating hormone (FSH) ii)Luteinizing hormone (LH)
5. ***Prolactin(PRL):*** Mammary gland development & milk production

Hormones by posterior lobe (Neurohypophysis)

1. ***Antidiuretic hormone (ADH):*** Increases reabsorption, reduces water through urine.
2. ***Oxytocin :*** contraction of uterus & milk ejection.

Thyroid Gland

- Triiodothyronine(T3)
- Tetraiodothyronine(T4)

- Maintains ***Basal Metabolic Rate*** (BMR), body temperature, cell metabolism.
- Controls growth and bone formation.

Parathyroid Gland

- Regulates calcium and phosphorus metabolism.
- Maintain blood calcium levels.

Pancreas (Exocrine & Endocrine)

Insulin
- Converts glucose to glycogen & transport it.
- Decreases its concentration in blood.

Glucagon
- Helps in breakdown of glycogen to glucose.
- Increases blood glucose level.

Adrenal Gland

Hormones of Adrenal Cortex
Cortisol & ***corticosterone*** (zona fasciculate) - Regulate cell metabolism, anti-inflammatory, anti-allergic agent.
Aldosterone (zona glomerulosa) - Reabsorbs sodium ions, regulates electrolyte balance, blood pressure, etc.,

Adrenal Medulla
Epinephrine (Adrenaline) & Norepinephrine (Noradrenalin): Produced during stress & emotion.

Reproductive Glands (Gonads)

Testes (Male Gonads)
Testosterone: helps spermatogenesis, Development of secondary sexual characters

Ovary (Female Gonads)
Estrogen: Causes changes in puberty, oogenesis, Development of secondary sexual characters
Progesterone: Premenstrual changes, maintains pregnancy, formation of placenta, etc.,

Thymus gland

Thymosin
- Stimulates immune function.
- Stimulates production & differentiation of lymphocytes.

Gland	Dysfunction of Human Hormones
Pituitary	***Growth hormone*** • ***Dwarfism :*** Decreased growth hormone in children. • ***Gigantism:*** Over secretion in children. • ***Acromegaly:*** Excess of growth hormone in adults. ***Vasopressin/ADH deficiency - Diabetes insipidus*** : Increase in urine.
Thyroid	***Hypothyroidism:*** Decreased secretion of thyroid hormones. • ***Goitre:*** Inadequate iodine in diet. Marked swelling in neck. • ***Cretinism (children) :*** stunted growth, mental defect. • ***Myxoedema (Adults) :*** Puffiness of face & hand. ***Hyperthyroidism :*** Excess of thyroid hormones - ***Grave's disease.***
Parthyroid	Removal of parathyroid ⇒ decrease in parathormone. • ***Tetany :*** Muscle spasm • Painful cramps of the limb muscles.
Pancreas	***Diabetes mellitus:*** deficiency of insulin. • ***Hyperglycemia*** - Increase in blood sugar. • ***Glycosuria*** - Excess glucose in urine. • ***Polyuria*** - Frequent urination. • ***Polydipsia*** - Increased thirst. • ***Polyphagia*** - Increase in appetite.

Plant Hormones

Types of Auxin:
i) Natural Auxins: Eg: IAA, PAA, IAN
ii) Synthetic Auxins: Eg: 2, 4 D, IBA, NAA

Growth promoting hormones :
Auxins, Cytokinins & Gibberellins

Growth inhibiting hormones :
Abscisic Acid & Ethylene

Other Names of plant hormones:
Stress hormone(plants) – Abscisic acid
Gaseous plant hormone – Ethylene

Other Names of some hormones in human:
- ★ Personality hormone – Thyroid hormone
- ★ Antidiuretic hormone – Vasopressin
- ★ Lactogenic hormone – Prolactin
- ★ Life saving hormone – Cortisol
- ★ Time messenger – Melotin from pineal gland
- ★ Emergency hormone – Adrenaline & Noradrenaline
- ★ Male sex hormone – Testosterone
- ★ Female sex hormone – Estrogen & Progesterone

17. REPRODUCTION IN PLANTS AND ANIMALS

Types of Reproduction in plants

✱ **Vegetative reproduction :** New plantlets are formed from vegetative (somatic) cells, buds or organs of plants.

- **Leaves:** Bryophyllum.
- **Fragmentation :** Spirogyra
- **Bulbils :** Agave
- **Stems :** Strawberry
- **Root :** Tuberous roots
- **Regeneration :** Hydra
- **Fission :** Amoeba
- **Budding :** Yeast

✱ **Asexual Reproduction :** Production of offspring by single parent without gametes. ***Eg :*** Fungi

✱ **Sexual Reproduction :** Two gametes (male & female) are fused to produce offspring.

1. **Pollination :** *i)* Self-pollination(autogamy) ***Eg:*** *Hibiscus ii)* Cross pollination(allogamy) ***Eg:*** Apples
   - ***Agents:*** i) By wind - Anemophily – ***Eg :*** Grasses iii) By water - Hydrophily – ***Eg :*** Hydrilla
     ii) By insects - Entomophily– ***Eg :*** Jasmine iv) By Animals - Zoophily – ***Eg :*** Cotton
2. **Fertilization:** Pollen grain → Stigma → Pollen tube → Embryo sac.

Sexual Reproduction in Human

Gametogenesis	=	Spermatogenesis	+	Oogenesis
(Formation of gametes with haploid cells)		*(Formation of Sperm)*		*(Formation of Ovum)*

- **Primary Sex Organs:** Testes in male and Ovary in female
- **Secondary/Accessory Sex Organs:** **Female:** Fallopian tubes, uterus, cervix and vagina.
  Male: Vas deferens, epididymis, seminal vesicle, prostate gland & penis
- ***Puberty :*** Increase in sex hormone in male(testosterone) & females(estrogen, progesterone)
- **Menstrual cycle : Process of Ovulation - 4 phases – 28 days**
  1. Menstrual or Destructive Phase : 4th – 5th days
  2. Follicular or Proliferative Phase : 6th – 13th days
  3. Ovulatory Phase : 14th day
  4. Luteal or Secretory Phase : 15th –28th days
- ***Menarche :*** Onset of puberty (11-13 years) ***Menopause :*** Ceasing of puberty (48-50 years)

✱ **Fertilization to Foetal Development:** **i)** Fertilization **ii)** Cleavage **iii)** Implantation **iv)** Gastrulation **v)** Organogenesis **vi)** Formation of Placenta **vii)** Pregnancy(Gestation) **viii)** Parturition(Childbirth) **ix)** Lactation

- Gestation period - 280 days; Colostrum - First milk.

✱ **Contraception :** Barrier, Hormonal, Intra-Uterine Devices (IUDs) and Surgical methods.

18. GENETICS

✱ ***Homozygous :*** Alike factors. ***Eg :*** TT-tall, tt-dwarf ***Heterozygous :*** Unlike factors. ***Eg :*** Tt – tall

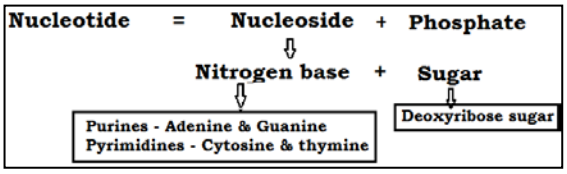
✱ **Monohybrid Cross :** Cross between one pair of contrasting characters.

✱ **Dihybrid Cross :** Cross between two pairs of contrasting characters.

✱ **Chromosomes :** Thin, long & thread like structures with two identical strands called ***sister chromatid.***

✱ **Deoxyribo Nucleic Acid(DNA):** Polynucleotide with millions of nucleotides that have genetic information.

- **Karyotype** is number, size & shape of chromosomes.
- ***Idiogram:*** Diagrammatic representation of karyotype.
- ***Haploid:*** Single set
- ***Diploid*** – Occur in pairs



✱ **Sex Determination:** Formation of zygote into male/female sex during development.

- Human have 23 pairs of chromosomes(22 pairs of autosomes & 1 pair is sex chromosome)
- **Autosomes :** Somatic characters**. Allosomes / Sex / Hetero chromosomes**(X & Y)**:** Determine sex
  Male – (one X & one Y) **– Heterogametic** ***Female*** – (two X) **- Homogametic**

✱ **Mutation** - *inheritable sudden change in genetic material (DNA).*

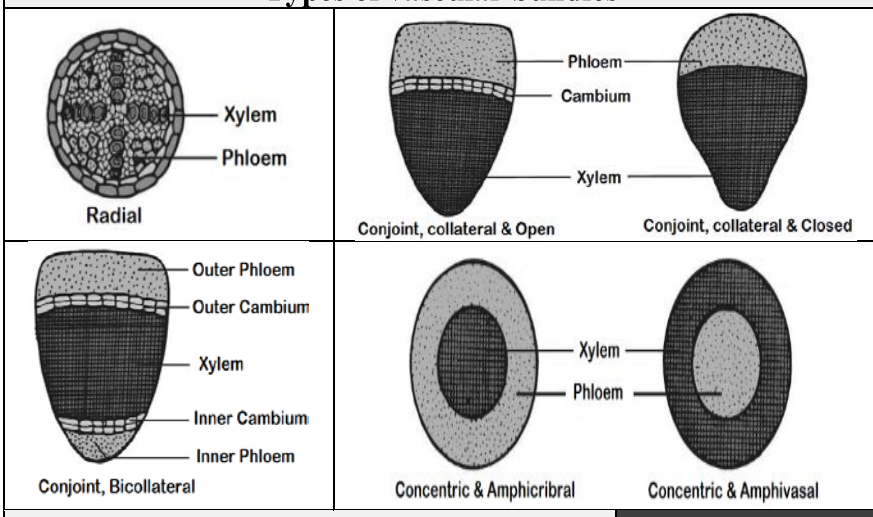
i) **Chromosomal mutation :** ★ Euploidy (*Triploidy (3n)*) ★ Aneuploidy (Monosomy (2n-1)) ★ *Down's syndrome:* (Trisomy 21).

ii) **Gene/Point mutation :** Changes in nucleotide sequence. (Substitution, deletion, insertion or inversion)

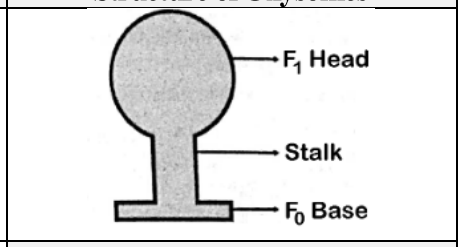
IMPORTANT DIAGRAMS FOR BIOLOGY

12 – Plant Anatomy and Plant Physiology

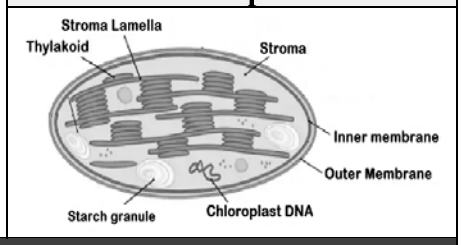
Types of vascular bundles



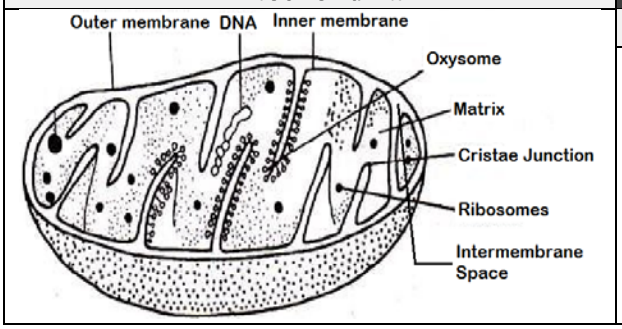
Structure of Oxysomes



Chloroplast

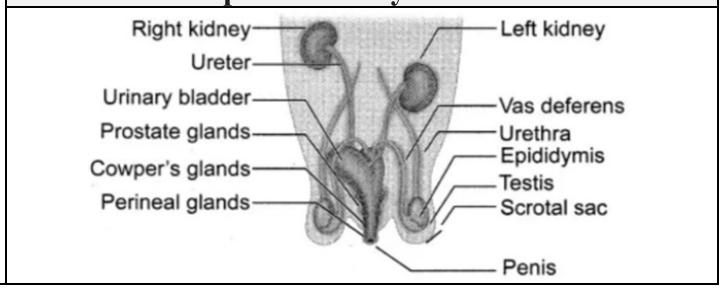


Mitochondria



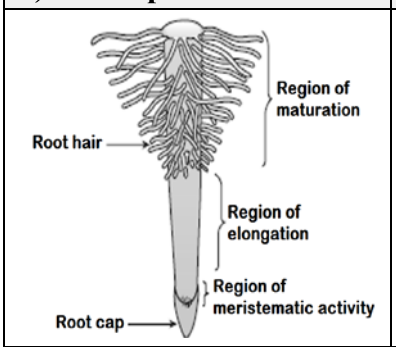
13 – Structural Organisation of Animals

Male reproductive system of Rabbit

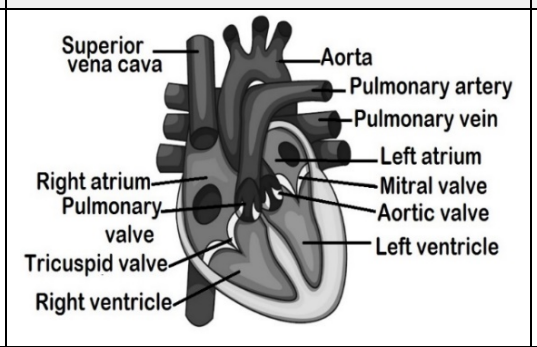


14 – Transportation in Plants and Circulation in Animals

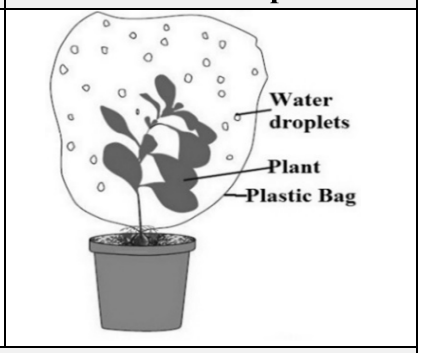
a) Root tip with root hairs



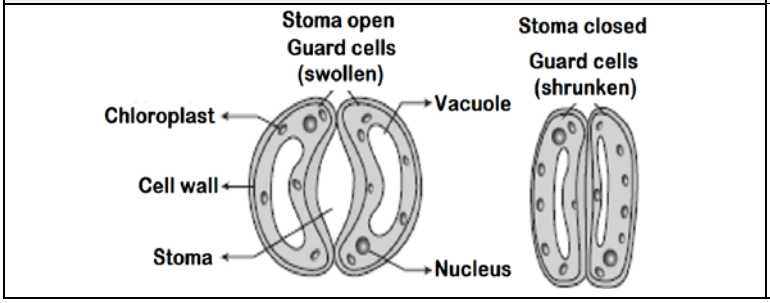
External Structure of Human Heart



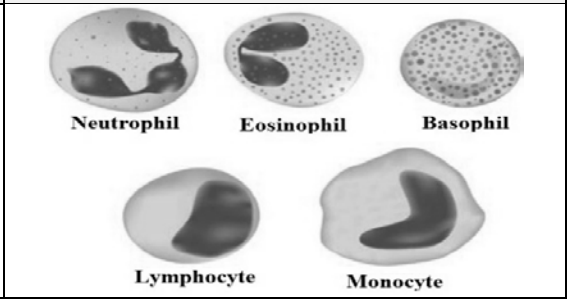
Process of Transpiration



b) Guard cell in turgid and flaccid condition

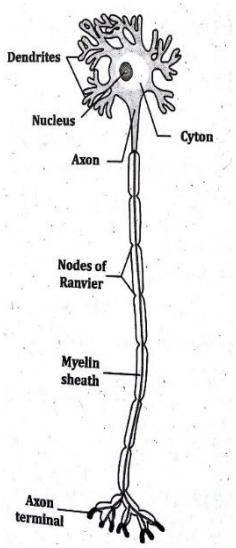


Leucocytes

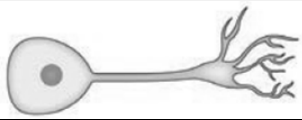


15 – Nervous System

Structure of Neuron



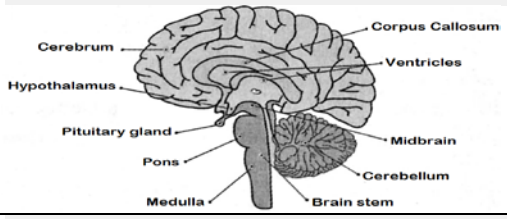
Unipolar Neurons



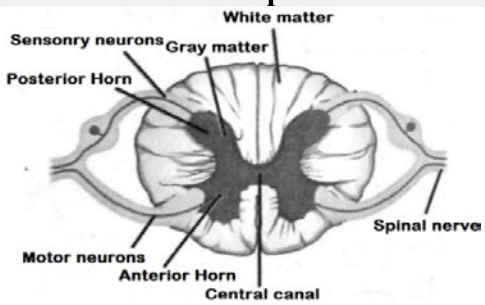
Bipolar Neurons

Multipolar Neurons

L.S of Human Brain

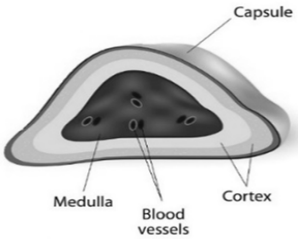


Structure of spinal cord

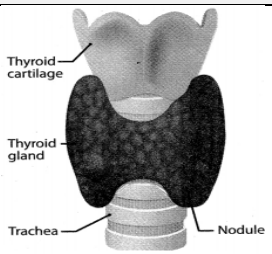


16 – Plant and Animal Hormones

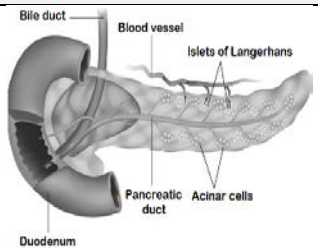
Adrenal Gland



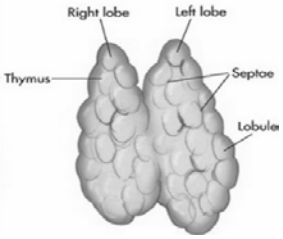
Thyroid Gland



Pancreas

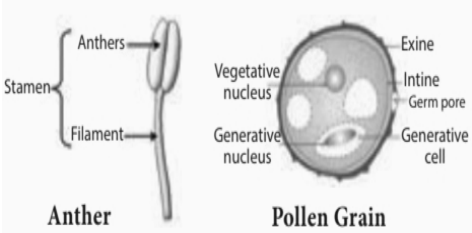


Thymus Gland

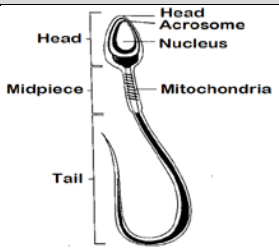


17 – Reproduction in Plants and Animals

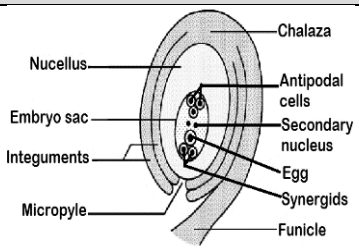
Structure of Anther and Pollen grain



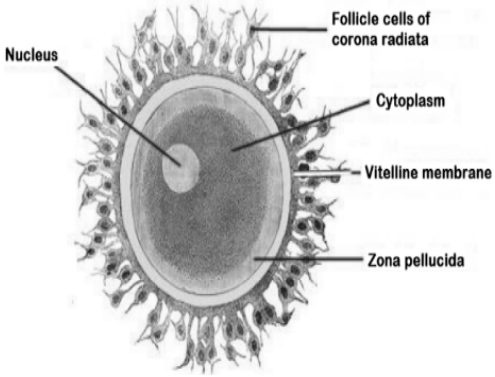
Structure of sperm



Structure of an Ovule

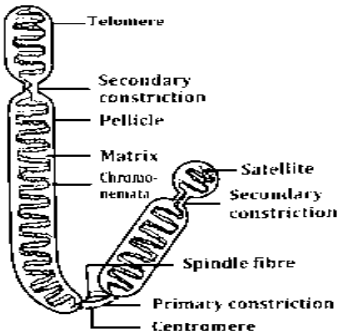


Structure of ovum

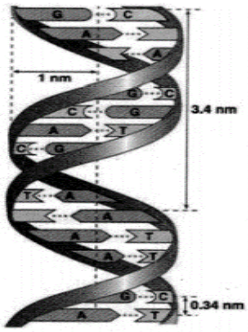


18 – Genetics

Structure of chromosome



Structure of DNA



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