

1. CHEMICAL REACTIONS AND EQUATIONS

1. KEY DEFINITIONS & TERMS (NCERT)

- **Chemical Reaction:** A process where the initial substance changes its nature and identity by breaking/making bonds between atoms.
- **Skeletal Equation:** An unbalanced chemical equation that represents a reaction without equalizing atoms on both sides.
- **Balanced Chemical Equation:** An equation where the number of atoms of each element is equal on both sides to satisfy the **Law of Conservation of Mass**.
- **Precipitate:** An insoluble solid formed during a reaction in a solution.
- **Exothermic/Endothermic:** Exothermic reactions **release** heat (e.g., respiration); endothermic reactions **absorb** energy (heat, light, or electricity).
- **Redox Reaction:** A reaction involving simultaneous oxidation (gain of O/loss of H) and reduction (loss of O/gain of H).
- **Corrosion/Rancidity:** Damage to metals by moisture/acids (Corrosion) and oxidation of fats/oils in food (Rancidity).

2. IMPORTANT CHEMICAL EQUATIONS

- **Combination:** $\text{CaO(s)} + \text{H}_2\text{O(l)} \longrightarrow \text{Ca(OH)}_2\text{(aq)} + \text{Heat}$ (Quick Lime to Slaked Lime).
- **Thermal Decomposition:** $2\text{Pb(NO}_3)_2\text{(s)} \xrightarrow{\Delta} 2\text{PbO(s)} + 4\text{NO}_2\text{(g)} + \text{O}_2\text{(g)}$ (**Brown fumes** of NO_2).
- **Photolytic Decomposition:** $2\text{AgCl(s)} \xrightarrow{\text{Sunlight}} 2\text{Ag(s)} + \text{Cl}_2\text{(g)}$ (White to grey; used in photography).
- **Displacement:** $\text{Fe(s)} + \text{CuSO}_4\text{(aq)} \longrightarrow \text{FeSO}_4\text{(aq)} + \text{Cu(s)}$ (Blue solution turns green).
- **Double Displacement:** $\text{Na}_2\text{SO}_4\text{(aq)} + \text{BaCl}_2\text{(aq)} \longrightarrow \text{BaSO}_4\text{(s)} + 2\text{NaCl(aq)}$ (**White precipitate**).
- **Respiration (Exothermic):** $\text{C}_6\text{H}_{12}\text{O}_6\text{(aq)} + 6\text{O}_2\text{(aq)} \longrightarrow 6\text{CO}_2\text{(aq)} + 6\text{H}_2\text{O(l)} + \text{energy}$.

3. OBSERVATIONS

Reaction Indicators: Change in state, Change in color, Evolution of gas, Change in temperature.

| Metal Corrosion | Coating Color |
|-----------------|----------------------|
| Iron | Reddish-brown (Rust) |
| Silver | Black |
| Copper | Green |

4. EXAM SHORTCUTS & MNEMONICS

- **Max Atom Rule:** Start balancing with the molecule having the **most atoms**.
- **OIL RIG:** Oxidation Is Loss (of H), Reduction Is Gain (of H).
- **Inert Packing:** Chips are flushed with **Nitrogen** to prevent oxidation/rancidity.

5. EXAM IMPORTANCE NOTES

- **2–3 Marks:** Balancing equations and identifying reaction types.
- **Observation Based:** Burning Mg (**dazzling white flame**), heating FeSO_4 (**burning sulphur smell**).
- **Board Favorite:** Why decomposition is the opposite of combination.



2.ACIDS, BASES AND SALTS

1. KEY DEFINITIONS & TERMS (NCERT)

- **Acids/Bases:** Acids furnish H^+ (aq) ions (sour); Bases furnish OH^- (aq) ions (bitter/soapy).
- **Alkali:** A base that is soluble in water, such as NaOH or KOH.
- **Olfactory Indicators:** Substances whose **odour** changes in acidic or basic media, e.g., onion, vanilla, clove.
- **Neutralisation:** Reaction between an acid and a base to produce salt and water: $\text{H}^+ + \text{OH}^- \longrightarrow \text{H}_2\text{O}$.
- **Water of Crystallisation:** Fixed number of water molecules chemically combined in one formula unit of a salt.

2. IMPORTANT CHEMICAL EQUATIONS

- **Acid + Metal:** $\text{Zn(s)} + \text{H}_2\text{SO}_4(\text{aq}) \longrightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g}) \uparrow$ (Test: Pop sound).
- **Base + Metal:** $2\text{NaOH(aq)} + \text{Zn(s)} \longrightarrow \text{Na}_2\text{ZnO}_2(\text{s}) + \text{H}_2(\text{g}) \uparrow$ (**Sodium Zincate**).
- **Carbonates + Acid:** $\text{Na}_2\text{CO}_3(\text{s}) + 2\text{HCl(aq)} \longrightarrow 2\text{NaCl(aq)} + \text{H}_2\text{O(l)} + \text{CO}_2(\text{g}) \uparrow$ (CO_2 turns lime water milky).
- **Chlor-Alkali Process:** $2\text{NaCl(aq)} + 2\text{H}_2\text{O(l)} \xrightarrow{\text{elect.}} 2\text{NaOH(aq)} + \text{Cl}_2(\text{g}) + \text{H}_2(\text{g})$.
- **Baking Soda to Washing Soda:** $2\text{NaHCO}_3 \xrightarrow{\Delta} \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$ then recrystallization.
- **Plaster of Paris (POP):** $\text{CaSO}_4 \cdot 2\text{H}_2\text{O} \xrightarrow{373\text{K}} \text{CaSO}_4 \cdot \frac{1}{2}\text{H}_2\text{O} + 1\frac{1}{2}\text{H}_2\text{O}$.

3. TABLES

Common Indicators:

| Indicator | Color in Acid | Color in Base |
|-----------------|---------------|---------------|
| Litmus | Red | Blue |
| Phenolphthalein | Colorless | Pink |
| Methyl Orange | Red | Yellow |

Natural Acids: Vinegar (Acetic), Curd (Lactic), Lemon (Citric), Ant sting (Methanoic).

4. IMPORTANT LAWS & FORMULAE

- **pH Scale:** Measures H^+ concentration (0–14). $\text{pH} < 7$ is Acidic; $\text{pH} > 7$ is Basic; $\text{pH} = 7$ is Neutral.
- **Dilution Rule:** Always add Acid to Water (A \rightarrow W) slowly with stirring; never water to acid to prevent splashing/burns.

5. EXAM SHORTCUTS & MNEMONICS

- **ABR:** Acid turns **B**lue to **R**ed.
- **pH vs $[\text{H}^+]$:** Inverse relationship—>Higher $[\text{H}^+]$ concentration = Lower pH.
- **POP Storage:** Must be kept in **moisture-proof** containers to avoid turning into hard Gypsum.

6. EXAM IMPORTANCE NOTES

- **Application: Antacids** (Milk of Magnesia) neutralize excess stomach acid.
- **pH values:** Tooth decay starts below **5.5**; Acid rain is below **5.6**.



3. METALS AND NON-METALS

1. PHYSICAL PROPERTIES & EXCEPTIONS (NCERT)

- **Properties:** Metals are lustrous, malleable (beaten into sheets), and ductile (drawn into wires). They are sonorous and good conductors of heat/electricity.
- **Exceptions:** Mercury is liquid at room temp. Sodium/Potassium/Lithium are soft (cut with knife). Iodine is a lustrous non-metal. Diamond (Carbon) is the hardest natural substance. Graphite (Carbon) conducts electricity.

2. KEY DEFINITIONS (METALLURGY & BONDING)

- **Amphoteric Oxides:** Metal oxides reacting with both acids and bases (e.g., Al_2O_3 , ZnO).
- **Reactivity Series:** Arrangement of metals in decreasing order of activity.
- **Ionic Compounds:** Formed by electron transfer from metal to non-metal.
- **Roasting/Calcination:** Roasting: Heating sulphide ores in excess air. Calcination: Heating carbonate ores in limited air.
- **Anodising:** Forming a thick protective oxide layer on aluminium.

3. IMPORTANT CHEMICAL EQUATIONS

- **Amphoteric Reaction:** $\text{Al}_2\text{O}_3 + 2\text{NaOH} \longrightarrow 2\text{NaAlO}_2 \text{ (Sod. Aluminate)} + \text{H}_2\text{O}$.
- **Metal + Water:** $2\text{K(s)} + 2\text{H}_2\text{O(l)} \longrightarrow 2\text{KOH(aq)} + \text{H}_2\text{(g)} + \text{Heat (Violent)}$.
- **Steam on Iron:** $3\text{Fe(s)} + 4\text{H}_2\text{O(g)} \longrightarrow \text{Fe}_3\text{O}_4\text{(s)} + 4\text{H}_2\text{(g)}$.
- **Thermit Reaction:** $\text{Fe}_2\text{O}_3\text{(s)} + 2\text{Al(s)} \longrightarrow 2\text{Fe(l)} + \text{Al}_2\text{O}_3\text{(s)} + \text{Heat}$.
- **Roasting (ZnS):** $2\text{ZnS} + 3\text{O}_2 \xrightarrow{\Delta} 2\text{ZnO} + 2\text{SO}_2$.
- **Calcination (ZnCO₃):** $\text{ZnCO}_3 \xrightarrow{\Delta} \text{ZnO} + \text{CO}_2$.

4. TABLES

Properties of Ionic Compounds:

| Property | Characteristic | Reason |
|---------------|---------------------|-------------------------------|
| Melting Point | Very High | Strong inter-ionic attraction |
| Solubility | Soluble in water | Polar nature |
| Conduction | Molten/Aqueous only | Ions are free to move |

5. EXAM SHORTCUTS & MNEMONICS

- **Reactivity Series:** Please Stop Calling Me A Cute Zebra I Like Her Call Smart Goat (K, Na, Ca, Mg, Al, C, Zn, Fe, Pb, H, Cu, Ag, Au).
- **Aqua Regia:** 3:1 ratio of conc. HCl and conc. HNO_3 ; dissolves gold/platinum.
- **Rust Prevention:** Galvanisation (Zinc coating), Alloying (Stainless steel: Fe+Ni+Cr).

6. EXAM IMPORTANCE NOTES

- **Frequent:** Differences between Roasting and Calcination.
- **Conceptual:** Why H_2 is not evolved with HNO_3 (it is a strong oxidising agent).
- **Practical:** Arrangement of metals by displacement reactions.

4. CARBON AND ITS COMPOUNDS

1. KEY DEFINITIONS & TERMS (NCERT)

- **Covalent Bond:** A bond formed by **sharing** electron pairs between atoms. Carbon forms these because losing/gaining 4 electrons is energy-intensive.
- **Catenation:** Carbon's unique ability to form long chains, branches, or rings by bonding with other carbon atoms.
- **Tetravalency:** Carbon has four valence electrons, allowing it to bond with four other atoms.
- **Homologous Series:** A series of compounds with the same functional group where successive members differ by a $-\text{CH}_2-$ unit (14u mass).
- **Structural Isomers:** Compounds with the same molecular formula but different structural arrangements.
- **Heteroatom:** An atom (like O, N, S, or halogens) that replaces hydrogen in a hydrocarbon chain.

2. IMPORTANT CHEMICAL EQUATIONS

- **Combustion:** $\text{CH}_4 + 2\text{O}_2 \longrightarrow \text{CO}_2 + 2\text{H}_2\text{O} + \text{Heat} + \text{Light}$.
- **Oxidation:** $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Alk} \cdot \text{KMnO}_4 + \text{Heat}} \text{CH}_3\text{COOH}$ (Ethanol to Ethanoic acid).
- **Addition (Hydrogenation):** $\text{CH}_2=\text{CH}_2 + \text{H}_2 \xrightarrow{\text{Ni Catalyst}} \text{CH}_3-\text{CH}_3$ (Vegetable oil to fats).
- **Substitution:** $\text{CH}_4 + \text{Cl}_2 \xrightarrow{\text{Sunlight}} \text{CH}_3\text{Cl} + \text{HCl}$.
- **Esterification:** $\text{CH}_3\text{COOH} + \text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Acid}} \text{CH}_3\text{COOCH}_2\text{CH}_3 + \text{H}_2\text{O}$.
- **Saponification:** $\text{Ester} + \text{NaOH} \longrightarrow \text{Alcohol} + \text{Sodium Salt of Carboxylic Acid}$.
- **Dehydration:** $\text{CH}_3\text{CH}_2\text{OH} \xrightarrow{\text{Hot Conc. H}_2\text{SO}_4} \text{CH}_2=\text{CH}_2 + \text{H}_2\text{O}$.

3. TABLES

Hydrocarbon Classification:

| Type | Bonding | General Formula | Reactivity |
|---------|----------------------|-----------------------------|---------------|
| Alkanes | Single (Saturated) | $\text{C}_n\text{H}_{2n+2}$ | Less Reactive |
| Alkenes | Double (Unsaturated) | C_nH_{2n} | More Reactive |
| Alkynes | Triple (Unsaturated) | $\text{C}_n\text{H}_{2n-2}$ | More Reactive |

Functional Groups: Alcohol ($-\text{OH}$), Aldehyde ($-\text{CHO}$), Ketone ($-\text{C}(=\text{O})-$), Carboxylic Acid ($-\text{COOH}$), Halo ($-\text{Cl}/-\text{Br}$).

4. EXAM SHORTCUTS & MNEMONICS

- **C-T Versatility:** Remember Catenation and Tetravalency as the dual reasons for millions of carbon compounds.
- **Flame Test:** Saturated = Clean blue flame; Unsaturated = Yellow sooty flame.
- **Micelle Rule:** Hydrophilic head (water-loving) and Hydrophobic tail (water-fearing/oil-loving).
- **Hard Water:** Soap + Hard Water ($\text{Ca}^{2+}/\text{Mg}^{2+}$ salts) = **Scum**.

5. EXAM IMPORTANCE NOTES

- **High Priority:** Drawing Electron Dot Structures for H_2 , O_2 , N_2 , NH_3 , CH_4 , and CO_2 .
- **Observation:** Ethanoic acid reacts with carbonates to evolve CO_2 which turns lime water milky.
- **Comparison:** Difference between soaps (biodegradable, scum in hard water) and detergents (non-biodegradable, effective in hard water).



5. LIFE PROCESSES

1. KEY TERMS & DEFINITIONS

- **Life Processes:** Collective maintenance jobs performed by living organisms even during inactivity.
- **Nutrition:** Transferring an external energy source (food) to the inside of the body.
- **Respiration:** Acquiring oxygen to break down food for cellular energy (ATP).
- **Transpiration:** Loss of water vapor from aerial parts of a plant.
- **Translocation:** Transport of soluble products of photosynthesis through the phloem.
- **Excretion:** Removal of harmful nitrogenous metabolic wastes from the body.

2. CORE PROCESSES / SEQUENCES

- **Photosynthesis:** Absorption of light (Chlorophyll) → Conversion (Light to Chemical) + Splitting of H_2O → Reduction of CO_2 to Carbohydrates.
- **Human Digestion:** Mouth (Salivary Amylase) → Oesophagus (Peristalsis) → Stomach (Pepsin/HCl) → Small Intestine (Villi absorption) → Large Intestine (H_2O absorption).
- **Glucose Breakdown (Cytoplasm → Pyruvate):**
 - **Aerobic (Mitochondria):** $CO_2 + H_2O + \text{Energy (High)}$.
 - **Anaerobic (Yeast):** $\text{Ethanol} + CO_2 + \text{Energy}$.
 - **Lack of O_2 (Muscle):** $\text{Lactic Acid} + \text{Energy (Cramps)}$.
- **Excretion Flow:** Nephron filtration → Selective re-absorption → Ureter → Bladder → Urethra.

3. TABLES / COMPARISONS

| Feature | Arteries | Veins |
|-----------|---------------------------------|------------------------------|
| Direction | Away from heart. | Toward the heart. |
| Wall Type | Thick, elastic (High Pressure). | Thin (Low Pressure). |
| Valves | Absent. | Present (Prevents backflow). |

4. EXAM IMPORTANCE & TIPS

- **High Weightage:** Double circulation is necessary for birds/mammals to maintain body temperature.
- **Practical:** KOH is used in experiments to absorb CO_2 .
- **Technical Detail:** Normal blood pressure is 120/80 mm of Hg.
- **Surface Area:** Alveoli (Lungs) and Villi (Intestine) both maximize area for exchange/absorption.

5. MNEMONICS & SHORTCUTS

- **"A-A":** Arteries carry blood **A**way.
- **"V-V":** Veins have **V**alves.
- **"Energy Currency":** ATP is the cell's battery.



6. CONTROL AND COORDINATION

1. KEY TERMS & DEFINITIONS

- **Receptors:** Nerve cell tips detecting stimuli (Gustatory: Taste; Olfactory: Smell).
- **Synapse:** The gap between neurons where electrical impulses become chemical signals.
- **Reflex Action:** Sudden, unconscious response to a stimulus.
- **Reflex Arc:** Pathway of impulse from receptor to effector via the spinal cord.
- **Tropic Movements:** Directional growth towards/away from a stimulus (e.g., light).

2. CORE PROCESSES / SEQUENCES

- **Nerve Impulse:** Dendrite (Acquisition) → Cell Body → Axon (Travel) → Nerve Ending (Chemical release).
- **Reflex Arc Sequence:** Stimulus → Receptor → Sensory Neuron → Spinal Cord → Motor Neuron → Effector (Muscle) → Response.
- **Phototropism (Auxin):** Light from one side → Auxin diffuses to shady side → Cells on shady side grow longer → Shoot bends toward light.
- **Feedback Mechanism (Insulin):** High blood sugar → Detected by Pancreas → More Insulin produced → Blood sugar falls → Insulin secretion reduced.

3. BRAIN & HORMONES

| Part/Hormone | Region/Source | Key Function |
|---------------|---------------|---|
| Cerebrum | Fore-brain | Thinking, memory, sensory interpretation. |
| Cerebellum | Hind-brain | Precision of voluntary actions; Posture/Balance . |
| Medulla | Hind-brain | Involuntary: Blood pressure, salivation, vomiting. |
| Adrenaline | Adrenal Gland | Heart rate increases; blood diverted to skeletal muscles. |
| Abscisic Acid | Plant | Inhibits growth; causes wilting of leaves. |

4. EXAM IMPORTANCE & TIPS

- **Protection:** Brain is in a **bony box** with fluid-filled shock absorbers; Spinal cord is in the **vertebral column**.
- **Plant Movement:** Sensitive plant (*Mimosa*) moves by changing water amount (swelling/shrinking), not growth.
- **Thyroxine:** Iodine is essential for its synthesis; deficiency causes Goitre (swollen neck).

5. MNEMONICS & SHORTCUTS

- **"C-C":** Cerebellum = Controls posture.
- **"M-M":** Medulla = Maintains involuntary/vital functions.
- **"Reflex Shortcut":** Formed in the spinal cord because the brain is too slow for emergencies.

7. HOW DO ORGANISMS REPRODUCE?

1. KEY TERMS & DEFINITIONS

- **DNA Copying:** The basic event of reproduction using chemical reactions to create two genetic blueprint copies.
- **Variation:** Inbuilt tendency for subtle differences during DNA copying; the basis for evolution and species survival.
- **Placenta:** A disc-like tissue in the uterine wall providing nutrition and oxygen to the embryo.
- **Menstruation:** Monthly cycle where the thickened uterine lining breaks down if fertilization does not occur.
- **Puberty:** The period during adolescence when reproductive tissues begin to mature.

2. CORE PROCESSES / SEQUENCES

- **DNA Copying Process:** DNA copy created → Additional cellular apparatus created → DNA copies separate → Cell divides into two.
- **Why Reproduce?:** Not essential for individual survival, but necessary for the stability and existence of a species.
- **Plant Fertilization:** Pollen on Stigma → Pollen tube grows through Style → Ovary → Male germ-cell fuses with Egg (Zygote).
- **Post-Fertilization:** Zygote → Embryo; Ovule → Seed; Ovary → Fruit.
- **DNA Stability:** Meiosis halves the chromosome number in germ-cells; fertilization restores the original DNA content in the progeny.

3. TABLES / COMPARISONS

| Method | Organism | Key Feature |
|------------------|--------------------|--|
| Binary Fission | <i>Amoeba</i> | Cell splits into two equal halves in any plane. |
| Multiple Fission | <i>Plasmodium</i> | One cell divides into many daughter cells simultaneously. |
| Fragmentation | <i>Spirogyra</i> | Body breaks into pieces; each grows into an individual. |
| Regeneration | <i>Planaria</i> | Specialized cells proliferate to grow whole body from cut parts. |
| Budding | <i>Yeast/Hydra</i> | An outgrowth develops and detaches from the parent. |
| Vegetative Prop. | <i>Bryophyllum</i> | New plants grow from roots, stems, or leaves. |

| Category | Method | Mechanism |
|------------|---------------------|---|
| Mechanical | Condoms | Blocks sperm; helps prevent STDs (HIV/Syphilis). |
| Chemical | Oral Pills | Changes hormonal balance to prevent egg release. |
| IUCD | Copper-T | Placed in uterus; prevents pregnancy but can cause irritation. |
| Surgical | Vasectomy/Tubectomy | Blocks vas deferens or fallopian tube to prevent gamete transfer. |

4. IMPORTANT DIAGRAM POINTS

- **Flower (Fig 7.7): Stamen** (Male: Anther + Filament); **Pistil** (Female: Stigma + Style + Ovary).
- **Seed (Fig 7.9):** Contains **plumule** (future shoot) and **radicle** (future root).
- **Male System (Fig 7.10): Testes** in **scrotum** (lower temperature needed for sperm); **Urethra** is a common passage for sperm and urine.
- **Female System (Fig 7.11): Fallopian tube** (site of fertilization); **Uterus** (site of implantation and development).

5. EXAM IMPORTANCE & TIPS

- **Variation:** Vital for species survival against environmental changes like global warming.
- **Placenta Detail:** Villi on embryo side; blood spaces on mother side for exchange of glucose, O₂, and waste.
- **Testosterone:** Regulates sperm formation and secondary sexual characteristics in boys.
- **Tissue Culture:** Growing disease-free plants from a "callus" in an artificial medium.

6. MNEMONICS & SHORTCUTS

- **"B-V-L":** Bryophyllum = Vegetative buds on Leaves.
- **"S-S-S":** Sperm is Small and Swimmer (motile).
- **"A-V-U":** Anther has Pollen; Ovary has Ovules.
- **"P-P-P":** Placenta Provides Passage for nutrition.

8. HEREDITY

1. KEY TERMS & DEFINITIONS

- **Heredity:** The process by which traits and characteristics are reliably inherited through reproduction.
- **Variation:** Subtle differences in body design between individuals of the same species.
- **Gene:** A section of DNA providing information for making one specific protein.
- **Dominant Trait:** A trait expressed even if only a single copy (e.g., 'T') is present.
- **Recessive Trait:** A trait expressed only when two identical copies (e.g., 'tt') are present.
- **Chromosome:** Independent pieces of DNA; humans have 22 paired sets and 1 pair of sex chromosomes.

2. CORE PROCESSES / SEQUENCES

- **Accumulation of Variation:** Original organism → Two individuals with subtle differences → Inherited differences + new differences in next generation.
- **Monohybrid Cross (Height):** Parent (TT x tt) → F_1 (All Tt/Tall) → Self-pollination → F_2 (1/4 short 'tt', 3/4 tall 'TT' or 'Tt').
- **Trait Expression Mechanism:** Gene (DNA) → Enzyme production → Enzyme efficiency → Hormone level → Characteristic (e.g., Height).
- **DNA Stability:** Each parent contributes one gene set via germ cells → Combination restores normal chromosome number in progeny.

3. TABLES

Mendel's Monohybrid vs. Dihybrid Results

| Cross Type | F_1 Generation | F_2 Phenotype Ratio | Key Conclusion |
|------------|------------------|-----------------------|--------------------------|
| Monohybrid | All Tall | 3:1 (Tall:Short) | Law of Dominance. |
| Dihybrid | All Round/Yellow | 9:3:3:1 | Independent Inheritance. |

Sex Determination Strategies

| Strategy | Mechanism | Example Organisms |
|---------------|----------------------------------|-------------------|
| Environmental | Temperature of fertilized eggs | Some reptiles. |
| Non-Genetic | Individuals can change sex | Snails. |
| Genetic | Inherited sex chromosomes (X, Y) | Human beings. |

4. IMPORTANT DIAGRAM POINTS

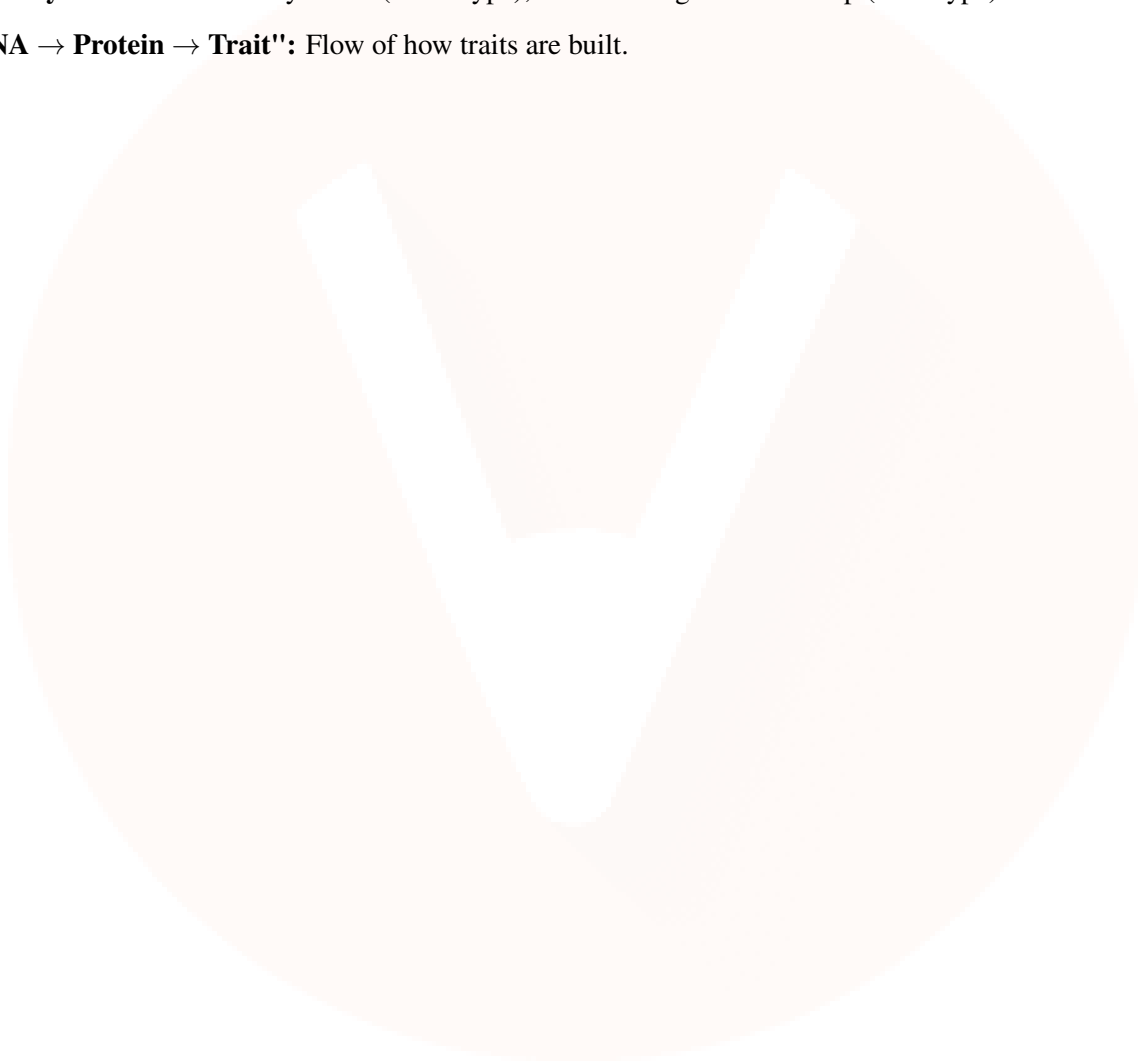
- **Diversity (Fig 8.1):** Shows inaccuracies in DNA copying create diversity over generations.
- **Independent Inheritance (Fig 8.5):** New combinations (e.g., short/round) prove traits recombine independently.
- **Sex Determination (Fig 8.6):** Females are XX; Males are XY. The **father** determines sex by contributing an X or Y.

5. EXAM IMPORTANCE & TIPS

- **High Weightage:** A trait in 60% of a population likely arose earlier than one in 10%.
- **35 Marks:** Independent inheritance is proven by "new combinations" in F_2 progeny.
- **Genetic Contribution:** Both parents contribute equal amounts of DNA to the child.

6. MNEMONICS & SHORTCUTS

- **"XY - Guy":** The Y chromosome is only in males and determines the boy.
- **"3:1 Physical":** 3:1 is what you *see* (Phenotype); 1:2:1 is the genetic makeup (Genotype).
- **"DNA → Protein → Trait":** Flow of how traits are built.



9. LIGHT REFLECTION AND REFRACTION

1. KEY DEFINITIONS & LAWS (NCERT)

- **Reflection of Light:** Process where a highly polished surface (mirror) reflects most incident light.
- **Laws of Reflection:** (i) $\angle i = \angle r$. (ii) Incident ray, normal, and reflected ray lie in the same plane.
- **Refraction of Light:** Change in direction of light when traveling obliquely between media.
- **Snell's Law:** $\frac{\sin i}{\sin r} = \text{constant}$ (Refractive Index) for a given pair of media.
- **Refractive Index (n):** Ratio of speed of light in vacuum (c) to speed in medium (v); $n = c/v$.
- **Power of a Lens (P):** Reciprocal of focal length in meters ($P = 1/f$); unit is Dioptre (D).

2. IMPORTANT FORMULAE

| | | |
|---------------------------------------|--|---|
| Mirror Formula | $\frac{1}{v} + \frac{1}{u} = \frac{1}{f}$ | $R = 2f$ |
| Lens Formula | $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$ | $P = \frac{1}{f(\text{m})}$ |
| Magnification (m) | $m = \frac{h'}{h} = -\frac{v}{u}$ (Mirror) | $m = \frac{h'}{h} = \frac{v}{u}$ (Lens) |
| Refractive Index | $n_{21} = \frac{v_1}{v_2} = \frac{\sin i}{\sin r}$ | $n_m = \frac{c}{v}$ |

3. IMAGE NATURE SUMMARY

- **Concave Mirror / Convex Lens:** Usually Real & Inverted (RI). Forms Virtual & Erect (VE) and Enlarged image only when the object is between Pole(P) or optical center(O) and Focus(F).
- **Convex Mirror / Concave Lens:** Always forms Virtual, Erect, and Diminished images regardless of object position.

4. DIAGRAM-BASED POINTS

- **Ray Rules:**
 - (1) Parallel rays pass through F .
 - (2) Rays through F emerge parallel.
 - (3) Rays through C (mirrors) or O (lenses) return/pass undeviated.
- **Lateral Displacement:** Emergent ray is parallel to incident ray but shifted sideward in a glass slab.

5. TEACHER SHORTCUTS & MNEMONICS

- **Sign Convention:** u is **ALWAYS** negative. f is **Positive** for Convex, **Negative** for Concave.
- **Nature:** "RI" (Real is Inverted) and "VE" (Virtual is Erect).
- **Lens Power:** Total power $P = P_1 + P_2 + \dots$

6. EXAM IMPORTANCE MARKERS

- **Diagrams:** Concave mirror (object between $P - F$) and Convex lens are high-frequency 5-mark questions.
- **Application:** Convex mirrors provide a wider field of view for rear-view use.



11. THE HUMAN EYE AND THE COLOURFUL WORLD

1. KEY DEFINITIONS & LAWS (NCERT)

- **Power of Accommodation:** The ability of the eye lens to adjust its focal length to see both nearby and distant objects clearly.
- **Near Point (Least Distance of Distinct Vision):** The minimum distance (25 cm for a normal adult) to see objects without strain.
- **Far Point:** The farthest distance visible clearly (Infinity for a normal eye).
- **Dispersion:** The splitting of white light into its seven constituent colours (VIBGYOR) via a prism.
- **Tyndall Effect:** Scattering of light by colloidal particles, making the light path visible.

2. IMPORTANT VALUES & DATA

| Feature | Normal Eye Value |
|------------------------|--------------------------|
| Eyeball Diameter | Approx. 2.3 cm |
| Near Point (D) | 25 cm |
| Far Point | Infinity (∞) |
| Least Scattered Colour | Red (Longest wavelength) |

3. VISION DEFECTS COMPARISON

| Defect | Description | Causes | Correction |
|---------------------------------------|--|---|------------------------|
| Myopia (Near-sighted) | Can't see far; image in front of retina. | Excessive lens curvature; eyeball elongation. | Concave Lens. |
| Hypermetropia (Far-sighted) | Can't see near; image behind retina. | Focal length too long; eyeball too small. | Convex Lens. |
| Presbyopia (Old-age) | Loss of accommodation power. | Weak ciliary muscles; rigid lens. | Bifocal Lenses. |

4. PHENOMENA & DIAGRAM POINTS

- **Prism Refraction:** Label Angle of Prism ($\angle A$) and Angle of Deviation ($\angle D$).
- **Atmospheric Refraction:** Explains stars twinkling (point source) and why sun is seen 2 mins before actual sunrise,.
- **Scattering:** Why sky is blue (fine particles scatter blue) and danger signals are red (least scattered).

5. TEACHER SHORTCUTS & EXAM MARKERS

- **Mnemonic:** "My Near Cave" (Myopia, Near-sighted, Concave).
- **Exclusion:** "Colour of sun at sunrise/sunset" is NOT for 2026 assessment.
- **Case-Based:** Eye donation (remove within 4-6 hours; one pair helps four people).



11. ELECTRICITY

1. KEY DEFINITIONS & LAWS (NCERT)

- **Electric Current (I):** The rate of flow of electric charges ($I = Q/t$).
- **Electric Potential Difference (V):** Work done to move a unit charge from one point to another ($V = W/Q$).
- **Ohm's Law:** The potential difference across a conductor is directly proportional to the current through it, provided temperature remains constant ($V \propto I$).
- **Resistance (R):** The property of a conductor to resist the flow of charges.
- **Resistivity (ρ):** A characteristic material property representing resistance per unit length and area.
- **Joule's Law of Heating:** Heat produced (H) is directly proportional to I^2 , R , and time t ($H = I^2 R t$).

2. IMPORTANT FORMULAE

| Quantity | Formula | Symbols & Units |
|-------------------|----------------------------------|--|
| Current | $I = Q/t$ | Q : Charge (C), t : Time (s) |
| Ohm's Law | $V = IR$ | V : Potential (V), R : Resistance (Ω) |
| Resistivity | $R = \rho \frac{l}{A}$ | l : Length (m), A : Area (m^2) |
| Electric Power | $P = VI = I^2 R = \frac{V^2}{R}$ | Unit: Watt (W) |
| Electrical Energy | $E = P \times t$ | Commercial unit: kWh (3.6×10^6 J) |

3. SERIES vs. PARALLEL COMPARISON

| Feature | Series Combination | Parallel Combination |
|------------------|---------------------------------------|------------------------------------|
| Current (I) | Same through each resistor | Divided among branches |
| Voltage (V) | Divided ($V = V_1 + V_2 + V_3$) | Same across each resistor |
| Total Resistance | Increases ($R_s = R_1 + R_2 + R_3$) | Decreases ($1/R_p = \sum 1/R_i$) |
| Failure Effect | Circuit breaks if one component fails | Other components continue to work |

4. DIAGRAM-BASED POINTS

- **Ammeter:** Always connected in **series**; measures current.
- **Voltmeter:** Always connected in **parallel** across points to measure V .
- **V-I Graph:** A straight line through the origin proves Ohm's Law.

5. TEACHER SHORTCUTS & MNEMONICS

- **MAT-L:** Factors affecting Resistivity/Resistance (**M**aterial, **A**rea, **T**emperature, **L**ength).
- **Parallel Shortcut:** For two resistors, $R_p = \frac{R_1 \times R_2}{R_1 + R_2}$ (Product over Sum).
- **Unit Conversion:** $1 \text{ mA} = 10^{-3} \text{ A}$ and $1 \mu\text{A} = 10^{-6} \text{ A}$.

6. EXAM IMPORTANCE MARKERS

- **Numerical-heavy:** Calculating equivalent resistance in complex circuits.
- **Conceptual:** Alloys (Nichrome) are used in heating elements because they have high resistivity and do not oxidise at high temperatures.



12. MAGNETIC EFFECTS OF ELECTRIC CURRENT

1. KEY DEFINITIONS & LAWS (NCERT)

- **Magnetic Field:** The region surrounding a magnet where its force can be detected.
- **Magnetic Field Lines:** Path along which a hypothetical free north pole would move; direction is North to South outside and South to North inside.
- **Right-Hand Thumb Rule:** Points thumb in current direction; wrapped fingers show magnetic field direction.
- **Solenoid:** A cylinder-shaped coil of many circular turns of insulated copper wire.
- **Fleming's Left-Hand Rule:** Mutually perpendicular Thumb (Force), Forefinger (Field), and Middle finger (Current).

2. FIELD PATTERNS & CHARACTERISTICS

- **Field Line Properties:** They are closed curves; they never intersect (otherwise two directions would exist at one point); closeness indicates field strength.
- **Straight Wire:** Field consists of concentric circles centred on the wire.
- **Solenoid:** Field inside is uniform (parallel straight lines) and similar to a bar magnet.
- **Electromagnet:** Formed by placing a soft iron core inside a current-carrying solenoid.

3. DOMESTIC ELECTRIC CIRCUITS

- **Supply:** 220 V potential difference and 50 Hz frequency AC power.
- **Wire Colors:** Live (Red), Neutral (Black), and Earth (Green).
- **Safety Devices:** **Fuse** (melts to break circuit during overloading/short-circuiting) and **Earth Wire** (prevents shocks from metallic bodies).
- **AC vs DC:** AC changes direction periodically; its main advantage is transmission over long distances without much energy loss.

4. TEACHER SHORTCUTS & MNEMONICS

- **Father-Mother-Child:** Fleming's Left-Hand Rule → **F**orce, **M**agnetic Field, **C**urrent.
- **MRI Basis:** Weak ion currents in the heart and brain produce magnetic fields used for medical imaging.
- **Clock Face Rule:** Clockwise current = South pole; Anti-clockwise = North pole.

5. EXAM IMPORTANCE MARKERS

- **Force Magnitude:** Highest when current is at right angles (90°) to the magnetic field.
- **Diagram Compulsory:** Field lines around a bar magnet and a current-carrying solenoid.

13. OUR ENVIRONMENT

1. KEY TERMS & DEFINITIONS

- **Ecosystem:** Interaction between biotic (living) and abiotic (temperature, soil, wind) components.
- **Trophic Level:** Each step in a food chain where energy transfer occurs.
- **Biological Magnification:** Progressive accumulation of non-degradable chemicals (pesticides) at higher trophic levels, reaching maximum in humans.
- **Biodegradable:** Substances broken down by biological processes (bacteria/enzymes).
- **Non-biodegradable:** Inert substances (plastics) that persist and may harm the ecosystem.

2. CORE PROCESSES / SEQUENCES

- **Energy Flow:** Sunlight (1% captured by plants) → Producers → Primary Consumers → Secondary → Tertiary.
- **10% Law:** Only 10% of energy available at one level reaches the next; the rest is lost as heat or used for digestion/growth.
- **Ozone Formation:** High energy UV splits $O_2 \rightarrow O + O$. Then, $O + O_2 \rightarrow O_3$ (Ozone).
- **Unidirectional Flow:** Energy captured by autotrophs never reverts to solar input; energy moving to higher levels is no longer available to previous levels.

3. TABLES / COMPARISONS

| Ecosystem Type | Examples | Origin |
|----------------|---------------------------------|--------------|
| Natural | Forests, Ponds, Lakes | Nature-made. |
| Artificial | Gardens, Crop-fields, Aquariums | Human-made. |

| Level | Organism Type | Position |
|--------------|---------------------------------|--------------------|
| First | Producers (Autotrophs) | Base of the chain. |
| Second | Herbivores (Primary Consumers) | Second level. |
| Third/Fourth | Carnivores (Secondary/Tertiary) | Top levels. |

4. IMPORTANT DIAGRAM POINTS

- **Food Web (Fig 13.3):** Branching lines showing how one organism is eaten by several others.
- **Energy Pyramid (Fig 13.2):** Narrows at the top as usable energy decreases at higher levels.
- **Ozone Shield:** Located in the stratosphere; shields Earth from damaging UV radiation.

5. EXAM IMPORTANCE & TIPS

- **Chain Length:** Food chains usually have only 34 steps because energy loss is too great to support more levels.
- **Ozone Depletion:** Linked to CFCs; 1987 UNEP agreement froze production to protect the atmosphere.
- **Decomposers:** Breakdown complex organic matter into simple inorganic substances for soil replenishment.
- **UV Effects:** Causes skin cancer and damage to organisms.

6. MNEMONICS & SHORTCUTS

- **"10% Rule":** Move up one level = Divide energy by 10.
- **"Uni-Energy":** Energy flow is a one-way street (Sun → Plant → Animal).
- **"CFC-Free":** Standard for refrigerators to prevent ozone holes.