



BIOLOGY TRICKS & TIPS

BASIC TO MODERATE | PAGE 1 OF 3

1. TAXONOMY & CLASSIFICATION

- Taxonomic order: Kingdom → Phylum/Division → Class → Order → Family → Genus → Species.
- Mnemonic: King Philip Came Over For Good Soup = K P C O F G S.
- Binomial name: Genus starts with a capital; species epithet starts lowercase; both are italicised in print.
- Prokaryotes lack a membrane-bound nucleus; eukaryotes have one. Do not confuse cell size with complexity.
- Viruses are acellular; they reproduce only inside a suitable host cell.
- Use exact NCERT examples and defining features when comparing kingdoms or taxonomic groups.

2. PLANT & ANIMAL DIVERSITY

- Compare algae, bryophytes, pteridophytes, gymnosperms and angiosperms by vascular tissue and seed formation; this is a study sequence, not a direct ancestor chain.
- Bryophytes: no true vascular tissue; water is needed for fertilisation. Sporophyte remains dependent on gametophyte.
- Pteridophytes: vascular, seedless plants; sporophyte is dominant and independent.
- Gymnosperms: naked ovules/seeds; angiosperms: seeds enclosed in fruits.
- Animal phyla: focus on symmetry, germ layers, coelom, segmentation and notochord as comparison clues.
- Chordates have a notochord at least at one stage; vertebrates have a vertebral column.

3. MORPHOLOGY & ANATOMY

- Root: usually positive geotropism; shoot: usually negative geotropism and positive phototropism.
- Dicot root: xylem usually fewer arms; monocot root: polyarch xylem and large pith (typical NCERT comparison).
- Dicot stem: vascular bundles arranged in a ring; monocot stem: bundles scattered (typical examples).
- Xylem mainly transports water/minerals; phloem transports organic nutrients from source to sink.
- Collenchyma provides flexible support; sclerenchyma provides strong support due to thick, often lignified walls.
- In floral formulae, read symmetry, sexuality, sepals, petals, stamens and carpels systematically.

4. CELL: ORGANELLES & BIOMOLECULES

- Mitochondria = ATP; chloroplast = photosynthesis; ribosome = protein; lysosome = digestion; Golgi = modify/package.
- Prokaryotic ribosomes are 70S; eukaryotic cytoplasmic ribosomes are 80S. Mitochondria/chloroplasts contain 70S ribosomes.
- RER has ribosomes and supports protein synthesis; SER is important in lipid synthesis and detoxification.
- Enzymes lower activation energy; they do not change the overall free-energy change of a reaction.
- Proteins are amino-acid polymers; nucleic acids are nucleotide polymers; glycogen/starch are storage polysaccharides.
- Cell membrane follows the fluid mosaic model; selective permeability is essential for transport.

5. CELL CYCLE & DIVISION

- Interphase = G1 (growth), S (DNA synthesis), G2 (preparation); M phase = nuclear division + cytokinesis.
- DNA content doubles in S phase, but chromosome number is counted by centromeres and does not double there.
- Mitosis: one division; normally produces two genetically similar daughter cells.
- Meiosis: two divisions; reduces chromosome number and creates variation through crossing over and independent assortment.
- Crossing over occurs during prophase I (pachytene); chiasmata become visible later in prophase I.
- Homologous chromosomes separate in meiosis I; sister chromatids separate in meiosis II.

6. MOLECULAR BIOLOGY QUICK CUES

- DNA: A pairs with T (2 H bonds); G pairs with C (3 H bonds). More GC generally means higher melting temperature.
- DNA strands are antiparallel; DNA polymerase builds the new strand in the 5-prime to 3-prime direction.
- Transcription copies DNA information into RNA; translation reads mRNA codons to build a polypeptide.
- Start codon: AUG (Met); stop codons: UAA, UAG, UGA. Stop codons do not encode amino acids.
- Genetic code is triplet, degenerate and nearly universal; a codon is read on mRNA, not DNA template.
- Replication is semiconservative: each daughter DNA molecule contains one parental and one newly made strand.



BIOLOGY TRICKS & TIPS

BASIC TO MODERATE | PAGE 2 OF 3

1. PLANT PHYSIOLOGY

● **Photosynthesis:** light reactions make ATP + NADPH; Calvin cycle uses them to fix CO₂ into carbohydrate intermediates.

- C₃ first stable product: 3-PGA; C₄ first stable product: oxaloacetate (4C). C₄ plants reduce photorespiration in hot conditions.
- Stomata regulate gas exchange and water loss; guard-cell turgor changes help open/close the pore.
- Auxin: elongation/apical dominance; gibberellin: stem elongation/germination; cytokinin: cell division; ABA: stress/dormancy cue.
- Transpiration pull contributes to xylem ascent; phloem translocation follows source-to-sink pressure-flow ideas.
- Nitrogen fixation converts atmospheric N₂ into usable reduced nitrogen; root nodules of legumes may contain Rhizobium.

2. DIGESTION & RESPIRATION

● **Bile emulsifies fats but has no digestive enzyme; pancreatic lipase digests triglycerides.**

- Pepsin works in acidic stomach conditions; trypsin and many pancreatic enzymes act in the small intestine.
- Most nutrient absorption occurs in the small intestine; villi and microvilli increase surface area.
- O₂ is mainly carried bound to haemoglobin; most CO₂ in blood is transported as bicarbonate ions.
- Oxyhaemoglobin dissociation increases with higher CO₂, higher H⁺, higher temperature and higher 2,3-BPG (Bohr-related effect).
- Aerobic respiration: glycolysis in cytosol; Krebs cycle in mitochondrial matrix; electron transport on inner mitochondrial membrane.

3. CIRCULATION & EXCRETION

● **Blood flow:** vena cava → RA → RV → pulmonary artery → lungs → pulmonary veins → LA → LV → aorta.

- Tricuspid valve: right atrium/right ventricle; bicuspid (mitral): left atrium/left ventricle.
- Arteries carry blood away from the heart; veins carry blood towards it. Oxygen content is not the definition.
- Nephron: glomerular filtration → selective reabsorption → tubular secretion; PCT reabsorbs much of the filtrate.
- ADH increases water reabsorption; aldosterone promotes Na⁺ reabsorption and K⁺ secretion in appropriate nephron segments.
- Counter-current mechanisms in loop of Henle/vasa recta help maintain the medullary osmotic gradient.

4. NERVOUS & ENDOCRINE SYSTEM

- Resting neuron: inside is negative relative to outside; Na⁺/K⁺ pump maintains ion gradients (3 Na⁺ out, 2 K⁺ in per ATP).
- Action potential: depolarisation mainly Na⁺ influx; repolarisation mainly K⁺ efflux (simplified standard sequence).
- Chemical synapse: neurotransmitter crosses synaptic cleft; transmission is usually one-way.

● **Insulin lowers blood glucose; glucagon raises it. Thyroxine helps regulate metabolic rate; ADH conserves water.**

- Anterior pituitary hormones differ from posterior pituitary release: ADH and oxytocin are made in hypothalamus and released from posterior pituitary.
- Negative feedback stabilises many hormone systems; do not mix up gland, hormone, target and effect.

5. HUMAN REPRODUCTION

- Spermatogenesis occurs in seminiferous tubules; Sertoli cells support developing sperm, Leydig cells secrete androgens.
- FSH supports follicular development; LH surge triggers ovulation; corpus luteum secretes progesterone.
- Fertilisation usually occurs in the ampullary-isthmic region of the oviduct; implantation occurs in the uterine endometrium.
- Menstrual cycle: follicular phase → ovulation → luteal phase; the corpus luteum regresses if pregnancy does not occur.
- Placenta supports exchange and releases hormones; it is not a complete barrier to all substances.
- Sperm contributes X or Y chromosome; the ovum normally contributes X. Avoid using this fact to place social blame.

6. REPRODUCTION IN FLOWERING PLANTS

● **Double fertilisation: one male gamete + egg = zygote (2n); the other + two polar nuclei = primary endosperm nucleus (usually 3n).**

- A typical mature embryo sac is 7-celled and 8-nucleate: egg apparatus (3), antipodals (3), central cell (2 polar nuclei).
- Microsporogenesis forms microspores in anthers; megasporogenesis forms megaspores in the ovule.
- Pollen-pistil interaction determines compatibility; the pollen tube delivers two male gametes to the embryo sac.
- After fertilisation: ovule → seed; ovary → fruit (typical pattern).
- Apomixis forms seeds without fertilisation; polyembryony means more than one embryo in a seed.



BIOLOGY TRICKS & TIPS

BASIC TO MODERATE | PAGE 3 OF 3

1. MENDELIAN GENETICS

● **Monohybrid $Aa \times Aa$: genotype 1 AA : 2 Aa : 1 aa ; phenotype 3 dominant : 1 recessive only with complete dominance.**

- Test cross: individual with dominant phenotype $\times$ homozygous recessive; offspring help reveal the unknown genotype.
- Dihybrid 9:3:3:1 ratio needs independent assortment and suitable complete-dominance assumptions.
- Incomplete dominance: heterozygote has intermediate phenotype; codominance: both alleles are expressed (AB blood group).
- ABO: I^A and I^B are codominant; i is recessive. Genotype matters: phenotype alone may not identify a unique genotype.
- Linkage can break expected independent-assortment ratios; recombination frequency estimates separation, up to about 50%.

2. HUMAN GENETICS & PEDIGREES

- Autosomal dominant traits often appear in successive generations; affected individuals may have an affected parent (not an absolute rule).
- Autosomal recessive traits can appear among siblings of unaffected carrier parents and may skip generations.
- X-linked recessive traits are more common in males; fathers do not pass an X chromosome to their sons.
- Down syndrome: trisomy 21; Turner syndrome: 45,X; Klinefelter syndrome: 47,XXY (learn karyotype and key features).
- Pedigree symbols: square = male; circle = female; shaded = affected (use the legend if a question defines another key).
- Separate genotype, phenotype, carrier status and inheritance pattern before calculating probability.

3. EVOLUTION & POPULATION GENETICS

● **Hardy-Weinberg: $p + q = 1$; $p^2 + 2pq + q^2 = 1$ for two alleles in the idealised model.**

- Equilibrium assumes very large population, random mating, no mutation, no migration and no natural selection.
- Evolution is a change in allele frequencies across generations; individuals do not evolve genetically during their lifetime.
- Natural selection acts on heritable variation; genetic drift is random and strongest in small populations.
- Homologous organs suggest common ancestry; analogous organs have similar function but different evolutionary origin.
- Adaptive radiation: diversification from a common ancestor into different ecological niches.

4. HUMAN HEALTH & IMMUNITY

- Innate immunity is rapid and non-specific; adaptive immunity is antigen-specific and can form memory.
- B cells can differentiate into antibody-secreting plasma cells; T cells contribute to cell-mediated immunity.
- Vaccination exposes the immune system to an antigen or its safe representation to develop immune memory.
- Antibiotics act against susceptible bacteria, not viruses; misuse promotes antimicrobial resistance.
- HIV targets CD4⁺ T-helper cells; AIDS involves severe immune-system impairment.
- For diseases, revise pathogen, transmission, symptoms, prevention and NCERT-listed vector/reservoir carefully.

5. BIOTECHNOLOGY & ECOLOGY

● **PCR cycle: denaturation $\rightarrow$ primer annealing $\rightarrow$ extension by thermostable DNA polymerase.**

- Restriction endonucleases cut specific DNA sequences; ligase joins DNA fragments; vectors carry inserted DNA.
- A good cloning vector commonly needs an origin of replication, selectable marker and cloning site.
- Population interactions: mutualism (+/+), competition (-/-), predation/parasitism (+/-), commensalism (+/0).
- Energy pyramid is always upright; biomass pyramid can be inverted in some aquatic ecosystems.
- Approximate 10% law: only a small fraction of energy at one trophic level passes to the next.

6. NEET BIOLOGY SMART-SOLVING

- NCERT first: learn definitions, diagrams, examples, tables, exceptions and exact wording before using extra sources.
- Turn each subtopic into a question: cover the answer, recall it, then check and correct immediately.
- For assertion/reason or statement questions, evaluate each statement independently before checking options.
- In diagrams, label direction and parts: heart flow, nephron, flower, embryo sac, cell organelles and cycles.
- Keep an error log: concept gap, forgotten fact, confusing pair, careless reading or time pressure.
- Final memory rule: revise after 1 day, after about 1 week, and again later; practise mixed MCQs regularly.