Cadetclub

GENERAL KNOWLEDGE / NDA GAT

Must-Know GK for NDA

Your GK revision at a glance

Facts. Formulas. Visuals. Quick comparisons.

The essentials for your NDA preparation

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Your GK recall map

Every topic is linked. Number ranges locate the entries within each subject.

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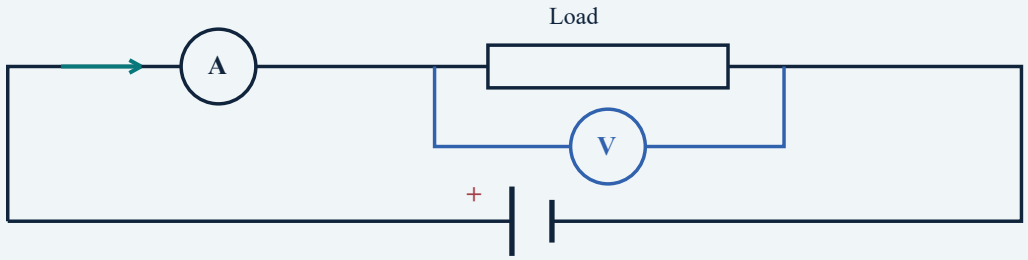
Use it actively: cover the right part of a line, recall the answer, then check it. Revisit the topic behind every incorrect practice answer.

Static core: use the monthly current-affairs PDFs for changing appointments, recent exercises, awards and events. This book makes no claim of a PYQ-frequency ranking.

Physics

METERS: SERIES OR PARALLEL?



Ammeter in series with the load; voltmeter across the load.

Remember. Units first; then choose the relation and its conditions.

1 Units, motion and forces

SI force, work and power. Newton (N), joule (J) and watt (W), respectively; pressure is measured in pascal (Pa).

Speed conversion. km/h × 5/18 = m/s; m/s × 18/5 = km/h.

Distance versus displacement. Distance follows the whole path; displacement joins start to finish and includes direction.

Average speed. Total distance ÷ total time; for equal distances at speeds a and b, average speed = 2ab/(a + b).

Uniform acceleration. $v = u + at$; $s = ut + \frac{1}{2}at^2$; $v^2 = u^2 + 2as$; use signed quantities.

2 Graphs and laws of motion

Graph shortcut. Position-time slope gives velocity; velocity-time slope gives acceleration; signed velocity-time area gives displacement.

Newton's first law. Zero resultant force means constant velocity, not necessarily rest; mass measures inertia.

Momentum and impulse. $p = mv$; impulse = change in momentum; for constant mass, resultant $F = ma$.

Third-law pair. Equal and opposite forces act on different bodies; they do not cancel on one body's force diagram.

Friction. Opposes relative slipping or its tendency at contact; static friction can act even when surfaces do not slide.

1 Gravity, energy and machines

Gravity versus g. G is universal; local g varies. Weight = mg, while mass does not change simply because g changes.

Inverse-square recall. Gravitational force = Gm_1m_2/r^2; doubling centre-to-centre separation makes force one-quarter.

Weightlessness. In free fall, apparent weight can be zero even when gravitational force is present; orbiting astronauts remain under gravity.

Work. $W = Fs\cos\theta$ for constant force; a force perpendicular to displacement does zero work.

Kinetic energy. $K = \frac{1}{2}mv^2$; doubling speed doubles momentum but quadruples kinetic energy for fixed mass.

2 Power and simple machines

Energy and power. Near Earth, $\Delta U = mg\Delta h$; power = work/time; efficiency = useful output/input.

Lever classes. First: fulcrum in the middle; second: load in the middle; third: effort in the middle.

Lever examples. Seesaw: first class; wheelbarrow: second class; tweezers: third class. Balance perpendicular turning moments, not force alone.

Pulleys. Ideal fixed pulley: mechanical advantage 1; single movable pulley with two supporting strands: 2. Real friction lowers efficiency.

Pendulum and stability. For small swings, $T = 2\pi\sqrt{(L/g)}$; mass is irrelevant. A lower centre of gravity and wider base resist toppling.

1 Fluids and everyday devices

Density. ρ = mass/volume; 1 g/cm^3 = 1000 kg/m^3. Relative density is a ratio with no unit.

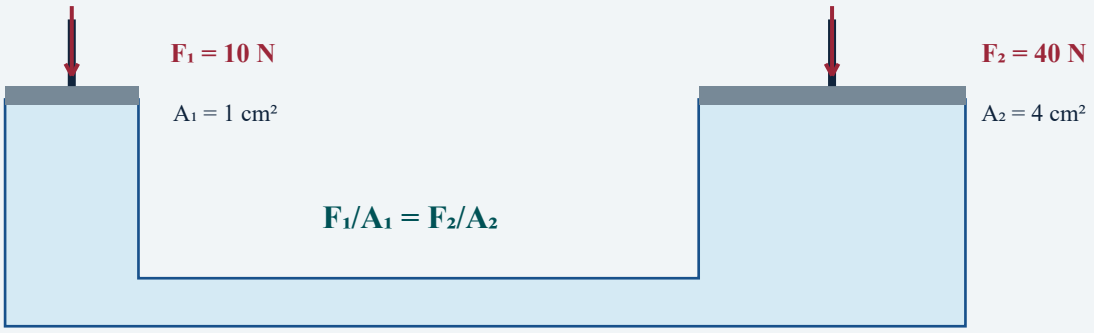
Pressure. P = normal force/area; smaller contact area means greater pressure for the same force.

Liquid pressure. Gauge pressure = ρgh; absolute pressure also includes the pressure at the liquid surface.

Hydraulic machines. Pascal's principle transmits an imposed pressure change through a confined fluid; force gain trades against movement distance.

Archimedes' principle. Buoyant force equals the weight of displaced fluid; use the fluid's density and the displaced volume.

HYDRAULIC PRESS: SAME PRESSURE, DIFFERENT FORCE



Idealised, equal-height pistons. Force gain trades against displacement; energy is not multiplied.

2 Floating and everyday devices

Floating fraction. For a uniform floating body, submerged fraction = body density/fluid density, ignoring surface tension and other supports.

Hydrometer. Floats higher in a denser liquid; a ship floats because its overall average density includes enclosed air.

Balloon. Rises when buoyancy exceeds total weight; heating the internal air lowers its density, all else suitably controlled.

Barometer. Measures atmospheric pressure; standard atmosphere = 101325 Pa ≈ 760 mmHg. Pressure generally falls with altitude.

Siphon and suction pump. A primed siphon's outlet must be below the source surface; ideal water suction lift near sea level is about 10.3 m, practically less.

1 Heat and temperature

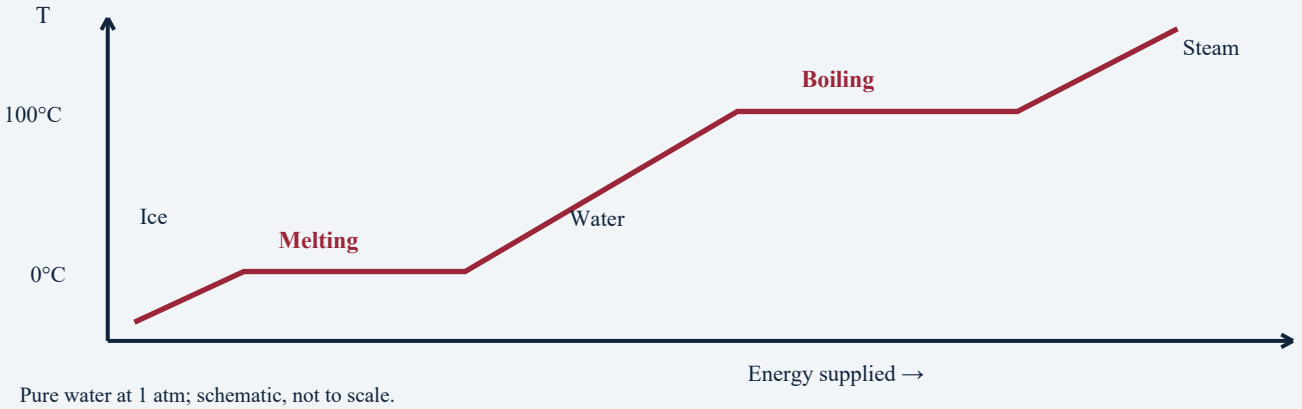
Temperature conversion. K = °C + 273.15; °F = 9°C/5 + 32; a change of 1°C equals a change of 1 K.

Kelvin notation. Use K, not °K. Celsius and Fahrenheit readings coincide at -40°.

Sensible heat. $Q = mc\Delta T$; heat capacity = mc; this relation covers temperature change without a phase change.

Latent heat. $Q = mL$; a pure substance can change state at fixed pressure without changing temperature while energy is transferred.

HEATING WATER: THE FLAT PARTS ARE PHASE CHANGES



Pure water at 1 atm; schematic, not to scale.

2 Heat transfer and everyday effects

Evaporation. Surface cooling process; promoted by heat, airflow and larger surface area, and slowed by greater humidity.

Water anomaly. Pure water at ordinary pressure is densest near 4°C; cooling from 4°C to 0°C expands it. Ice floats.

Conduction and convection. Conduction needs no bulk material movement; convection transports energy through moving fluid, not through rigid solids.

Thermal radiation. Needs no medium. At corresponding conditions, good absorbers are good emitters; a vacuum does not stop radiation.

Pressure cooker. Higher internal pressure raises water's boiling temperature; lower atmospheric pressure lowers boiling point at altitude.

Thermos and clock. Vacuum limits conduction/convection; reflective walls reduce radiation. A heated, lengthened pendulum makes its clock run slow.

1 Sound, light and vision

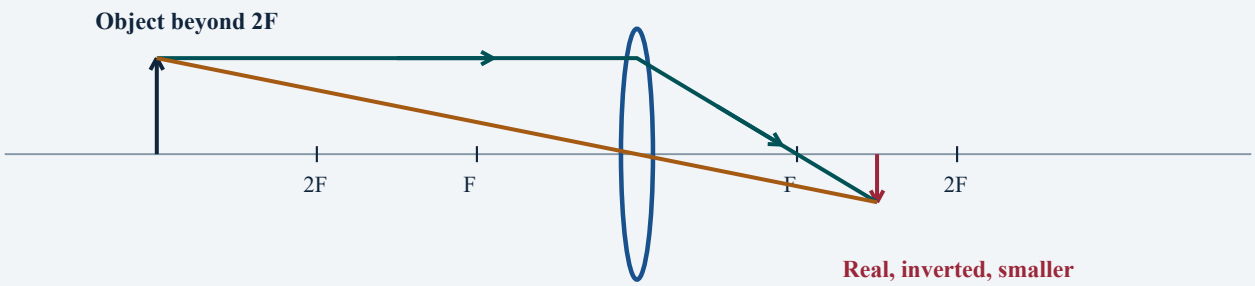
Wave relation. $v = f\lambda$; $f = 1/T$. Sound in air is longitudinal; a stretched-string wave is transverse.

Pitch, loudness, timbre. Pitch mainly follows frequency; intensity generally rises with amplitude squared; timbre depends on waveform/harmonics.

Sound and vacuum. Sound needs a material medium; electromagnetic waves do not. Use the question's sound speed, not a universal 340 m/s.

Hearing and echo. Typical young-human range: about 20 Hz-20 kHz. Echo/SONAR distance = wave speed × round-trip time/2.

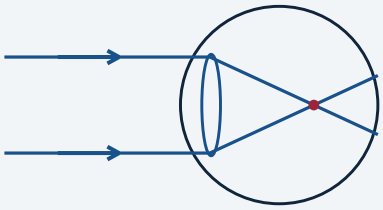
CONVEX LENS: TRACE THE PRINCIPAL RAYS



Object beyond 2F → image between F and 2F on the far side. Thin lens in air; schematic.

VISION DEFECTS: WHERE DOES THE IMAGE FOCUS?

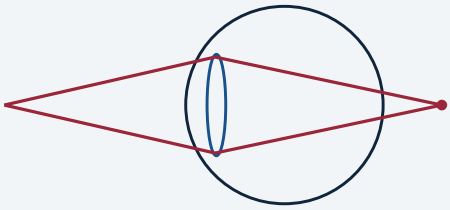
MYOPIA



Focus before retina

Correction: concave (-) lens

HYPERMETROPIA



Focus beyond retina

Correction: convex (+) lens

Uncorrected-eye schematics: distant object (left), near object (right). Not to scale.

2 Reflection, mirrors and refraction

Reflection. Incidence angle = reflection angle, measured from the normal. A ray 30° to the surface is 60° to the normal.

Plane mirror. Virtual, upright, same-size image; image distance behind equals object distance in front.

Concave versus convex mirror. Concave can form real or virtual images; convex gives a virtual, upright diminished image of a real object.

Refraction. $n = c/v$; $n_1 \sin i = n_2 \sin r$. Toward higher refractive index, an oblique ray bends toward the normal.

3 Optics and the human eye

Lens and mirror signs. Cartesian convention: mirror $1/f = 1/v + 1/u$; thin lens $1/f = 1/v - 1/u$. Do not mix them.

Lens power. $P = 1/f$ in metres, measured in dioptres; thin lenses in contact have approximately additive powers.

Dispersion and scattering. Ordinary glass generally deviates violet more than red; atmospheric small-particle scattering favours shorter wavelengths. These are different mechanisms.

Vision correction. Myopia: concave lens; hypermetropia: convex lens; presbyopia: age-related loss of accommodation, not simply hypermetropia.

Eye and instruments. Retina receives the real inverted image; iris controls pupil size. Periscope redirects rays; microscope enlarges small objects; telescope views distant ones.

1 Electricity, magnetism and radiation

Current and voltage. $I = Q/t$; V = energy/charge. Conventional current opposes electron drift in a metallic conductor.

Meter connection. Ammeter → series, very low ideal resistance; voltmeter → parallel, very high ideal resistance.

Ohm's law. $V = IR$ for an ohmic conductor at unchanged physical conditions; wire resistance $R = \rho L/A$.

Series and parallel. Series: same current, resistances add. Parallel: same voltage; reciprocal resistances add.

2 Power, safety and magnetism

Electrical power. $P = VI$; for a resistor, $P = I^2R = V^2/R$. Fixed-current and fixed-voltage comparisons differ.

Commercial electricity unit. 1 unit = 1 kWh = 3.6×10^6 J; kWh is energy, not power.

Safety and cells. Fuse interrupts excess current; earthing provides a fault-current path. Primary cells are not designed for recharge; secondary cells are rechargeable.

Magnetic field recall. Outside a bar magnet, field runs N → S; inside, S → N. Cutting it produces smaller two-pole magnets.

3 Electrical machines and radiation

Motor, generator, transformer. Motor: electrical → mechanical; generator: mechanical → electrical; transformer needs changing magnetic flux, not steady DC.

Electromagnetic order. Radio → microwave → infrared → visible → ultraviolet → X-ray → gamma, broadly increasing frequency; all travel at c in vacuum.

X-rays and total reflection. X-rays are ionising electromagnetic radiation. Total internal reflection needs higher-to-lower index travel and incidence above the critical angle.

Historical devices. Telegraph: coded current pulses; telephone: sound ↔ electrical signal; acoustic gramophone: record groove → stylus → diaphragm vibrations.

Compass and transformer. Compass aligns with the local magnetic field, not invariably true north; ideal transformer voltage ratio equals secondary/primary turns ratio.

1 Static electricity and charge detection

Charging by friction. Rubbing suitable materials transfers electrons between them; it does not create net electric charge.

Charge interaction. Like charges repel and unlike charges attract. A charged body may also attract a neutral object by redistributing its charges.

Electroscope. Its conducting leaves separate when they acquire charges of the same sign; it detects electric charge, not electric current.

Lightning conductor. A properly earthed conducting rod provides a path for lightning current towards the ground; the protective system depends on its earth connection.

1 Simple musical instruments and vibration

Instrument and vibrating part	Sitar or veena: stretched string; tabla: stretched membrane; flute: vibrating air column. Identify the vibrating system, not just the instrument's material.
String tuning	For a given string, shortening its vibrating length raises its fundamental frequency; increasing tension also raises frequency when the other conditions stay unchanged.
The whole instrument matters	A vibrating string or membrane sets other parts of the instrument into vibration too. Its body helps radiate the sound; the audible sound is not from the string alone.

Chemistry

FOLLOW THE ELECTRONS, THEN NAME THE AGENT

LOSE electrons	→	**OXIDATION**	The donor is a reducing agent.
GAIN electrons	→	**REDUCTION**	The acceptor is an oxidising agent.

Remember. OIL RIG: Oxidation Is Loss; Reduction Is Gain of electrons.

1 Atoms, periodicity and bonding

Atomic number. Number of protons; equals electron count only in a neutral atom. Mass number = protons + neutrons.

Isotopes and isobars. Isotopes: same atomic number, different mass number. Isobars: same mass number, different atomic number.

Ions. Loss of electrons forms positive ions; gain forms negative ions. Ordinary chemical changes do not change the nucleus.

Mole. One mole contains exactly $6.02214076 \times 10^{23}$ specified entities; amount = mass/molar mass.

Valency shortcut. For many main-group school examples, valency follows electrons lost, gained or shared to reach a stable outer-shell arrangement.

2 Periodicity and chemical bonds

Modern periodic table. Ordered by atomic number; periods are rows, groups are columns. Same-group elements often share related valence behaviour.

Group families. Group 1 metals (excluding hydrogen): alkali metals; 2: alkaline earth metals; 17: halogens; 18: noble gases. Hydrogen is in Group 1 but is a nonmetal.

Metallic character. Generally decreases across a period and increases down a group; trends have exceptions and depend on the property compared.

Ionic versus covalent. Ionic bonding involves electrostatic attraction between ions; covalent bonding involves shared electron pairs.

Ionic conductivity. Ionic solids generally conduct when molten or suitably dissolved, not as rigid crystals with immobile ions.

1 Reactions and chemical calculations

Conservation of mass. In a closed chemical reaction, total mass is conserved; balance equations with coefficients, not altered formula subscripts.

Physical versus chemical. Melting changes physical state; rusting forms new substances. Reversibility alone is not a reliable classification test.

Reaction patterns. Combination: several reactants form a product; decomposition: one compound breaks down; displacement replaces a less reactive constituent.

Double displacement. Ions exchange partners; precipitation produces an insoluble solid. Not every ion exchange yields an observable change.

Oxidation and reduction. Oxidation loses electrons; reduction gains electrons. Memory aid: OIL RIG; both occur together in a redox process.

2 Agents, energy and gas calculations

Agents. An oxidising agent accepts electrons and is reduced; a reducing agent donates electrons and is oxidised.

Exothermic versus endothermic. Exothermic releases heat; endothermic absorbs heat. Photosynthesis stores energy; fuel combustion releases it.

Catalyst. Changes reaction rate without being consumed overall; it does not alter the equilibrium constant at fixed temperature.

Gas-volume condition. For ideal gases, equal volumes at the same temperature and pressure contain equal numbers of particles; state these conditions.

Molar gas volume. About 22.4 L/mol at 0°C and 1 atm for an ideal gas; a different standard pressure gives a different value.

1 Acids, bases and salts

Acids and bases in water. Acids increase hydronium-ion concentration; bases increase hydroxide-ion concentration in the usual aqueous school treatment.

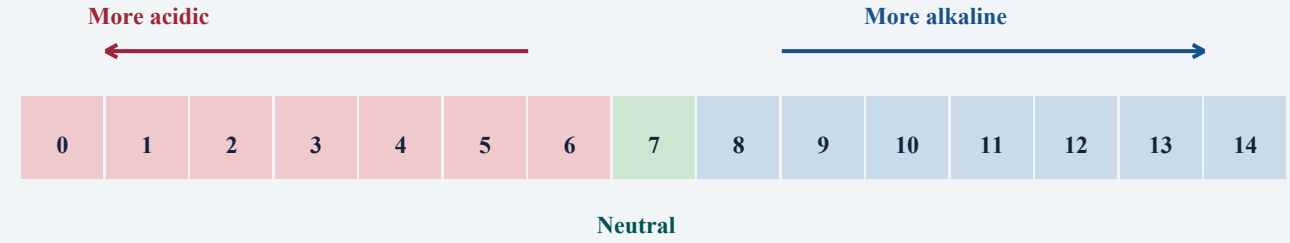
pH. At 25°C, neutral pure water has pH 7; lower pH is more acidic. Neutral pH depends on temperature.

pH scale shortcut. A one-unit pH drop corresponds to ten times the hydrogen-ion activity, approximately concentration in dilute simple examples.

Litmus. Acid turns blue litmus red; base turns red litmus blue. Dry gases may not affect dry litmus without water.

Indicators. Phenolphthalein: colourless in acidic, pink in sufficiently alkaline solution; methyl orange: red in acidic, yellow in alkaline solution.

pH: ONE UNIT MEANS A TENFOLD CHANGE



Lower pH → greater hydrogen-ion activity.

Typical aqueous scale at 25°C. Neutral pH depends on temperature; extreme values can lie outside 0-14.

2 Reactions and everyday salts

Neutralisation. Acid + base commonly gives salt + water; equal volumes alone do not guarantee neutrality.

Carbonate test. Acid + carbonate/hydrogencarbonate releases CO_2; it turns limewater milky, with excess CO_2 potentially clearing it.

Baking versus washing soda. Baking: $NaHCO_3$; washing: $Na_2CO_3 \cdot 10H_2O$. Baking powder is a mixture, not pure baking soda.

Quicklime and slaked lime. Quicklime: CaO; slaked lime: $Ca(OH)_2$. Adding water to quicklime releases considerable heat.

Gypsum and plaster of Paris. Gypsum: $CaSO_4 \cdot 2H_2O$; plaster: $CaSO_4 \cdot \frac{1}{2}H_2O$. Plaster sets by rehydrating.

1 Metals, nonmetals and corrosion

Reactivity series recall. A useful school order: K, Na, Ca, Mg, Al, Zn, Fe, Pb, H, Cu, Hg, Ag, Au; compare position, not alphabet.

Displacement rule. A sufficiently reactive metal can displace a less reactive metal from a suitable salt solution.

Amphoteric oxides. Aluminium oxide and zinc oxide react with both suitable acids and bases.

Rusting. Iron corrosion requires oxygen and moisture; rust is hydrated iron oxide, not a single universally fixed hydration formula.

Galvanisation. Coats iron/steel with zinc; zinc provides barrier protection and can act sacrificially.

2 Materials and extraction

Passivation. Aluminium's adherent oxide film helps protect it despite its high chemical reactivity.

Alloy pairs. Brass: copper + zinc; bronze: copper + tin; stainless steel typically contains chromium in an iron-based alloy.

Nonmetal exceptions. Graphite conducts electricity; iodine is lustrous. Mercury is a liquid metal at ordinary room temperature.

Extraction shortcut. Highly reactive metals usually require electrolytic methods; less reactive metal compounds can often be chemically reduced.

Electrolysis. Oxidation occurs at the anode; reduction at the cathode. Electrode signs depend on whether the cell is electrolytic or galvanic.

1 Carbon, fuels and common materials

Carbon bonding. Carbon is tetravalent and shows catenation; many compounds contain long chains, branches or rings.

Diamond versus graphite. Diamond: hard three-dimensional network; graphite: layered structure with mobile electrons and electrical conductivity.

Saturated versus unsaturated. Alkanes have C-C single bonds; alkenes include C=C; alkynes include C≡C. Compare within the relevant homologous series.

Homologous series. Successive members differ by CH_2 and share a functional group and related chemical behaviour.

Functional groups. Alcohol: -OH; aldehyde: -CHO; ketone: >C=O; carboxylic acid: -COOH.

2 Everyday carbon chemistry

Ethanol versus ethanoic acid. Ethanol: C_2H_5OH; ethanoic acid: CH_3COOH. Vinegar is a dilute aqueous ethanoic-acid solution.

Soaps and detergents. Soap forms scum with calcium/magnesium ions in hard water; many synthetic detergents work better under these conditions.

Fuel composition. Natural gas is mainly methane; LPG mainly propane/butane; CNG means compressed natural gas, not a different molecule.

Incomplete combustion. Can form poisonous CO and soot; CO reduces oxygen transport by binding strongly to haemoglobin.

Material associations. Ordinary soda-lime glass contains silica with sodium/calcium compounds; cement is not simply powdered limestone; gunpowder traditionally mixes nitrate, charcoal and sulphur.

1 Air, water and environmental chemistry

Dry-air composition. Approximately 78% nitrogen, 21% oxygen and 0.93% argon by volume; water vapour and CO_2 vary.

Oxygen test. Supports combustion; a glowing splint can relight in oxygen. Oxygen itself is not a fuel.

Hydrogen test. Burns with a characteristic pop in a suitable small test; hydrogen is combustible, unlike combustion-supporting oxygen.

Hard water. Dissolved calcium/magnesium salts cause hardness; boiling removes temporary hardness but not all permanent hardness.

Water treatment. Filtration removes suspended matter; disinfection controls microbes. Boiling does not remove every dissolved chemical pollutant.

2 Environment and useful chemicals

Acid rain. Mainly associated with sulphur and nitrogen oxides; CO_2 alone explains ordinary rain's mild acidity, not the usual acid-rain problem.

Greenhouse versus ozone. Greenhouse gases affect heat balance; stratospheric ozone absorbs much harmful UV. These are different environmental issues.

Fertilisers. N, P and K denote nitrogen, phosphorus and potassium nutrients; excessive nutrient runoff can drive eutrophication.

Safety-match association. Red phosphorus is chiefly on the striking surface; match-head composition differs. White phosphorus is not interchangeable with red phosphorus.

Bleaching and disinfection. Chlorine-containing compounds can oxidise and disinfect; bleaching powder is commonly represented in school chemistry as $CaOCl_2$, with actual composition more complex.

1 Formula pairs and everyday manufacture

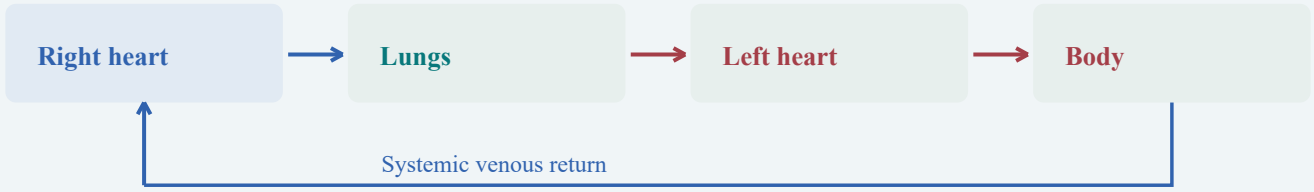
Mineral acids	Hydrochloric: HCl; sulphuric: H_2SO_4; nitric: HNO_3. Strength is not the same as concentration.
Common alkalis	Sodium hydroxide: NaOH; potassium hydroxide: KOH. An alkali is a water-soluble base; not every base is an alkali.
Organic-acid pairs	Acetic/ethanoic: vinegar; citric: citrus fruits; lactic: sour milk/fermentation contexts; tartaric: tamarind and grapes.
Common salts	Sodium chloride: NaCl; potassium nitrate: KNO_3; copper sulphate pentahydrate: $CuSO_4 \cdot 5H_2O$.
Fertiliser formula	Urea: $CO(NH_2)_2$, a nitrogen fertiliser; ammonium sulphate: $(NH_4)_2SO_4$.

2 Everyday manufacture and materials

Glucose and sucrose	Glucose: $C_6H_{12}O_6$; sucrose: $C_{12}H_{22}O_{11}$. Same elements do not imply the same compound.
Hydrated-salt trap	Water of crystallisation belongs to a crystal's formula; it is not merely water left on an unwashed crystal surface.
Cement and concrete	Cement binds; concrete combines cement, water and aggregates. Reinforced concrete also contains reinforcement, commonly steel.
Paper, ink and paint	Paper is chiefly cellulose-based; inks use colourants and a carrier; paints combine pigments, binders and other formulation ingredients.
Soap preparation	Saponification is alkaline hydrolysis of fats/oils producing soap and glycerol; detergents are not all made by this same reaction.

Biology and General Science

BLOOD FLOW: ARTERY DOES NOT ALWAYS MEAN OXYGENATED



Right heart → lungs: pulmonary artery. Lungs → left heart: pulmonary veins.

Remember. Artery = away from heart; vein = toward heart. Oxygen content is not the definition.

1 Cells, tissues and heredity

Cell nucleus. Contains most cellular DNA in typical eukaryotic cells; prokaryotes lack a membrane-bound nucleus.

Mitochondria and ribosomes. Mitochondria support aerobic ATP production; ribosomes synthesise proteins. Mature mammalian red cells lack mitochondria and a nucleus.

Chloroplasts. Site of photosynthesis in green plant cells; chlorophyll absorbs light, while carbohydrate formation also needs carbon fixation reactions.

Cell membrane versus wall. Membrane regulates exchange; plant cell walls provide support. Osmosis concerns water movement across a selectively permeable membrane.

Mitosis versus meiosis. Mitosis generally preserves chromosome number; meiosis halves it in the production of haploid cells and promotes variation.

2 Heredity and plant tissues

Human chromosome count. Most human somatic cells have 46 chromosomes in 23 pairs; typical gametes have 23, not 23 pairs.

Gene and chromosome. A gene is a DNA sequence associated with a functional product; chromosomes organise DNA with proteins.

DNA versus RNA. DNA usually stores hereditary information; RNA participates in gene expression. Some viruses use RNA as genetic material.

Xylem versus phloem. Xylem mainly transports water/minerals; phloem distributes sugars and other organic solutes between sources and sinks.

Plant growth tissues. Meristems actively divide; permanent tissues specialise. Root hairs increase absorptive surface area.

1 Human organs and circulation

Heart circulation. Right side pumps blood toward lungs; left side pumps toward the body. Humans normally have double circulation.

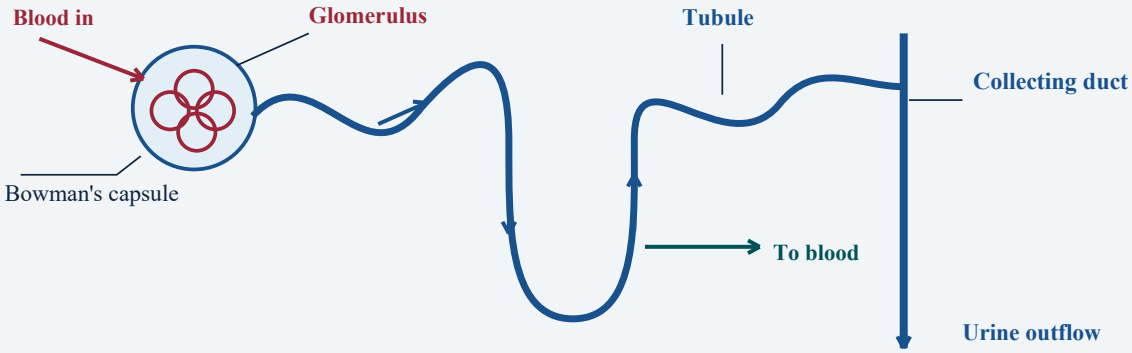
Artery versus vein. Arteries carry blood away from the heart; veins carry it toward the heart. Oxygenation is not the defining distinction.

Pulmonary exception. Pulmonary artery carries relatively deoxygenated blood; pulmonary veins carry oxygenated blood in normal adult circulation.

Blood components. Red cells transport respiratory gases; white cells defend; platelets support clotting; plasma carries dissolved substances.

Haemoglobin. Iron-containing respiratory pigment of red cells; iron deficiency can cause anaemia, but not all anaemia is iron deficiency.

NEPHRON: FILTRATION FIRST, THEN SELECTIVE REABSORPTION



Simplified functional layout; surrounding blood vessels are omitted. Not to scale.

2 Blood groups and organ functions

ABO and Rh. Blood-group compatibility depends on antigens, antibodies and the component transfused; simple universal-donor labels have clinical limitations.

Kidney and nephron. Nephrons filter and modify fluid to form urine; kidneys help regulate water, ions, acid-base balance and waste removal.

Liver roles. Produces bile, processes nutrients and detoxifies many substances; bile is stored/concentrated in the gall bladder, not produced there.

Lungs. Gas exchange occurs mainly across alveolar surfaces; inhalation involves diaphragm contraction and increased chest volume.

Skin and sense organs. Skin contributes to protection and temperature regulation; the ear's cochlea supports hearing and semicircular canals help balance.

1 Digestion, hormones and coordination

Digestive sequence. Mouth → oesophagus → stomach → small intestine → large intestine; most nutrient absorption occurs in the small intestine.

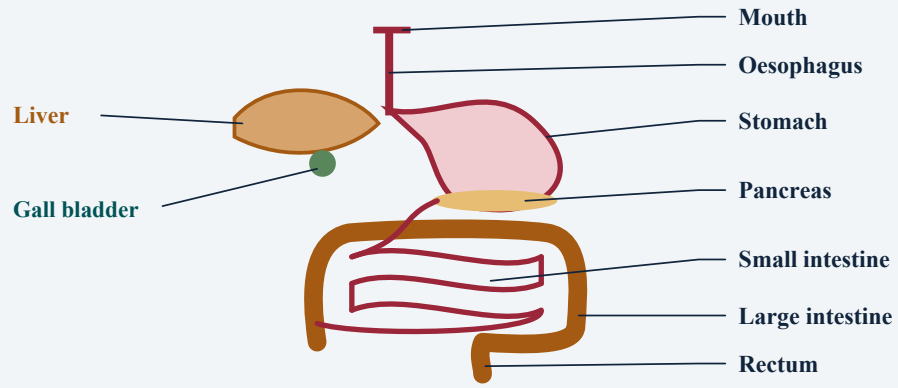
Digestive enzymes. Amylase acts on starch; proteases on proteins; lipases on fats. Bile aids fat digestion but is not a digestive enzyme.

Stomach and intestine. Stomach acid supports pepsin action; alkaline secretions help provide suitable conditions for many intestinal enzymes.

Pancreas. Has exocrine digestive secretion and endocrine hormone production; insulin lowers blood glucose through several coordinated effects.

Insulin and glucagon. Insulin generally lowers blood glucose; glucagon generally raises it. Both come from pancreatic islet cells of different types.

DIGESTIVE SYSTEM: TRACE THE FOOD PATHWAY



Schematic anatomy. Most nutrient absorption takes place in the small intestine.

2 Hormones and nervous coordination

Thyroid and iodine. Iodine is required for thyroid-hormone production; deficiency can cause goitre, but goitre has other possible causes too.

Adrenaline. Adrenal medulla hormone associated with fight-or-flight responses, including increased heart activity and energy availability.

Pituitary and hypothalamus. Pituitary regulates several endocrine glands, while the hypothalamus links nervous and endocrine control; 'master gland' is a simplification.

Reflex action. A rapid involuntary response follows a reflex pathway; some reflexes are mediated through the spinal cord, others through the brain.

Nervous-system divisions. Central: brain and spinal cord; peripheral: associated nerves. Cerebellum supports coordination and balance; medulla regulates vital functions.

1 Nutrition and deficiency pairs

Energy nutrients	Carbohydrates and proteins yield about 4 kcal/g; fats about 9 kcal/g in standard food-energy calculations.
Vitamin A	Deficiency can cause night blindness and other eye changes; carrots supply beta-carotene, a vitamin-A precursor.
Vitamin B_1	Thiamine deficiency causes beriberi; do not confuse it with niacin deficiency, associated with pellagra.
Vitamin C	Deficiency causes scurvy; vitamin C supports collagen formation and can aid absorption of non-haem iron.
Vitamin D	Deficiency can cause rickets in children and osteomalacia in adults; it supports calcium/phosphate regulation.

2 Vitamins, minerals and diet

Vitamin K	Required for normal production of several clotting proteins; not the same substance as the mineral potassium, whose symbol is K.
Mineral pairs	Iron → haemoglobin; iodine → thyroid hormones; calcium/phosphorus → bones and teeth, alongside other essential roles.
Protein-energy malnutrition	Kwashiorkor and marasmus are classic severe-malnutrition syndromes; their real causes and presentations are more complex than one-nutrient slogans.
Balanced diet	Must provide energy, essential nutrients, fibre and water appropriate to age/activity; more calories alone do not ensure good nutrition.
Fibre	Supports normal bowel function and other health benefits; it is not digested like starch by human small-intestinal enzymes.

1 Human-body quick pairs

Skeleton	A typical adult has 206 bones; counts vary with age and individual variation. Tendons join muscle to bone; ligaments join bone to bone.
Bone superlatives	Femur is the longest bone; stapes in the middle ear is the smallest. Superlatives refer to the typical adult human skeleton.
Body covering and gland	Skin is the largest organ by common whole-body treatment; liver is the largest internal solid organ and a major gland.
Bile and urea	Liver produces bile and forms urea from nitrogenous waste; kidneys excrete urea in urine.
Blood-cell lifespan	Typical circulating human red cells survive about 120 days; white-cell lifespans vary greatly by type.

2 Organs and biological pairs

Diaphragm	Muscular partition between chest and abdomen; contraction assists inhalation by increasing thoracic volume.
Enamel	Tooth enamel is highly mineralised and the body's hardest tissue; it is not living bone tissue.
Hormone-gland pairs	Growth hormone: anterior pituitary; thyroxine: thyroid; insulin: pancreas; adrenaline: adrenal medulla.
Female reproductive sites	Fertilisation usually occurs in a fallopian tube; implantation normally occurs in the uterine lining. These are different events and places.
Immune-cell distinction	Antibodies are produced by plasma cells derived from B lymphocytes; phagocytes engulf material. Not all white cells perform the same function.

1 Diseases, vectors and immunity

Malaria. Caused by Plasmodium parasites; transmitted mainly by infected female Anopheles mosquitoes, not by all mosquitoes.

Dengue and chikungunya. Viral infections commonly spread by infected Aedes mosquitoes; the vector is not the disease-causing pathogen.

Tuberculosis. Bacterial disease caused mainly by Mycobacterium tuberculosis; commonly spreads through airborne infectious particles.

Cholera and typhoid. Bacterial diseases associated with contaminated food/water; the organisms are Vibrio cholerae and Salmonella Typhi, respectively.

Rabies and AIDS. Rabies is viral and commonly transmitted through infected-animal saliva; AIDS results from HIV infection, not ordinary social contact.

2 Treatment, prevention and spread

Ringworm. Fungal infection despite the name; it is not caused by an actual worm.

Antibiotics. Target susceptible bacteria; they do not directly treat viral infections. Inappropriate use promotes antimicrobial resistance.

Vaccination. Trains adaptive immune responses and memory; passive immunity supplies ready-made antibodies and is usually temporary.

Smallpox milestone. WHO declared smallpox eradicated in 1980; its causative agent was variola virus.

Endemic, epidemic, pandemic. Endemic: usual regional presence; epidemic: excess occurrence in a population; pandemic: widespread epidemic across countries/continents.

1 Plants, reproduction and ecosystems

Photosynthesis recall. Uses light energy to build organic compounds from CO_2 and water; released oxygen originates from water.

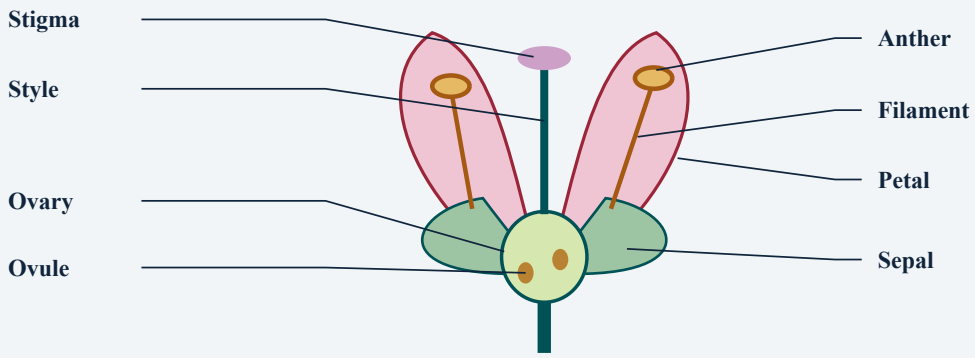
Respiration versus breathing. Cellular respiration releases usable energy from substrates; breathing ventilates respiratory surfaces. Plants also respire.

Stomata and transpiration. Stomata regulate gas exchange and water loss; guard cells control opening. Transpiration helps water transport and cooling.

Tropisms. Phototropism responds to light; gravitropism to gravity; growth responses differ from an animal's locomotion.

Pollination versus fertilisation. Pollination transfers pollen to a receptive stigma; fertilisation fuses gametes. Neither word means seed dispersal.

FLOWER: OVULE BECOMES SEED; OVARY BECOMES FRUIT



Simplified longitudinal section. The pistil includes stigma, style and ovary; the stamen includes anther and filament.

2 Reproduction and ecosystem energy

Flower-to-fruit pair. After fertilisation, the ovule generally develops into a seed and the ovary into a fruit; accessory tissues may also contribute.

Reproduction contrasts. Asexual reproduction uses no gamete fusion; sexual reproduction combines genetic material and commonly increases variation.

Food-chain direction. Arrows show energy transfer from food to consumer; decomposers recycle nutrients rather than sending energy back to the Sun.

Ecological energy. Energy flow is one-way; nutrients cycle. The '10% law' is a useful approximate trophic-transfer model, not an exact universal constant.

Biomagnification. Some persistent pollutants increase in concentration up food chains; this differs from nutrient enrichment of water, called eutrophication.

1 Living and non-living: the basis of life

Metabolism. The coordinated chemical reactions of a living organism include building up and breaking down substances. A single reaction outside an organism is not itself a living organism.

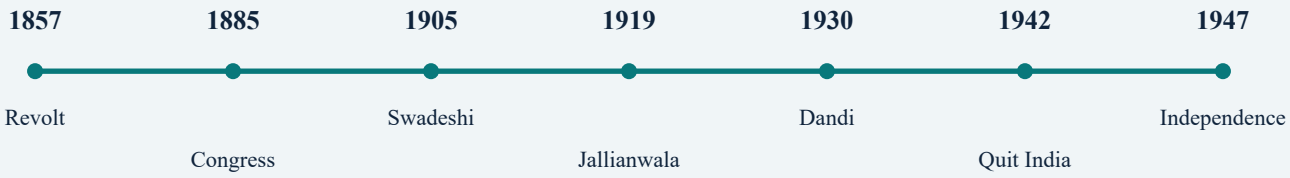
Growth is not enough. Living growth involves internal biological activity; crystals can grow by external deposition. An increase in size alone does not establish that something is alive.

Movement and response. A moving vehicle is not alive, while a rooted plant is living. Living organisms respond to stimuli; locomotion is not a universal test of life.

Protoplasm. A traditional term for the living contents of a cell; in a nucleated cell it includes the cytoplasm and nucleus. It is not another name for the cell wall.

History and Culture

NATIONAL MOVEMENT: FIX THE CHRONOLOGY



Selected milestones; schematic spacing, not a chronological scale.

Remember. Keep event, year and person together; similar names often belong to different periods.

1 Ancient India: sites, texts and ideas

Harappan chronology. The mature Harappan phase is conventionally dated about 2600-1900 BCE; Harappa and Mohenjo-daro are in present-day Pakistan.

Harappan site pairs. Dholavira and Lothal: Gujarat; Kalibangan: Rajasthan; Rakhigarhi: Haryana. Mohenjo-daro is associated with the Great Bath.

Harappan economy. Urban settlements used standardised weights, craft production and long-distance trade; their script remains undeciphered.

Vedic texts. Rigveda: hymns; Samaveda: chants; Yajurveda: sacrificial formulae; Atharvaveda: varied hymns and spells. Upanishads develop philosophical enquiry.

Mahajanapadas. Sixteen major states are described in early Buddhist traditions; Magadha rose around the middle Ganga region.

2 Buddhist and Jain traditions

Buddha's life places. Lumbini: birth; Bodh Gaya: enlightenment; Sarnath: first sermon; Kushinagar: mahaparinirvana.

Buddhist core. Four Noble Truths and the Eightfold Path; the Tripitaka is a major canonical collection in the Pali tradition.

Jainism. Mahavira is the twenty-fourth Tirthankara; Rishabhanatha is traditionally the first. Ahimsa is central to Jain ethics.

Jain vows. Nonviolence, truthfulness, non-stealing, non-possession and celibacy; do not confuse Jain Tirthankaras with Buddhist councils.

Early-language distinction. Pali is especially associated with Theravada Buddhist texts; Prakrits with many early Jain texts; Sanskrit has a wider literary/religious range.

1 Mauryas, Guptas and southern kingdoms

Mauryan foundation. Chandragupta Maurya founded the dynasty; Chanakya/Kautilya is associated with his statecraft tradition and the Arthashastra.

Ashoka and Kalinga. Ashoka's Kalinga conquest is conventionally placed around 261 BCE; Rock Edict XIII discusses the war and its consequences.

Ashokan inscriptions. Most edicts use Prakrit and Brahmi; some northwestern inscriptions use Kharosthi, Greek or Aramaic.

Megasthenes. Greek envoy associated with Chandragupta Maurya's court; his account is known as Indica through later fragments.

Gupta associations. Samudragupta: Prayaga/Allahabad pillar inscription by Harishena; Chandragupta II: traditionally associated with the title Vikramaditya.

2 Scholars, travellers and southern kingdoms

Classical scholars. Kalidasa: Sanskrit literature; Aryabhata: mathematics/astronomy; Charaka: medicine; Sushruta: surgery tradition.

Travel accounts. Faxian visited during the Gupta period; Xuanzang visited during Harsha's reign. They were different Chinese travellers.

Sangam literature. Early Tamil literary tradition associated with the Chera, Chola and Pandya regions; not a single royal chronicle.

Chola administration. Rajaraja I built the Brihadisvara temple at Thanjavur; Rajendra I expanded Chola power, including overseas expeditions.

Pallava and Chalukya sites. Mamallapuram is associated with Pallavas; Badami, Aihole and Pattadakal with early Chalukyas.

1 Sultanate, Mughals and regional powers

Delhi Sultanate order. Mamluk/Slave → Khalji → Tughlaq → Sayyid → Lodi. The Sultanate preceded Mughal rule in Delhi.

Iltutmish and Razia. Iltutmish consolidated early Sultanate rule; Razia ruled Delhi as Sultan in the thirteenth century.

Alauddin Khalji. Associated with market regulations, military expansion and measures to strengthen central control.

Muhammad bin Tughlaq. Associated with the Daulatabad capital-transfer experiment and token currency; Firoz Shah Tughlaq is a different ruler.

First Battle of Panipat. 1526: Babur defeated Ibrahim Lodi; Mughal rule began. Second: 1556, Akbar's forces defeated Hemu.

2 Mughals and regional powers

Akbar. Introduced the mansabdari framework and pursued sulh-i kul; his court historian Abul Fazl wrote Akbarnama and Ain-i Akbari.

Mughal monuments. Humayun's Tomb: Delhi; Taj Mahal: Agra, commissioned by Shah Jahan; Buland Darwaza: Fatehpur Sikri, associated with Akbar.

Sher Shah Suri. Associated with administrative and road reforms and a standard silver rupiya; his Sur rule interrupted early Mughal rule.

Vijayanagara. Founded in 1336 by Harihara and Bukka; Krishnadevaraya belonged to the Tuluva dynasty. Talikota: 1565.

Maratha rise. Shivaji was crowned in 1674 at Raigad; the Ashtapradhan was his council of eight ministers.

1 Culture, faith and reform traditions

Bhakti associations. Kabir criticised ritual divisions; Mirabai expressed devotion to Krishna; Tulsidas composed Ramcharitmanas in Awadhi.

Sikh Gurus. Guru Nanak founded the Sikh tradition; Guru Gobind Singh founded the Khalsa in 1699 and was the tenth human Guru.

Sufi traditions. Chishti and Suhrawardi were influential orders; a khanqah was a Sufi centre, not a Buddhist monastery.

Temple-style recall. Nagara: broadly northern; Dravida: broadly southern; Vesara: mixed/developed Deccan traditions. Real monuments show regional variation.

Rock-cut and stupa sites. Ajanta: largely Buddhist caves and paintings; Ellora: Buddhist, Hindu and Jain caves; Sanchi: celebrated Buddhist stupas.

2 Dance, education and social reform

Classical dance pairs. Bharatanatyam: Tamil Nadu; Kathakali/Mohiniyattam: Kerala; Kuchipudi: Andhra Pradesh; Odissi: Odisha; Sattriya: Assam.

More dance pairs. Kathak: northern India; Manipuri: Manipur. Folk dances and classical forms are different categories.

Reform organisations. Brahmo Samaj: Raja Rammohan Roy, 1828; Arya Samaj: Dayanand Saraswati, 1875.

Education and service. Aligarh movement: Sir Syed Ahmad Khan; Ramakrishna Mission: Swami Vivekananda, 1897.

Social reform legislation. Sati abolition in Bengal: 1829, under William Bentinck; Hindu Widows' Remarriage Act: 1856, associated with Vidyasagar's campaign.

1 Company rule and the revolt of 1857

European arrivals. Vasco da Gama reached Calicut in 1498; the English East India Company received its charter in 1600.

Plassey and Buxar. Plassey: 1757; Buxar: 1764. Diwani rights over Bengal, Bihar and Orissa followed in 1765.

Land-revenue systems. Permanent Settlement: zamindars; Ryotwari: cultivator settlement; Mahalwari: village/estate-based assessment. Regional practice varied.

Subsidiary alliance versus lapse. Subsidiary alliance is associated with Wellesley; Doctrine of Lapse with Dalhousie. They were different expansion methods.

1857 outbreak. The uprising began at Meerut on 10 May 1857 before rebels moved to Delhi; causes extended beyond the cartridge controversy.

2 Resistance, rule and economic critique

1857 leadership pairs. Delhi: Bahadur Shah II; Kanpur: Nana Sahib; Jhansi: Lakshmibai; Lucknow: Begum Hazrat Mahal; Bihar: Kunwar Singh.

1858 transfer. Government of India Act 1858 transferred rule from the Company to the British Crown; Company rule and British rule are not identical periods.

Early colonial regulation. Regulating Act: 1773; Pitt's India Act: 1784. The former created the Governor-General of Bengal's office.

Economic critique. Dadabhai Naoroji articulated the drain-of-wealth critique; R.C. Dutt also analysed colonial economic effects.

Peasant and tribal resistance. Indigo revolt: 1859-60; Santhal uprising: 1855-56; Birsa Munda's movement arose in the Chotanagpur region.

1 National movement: 1885-1919

Congress foundation. Indian National Congress first met at Bombay in 1885; first president: W.C. Bonnerjee; A.O. Hume helped organise it.

Moderate versus extremist phase. Naoroji, Gokhale and Pherozeshah Mehta are associated with Moderates; Lal-Bal-Pal with assertive nationalism.

Bengal partition and Swadeshi. Partition announced under Curzon in 1905; Swadeshi/boycott expanded in protest; partition was annulled in 1911.

Muslim League and Surat. All-India Muslim League founded at Dacca in 1906; Congress split at Surat in 1907.

Home Rule. Tilak and Annie Besant launched separate Home Rule Leagues in 1916; Lucknow Pact also belongs to 1916.

2 Gandhi, reforms and resistance

Gandhi's early campaigns. Champaran: 1917, indigo cultivators; Ahmedabad mill strike and Kheda campaign: 1918.

Rowlatt Act. 1919 legislation extended extraordinary detention/trial powers; Gandhi organised opposition to it.

Jallianwala Bagh. 13 April 1919, Amritsar; troops under Brigadier-General Reginald Dyer fired on the gathering.

Constitutional reforms of 1919. Government of India Act 1919 introduced provincial dyarchy; do not confuse it with 1935 provincial autonomy.

Revolutionary associations. Ghadar movement grew among overseas Indians; Hindustan Socialist Republican Association is associated with Bhagat Singh and colleagues.

1 National movement: 1920-1947

Non-Cooperation. Launched in 1920; Gandhi suspended it in 1922 after the Chauri Chaura violence.

Simon Commission. Appointed in 1927, arrived in 1928; opposition highlighted its lack of Indian members.

Lahore Congress. 1929 session under Jawaharlal Nehru adopted the complete-independence goal; 26 January 1930 was observed as Independence Day.

Salt Satyagraha. Gandhi's Dandi March: 1930; Civil Disobedience challenged the salt laws and wider colonial authority.

Gandhi-Irwin Pact. 1931; Gandhi then attended the Second Round Table Conference, not all three conferences.

2 From the Poona Pact to independence

Poona Pact. 1932 agreement between Ambedkar and Gandhi's side provided reserved seats within joint electorates, replacing the separate-electorate arrangement for Depressed Classes.

Government of India Act 1935. Provided provincial autonomy and a proposed federation; the federation did not come into operation as planned.

Quit India. Congress adopted the resolution at Bombay in August 1942 after the Cripps Mission failed; 'Do or Die' is associated with it.

INA leadership. Mohan Singh organised the first INA in 1942; Subhas Chandra Bose later reorganised and led it and the Azad Hind government.

Transfer of power. Cabinet Mission: 1946; Mountbatten Plan: 3 June 1947; Indian Independence Act: 1947; independence: 15 August 1947.

1 World changes and post-independence foundations

Renaissance. European cultural/intellectual revival with a major Italian beginning; not identical to the later Industrial Revolution.

American independence. Declaration: 1776; US Constitution drafted: 1787. Independence and constitutional adoption are different milestones.

French Revolution. Began in 1789; associated with liberty, equality and fraternity and challenges to the old social order.

Industrial Revolution. Began in Britain; mechanised production, steam power and factory organisation transformed industry and society.

Russian Revolution. 1917: February Revolution ended Tsarist rule; October Revolution brought Bolsheviks to power under Lenin, using the old Russian calendar labels.

2 War and independent India

World wars. First: 1914-18; Second: 1939-45. League of Nations followed the First; United Nations followed the Second.

Integration of India. Sardar Vallabhbhai Patel and V.P. Menon played central roles in integrating princely states after independence.

Gandhian ideas. Sarvodaya means welfare/uplift of all; Gandhi developed the idea through, among other influences, Ruskin's Unto This Last.

Bhoodan. Vinoba Bhave began the land-gift movement at Pochampally in 1951; voluntary land donation was its central method.

Community development. Community Development Programme: 1952; Balwant Rai Mehta Committee: 1957; Panchayati Raj inaugurated at Nagaur, Rajasthan, in 1959.

1 Books, newspapers and authors

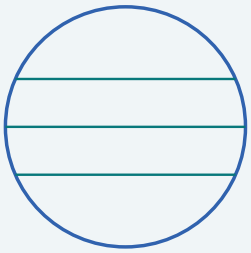
Gandhi's works	Hind Swaraj: M.K. Gandhi; he edited Young India, Navajivan and Harijan during different periods.
Nehru's books	The Discovery of India and Glimpses of World History: Jawaharlal Nehru; India Wins Freedom: Maulana Abul Kalam Azad.
Tagore and Bankim	Gitanjali: Rabindranath Tagore; Anandamath: Bankim Chandra Chattopadhyay. Their national-song associations are different.
Tilak's press	Kesari was in Marathi; The Mahratta in English. Both are associated with Tilak's nationalist journalism.
Economic-nationalist writing	Poverty and Un-British Rule in India: Dadabhai Naoroji; economic drain was a major theme of nationalist critique.

2 Texts, travellers and literary associations

Early nationalist press	Bengal Gazette/Hicky's Gazette began in 1780; it is commonly identified as India's first printed newspaper.
Ancient literary pairs	Abhijnanasakuntalam: Kalidasa; Harshacharita: Banabhatta; Rajatarangini: Kalhana.
Sultanate and Mughal accounts	Baburnama: Babur; Akbarnama: Abul Fazl; Tughlaq-era travel observations are associated with Ibn Battuta.
Travellers' context	Al-Biruni studied Indian society and learning; Ibn Battuta visited during Muhammad bin Tughlaq's reign. They belong to different centuries.
More author pairs	Unhappy India: Lala Lajpat Rai; The Indian Struggle: Subhas Chandra Bose; these are different works and authors.

Geography and Environment

LATITUDE LOCATES; LONGITUDE SETS LOCAL SOLAR TIME



Schematic globe

15° = 1 hour; 1° = 4 minutes

East: later clock time. West: earlier.

82½° E ÷ 15 = 5½ hours

IST = UTC + 05:30

Remember. Longitude sets the clock: 1° = 4 minutes; east is ahead in local solar time.

1 Earth, coordinates and time

Latitude versus longitude. Latitude measures north/south angular distance from the equator; longitude measures east/west distance from the prime meridian.

Important parallels. Equator: 0°; tropics: about 23½° N/S; polar circles: about 66½° N/S. These are approximate school values.

Longitude-time shortcut. Earth turns 360° in about 24 hours: 15° per hour, 1° per 4 minutes; east is ahead in local solar time.

Indian Standard Time. Based on 82°30′ E; IST = UTC + 5 hours 30 minutes. India uses one official standard time.

Date Line. Approximately follows 180° with political deviations; westward crossing normally adds a day, eastward crossing subtracts one.

2 Seasons and the rotating Earth

Seasons. Caused mainly by Earth's axial tilt and revolution, not simply by Earth-Sun distance.

Solstice versus equinox. Solstices mark extreme solar declination; equinoxes bring nearly equal day/night lengths, not exactly equal everywhere.

Northern-season sequence. June solstice: northern summer; December solstice: northern winter. Southern seasons are reversed.

Rotation effects. Day/night and apparent daily sky motion; Coriolis deflection is right in the Northern Hemisphere and left in the Southern.

Great circles. Divide a sphere into equal hemispheres; the equator is a great circle, while other latitude circles are smaller circles.

1 Solar system and Earth's interior

Planet order. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune; terrestrial planets are the inner four.

Planet contrasts. Venus is hotter on average than Mercury because of its strong greenhouse effect; Jupiter is the largest planet.

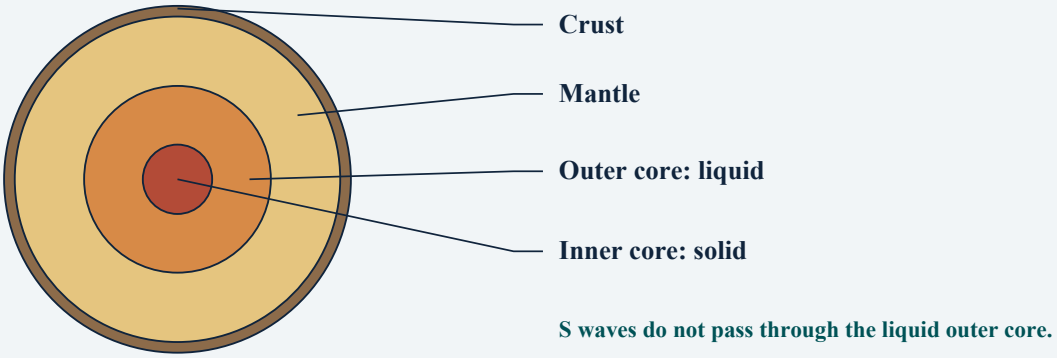
Small bodies. Asteroid: rocky/metallic body; comet: volatile-rich body; meteor: atmospheric light streak; meteorite: surviving material reaching the ground.

Eclipse geometry. Solar: Moon between Sun and Earth; lunar: Earth between Sun and Moon. Alignment and orbital tilt determine whether an eclipse occurs.

Moon phase trap. New moon permits a solar eclipse and full moon permits a lunar eclipse; neither phase guarantees an eclipse every month.

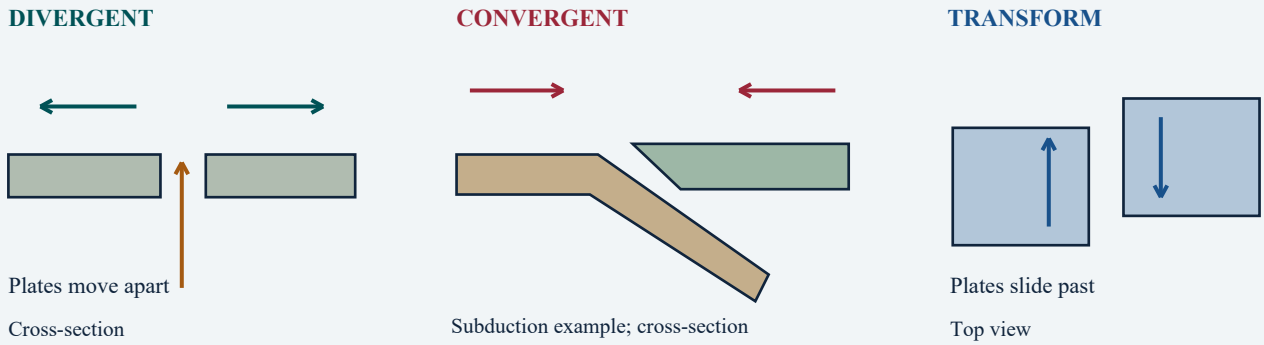
Distance units. Astronomical unit: Earth-Sun orbital-distance reference; light-year: distance travelled by light in one year, not a time unit.

INSIDE EARTH: THE OUTER CORE IS LIQUID



Schematic cross-section; crust thickness exaggerated. Layer thicknesses are not to scale.

THREE PLATE BOUNDARIES: CHECK THE MOTION



Schematic; continental collision is another kind of convergence. Not all convergent boundaries look identical.

2 Read the evidence inside Earth

Earth layers. Crust → mantle → core; outer core is liquid and inner core is solid in the standard model.

Seismic waves. P waves travel through solids and fluids; S waves do not propagate through liquids. Their paths reveal Earth's interior.

Plate tectonics. Divergent boundaries separate plates; convergent boundaries bring them together; transform boundaries involve mainly sideways motion.

Earthquake terms. Focus/hypocentre: origin within Earth; epicentre: surface point above it. Magnitude and observed intensity are different measures.

1 Landforms, rocks and drainage

Rock cycle. Igneous: cooled molten material; sedimentary: consolidated sediments or chemical/biological deposits; metamorphic: transformed by heat/pressure without complete melting.

Rock examples. Granite/basalt: igneous; sandstone/limestone: sedimentary; marble/slate: metamorphic.

Weathering versus erosion. Weathering breaks material down in place; erosion removes and transports it. Deposition lays transported material down.

River work. Upper-course vertical erosion favours valleys; deposition helps build floodplains, levees and deltas where conditions permit.

Delta versus estuary. A delta is a depositional river-mouth landform; an estuary is a tidal river-mouth system, not necessarily a delta.

2 Landforms and Indian relief

Glacial landforms. U-shaped valleys, cirques and moraines are classic glacial features; V-shaped valleys are commonly associated with river erosion.

Wind landforms. Dunes result from deposition; mushroom rocks and deflation hollows illustrate wind-related erosion processes.

Groundwater and karst. Limestone dissolution can form caves and sinkholes; stalactites hang from roofs, stalagmites grow upward from floors.

India's relief divisions. Himalayas, Northern Plains, Peninsular Plateau, Indian Desert, coastal plains and islands form a useful broad classification.

Mountain contrasts. Himalayas are geologically young fold mountains; the Peninsular Plateau contains much older rocks and land surfaces.

1 Atmosphere, weather and climate

Atmospheric layers. Troposphere: most weather; stratosphere: ozone-rich zone; mesosphere: many meteors burn; thermosphere includes much ionospheric activity.

Lapse-rate caution. Temperature usually decreases with height in the troposphere, but inversions reverse this locally; one rate does not fit all layers.

Pressure belts. Equatorial low, subtropical highs, subpolar lows and polar highs are idealised global belts that shift seasonally.

Planetary winds. Trades blow toward equatorial lows; westerlies dominate many mid-latitudes; polar easterlies originate near polar highs.

Cyclone versus anticyclone. Northern Hemisphere: cyclonic flow is generally anticlockwise around low pressure; anticyclonic flow is clockwise around high pressure.

2 Moisture, rain and local weather

Humidity and dew point. Relative humidity compares actual water vapour with saturation at that temperature; dew point is the cooling temperature for saturation.

Rainfall types. Convectional: rising heated air; orographic: air forced over relief; frontal/cyclonic: air-mass interaction and uplift.

Fog versus cloud. Both contain suspended tiny water droplets or ice; fog is essentially cloud at or near the surface.

Land and sea breezes. Day: sea-to-land surface breeze is common; night: land-to-sea, driven by differential heating and pressure differences.

Weather versus climate. Weather is short-term atmospheric state; climate describes longer-term patterns and statistics, not one unusual season.

1 Oceans, monsoons and Indian climate

Ocean salinity. About 35 parts per thousand is a useful mean open-ocean reference; local salinity varies with evaporation, rainfall, rivers and ice.

Tides. Mainly driven by Moon/Sun gravity; spring tides near new/full moon have greater range, neap tides near quarter phases smaller range.

Currents. Warm/cold describe relative thermal influence: Gulf Stream is warm; Labrador and Humboldt/Peru currents are cold.

Monsoon mechanism. Seasonal circulation changes involve land-sea heating contrasts, migrating rain belts, topography and ocean-atmosphere interactions.

Southwest monsoon. Arabian Sea and Bay of Bengal branches deliver most of India's annual rainfall; local timing and totals vary.

2 Regional climate and variability

Northeast monsoon. Important for autumn/early-winter rain on the Tamil Nadu coast; it is not India's main summer southwest-monsoon season.

Western disturbances. Extratropical systems bring winter rain/snow to northwestern India and the Himalayas; useful for many rabi crops.

Rain shadow. Leeward regions often receive less orographic rain; the Deccan east of the Western Ghats illustrates this effect.

El Niño and La Niña. Warm and cool phases of tropical Pacific variability, respectively; they influence weather but do not alone determine every Indian monsoon outcome.

Tropical cyclones. Need suitable warm-ocean and atmospheric conditions; Coriolis influence is weak near the equator, limiting formation there.

1 Indian rivers, passes and islands

Ganga origin names. Bhagirathi and Alaknanda meet at Devprayag; downstream the combined river is called Ganga.

Ganga tributaries. Yamuna joins at Prayagraj; Ghaghara, Gandak and Kosi are major Himalayan tributaries. Son joins from the peninsular side.

Brahmaputra names. Yarlung Tsangpo in Tibet; Siang/Dihang in Arunachal Pradesh; Brahmaputra in Assam; Jamuna in Bangladesh.

Indus system. Jhelum, Chenab, Ravi, Beas and Sutlej are major tributaries; the Indus system drains mainly toward the Arabian Sea.

Peninsular rivers. Godavari, Krishna, Kaveri and Mahanadi generally flow east; Narmada and Tapi flow west through rift-related valleys.

2 River dams, passes and islands

River-dam pairs. Bhakra: Sutlej; Hirakud: Mahanadi; Tehri: Bhagirathi; Sardar Sarovar: Narmada.

Pass pairs. Zoji La: Kashmir-Ladakh route; Nathu La: Sikkim; Shipki La: Himachal Pradesh. Pass locations matter more than name recognition alone.

Ghats. Western Ghats are generally more continuous; Eastern Ghats are interrupted by major rivers. The Nilgiri region links their southern systems.

Island groups. Andaman and Nicobar lie in the Bay of Bengal; Lakshadweep lies in the Arabian Sea and is mainly coral atolls/reefs.

Channels and straits. Ten Degree Channel separates Andaman/Nicobar groups; Palk Strait lies between India and Sri Lanka; Malacca links Indian/Pacific sea routes.

3 Channels, coasts and geographic pairs

Lakshadweep channels. Nine Degree Channel separates Minicoy from the main Lakshadweep group; Eight Degree Channel lies between Minicoy and the Maldives.

Tropic of Cancer in India. Gujarat, Rajasthan, Madhya Pradesh, Chhattisgarh, Jharkhand, West Bengal, Tripura and Mizoram, broadly west to east.

Coastal-region pairs. Konkan: broadly Maharashtra-Goa coast; Malabar: broadly Kerala coast; Coromandel: southeastern peninsular coast.

Coast and river-mouth trap. A west-flowing Indian river need not form a delta; Narmada and Tapi are standard estuary examples.

1 Soils, farming, minerals and industry

Alluvial soils. Widespread in northern plains and river valleys; khadar is newer alluvium, bhangar older alluvium.

Black soils. Often clay-rich with high moisture retention; strongly associated with Deccan basalt regions and cotton cultivation.

Red and laterite soils. Red colour often reflects iron compounds; laterite develops under intense leaching in warm, wet conditions.

Crop seasons. Kharif: generally monsoon-sown; rabi: generally winter-sown; zaid: shorter summer season between major crops.

Crop-climate pairs. Rice: generally warm/wet; wheat: cooler growth period and dry ripening; tea: humid conditions with well-drained soils.

2 Resources, industry and ports

Millet recall. Jowar: sorghum; bajra: pearl millet; ragi: finger millet. Many millets tolerate relatively dry conditions.

Plantation and fibre pairs. Rubber: warm/humid; coffee: often shaded uplands; jute: warm humid deltaic areas; cotton: warm frost-free growing season.

Mineral-region pairs. Coal: Damodar valley belts; iron ore: Odisha-Jharkhand-Chhattisgarh and other belts; bauxite: several plateau regions including Odisha.

Industry-location logic. Raw materials, power, labour, transport, markets and policy all matter; iron/steel is not located by coal alone.

Port pairs. Deendayal/Kandla: Gujarat; Paradip: Odisha; Visakhapatnam: Andhra Pradesh; Kochi: Kerala; Chennai: Tamil Nadu.

1 Ecology, conservation and environmental agreements

Ecosystem roles. Producers fix energy; consumers obtain it by feeding; decomposers recycle nutrients. Energy is not recycled in the same way as matter.

Biodiversity levels. Genetic, species and ecosystem diversity; a hotspot combines exceptional endemism with severe habitat loss under defined criteria.

India-linked hotspots. Himalaya, Indo-Burma, Western Ghats-Sri Lanka and Sundaland include parts of India; the Indian Sundaland component includes Nicobar Islands.

In-situ versus ex-situ. In-situ protects organisms in natural habitats; ex-situ includes suitable zoos, botanical gardens and seed/gene banks.

Protected-area distinctions. National parks, wildlife sanctuaries and biosphere reserves have different legal/management frameworks; their names are not interchangeable.

2 Agreements and environmental distinctions

Ramsar Convention. Concerns conservation and wise use of wetlands; Ramsar designation is not the same as national-park status.

Montreal versus Paris. Montreal Protocol addresses ozone-depleting substances; Paris Agreement addresses climate change under the UNFCCC framework.

CITES. Regulates international trade in listed wild animals/plants and their products; it does not simply ban all wildlife trade.

Pollution contrasts. Bioaccumulation: buildup within an organism; biomagnification: increasing concentrations along food chains; eutrophication: nutrient enrichment of water.

Sustainable development. Meeting present needs without compromising future generations is the standard guiding idea; conservation includes resource use as well as protection.

1 Major natural regions and vegetation

Equatorial rainforest	Warm conditions and rainfall throughout the year support dense evergreen forests. There is no marked dry season in the equatorial wet type.
Savanna	A tropical wet-and-dry regime supports extensive grasses with scattered trees. Seasonal rainfall distinguishes it from equatorial rainforest.
Desert	Aridity is the defining feature; deserts can be hot or cold. Sparse rainfall and high moisture stress limit vegetation.
Mediterranean region	Typically has dry summers and wetter winters; drought-resistant shrubs and trees are characteristic. Do not reverse its rainfall seasons.
Tundra	A short growing season supports low vegetation such as mosses and lichens. It differs from the permanently ice-covered polar ice-cap type.
Indian vegetation pairs	Wet Western Ghats and Andaman-Nicobar regions: tropical evergreen forests; dry Rajasthan: thorn vegetation; suitable tidal coastal areas: mangroves. Himalayan vegetation changes with altitude.

Indian Polity and Governance

THREE PARTS, THREE DIFFERENT FUNCTIONS

PART III	PART IV	PART IVA
Fundamental Rights	**Directive Principles**	**Fundamental Duties**
Enforceable rights	Guides to governance	Duties of citizens

Directive Principles are not directly court-enforceable like Fundamental Rights.

Remember. 73rd = rural; 74th = urban. Eleventh Schedule = 29 matters; Twelfth = 18.

1 Constitutional foundations

Constitution-making dates. Constituent Assembly first met on 9 December 1946; Constitution adopted on 26 November 1949; major provisions commenced on 26 January 1950.

Assembly leadership. Rajendra Prasad chaired the Constituent Assembly; B.R. Ambedkar chaired its Drafting Committee. These were different offices.

Preamble keywords. Sovereign, socialist, secular, democratic republic; socialist, secular and integrity were added by the Forty-second Amendment, 1976.

Federal structure. Article 1 calls India a Union of States; the Constitution combines federal division with significant Union powers.

Constitutional supremacy. Ordinary law must conform to the Constitution; Parliament can amend it subject to constitutional procedure and the basic-structure doctrine.

2 Institutions, schedules and amendments

Parliamentary government. The executive is accountable to the legislature; at Union level, the Council of Ministers is collectively responsible to Lok Sabha.

Borrowed-feature pairs. Parliamentary conventions: British influence; Fundamental Rights: US influence; Directive Principles: Irish influence; Concurrent List: Australian influence.

Schedules recall. Eighth: scheduled languages; Tenth: anti-defection; Eleventh: Panchayat subjects; Twelfth: municipal subjects.

Seventh Schedule. Union, State and Concurrent Lists divide legislative subjects; residuary legislative power belongs to Parliament under the constitutional scheme.

Amendment route. Article 368 governs major constitutional amendments; some changes also require ratification by at least half the State legislatures.

1 Rights, duties and guiding principles

Part III versus Part IV. Fundamental Rights are enforceable through constitutional remedies; Directive Principles guide governance but are not directly enforceable by courts.

Equality cluster. Article 14: equality before law/equal protection; 15: prohibited discrimination; 16: equality of opportunity in public employment, subject to constitutional provisions.

Articles 17 and 18. 17 abolishes untouchability; 18 deals with abolition of titles, with stated exceptions such as military/academic distinctions.

Freedom and personal liberty. Article 19 protects specified citizen freedoms; Article 21 protects life/personal liberty of persons, not citizens alone.

Education. Article 21A provides free and compulsory education for children aged 6-14, in the manner determined by law.

2 Remedies, duties and guiding principles

Exploitation and religion. Articles 23-24 address trafficking/forced labour and child labour; Articles 25-28 concern religious freedom, with qualifications.

Constitutional remedies. Article 32: Supreme Court enforcement of Fundamental Rights; Article 226: High Court writ powers, including other legal rights.

Property right. Article 300A protects against deprivation of property except by authority of law; property is no longer a Fundamental Right.

Fundamental Duties. Article 51A, Part IVA; originally ten duties added in 1976, with an eleventh added by the Eighty-sixth Amendment, 2002.

DPSP associations. Equal justice/legal aid: Article 39A; village Panchayats: 40; environment: 48A. Duties and Directive Principles are different categories.

1 Parliament and law-making

Parliament's components. President + Rajya Sabha + Lok Sabha; the President is a constitutional component without being a member of either House.

House characteristics. Rajya Sabha is not dissolved; approximately one-third retire every two years. Lok Sabha's normal term is five years unless dissolved earlier.

Age thresholds. Lok Sabha candidate: at least 25; Rajya Sabha candidate: at least 30; voting age: 18, subject to legal eligibility.

Presiding officers. Lok Sabha: Speaker; Rajya Sabha: Vice-President as ex-officio Chairman. The Deputy Chairman is elected by Rajya Sabha.

Money Bill. Article 110 defines it; introduced only in Lok Sabha with the required recommendation; Rajya Sabha has 14 days to return recommendations.

2 Law-making, accountability and the budget

Financial Bill caution. Every Money Bill is a Financial Bill in a broad classification, but not every Financial Bill is a Money Bill.

Joint sitting. Article 108 can resolve specified ordinary-bill deadlocks; not available for Money Bills or Constitution Amendment Bills.

No-confidence motion. Tests support in Lok Sabha; collective ministerial responsibility is not owed to Rajya Sabha in the same way.

Budget terminology. Article 112: Annual Financial Statement; grants are voted in Lok Sabha; charged expenditure is discussed but not voted as a demand for grant.

Anti-defection. Tenth Schedule; the presiding officer decides disqualification subject to judicial review. A party whip is not itself a constitutional amendment.

1 Union and State executives

President. Constitutional head of the Union; ordinarily acts on ministerial advice, with constitutional provisions governing reconsideration and other functions.

Presidential election. Indirect election by elected MPs and elected MLAs of States plus the constitutionally specified UTs of Delhi and Puducherry.

Vice-President. Elected by members of both Houses of Parliament, including nominated members; not by the presidential electoral college.

President qualifications and term. Minimum age 35; normal term five years; impeachment for constitutional violation is governed by Article 61.

Prime Minister. Appointed by the President; other Union ministers are appointed on the Prime Minister's advice.

2 Ministers, ordinances and State executives

Minister's House membership. A minister who is not a member of Parliament for six consecutive months ceases to be a minister, under Article 75(5).

Ordinances. Article 123 gives the President ordinance power under constitutional conditions; ordinances must be laid before Parliament and face time limits.

Governor. Constitutional head of a State, appointed by the President; ordinarily acts on State ministerial advice, with specified discretionary situations.

Chief Minister. Heads the State Council of Ministers, which is collectively responsible to the State Legislative Assembly.

Attorney General. Article 76: chief legal adviser to the Government of India; different from the constitutional auditing office of the CAG.

1 Courts and constitutional bodies

Supreme Court versus High Courts. Supreme Court is the apex court; High Courts head State/territorial judicial systems. Judicial review examines constitutionality and legality.

Judicial retirement ages. Supreme Court judge: 65; High Court judge: 62. Do not exchange these figures.

Writ recall. Habeas corpus: detention; mandamus: public duty; prohibition: restrain jurisdictional excess; certiorari: quash; quo warranto: authority to hold public office.

Advisory jurisdiction. Article 143 permits presidential references to the Supreme Court; an advisory opinion is not an ordinary appeal.

Basic structure. Kesavananda Bharati, 1973: Parliament's amendment power cannot destroy the Constitution's basic structure.

2 Constitutional institutions

Election Commission. Article 324: superintendence/control of elections to Parliament, State legislatures and President/Vice-President; local-body elections have State Election Commissions.

CAG. Article 148 establishes the Comptroller and Auditor General; audits public accounts within the constitutional/statutory framework.

Finance Commission. Article 280; recommends fiscal distributions and related matters. It is not the same as the GST Council or NITI Aayog.

UPSC. A constitutional public-service commission under the Articles 315 onward framework; not the recruiting body for every government post.

Constitutional versus other bodies. ECI, CAG and UPSC are constitutional; NHRC is statutory; NITI Aayog was created by an executive resolution.

1 Federalism, local government and emergencies

Local-government amendments. Seventy-third: Panchayats; Seventy-fourth: municipalities; both passed in 1992 and took effect in 1993.

Gram Sabha. Comprises persons registered on the electoral rolls of a village within the Panchayat area; it is not merely the elected Panchayat.

Local schedules. Eleventh Schedule lists 29 matters; Twelfth lists 18. Actual devolution also depends on the constitutional scheme and State law.

Local-government term. Normally five years; election timing after dissolution and other details follow constitutional provisions.

Women in local bodies. Constitutional minimum reservation is one-third in specified elected local-body seats/offices; many States provide a higher proportion by law.

2 Emergencies and federalism

National Emergency. Article 352: war, external aggression or armed rebellion; the old phrase internal disturbance is not the present ground.

President's Rule. Article 356 addresses failure of constitutional machinery in a State; it differs from a nationwide Article 352 emergency.

Financial Emergency. Article 360 is the relevant provision; it is distinct from an ordinary fiscal deficit or a budget announcement.

Rights during emergency. Articles 20 and 21 are protected from suspension of court enforcement under Article 359; avoid the slogan that every right automatically disappears.

Cooperative federalism. Union-State coordination operates through several institutions; legislative, administrative and financial relations are related but distinct.

Economics and Development

THE DEFICIT THAT EXCLUDES INTEREST

Fiscal deficit	-	Minus interest	=	Primary deficit
₹100 crore		₹30 crore		₹70 crore

Illustrative annual flows. A deficit is not the accumulated stock of public debt.

Remember. Primary deficit = fiscal deficit - interest payments; these are flows, not total debt.

1 National income and basic measures

GDP. Value of final goods/services produced within domestic territory over a period; nationality of the producer is not the defining boundary.

GNI. GDP plus net primary income from abroad; this is the modern national-income counterpart of the older GNP terminology.

Gross versus net. Net measures subtract consumption of fixed capital/depreciation; gross measures do not.

GVA and GDP. GDP at market prices = GVA at basic prices + product taxes - product subsidies.

Nominal versus real. Nominal uses current prices; real uses a price-adjusted measure. Nominal growth is not identical to growth in output volume.

2 Prices, income and economic sectors

GDP deflator. Nominal GDP/real GDP × 100, when both series are consistently defined for the same period.

Per-capita income. Aggregate income divided by population; it does not show income distribution or guarantee equal living standards.

Economic sectors. Primary: direct natural-resource activities; secondary: manufacturing/construction; tertiary: services. Agriculture's share and employment share can differ.

Inflation and purchasing power. A sustained rise in general prices reduces money's purchasing power; an increase in one item's price is not necessarily general inflation.

CPI versus WPI. CPI tracks consumer-price baskets; WPI tracks wholesale goods prices. Their coverage and weights differ; WPI is not a full consumer cost-of-living index.

1 Money, banking and monetary policy

RBI milestones. Began operations on 1 April 1935; nationalised in 1949. It is India's central bank, not a normal retail commercial bank.

Currency issuers. RBI issues banknotes except the Government-issued ₹1 note; coins are minted by Government and distributed through RBI arrangements.

Signatures. RBI banknotes normally bear the Governor's signature; the ₹1 note bears the Finance Secretary's signature.

Repo mechanism. RBI provides liquidity against eligible securities with a repurchase arrangement; a policy-rate change does not instantly alter every loan contract.

CRR versus SLR. CRR: prescribed cash balance with RBI; SLR: prescribed liquid assets held by banks, including eligible cash/gold/securities.

2 Banking and financial institutions

Monetary Policy Committee. Six members: three from RBI and three appointed by the Union Government; the RBI Governor chairs it and has a casting vote in a tie.

Commercial banking. Accepts deposits and extends credit; banks create deposit money through lending within regulatory, funding and risk constraints.

Demand versus time deposits. Demand deposits are withdrawable on demand; time deposits have agreed maturity conditions. Money is broader than currency notes alone.

Institutions. NABARD: agriculture/rural development finance; SIDBI: MSME development finance; SEBI: securities-market regulator.

Banking trap. A bank's liquidity, profitability and solvency are different ideas; a digital payment method is not automatically a separate legal currency.

1 Budget, taxation and public finance

Revenue versus capital receipts. Borrowings create liabilities and are capital receipts; taxes are revenue receipts. Classification depends on the nature of the transaction.

Revenue expenditure. Generally does not directly create a government asset or reduce a liability; capital expenditure may do either, under budget classifications.

Revenue deficit. Revenue expenditure minus revenue receipts; a different measure from the fiscal deficit.

Fiscal deficit. Total expenditure minus revenue receipts and non-debt capital receipts; broadly measures the government's net borrowing requirement.

Primary deficit. Fiscal deficit minus interest payments; do not subtract total debt repayment instead.

2 Taxes, GST and transfers

Direct versus indirect taxes. Income tax is direct; GST is an indirect consumption tax. The person remitting tax and bearing its economic burden can differ.

GST milestone. Constitutional framework: One Hundred and First Amendment, 2016; GST rolled out on 1 July 2017.

GST structure. Intra-State supplies ordinarily involve CGST + SGST/UTGST; inter-State supplies ordinarily involve IGST, subject to legal classifications.

Tax-rate memory. Progressive taxation means the average tax rate rises as income rises. A constant average rate is proportional taxation; collecting more rupees alone does not make a tax progressive.

Subsidy and transfer. A transfer payment is not payment for newly produced government-purchased output; avoid automatically counting it as a direct GDP addition.

1 External sector and development

Exports versus imports. Exports sell domestic output abroad; imports purchase foreign output. A trade deficit concerns goods trade in the usual merchandise measure.

Current account. Covers goods, services, primary income and secondary income/transfers; it is broader than merchandise trade alone.

Exchange-rate terms. Depreciation/appreciation generally describe market movements; devaluation/revaluation describe official changes under a fixed/managed parity framework.

Currency depreciation. Can make imports costlier in domestic currency; export gains depend on demand, costs, invoicing and other conditions.

Balance of payments. Records transactions between residents and nonresidents; residence is an economic concept, not merely citizenship.

2 Investment and development

Foreign investment. FDI implies a lasting interest/influence in an enterprise; portfolio investment concerns securities without the same direct-investment relationship.

Human development. UNDP's HDI combines health, education and income dimensions; GDP alone is not the index.

Poverty and unemployment. Poverty concerns deprivation; unemployment concerns lack of work under specified labour-force definitions. Their measurement methods matter.

Disguised unemployment. Some workers can be removed without materially reducing output in the usual textbook example; different from seasonal unemployment.

Sustainable growth. Economic growth raises output; development includes wider structural and welfare changes, distribution and sustainability.

1 Planning, agriculture and social development

Planning Commission. Established in 1950 by executive resolution; NITI Aayog replaced it in 2015, also through executive action.

First and Second Plans. First: 1951-56, strong agriculture/irrigation emphasis; Second: 1956-61, associated with Mahalanobis and heavy industry.

Plan chronology. Third: 1961-66; annual-plan break: 1966-69; Twelfth: 2012-17. Five-Year Plans are historical frameworks, not the current recurring planning format.

Green Revolution. High-yield varieties, irrigation, fertilisers and supporting institutions raised foodgrain output, especially wheat/rice in early beneficiary regions.

White Revolution. Operation Flood is associated with dairy cooperatives and Verghese Kurien; it is distinct from foodgrain-focused Green Revolution.

2 Agriculture and social development

MSP. Government announces minimum support prices for specified crops; announcement does not mean universal procurement of every farmer's crop.

Public distribution. PDS distributes specified food commodities through an organised public system; food availability and access are different food-security dimensions.

Cooperative principle. Member-owned, democratically controlled enterprise; one-member-one-vote is a common cooperative principle, subject to the applicable legal structure.

Demographic dividend. Potential gain from a favourable working-age population share; education, health and jobs determine whether the potential is realised.

Inclusive development. Financial inclusion concerns useful access and use of financial services; opening an account alone does not settle every access or welfare problem.

Defence and Security

SELECTED RANK EQUIVALENTS: ROWS ARE NOT CONSECUTIVE

ARMY	NAVY	AIR FORCE
Lieutenant	Sub Lieutenant	Flying Officer
Captain	Lieutenant	Flight Lieutenant
Major	Lieutenant Commander	Squadron Leader
Colonel	**Captain**	**Group Captain**

The same word can denote very different seniority in different services.

Remember. A Navy Captain equals an Army Colonel, not an Army Captain. Always read the service.

1 Services, institutions and training

Three armed services. Indian Army, Indian Navy and Indian Air Force have distinct land, maritime and air roles, with increasing joint operations.

Supreme command. The President holds supreme command of the Defence Forces under Article 53, exercised within the constitutional and legal system.

Chief of Defence Staff. Supports jointness and heads the Department of Military Affairs as Secretary; not another name for the Chief of the Army Staff.

NDA. National Defence Academy at Khadakwasla, Pune, provides joint pre-commission training for cadets of the three services.

Army training pair. Indian Military Academy: Dehradun; Officers Training Academy: Chennai. Entry routes and commissioning schemes differ.

2 Institutions and security organisations

Naval and air academies. Indian Naval Academy: Ezhimala, Kerala; Air Force Academy: Dundigal near Hyderabad, Telangana.

DRDO. Defence Research and Development Organisation, formed in 1958, headquartered in New Delhi; works with laboratories, services and industrial partners.

HAL. Hindustan Aeronautics Limited is a major aerospace public-sector enterprise headquartered in Bengaluru; ADA leads Tejas design and HAL is its principal production partner.

Coast Guard. Maritime law-enforcement and safety roles; distinct from the Navy. Coast Guard Day is observed on 1 February.

CAPF distinction. BSF, CRPF, CISF and ITBP operate under the Ministry of Home Affairs; the Army is under the Ministry of Defence.

1 Commissioned-rank equivalents and gallantry

First commissioned ranks	Army Lieutenant ↔ Navy Sub Lieutenant ↔ Air Force Flying Officer.
Next rank pair	Army Captain ↔ Navy Lieutenant ↔ Air Force Flight Lieutenant; a Navy Captain is a much more senior rank than an Army Captain.
Field-officer equivalents	Major ↔ Lieutenant Commander ↔ Squadron Leader; Lieutenant Colonel ↔ Commander ↔ Wing Commander.
Colonel equivalents	Colonel ↔ Captain ↔ Group Captain. Read the service name before interpreting a rank.
One-star equivalents	Brigadier ↔ Commodore ↔ Air Commodore; these are not the chiefs' four-star ranks.

2 Senior ranks and gallantry awards

Two-star equivalents	Major General ↔ Rear Admiral ↔ Air Vice Marshal.
Three-star equivalents	Lieutenant General ↔ Vice Admiral ↔ Air Marshal.
Four-star equivalents	General ↔ Admiral ↔ Air Chief Marshal; exceptional five-star ranks form a separate category.
Gallantry in face of enemy	Param Vir Chakra → Maha Vir Chakra → Vir Chakra, within that award family, highest first.
Gallantry otherwise than face of enemy	Ashoka Chakra → Kirti Chakra → Shaurya Chakra, within that family; the war/peace shorthand is less precise than the award conditions.

1 Platforms, missiles and technical distinctions

Ballistic versus cruise. Ballistic missiles follow a largely ballistic trajectory after powered phases; cruise missiles use sustained aerodynamic flight and propulsion.

Missile-role pairs. Agni/Prithvi: surface-to-surface ballistic families; Akash: surface-to-air; Nag: anti-tank guided missile family.

BrahMos. India-Russia joint cruise-missile programme; a cruise missile is not automatically subsonic.

Pinaka. Multi-barrel rocket-launcher system; do not classify every rocket as a guided ballistic missile.

Tejas. Indian light combat aircraft programme; aircraft manufacturer, designer and user service have different responsibilities.

2 Naval systems and technical distinctions

INS Vikrant. India's first indigenously built aircraft carrier was commissioned in 2022; not India's first aircraft carrier of any origin.

INS Arihant. Indigenously built nuclear-powered ballistic-missile submarine; nuclear propulsion and nuclear armament describe different features.

Submarine contrasts. SSBN: nuclear-powered ballistic-missile submarine; SSN: nuclear-powered attack submarine; conventional submarines use different propulsion arrangements.

Radar versus SONAR. Radar uses electromagnetic waves; SONAR uses sound, commonly for underwater detection/ranging.

Guidance versus propulsion. Guidance controls the flight path; propulsion provides thrust. Range, payload, speed and accuracy are separate performance measures.

1 Days and operations: keep the year attached

Army Day	15 January; commemorates K.M. Cariappa taking over as the first Indian Commander-in-Chief of independent India's Army in 1949.
Air Force Day	8 October; associated with the establishment of the Indian Air Force in 1932.
Navy Day	4 December; commemorates naval achievements including Operation Trident's 1971 attack on Karachi.
Flag Day and Vijay Divas	Armed Forces Flag Day: 7 December; Vijay Divas: 16 December, associated with victory in the 1971 war.
Kargil Vijay Diwas	26 July; commemorates the successful conclusion of the 1999 Kargil conflict's operations.

2 Operations: remember the year

Operation Vijay ambiguity	Used for Goa's liberation in 1961 and the Kargil operation in 1999; the year/context determines the answer.
Operation Meghdoot	1984 operation associated with securing positions in the Siachen area.
Operation Cactus	1988 Indian military intervention in the Maldives following an attempted coup.
Operation Pawan	Associated with Indian Peace Keeping Force operations in Sri Lanka from the late 1980s.
Operation Raahat	2015 evacuation operation associated with Yemen; evacuation operations are not the same category as combat offensives.

World Institutions, Space and Static Awareness

HEADQUARTERS: REMEMBER CITY + MANDATE

GENEVA	PARIS	ROME
WHO: health	**UNESCO**	**FAO**
ILO: labour; WTO: trade	Education, science, culture	Food and agriculture

A selected memory aid, not a complete list of organisations in these cities.

Remember. Geneva: health/labour/trade; Paris: UNESCO; Rome: FAO. Match the mandate too.

1 United Nations and international frameworks

United Nations milestone. UN Charter entered into force on 24 October 1945; UN Day is observed on 24 October.

Six principal organs. General Assembly, Security Council, ECOSOC, Trusteeship Council, International Court of Justice and Secretariat.

Security Council. 15 seats: five permanent and ten elected; permanent members are China, France, Russia, UK and US.

Veto caution. Permanent-member veto concerns substantive Security Council decisions; it is not a General Assembly voting power.

UN General Assembly. Each member State has one vote; population size does not give additional votes.

2 UN institutions and international principles

UN Secretary-General. Appointed by the General Assembly on Security Council recommendation; this is not a direct global popular election.

ICJ. International Court of Justice sits at The Hague; it is distinct from the International Criminal Court.

UN headquarters. UN headquarters: New York; major UN offices also operate in Geneva, Vienna and Nairobi.

Trusteeship Council. Suspended regular operations in 1994 after Palau's independence; it remains a principal organ under the Charter.

Panchsheel. Five principles include sovereignty/territorial integrity, non-aggression, non-interference, equality/mutual benefit and peaceful coexistence.

1 Organisations and headquarters

Geneva cluster	WHO: health; ILO: labour; WTO: trade; WMO: meteorology. Same city does not mean the same organisation.
Paris and Rome	UNESCO headquarters: Paris; FAO headquarters: Rome. UNESCO is not the UN's food agency.
Bretton Woods	1944 conference shaped IMF and World Bank institutions; IMF and World Bank are not the same lender with two names.
Washington institutions	IMF and World Bank headquarters are in Washington, DC; their mandates and lending frameworks differ.
ASEAN and SAARC	ASEAN Secretariat: Jakarta; SAARC Secretariat: Kathmandu. Membership lists can change and should be checked separately.

2 International groupings and humanitarian bodies

Commonwealth and NATO	Commonwealth Secretariat: London; NATO headquarters: Brussels. Membership in one does not imply membership in the other.
G20	A major international economic-cooperation forum; the African Union was admitted as a permanent member in 2023.
BRICS	Originally Brazil, Russia, India, China, South Africa in the familiar acronym; later expansion means that acronym is not a complete current membership list.
Non-Aligned Movement	First summit: Belgrade, 1961; non-alignment is not simply legal neutrality in every conflict.
International humanitarian distinction	ICRC is associated with humanitarian protection and Geneva Conventions; it is not a UN military force.

1 Indian space and scientific associations

ISRO foundation. Indian Space Research Organisation was established in 1969; its headquarters are in Bengaluru.

Aryabhata satellite. India's first satellite, launched on 19 April 1975 by a Soviet rocket; not launched by an Indian launch vehicle.

Rohini RS-1. Placed in orbit by India's SLV-3 in July 1980, marking an important indigenous launch-vehicle milestone.

Chandrayaan milestones. Chandrayaan-1 launched in 2008; Chandrayaan-3 soft-landed on 23 August 2023. Landing region and exact lunar pole are not identical.

Lander and rover. Chandrayaan-3 lander: Vikram; rover: Pragyan. A mission's orbiter, lander and rover are different components.

2 Vehicles, applications and scientific associations

Mars and Sun missions. Mars Orbiter Mission launched in 2013; Aditya-L1 launched in 2023 to study the Sun from a suitable L1-region orbit.

Launch-vehicle distinction. A satellite is a payload; PSLV, GSLV and LVM3 are launch-vehicle families. A mission name is not necessarily a rocket name.

Navigation and sensing. NavIC: India's regional satellite-navigation system; remote sensing observes Earth, while navigation estimates position/time.

Science-name pairs. C.V. Raman: Raman effect; S.N. Bose: quantum statistics; Homi Bhabha: Indian nuclear programme; Vikram Sarabhai: Indian space programme.

Discovery associations. Newton: laws of motion/gravitation; Faraday: electromagnetic induction; Rutherford: nuclear atomic model; Alexander Fleming: penicillin discovery.

1 Symbols, awards, observances and sports

National Flag. Adopted by the Constituent Assembly on 22 July 1947; Ashoka Chakra has 24 spokes. Flag proportions are 3:2 length to height.

National Emblem. Adapted from the Sarnath Lion Capital of Ashoka; motto Satyameva Jayate comes from the Mundaka Upanishad.

National Anthem and Song. Jana Gana Mana: Rabindranath Tagore; Vande Mataram: Bankim Chandra Chattopadhyay, appearing in Anandamath.

Civilian award order. Bharat Ratna is the highest civilian award; Padma Vibhushan → Padma Bhushan → Padma Shri is the Padma hierarchy.

Nobel distinction. Original Nobel fields exclude economics; the Sveriges Riksbank economics memorial prize was established in 1968.

2 Observances, sports and current affairs

Important observances. World Health Day: 7 April; World Environment Day: 5 June; International Yoga Day: 21 June.

Indian science and sports days. National Science Day: 28 February, linked to Raman effect; National Sports Day: 29 August, Dhyan Chand's birth anniversary.

Trophy pairs. Ranji: domestic first-class cricket; Santosh: national football competition; Thomas Cup: men's team badminton; Uber Cup: women's team badminton.

Olympic rings. Five interlaced rings represent the union of five continents and athletes worldwide; individual ring colours are not officially assigned to particular continents.

Current-affairs companion. Use Cadetclub's monthly editions for recent appointments, exercises, winners, summits and missions; this static core does not substitute for current news.

Essential formulas

Use the stated conditions and consistent units. A remembered formula without its conditions can give the wrong answer.

Area	Relation	Condition / cue
Motion	$v = u + at$; $s = ut + \frac{1}{2}at^2$ $v^2 = u^2 + 2as$	Constant acceleration; signed quantities.
Average speed	$2ab/(a + b)$	Only for two equal-distance legs at positive speeds a and b.
Work and energy	$W = Fs\cos\theta$; $K = \frac{1}{2}mv^2$ $\Delta U = mg\Delta h$; power = W/t	Constant force; near-surface potential-energy approximation.
Fluids	$\rho = m/V$; $\Delta P = \rho gh$ $F_B = \rho_{fluid} g V_{displaced}$	Add surface pressure for absolute pressure.
Heat	$Q = mc\Delta T$; $Q = mL$	Temperature change versus phase change.
Temperature	$K = °C + 273.15$ $°F = 9°C/5 + 32$	A rise of 1°C equals a rise of 1 K.
Waves and echo	$v = f\lambda$; $f = 1/T$ Distance = vt/2	Echo uses round-trip time and the relevant medium speed.
Small pendulum	$T = 2\pi\sqrt{(L/g)}$	Small angular amplitude; negligible damping.
Optics	Mirror: $1/f = 1/v + 1/u$ Lens: $1/f = 1/v - 1/u$ Power = 1/f(m)	Cartesian signs; metres for dioptres.
Electricity	$V = IR$; $P = VI$; $E = Pt$ Resistor: $P = I^2R = V^2/R$	Ohmic V-I relation requires unchanged physical conditions.
Economics	Primary deficit = fiscal deficit - interest	Annual flows; not the debt stock.
Time and units	1° longitude = 4 minutes 1 kWh = 3.6×10^6 J	Local solar-time approximation; kWh is energy.

Compare in seconds

These pairs cause avoidable errors. Recall the defining distinction before picking a familiar-looking word.

Often confused	Keep the distinction
Mass / weight	Mass: inertia, kg; weight: gravitational force, N.
Heat / temperature	Heat: transferred energy; temperature determines the direction of spontaneous heat transfer.
Oxidising / reducing agent	Oxidising agent gains electrons and is reduced; reducing agent loses electrons and is oxidised.
Baking / washing soda	$NaHCO_3$ / $Na_2CO_3 \cdot 10H_2O$.
Artery / vein	Away from heart / toward heart; oxygen content has exceptions.
Pollination / fertilisation	Pollen transfer / gamete fusion.
Latitude / longitude	North-south angular position / east-west angular position; longitude links to time.
Weather / climate	Short-term atmospheric state / longer-term patterns and statistics.
Plassey / Buxar	1757 / 1764; Diwani followed in 1765.
Part III / IV / IVA	Fundamental Rights / Directive Principles / Fundamental Duties.
Money / Financial Bill	Money Bills are a specific constitutional category, not every Bill involving finance.
Fiscal / primary deficit	Primary deficit removes interest payments from fiscal deficit.
Army / Navy Captain	Army Captain is junior to Colonel; Navy Captain equals Army Colonel.
Radar / SONAR	Electromagnetic waves / sound.
ICJ / ICC	Different courts; the ICJ is a principal UN organ.