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GENERAL KNOWLEDGE / CDS EXAMINATION

# Must-Know GK for CDS

## Your GK revision at a glance

Facts. Formulas. Visuals. Quick comparisons.

The essentials for your CDS 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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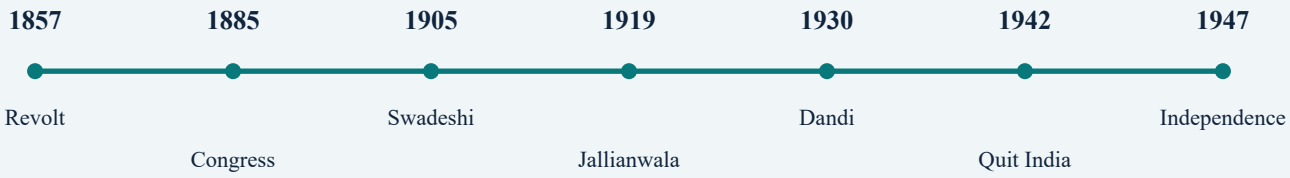
**Use it actively:** cover the right part of a line, recall the answer, then check it. Revisit the topic behind every incorrect practice answer.

**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.

# 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. |

## 1 Colonial Acts and constitutional milestones

**Charter Act 1813.** Ended most Company trade monopoly, but retained exceptions for tea and trade with China; political rule did not end in 1813.

**Charter Act 1833.** Ended the Company's commercial activities and made the Governor-General of Bengal the Governor-General of India.

**Charter Act 1853.** Separated legislative/executive functions of the Governor-General's council and opened the route to competitive civil-service recruitment.

**Indian Councils Act 1861.** Expanded legislative councils and associated nominated Indians with legislative work; it did not introduce responsible government.

**Morley-Minto reforms.** Indian Councils Act 1909 introduced separate electorates for Muslims; provincial dyarchy came later, in 1919.

## 2 Constitutional negotiations and transfer of power

**Dyarchy versus autonomy.** 1919 divided provincial subjects into transferred/reserved categories; 1935 provincial autonomy replaced that provincial dyarchy framework.

**1935 federal trap.** The proposed all-India federation did not operate as planned; provincial autonomy did operate, with ministries formed after the 1937 elections.

**Cripps Mission.** 1942 proposals offered post-war constitutional change and Dominion status; they did not immediately transfer full independent power.

**Cabinet Mission framework.** 1946 plan proposed a limited Union dealing with defence, foreign affairs and communications, alongside provincial groupings.

**Independence Act distinction.** The 1947 Act provided for two independent Dominions; India's republican Constitution commenced mainly in January 1950.

## 1 Organisations, movements and chronology

**Association chronology.** Poona Sarvajanik Sabha: 1870; Indian Association: 1876; Madras Mahajana Sabha: 1884; Bombay Presidency Association: 1885.

**Indian Association.** Associated with Surendranath Banerjea and Anandamohan Bose; it preceded the Indian National Congress.

**Satyashodhak Samaj.** Founded by Jyotirao Phule in 1873; challenged caste hierarchy and promoted social reform.

**Self-Respect Movement.** Associated with E.V. Ramasamy/Periyar from 1925; distinct from Phule's nineteenth-century organisation.

**Ghadar's origins.** Organised in North America in 1913; Sohan Singh Bhakna was founding president and Lala Har Dayal a major organiser.

## 2 Campaigns, parties and chronology

**Ghadar location caution.** The Pacific-coast association's early meeting was at Astoria; its newspaper/headquarters became associated with San Francisco. Do not collapse every milestone into one location.

**Bardoli Satyagraha.** 1928 campaign associated with Vallabhbhai Patel and opposition to increased land-revenue assessment in Gujarat.

**Chittagong armoury raid.** 1930 revolutionary action associated with Surya Sen; distinct from the 1925 Kakori train action.

**Swaraj Party.** Founded in 1923 by C.R. Das and Motilal Nehru; pursued council entry to challenge colonial government from within legislatures.

**Civil Disobedience chronology.** Dandi March: 1930; Gandhi-Irwin Pact: 1931; Poona Pact: 1932; Quit India: 1942. Compare sequence before personalities.

# 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.

## 1 Parliamentary tools and constitutional lists

**Union List examples.** Defence, foreign affairs, currency, insurance and census are Union subjects; census is not a Concurrent List subject.

**State List examples.** Public order, police, agriculture and taxes on lands/buildings are standard examples, subject to constitutional qualifications.

**Concurrent List examples.** Education, forests, marriage/divorce and criminal procedure are examples; both Union and States can legislate within the constitutional scheme.

**Forty-second Amendment lists.** Education and forests moved from the State List to the Concurrent List in 1976; their earlier classification is a common trap.

**No-confidence scope.** Concerns the Council of Ministers collectively in Lok Sabha; specific grounds need not form part of the motion.

### SEVENTH SCHEDULE: MATCH THE SUBJECT TO ITS LIST

| UNION | STATE | CONCURRENT |
|---|---|---|
| Defence; census | Police; agriculture | Education; forests |
| Currency; insurance | Land/building taxes | Marriage; criminal procedure |

Selected examples; constitutional qualifications apply. Education and forests moved in 1976.

## 2 Parliamentary questions and procedure

**Censure distinction.** A censure motion criticises specified policies/actions and states grounds; it may concern an individual minister or the government, unlike collective no-confidence.

**Question types.** Starred questions seek oral answers and allow supplementary questions; unstarred questions seek written answers without the same supplementary procedure.

**Quorum.** One-tenth of the total membership is the constitutional quorum of either House, unless Parliament otherwise provides by law.

**Appropriation versus Finance Bill.** Appropriation authorises withdrawal from the Consolidated Fund; Finance legislation gives effect to taxation proposals. Both belong to the budget process but perform different functions.

**Adjournment and prorogation.** Adjournment suspends a sitting; prorogation ends a session; dissolution ends Lok Sabha itself. Rajya Sabha is not dissolved.

## 1 Public offices, elections and judicial safeguards

**UPSC age and term.** A member ordinarily serves six years or until age 65, whichever is earlier; State PSC members face the corresponding age limit of 62.

**Governor's tenure.** Normal term is five years, subject to the President's pleasure; Governors are not removed through the President's impeachment process.

**Ministerial-size ceiling.** The Ninety-first Amendment limits Union ministers, including the Prime Minister, to 15% of Lok Sabha's total membership.

**Disqualification authority.** Office-of-profit and other Article 102(1) disqualification questions are decided by the President on Election Commission opinion; anti-defection follows a different route.

**CEC removal safeguard.** Chief Election Commissioner removal follows the constitutional protection linked to Supreme Court judges; other Election Commissioners require the CEC's recommendation for removal.

## 2 Jurisdiction, review and financial scrutiny

**Election petitions.** Ordinary parliamentary/State-legislature election disputes are tried through election petitions under the statutory framework, not decided as routine disputes by the ECI.

**Supreme Court jurisdiction.** Article 131 concerns specified federal disputes; Article 32 concerns Fundamental Rights; Article 136 concerns special leave to appeal.

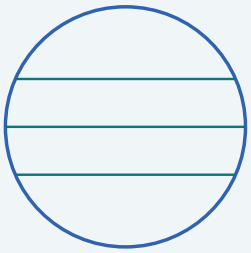
**Judicial review versus appeal.** Reviewing constitutionality is not the same as being a general appeal court for every policy disagreement.

**CAG reports.** Union-account reports go to the President for laying before Parliament; State-account reports go to the Governor for laying before the State legislature.

**Public Accounts Committee.** Examines public expenditure/accounts with CAG material; it is a parliamentary committee, not itself the constitutional auditor.

# 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.

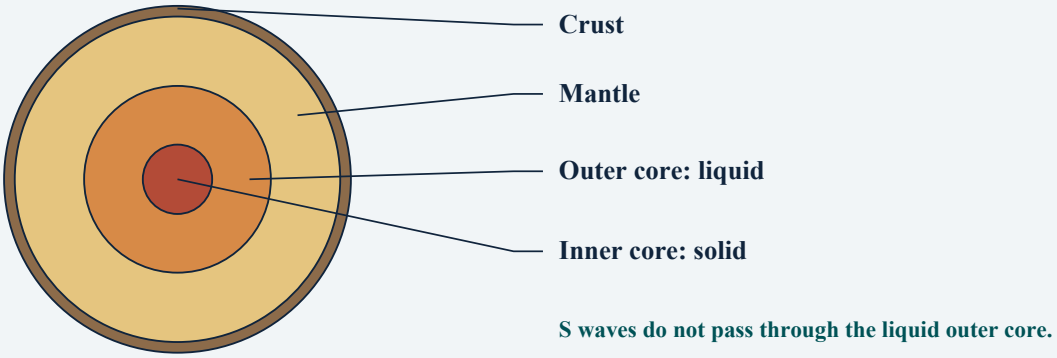
**Small bodies.** Asteroid: rocky/metallic body; comet: volatile-rich body; meteor: atmospheric light streak; meteorite: surviving material reaching the ground.

**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.

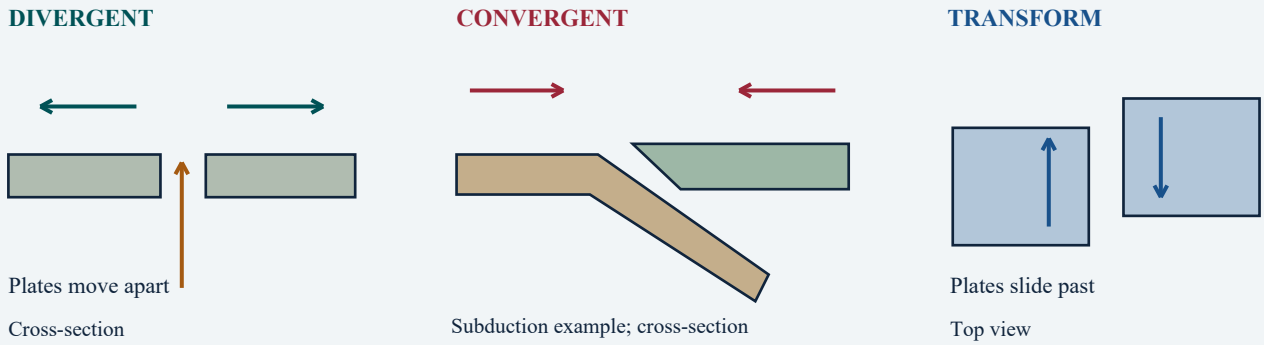
**Distance units.** Astronomical unit: Earth-Sun orbital-distance reference; light-year: distance travelled by light in one year, not a time unit.

### 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 World climates and atmospheric comparisons

**Köppen broad groups.** A: tropical; B: dry; C: temperate; D: cold/continental; E: polar. Subletters describe further precipitation/temperature differences.

**Af versus Aw.** Af: tropical rainforest with no dry season; Aw: tropical wet-and-dry/savanna climate with a winter dry season.

**Mediterranean climate.** Typical pattern: dry summers and wetter winters; common on western continental margins around 30°-45° latitude.

**Marine west coast.** Generally mild temperatures, no pronounced dry season and cool-to-warm summers; severely cold summers are not its defining feature.

**Steppe versus desert.** Steppe is semi-arid; desert is more arid. Both belong to the broad dry-climate group, but vegetation and moisture availability differ.

### CLIMATE PAIRS: RAINFALL PATTERN IS THE CLUE

| CLIMATE | MOISTURE PATTERN | TEMPERATURE CLUE |
|---|---|---|
| **Rainforest** | **No dry season** | **Tropical** |
| Savanna | Winter dry season | Tropical |
| Mediterranean | Dry summer; wetter winter | Temperate |
| Marine west coast | No pronounced dry season | Mild; not severe-cold summer |
| Steppe | Semi-arid | Dry-climate group |

Broad recall patterns; classification uses precise temperature and precipitation thresholds.

## 2 Cold climates and atmospheric controls

**Humid subtropical variants.** Humid subtropical climates have hot/warm summers; some have dry winters while others lack a distinct dry season.

**Tundra versus ice cap.** Tundra permits a short thaw/growing season; ice-cap climate remains colder. Polar classification concerns temperature, not merely latitude.

**Water vapour.** Variable atmospheric constituent; affects latent heat, greenhouse warming, clouds and atmospheric stability. It is not a permanent gas in fixed proportion.

**Trace-gas order.** In standard dry-air reference composition, xenon < hydrogen < helium < neon by volume; these are far less abundant than nitrogen/oxygen.

**Circulation controls.** Unequal solar heating, Earth's rotation and land-ocean distribution all shape planetary winds; one factor alone is insufficient.

## 1 Strategic passages, boundaries and drainage contrasts

**Hormuz.** Connects the Persian Gulf with the Gulf of Oman; important for access from the Gulf toward the Arabian Sea.

**Bab-el-Mandeb.** Connects the Red Sea with the Gulf of Aden; the Suez route also depends on this southern Red Sea entrance.

**Turkish straits.** Bosporus links Black Sea-Marmara; Dardanelles links Marmara-Aegean. They are two different straits in one sea route.

**Suez versus Panama.** Suez connects Mediterranean-Red Sea; Panama connects Atlantic-Pacific routes. Neither is a naturally formed strait.

**Gibraltar.** Connects Atlantic Ocean and Mediterranean Sea; lies between southern Europe and northern Africa.

## 2 Boundaries and drainage patterns

**Durand Line.** Boundary line associated with Afghanistan and Pakistan; not the India-Pakistan partition line.

**Radcliffe versus McMahon.** Radcliffe: 1947 India-Pakistan partition demarcation; McMahon: eastern India-China boundary context, with disputed status.

**LoC versus LAC.** Line of Control: India-Pakistan control in the Jammu-Kashmir context; Line of Actual Control: India-China. Neither term is a synonym for every international boundary.

**Antecedent drainage.** A river maintains an older course while the surrounding land is uplifted; superimposed drainage develops on a cover and becomes imposed on underlying structures.

**River-pattern pairs.** Dendritic: branching tree pattern; trellis: structurally controlled parallel valleys with tributaries; radial: flow away from a central high.

# 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.

## 1 Prices, financial markets and policy interpretation

**Inflation versus disinflation.** Inflation raises the general price level; disinflation slows its rate of increase. Prices can still rise during disinflation.

**Deflation versus stagflation.** Deflation: falling general price level; stagflation: inflation alongside weak/stagnant activity and unemployment pressures.

**Real interest rate.** Approximately nominal interest rate minus inflation for small rates; exact compounding gives a slightly different result.

**Bond-price relation.** For a fixed promised cash-flow stream, market price and required yield move inversely, other things equal.

**Primary versus secondary market.** New securities are issued in primary markets; existing securities trade in secondary markets. An exchange trade is not always fresh financing for the issuer.

## 2 Balance sheets and policy interpretation

**Balance-sheet distinction.** A fiscal deficit is a government financing-flow measure; a current-account deficit concerns external transactions. One does not mechanically equal the other.

**Crowding out.** Government borrowing can displace private spending through financing/interest-rate channels under some conditions; it is not an automatic universal outcome.

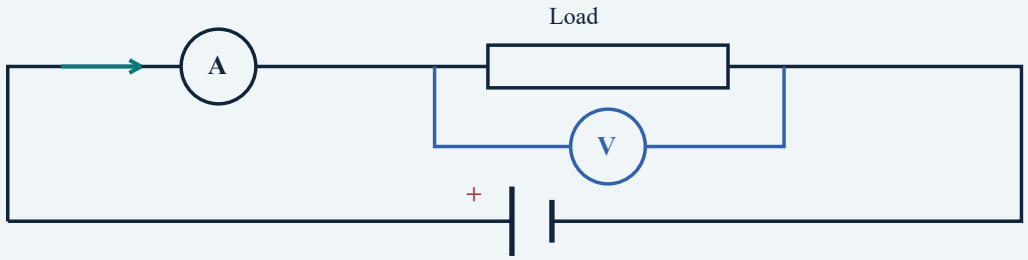
**Supply shocks.** A cost shock can raise prices while weakening output; demand management alone may not remove the underlying supply constraint.

**Income versus wealth.** Income is measured over a period; wealth is a stock at a point in time. GDP is not the value of all assets owned.

**Transfer versus value added.** A financial transfer changes purchasing power/claims; GDP measures production value added and must not double-count intermediate output.

# 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.** $\rho$ = mass/volume; 1 $g/cm^3$ = 1000 $kg/m^3$. Relative density is a ratio with no unit.

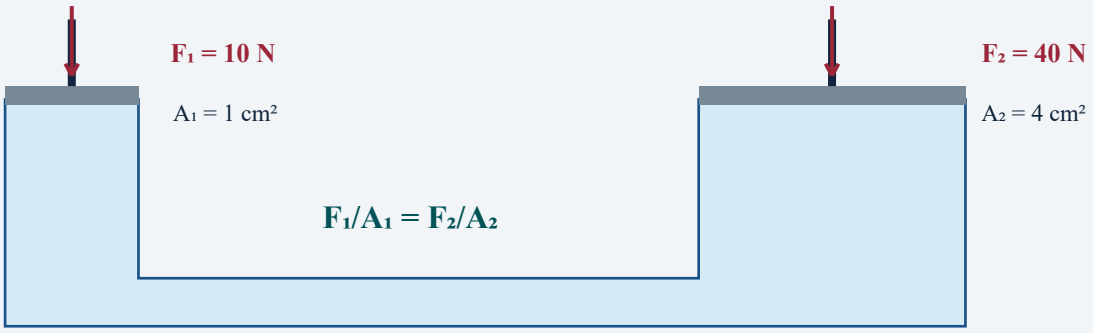
**Pressure.** P = normal force/area; smaller contact area means greater pressure for the same force.

**Liquid pressure.** Gauge pressure = $\rho gh$; 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

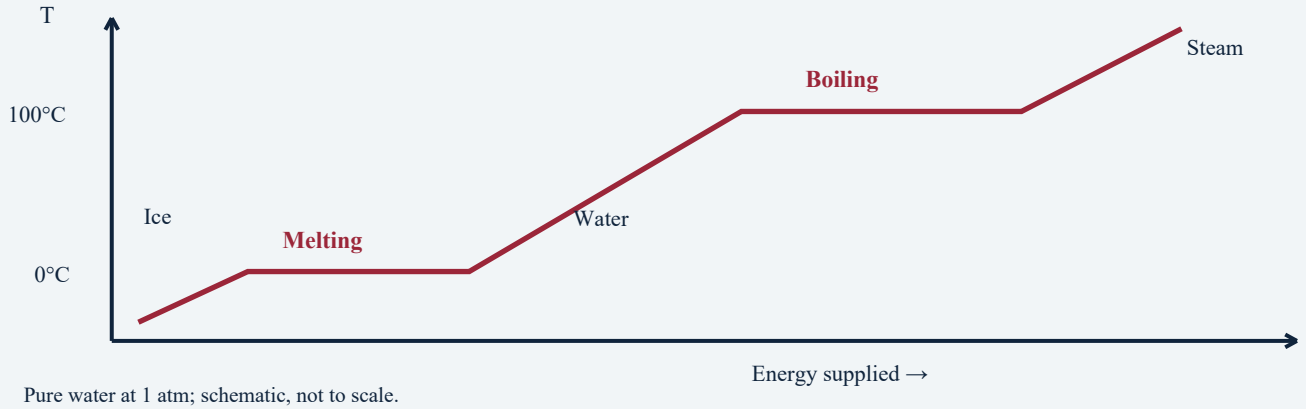
**Temperature conversion.** K = °C + 273.15; °F = 9°C/5 + 32; a change of 1°C equals a change of 1 K.

**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

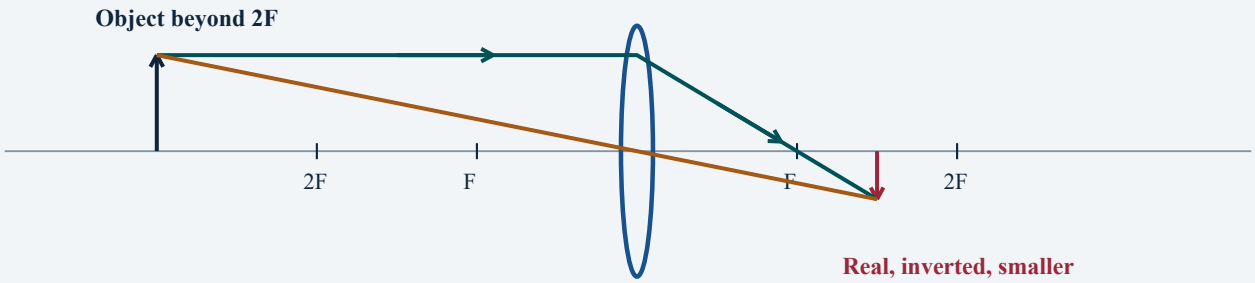
**Wave relation.** $v = f\lambda$; $f = 1/T$. Sound in air is longitudinal; a stretched-string wave is transverse.

**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.

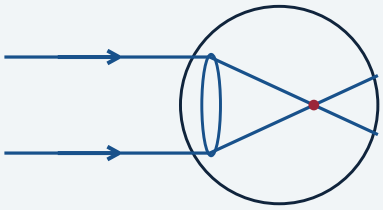
### CONVEX LENS: TRACE THE PRINCIPAL RAYS




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

### VISION DEFECTS: WHERE DOES THE IMAGE FOCUS?

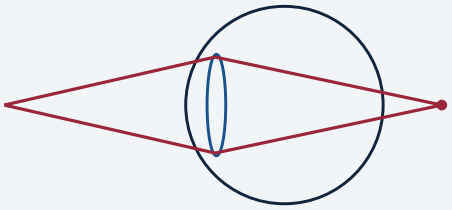
**MYOPIA**



**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 = $3.6 \times 10^6$ 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 Applied relationships and statement traps

**Uniform circular motion.** Speed may remain constant while velocity changes; centripetal acceleration points toward the centre and has magnitude $v^2/r$.

**Braking-distance shortcut.** For braking to rest at constant deceleration, braking distance grows with initial speed squared. Total stopping distance also includes reaction distance.

**Satellite motion.** Gravity supplies the orbital acceleration; a satellite's continuous free fall does not mean the gravitational field has vanished.

**Resonance and damping.** Strong response occurs near a suitable natural frequency; damping limits amplitude. Periodic forcing alone does not guarantee resonance.

**String-frequency comparison.** For an ideal stretched string, frequency rises with tension and falls with vibrating length or mass per length, other things equal.

## 2 Waves, light and electromagnetic induction

**Frequency at a boundary.** At a stationary interface, transmitted light keeps the incident frequency while speed and wavelength can change.

**Total internal reflection test.** Both higher-to-lower refractive-index travel and incidence greater than the critical angle are needed; high incidence alone is insufficient.

**Photoelectric distinction.** Photon energy follows frequency, $E = hf$; brighter light need not mean greater energy per photon. Photoelectric emission has a material-dependent threshold frequency.

**Induction test.** A changing linked magnetic flux induces emf; an induced current also needs a conducting path. A stationary unchanged magnet/coil setup is insufficient.

**Transformer comparison.** An ideal step-up transformer raises voltage and lowers current correspondingly; it cannot multiply power and does not run continuously on steady DC.

# 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.

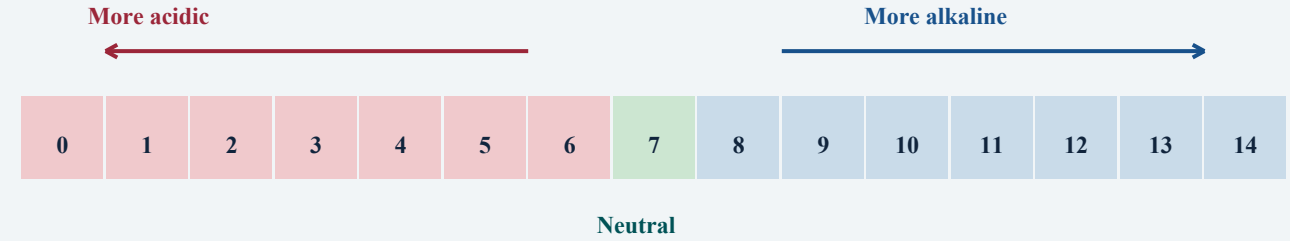
**pH.** At 25°C, neutral pure water has pH 7; lower pH is more acidic. Neutral pH depends on temperature.

**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. |

## 1 Solutions, reaction conditions and materials

**Strong versus concentrated.** Strong/weak describes ionisation behaviour in the relevant solvent; concentrated/dilute describes amount per solution quantity. They are different classifications.

**Solubility versus rate.** Stirring can speed dissolution without necessarily increasing equilibrium solubility at the same temperature.

**Temperature and gases.** Gas solubility in water commonly falls as temperature rises; pressure increases gas solubility under suitable conditions.

**Electrolyte carriers.** Current in electrolytes is carried by moving ions; metallic conduction is chiefly associated with electrons.

## 2 Equilibrium, catalysts and materials

**Chemical equilibrium.** Forward and reverse reactions continue at equal rates in dynamic equilibrium; equal rates do not require equal reactant/product concentrations.

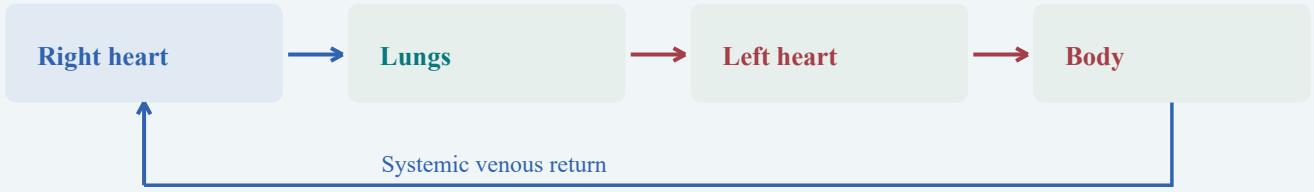
**Catalyst at equilibrium.** Speeds approach to equilibrium by affecting reaction pathways; it does not shift the equilibrium composition at fixed temperature.

**Polymer pairs.** Polythene: ethene polymer; PVC: vinyl-chloride polymer; nylon is a synthetic polyamide. Polymer names are not elemental formulas.

**Adsorption versus absorption.** Adsorption accumulates material at a surface; absorption takes material into the bulk. Activated charcoal illustrates adsorption applications.

# 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.

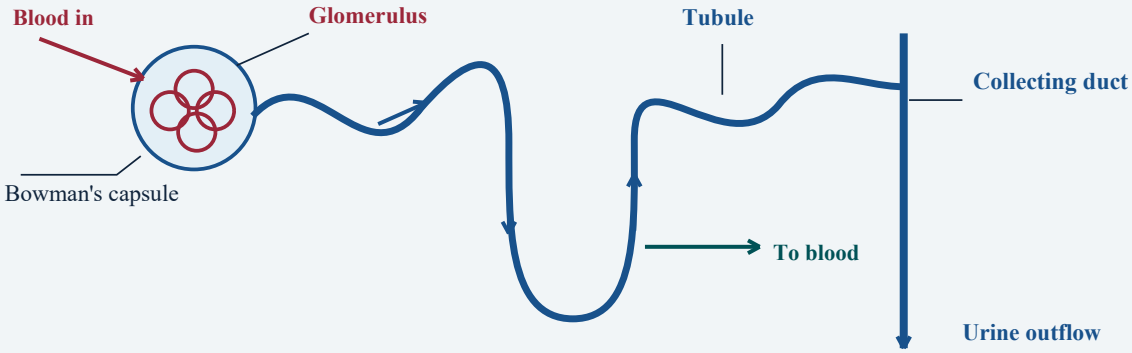
**Artery versus vein.** Arteries carry blood away from the heart; veins carry it toward the heart. Oxygenation is not the defining distinction.

**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.

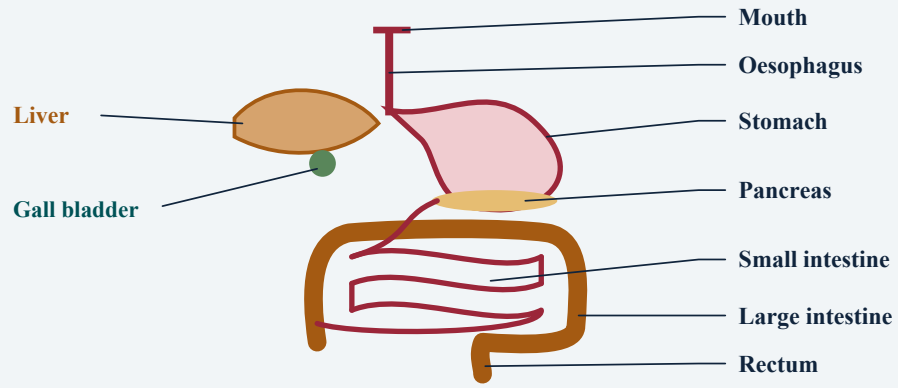
**Digestive enzymes.** Amylase acts on starch; proteases on proteins; lipases on fats. Bile aids fat digestion but is not a digestive enzyme.

**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.

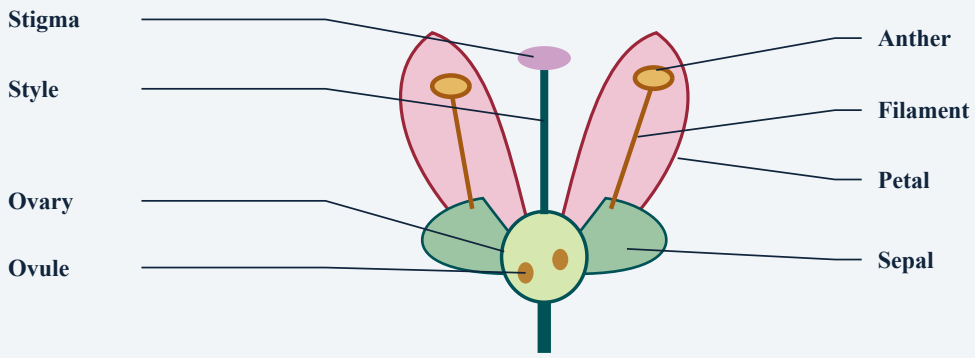
**Respiration versus breathing.** Cellular respiration releases usable energy from substrates; breathing ventilates respiratory surfaces. Plants also respire.

**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 Human physiology, genetics and ecological reasoning

**Respiratory gas exchange.** Oxygen/$CO_2$ diffusion depends on partial-pressure gradients; breathing movements and cellular respiration are distinct processes.

**Renal reabsorption.** Filtration is followed by selective return of useful solutes and much water to blood; urine volume is not the same as initial filtrate volume.

**Endocrine signalling.** Hormones act through receptors in responsive target cells; carrying a hormone in blood does not make every cell equally responsive.

**Sex chromosomes.** In the usual human XX/XY system, eggs contribute X and sperm contribute X or Y; sex determination is not attributed to the mother's chromosome choice.

## 2 Genetic, medical and ecological distinctions

**Dominant versus common.** A dominant allele's expression in a heterozygote does not imply that it is more frequent or beneficial in a population.

**Vaccines versus antibiotics.** Vaccines prepare immune responses; antibiotics act against susceptible bacteria. Neither category is a universal cure for all infections.

**Food-web stability.** Many feeding connections form a food web; removing one species can affect several pathways, not only one straight chain.

**Ecological succession.** Community composition changes over time after new habitat or disturbance; the pathway depends on conditions and prior biological legacies.

# 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. |

## 1 Operational roles and technical vocabulary

**Jointness versus identical roles.** Joint planning integrates different service capabilities; it does not erase the land, maritime and air domains or make all equipment interchangeable.

**Carrier versus submarine.** An aircraft carrier supports embarked air operations; a submarine operates submerged. Nuclear-powered does not automatically mean nuclear-armed.

**Missile seeker versus engine.** A seeker senses/tracks a target; the engine provides thrust; navigation/guidance/control link information to flight corrections.

**Air defence versus air superiority.** Air defence protects against aerial threats; air superiority concerns a degree of control of air operations in a specified area/time.

## 2 Electronic warfare and performance terms

**Amphibious operation.** Projects forces from sea toward land; an airborne operation uses air delivery. A joint operation can combine both.

**Electronic warfare.** Uses the electromagnetic spectrum for sensing, protection and attack; it is broader than simply jamming every radio signal.

**Precision and range.** Long range does not itself establish accuracy, payload capacity or target type; compare the actual parameter named in the question.

**Exercise-name caution.** Participants, editions and venues can change. Learn recurring exercise associations, but verify the named year's details in current affairs.

# 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.

## 1 Institutions, agreements and scientific applications

**UN agency versus organ.** WHO/UNESCO/ILO are specialised agencies; Security Council/General Assembly/ICJ are principal organs. These are different institutional categories.

**Security Council elections.** Ten elected members normally serve two-year terms; the five permanent seats follow a different constitutional arrangement under the Charter.

**ICJ versus ICC jurisdiction.** ICJ deals with disputes between States and advisory opinions; ICC concerns individual criminal responsibility within its legal jurisdiction.

**WTO versus IMF.** WTO concerns trade rules; IMF concerns monetary/financial stability and balance-of-payments support. Their mandates overlap neither completely nor exclusively with development banking.

## 2 Agreements, satellites and instruments

**Climate-agreement layers.** UNFCCC is the framework convention; Kyoto Protocol and Paris Agreement are later instruments under that framework, with different architectures.

**Remote sensing versus navigation.** Remote sensing measures properties of Earth/objects from a distance; navigation services support position, navigation and timing.

**Geostationary conditions.** A geostationary orbit is circular and equatorial with an eastward period matching Earth's sidereal rotation, about 23 h 56 min, so it appears fixed over a longitude.

**Scientific-instrument pairs.** Spectrometer: spectral information; seismometer: ground motion; barometer: pressure; hydrometer: liquid-density comparison. Similar names do not imply the same measurement.

# 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 | $v = u + at$; $s = ut + \frac{1}{2}at^2$<br>$v^2 = u^2 + 2as$ | Constant acceleration; signed quantities. |
| Average speed | $2ab/(a + b)$ | Only for two equal-distance legs at positive speeds a and b. |
| Work and energy | $W = Fs\cos\theta$; $K = \frac{1}{2}mv^2$<br>$\Delta U = mg\Delta h$; power = W/t | Constant force; near-surface potential-energy approximation. |
| Fluids | $\rho = m/V$; $\Delta P = \rho gh$<br>$F_B = \rho_{fluid} g V_{displaced}$ | Add surface pressure for absolute pressure. |
| Heat | $Q = mc\Delta T$; $Q = mL$ | Temperature change versus phase change. |
| Temperature | $K = °C + 273.15$<br>$°F = 9°C/5 + 32$ | A rise of 1°C equals a rise of 1 K. |
| Waves and echo | $v = f\lambda$; $f = 1/T$<br>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: $1/f = 1/v + 1/u$<br>Lens: $1/f = 1/v - 1/u$<br>Power = 1/f(m) | Cartesian signs; metres for dioptres. |
| Electricity | $V = IR$; $P = VI$; $E = Pt$<br>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<br>1 kWh = $3.6 \times 10^6$ 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. |