

Class XII

Biology

One-page chapter summaries
Large print • CBSE 2026-27 syllabus

1. Sexual Reproduction in Flowering Plants — page 2
2. Human Reproduction — page 3
3. Reproductive Health — page 4
4. Principles of Inheritance and Variation — page 5
5. Molecular Basis of Inheritance — page 6
6. Evolution — page 7
7. Human Health and Disease — page 8
8. Microbes in Human Welfare — page 9
9. Biotechnology: Principles and Processes — page 10
10. Biotechnology and its Applications — page 11
11. Organisms and Populations — page 12
12. Ecosystem — page 13
13. Biodiversity and its Conservation — page 14

Chapter 1: Sexual Reproduction in Flowering Plants

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Big idea: Pollination and double fertilisation turn ovules into seeds and ovaries into fruits.

Key points

- **Anther**: bilobed, tetrasporangiate; innermost wall layer **tapetum** nourishes pollen. Pollen mother cell ($2n$) → meiosis → pollen grains (n).
- Pollen **exine** is made of **sporopollenin**, the most resistant organic material; has **germ pores**.
- Megaspore mother cell → 4 megaspores, 1 survives → 3 mitoses → **8-nucleate, 7-celled embryo sac** (egg + 2 synergids, 3 antipodals, central cell with 2 polar nuclei).
- Pollination: **autogamy**, **geitonogamy** (another flower, same plant), **xenogamy**.
- **Outbreeding devices**: pollen and stigma maturing at different times, different positions, **self-incompatibility**, unisexual flowers.
- **Double fertilisation**: syngamy (male gamete + egg → zygote, $2n$) + triple fusion (male gamete + 2 polar nuclei → PEN, $3n$).
- **Apomixis**: seed without fertilisation. **Polyembryony** (citrus, mango). **Parthenocarpy**: seedless fruit (banana).

Key facts & ploidy

- Zygote $2n$; endosperm $3n$; egg, synergids, pollen n ; nucellus $2n$.
- Castor, maize: stop autogamy only. Papaya (dioecious): stops both.
- Hybridisation: **emasculation** → **bagging** → pollinate → rebag.

Diagrams, maps & graphs to practise

- T.S. of anther; L.S. of anatropous ovule
- 7-celled embryo sac; dicot embryo

Exam focus: how to score

- Ploidy questions are frequent: name the cell and give n , $2n$ or $3n$.
- Geitonogamy: functionally cross, genetically self. Write both halves.

★ Important questions from CBSE sample papers

- Geitonogamy can be compared with cross-pollination as well as self-pollination. Comment. (SQP 2026-27, 2 marks)
- Name the two products of double fertilisation, their ploidy, and which develops first. (SQP 2026-27, 3 marks)
- Explain how autogamy is prevented in castor and papaya. (SQP 2024-25, part of 5 marks)

Remember: Egg + male gamete = $2n$ embryo; polar nuclei + male gamete = $3n$ endosperm.

Chapter 2: Human Reproduction

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Big idea: Gametes meet in the oviduct; the embryo implants and grows in the uterus.

Key points

- Testes in scrotum, 2–2.5 °C below body temperature. **Sertoli cells** nourish sperm; **Leydig cells** secrete androgens.
- Female: ovaries, oviduct (ampulla), uterus (endometrium), cervix, vagina.
- **Spermatogenesis** from puberty: spermatogonium (2n) → primary spermatocyte → secondary spermatocytes (n) → spermatids → sperm.
- **Oogenesis** starts before birth; ovulation releases a **secondary oocyte**; meiosis II ends only when a sperm enters.
- **Menstrual cycle** (~28 days): menstrual (3–5 days) → follicular → **LH surge** → **ovulation (~day 14)** → luteal (corpus luteum, progesterone).
- Fertilisation in the **ampulla** → morula (8–16 cells) → blastocyst. **Trophoblast** implants; **inner cell mass** forms the embryo.
- Placenta secretes **hCG, hPL**, oestrogens, progestogens. Birth: **foetal ejection reflex** + oxytocin; **colostrum** has antibodies.

Key facts & numbers

- Primary spermatocyte = 46 chromosomes; secondary spermatocyte, spermatid, sperm = 23.
- LH → Leydig cells (androgens); FSH → Sertoli cells (spermiogenesis).
- Baby's sex is decided by the sperm (X or Y).

Diagrams, maps & graphs to practise

- Male and female reproductive systems
- Seminiferous tubule; ovary section; sperm

Exam focus: how to score

- Flow charts of spermatogenesis and oogenesis with ploidy earn full marks.
- Link FSH, LH surge and progesterone to each phase of the cycle.

★ Important questions from CBSE sample papers

- Madhuri's cycles vary from 20 to 45 days with heavy bleeding. How might absence of an LH surge explain this? (SQP 2026-27, 4 marks)
- A blood test is negative for hCG. What does it imply? Which tissue produces hCG? (SQP 2024-25, 2 marks)
- Explain embryonic development from morula till establishment of pregnancy. (SQP 2023-24, 3 marks)

Remember: Morula → blastocyst → trophoblast implants → placenta makes hCG.

Chapter 3: Reproductive Health

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Big idea: Healthy reproduction needs safe birth control, STI prevention and help for infertility.

Key points

- Legal marriage age: 18 (female), 21 (male). Ideal contraceptive: user-friendly, reversible, few side effects.
- **Natural**: periodic abstinence (days 10–17), withdrawal, **lactational amenorrhea** (up to ~6 months after birth).
- **Barriers**: condoms (also block STIs), diaphragms, cervical caps. **IUDs** (CuT, Multiload 375, LNG-20) suit **spacing children**.
- **Pills** stop ovulation and implantation; **Saheli** is non-steroidal, once a week. Emergency: within **72 hours**.
- **Terminal**: vasectomy, tubectomy. **MTP** is relatively safe up to 12 weeks (MTP Amendment Act, 2017).
- **STIs**: gonorrhoea, syphilis, herpes, chlamydiasis, hepatitis-B, HIV. Hepatitis-B, herpes, HIV are not fully curable.
- **ART**: IVF-ET; **ZIFT** (embryo up to 8 blastomeres → fallopian tube); **IUT** (more than 8 → uterus); **GIFT**; **ICSI**; **IUI**.

How each method works

- Copper IUD: Cu ions cut sperm motility and fertilising capacity.
- Hormone IUD: uterus unsuitable for implantation, cervix hostile to sperm.
- GIFT: donor ovum into the fallopian tube of a female who cannot make ova.
- ICSI: sperm injected into ovum. IUI: semen placed in uterus (low count).

Exam focus: how to score

- Case questions: match the couple's problem to ZIFT, IUT, GIFT, ICSI or IUI and justify.
- Match each situation to a contraceptive and its mode of action.
- Condom is the only method that also prevents STIs.

★ Important questions from CBSE sample papers

- Female A has blocked fallopian tubes; male B has very low sperm count. Which two ARTs would you recommend? Justify. (SQP 2026-27, 3 marks)
- Suggest a contraceptive: Mohini wants protection from conception and STIs; Lalita wants no more children; Geeta wants a reversible method. (SQP 2025-26, 3 marks)
- Suggest a suitable ART for five couples with different test reports and justify. (SQP 2023-24, 5 marks)

Remember: ≤ 8 blastomeres → ZIFT (tube); > 8 → IUT (uterus).

Chapter 4: Principles of Inheritance and Variation

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Big idea: Genes on chromosomes pass to offspring in predictable patterns, with exceptions.

Key points

- Mendel used **garden pea** (7 trait pairs). Laws: **dominance**, **segregation**, **independent assortment**.
- **Incomplete dominance**: snapdragon (F2 1:2:1). **Co-dominance + multiple alleles**: ABO blood groups (I^A , I^B , i).
- **Chromosomal theory**: Sutton & Boveri. Morgan (*Drosophila*) found **linkage**; Sturtevant mapped genes by recombination.
- **Polygenic**: human skin colour. **Pleiotropy**: one gene, many effects (phenylketonuria).
- Sex: humans XX/XY (father decides); birds ZW female; honey bee **haplodiploid** (unfertilised egg → male).
- **Haemophilia, colour blindness: sex-linked recessive**. Sickle-cell, thalassemia, PKU: autosomal recessive.
- **Down's** (trisomy 21), **Klinefelter's** (44+XXY), **Turner's** (44+XO).

Ratios & key facts

- Monohybrid F2: 3:1 (phenotype), 1:2:1 (genotype). Dihybrid: **9:3:3:1**. Test cross: 1:1.
- ABO: 6 genotypes, 4 phenotypes.
- Sickle-cell: GAG → GUG; glutamic acid → valine at 6th position of β -globin.

Diagrams, maps & graphs to practise

- Monohybrid and dihybrid Punnett squares
- Pedigree symbols; sex-linked pedigree

Exam focus: how to score

- Write genotypes, gametes, Punnett square and ratio: each step carries marks.
- Incomplete dominance = blend; co-dominance = both show.
- X-linked recessive pedigrees mostly affect males.

★ Important questions from CBSE sample papers

- Mice: cross $Rrbb \times RrBb$; draw the Punnett square, give the ratio and Running-Black count in 64 offspring. (SQP 2026-27, 3 marks)
- How can a single gene mutation cause phenylketonuria? Explain pleiotropy. (SQP 2026-27, 3 marks)
- A foetus has 45 chromosomes with one X. Name the condition and how it arises. (SQP 2023-24, 3 marks)

Remember: Dominance, segregation, assortment; then exceptions: blend, both, many.

Chapter 5: Molecular Basis of Inheritance

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Big idea: DNA stores information, copies itself, and is read into RNA and protein.

Key points

- Double helix (Watson & Crick): antiparallel; A=T, G≡C; 10 bp per turn, 3.4 nm pitch. **Nucleosome** = histone octamer + 200 bp.
- DNA is genetic material: Griffith, Avery-MacLeod-McCarty, **Hershey-Chase** (³²P DNA entered bacteria, ³⁵S protein did not).
- **Semi-conservative replication**: Meselson & Stahl (¹⁵N). Leading strand continuous; lagging in **Okazaki fragments**, joined by ligase.
- Transcription unit: **promoter** – structural gene – **terminator**. Coding strand matches mRNA (T→U).
- Eukaryotic hnRNA: **splicing** (introns out), **capping** (5'), **tailing** (poly-A, 3').
- **Code**: triplet; AUG = start (Met); UAA, UAG, UGA = stop; degenerate, unambiguous, near-universal. tRNA = adapter.
- **Lac operon**: lactose (inducer) binds repressor, so z, y, a are transcribed. **DNA fingerprinting** uses VNTRs.

Numbers & enzymes

- Length = bp × 0.34 nm. Human DNA ≈ 2.2 m; genome ≈ 3 × 10⁹ bp, ~30,000 genes.
- Bacteria: σ factor starts, ρ factor stops transcription.
- RNA pol I → rRNA; II → hnRNA; III → tRNA, 5S rRNA, snRNA.
- z = β-galactosidase, y = permease, a = transacetylase.

Diagrams, maps & graphs to practise

- Nucleosome; replication fork
- Transcription unit; lac operon

Exam focus: how to score

- Write template, coding and mRNA strands with 5'/3' polarity.
- Count amino acids from AUG to the codon before the stop; remove introns first.
- Substitution vs frameshift (insertion/deletion) mutations.

★ Important questions from CBSE sample papers

- A DNA stretch suffers two UV errors. Name each mutation type and give the amino acid sequence formed. (SQP 2026-27, 5 marks)
- How is the rate of initiation of RNA polymerase at a promoter regulated in prokaryotes? (SQP 2025-26, 2 marks)
- Describe the steps of Southern blot hybridisation using radiolabelled VNTR as a probe. (SQP 2024-25, 3 marks)

Remember: DNA → RNA → protein; AUG starts, UAA/UAG/UGA stop.

Chapter 6: Evolution

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Big idea: Life arose from chemicals; natural selection on variation has shaped every species.

Key points

- Earth $\approx$ 4.5 billion years old; life $\sim$ 4 billion years ago. **Miller**: CH_4 , H_2 , NH_3 , water vapour at $800^\circ\text{C} \rightarrow$ amino acids.
- **Homologous organs** (divergent: forelimbs of whale, bat, human) vs **analogous** (convergent: wings of butterfly and bird).
- Selection today: **industrial melanism** (peppered moth); antibiotic resistance.
- **Adaptive radiation**: Darwin's finches, Australian marsupials.
- **Darwin**: natural selection of the fittest. **de Vries**: mutation, saltation (evening primrose).
- **Hardy-Weinberg** disturbed by gene flow, genetic drift, mutation, recombination, natural selection.
- Selection: **stabilising, directional, disruptive**. Humans: Homo habilis (650–800 cc) $\rightarrow$ H. erectus (900 cc) $\rightarrow$ Neanderthal (1400 cc) $\rightarrow$ H. sapiens.

Formula & key facts

- **$p^2 + 2pq + q^2 = 1$** ; $p + q = 1$. $2pq$ = heterozygotes.
- Homologous: Bougainvillea thorn, Cucurbita tendril. Analogous: sweet potato, potato.
- Founder effect: a small group drifts into a new population.

Diagrams, maps & graphs to practise

- Miller's apparatus; homologous forelimbs
- Three types of natural selection (graphs)

Exam focus: how to score

- Hardy-Weinberg sums: find q from q^2 first, then p and $2pq$.
- Classify examples correctly as homologous or analogous.
- Giraffe neck = directional selection.

★ Important questions from CBSE sample papers

- Movement of landmasses changed animal distribution and evolution. Explain with two examples. (SQP 2026-27, 2 marks)
- Beetles in H-W equilibrium: 40% red (bb). Find % heterozygous and frequency of BB . (SQP 2024-25, 4 marks)
- Name the three types of natural selection shown and graph the result after generations. (SQP 2023-24, 3 marks)

Remember: Homologous = same origin, different job; analogous = same job, different origin.

Chapter 7: Human Health and Disease

Class XII • Biology • CBSE 2026-27

Big idea: Pathogens, cancer and drugs threaten health; immunity and awareness protect it.

Key points

- **Typhoid:** *Salmonella typhi* (Widal test). **Pneumonia:** *Streptococcus*, *Haemophilus*. **Common cold:** rhino viruses.
- **Malaria:** *Plasmodium* via female *Anopheles*; sporozoites → liver → RBCs; **haemozoin** causes chill and fever.
- **Amoebiasis** (*Entamoeba*), **ascariasis** (*Ascaris*), **filariasis** (*Wuchereria*), **ringworm** (*Microsporum*, *Trichophyton*). Dengue, chikungunya: *Aedes*.
- **Innate immunity:** barriers. **Acquired:** B cells (antibodies), T cells (cell-mediated).
- **Secondary (anamnestic) response** is faster and stronger due to memory cells: basis of vaccines. Passive = ready-made antibodies.
- **HIV** multiplies in macrophages, destroys **helper T cells**; tested by ELISA. Cancer spreads by **metastasis**.
- Drugs: opioids (heroin), cannabinoids, cocaine. **Dependence** brings withdrawal symptoms.

Key facts

- Antibody = H_2L_2 ; IgA, IgM, IgE, IgG. Colostrum gives IgA.
- Primary lymphoid: bone marrow, thymus. Secondary: spleen, lymph nodes, tonsils, Peyer's patches.

Diagrams, maps & graphs to practise

- Life cycle of *Plasmodium*; antibody structure
- Replication of HIV

Exam focus: how to score

- Give pathogen + vector + symptom together.
- Graphs: primary vs secondary response; HIV vs helper T count.
- Active vs passive immunity with an example each.

★ Important questions from CBSE sample papers

- How does addiction differ from dependence? Why must long-term users keep raising the dose? (SQP 2026-27, 3 marks)
- A mosquito-borne non-viral disease causes recurring fever. Explain the cause and how the pathogen multiplies in humans. (SQP 2024-25, 4 marks)
- Explain the role of primary and secondary lymphoid organs with examples. (SQP 2023-24, 5 marks)

Remember: Memory cells make the second attack weaker: that is why vaccines work.

Chapter 8: Microbes in Human Welfare

Class XII • Biology • CBSE 2026-27

Big idea: Microbes make food, medicines and fuel, clean sewage, and protect crops.

Key points

- **Lactobacillus**: curd, more vitamin B12. **Saccharomyces cerevisiae**: bread, alcoholic drinks. Swiss cheese holes: CO₂ from Propionibacterium.
- **Penicillin** (Fleming); use antibiotics judiciously to avoid resistance.
- Acids: citric (Aspergillus niger), acetic (Acetobacter), butyric (Clostridium), lactic (Lactobacillus).
- **Sewage**: primary (filter, settle) → secondary (aeration; **flocs** eat organic matter, BOD falls) → anaerobic digesters → biogas.
- **Biogas** (mostly methane) from **methanogens** (Methanobacterium); gobar gas by IARI and KVIC.
- **Biocontrol**: ladybird (aphids), Bt (caterpillars), Trichoderma, **Nucleopolyhedrovirus (baculovirus)**.
- **Biofertilisers**: Rhizobium, Azotobacter, Azospirillum; Anabaena, Nostoc (paddy); **Glomus** mycorrhiza (phosphorus).

Microbe → product

- Streptokinase: clot buster. Cyclosporin A: immunosuppressant. Statins (Monascus): lower cholesterol.
- **BOD**: O₂ used by microbes in 1 L water; high BOD = high pollution.
- Baculoviruses are species-specific: safe for non-target insects.

Exam focus: how to score

- Pair each microbe with its product.
- Explain why BOD falls in the aeration tank.
- Justify NPV/Bt as eco-friendly, species-specific biocontrol.

★ Important questions from CBSE sample papers

- A farmer used Nucleopolyhedrovirus on cabbage loopers. Justify the choice; suggest another IPM strategy. (SQP 2026-27, 4 marks)
- Explain the role of the three main sources of biofertilisers. (SQP 2024-25, 3 marks)
- The aeration tank of a sewage plant fails. Explain the impact on treatment and BOD. (SQP 2023-24, 3 marks)

Remember: High BOD = dirty water; flocs eat organic matter to bring it down.

Chapter 9: Biotechnology: Principles and Processes

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Big idea: Recombinant DNA technology cuts, joins and copies genes, then grows them in hosts.

Key points

- Core: **genetic engineering** + **bioprocess engineering**. First rDNA: Cohen & Boyer, 1972.
- **Restriction enzymes** cut at **palindromes**, leaving **sticky ends**; **DNA ligase** joins them.
- **Gel electrophoresis**: DNA moves to anode; small pieces go farther; ethidium bromide stain.
- **Vector** needs **ori**, a **selectable marker**, cloning sites (pBR322). Plants: **Agrobacterium** Ti plasmid; animals: retroviruses.
- **Insertional inactivation**: insert in lacZ → **colourless colonies** = **recombinant**; blue = non-recombinant.
- Entry: CaCl₂ + heat shock (42 °C), microinjection, **gene gun**. Break cells: lysozyme, cellulase, chitinase; **chilled ethanol** precipitates DNA.
- **PCR**: denaturation → primer annealing → extension (**Taq polymerase**). Then bioreactors and downstream processing.

Key facts

- EcoRI: E = Escherichia, co = coli, R = strain RY 13, I = first found.
- BamHI palindrome: 5'-GGATCC-3' / 3'-CCTAGG-5'.
- pBR322: BamHI, Sall in tetR; PstI, PvuI in ampR.

Diagrams, maps & graphs to practise

- EcoRI cut forming rDNA; pBR322 map
- PCR cycle; stirred-tank bioreactor

Exam focus: how to score

- Insert in tetR: cell resists ampicillin, becomes tetracycline-sensitive.
- Explain why recombinants are colourless in blue-white selection.
- Use cellulase only for plant cells; lysozyme for bacteria.

★ Important questions from CBSE sample papers

- How have pathogens been modified into vectors? Describe one plant and one animal vector. (SQP 2026-27, 3 marks)
- Explain how PCR amplifies a small amount of template DNA. (SQP 2024-25, 3 marks)
- Why is insertional inactivation preferred to antibiotic resistance to detect recombinants? (SQP 2025-26, 2 marks)

Remember: Cut (restriction enzyme), join (ligase), carry (vector), copy (PCR).

Chapter 10: Biotechnology and its Applications

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Big idea: Biotech gives pest-proof crops, human insulin, gene therapy and transgenic animals.

Key points

- GM crops: stress-tolerant, fewer pesticides, less post-harvest loss, better nutrition (golden rice).
- **Bt cotton**: cry genes from **Bacillus thuringiensis**; inactive **protoxin** turns active in alkaline gut, makes pores in midgut cells.
- **RNA interference**: dsRNA silences mRNA of nematode **Meloidogyne incognita**.
- **Insulin**: chains A and B made in E. coli, joined by disulphide bonds (Eli Lilly, 1983).
- **Gene therapy**: 1990, girl with **ADA deficiency**; ADA cDNA into lymphocytes by retroviral vector.
- Diagnosis: PCR, **ELISA** (antigen-antibody). **Transgenic animals** (>95% mice): disease study, vaccine safety.
- **Rosie** cow: human protein milk (2.4 g/L, α -lactalbumin). **GEAC** checks GM safety; **biopiracy** (basmati patent).

Key facts

- cryIAC, cryIIAb → cotton bollworms; cryIAb → corn borer.
- Permanent ADA cure: gene into marrow cells at early embryo stage.
- Transgenic = organism carrying a foreign gene.

Exam focus: how to score

- Bt: protoxin → alkaline activation → pores → cell lysis → death.
- RNAi: nematode, Agrobacterium vector, dsRNA silencing.
- Ethics questions: give one clear concern (safety, biodiversity, patent).

★ Important questions from CBSE sample papers

- Rosie's milk has 2.4 g/L α -lactalbumin. Which milk gives least? Predict an ethical concern if raised further. (SQP 2026-27, 2 marks)
- Explain how biotechnology helps prevent nematode infestation and raise yield. (SQP 2024-25, 5 marks)
- GM corn resisted corn borers. Name the gene and explain Bt's effect on the pest. (SQP 2023-24, 3 marks)

Remember: Bt toxin wakes up only in the insect's alkaline gut.

Chapter 11: Organisms and Populations

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Big idea: Populations grow, age and interact with other species.

Key points

- Attributes: birth rate, death rate, sex ratio, **age pyramid**: expanding (triangle), stable (bell), declining (urn).
- Growth: $N_{t+1} = N_t + [(B + I) - (D + E)]$.
- **Exponential** (J-curve): unlimited resources. **Logistic** (S-curve) levels off at carrying capacity **K**.
- **Mutualism** (+/+): lichens, mycorrhiza, fig-wasp; Ophrys orchid 'sexual deceit'.
- **Predation** (+/-): Cactoblastis moth controlled prickly pear. Defences: camouflage, toxins (Monarch butterfly).
- **Competition** (-/-): Gause's **competitive exclusion**; Balanus excluded Chthamalus. **Resource partitioning**: MacArthur's warblers.
- **Parasitism** (+/-): Cuscuta, cuckoo. **Commensalism** (+/0): orchid on mango, cattle egret.

Equations & key facts

- Exponential: $\frac{dN}{dt} = rN$; $N_t = N_0 e^{rt}$.
- Logistic: $\frac{dN}{dt} = rN (K - N)/K$.
- India's r (1981) = 0.0205. Amensalism: -/0.

Diagrams, maps & graphs to practise

- Age pyramids
- J and S growth curves

Exam focus: how to score

- Broad-based pyramid = growing; urn = declining.
- Give +/- signs and one example for each interaction.
- Explain coexistence by resource partitioning.

★ Important questions from CBSE sample papers

- A nematode lives in ants without killing them. What interaction is this? Why is early harm bad for it? (SQP 2026-27, 3 marks)
- Warblers feed on different parts of a spruce tree. How do they co-exist? Does Gause's principle apply? (SQP 2024-25, 3 marks)
- Comment on Japan's age pyramids for 1950, 2007 and 2050. (SQP 2025-26, 3 marks)

Remember: J-curve = unlimited food; S-curve = stops at K.

Chapter 12: Ecosystem

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Big idea: Energy flows one way from the sun, losing about 90% at each level.

Key points

- Ecosystem = biotic + abiotic parts; **stratification**: trees, shrubs, herbs.
- **GPP** = total photosynthesis; **NPP = GPP – R**. Biosphere NPP ≈ 170 billion tons/year; oceans only 55.
- **Decomposition**: fragmentation → leaching → catabolism → humification → mineralisation.
- Fast if warm, moist, nitrogen-rich; slow with lignin, chitin, cold.
- Under 50% of sunlight is **PAR**; plants capture 2–10% of it.
- Energy flow is **unidirectional**; **10 per cent law**.
- Biomass pyramid is **inverted in sea**; **energy pyramid is always upright**.

Formulas & key facts

- $NPP = GPP - R$.
- $1000\text{ J} \rightarrow 100\text{ J} \rightarrow 10\text{ J} \rightarrow 1\text{ J}$ up the chain.
- Standing crop = living biomass at a given time.
- Inverted pyramid of numbers: one tree, many insects.

Diagrams, maps & graphs to practise

- Pyramids of number, biomass, energy
- Decomposition cycle

Exam focus: how to score

- Numericals: compute NPP or energy at each level with units.
- Why energy pyramid is never inverted: heat lost at every level.
- Draw pyramids from data and label trophic levels.

★ Important questions from CBSE sample papers

- Region X: GPP 3500, R 1300 g/m²/year. Calculate NPP; give its significance. (SQP 2026-27, 2 marks)
- Organic waste in a compost pile shrinks over weeks. Explain the processes and organisms involved. (SQP 2026-27, 5 marks)
- Biomass: phytoplankton 4, zooplankton 11, small fish 25, large fish 37 kg/m². Draw the pyramid; upright or inverted? (SQP 2023-24, 2 marks)

Remember: Energy never goes back: 10% moves up, 90% is lost as heat.

Chapter 13: Biodiversity and its Conservation

Class XII • Biology • CBSE 2026-27

Big idea: Life's variety is unevenly spread, fast disappearing, and must be protected.

Key points

- Levels: **genetic** (Rauwolfia; 50,000+ rice strains), **species**, **ecological**.
- ~1.5 million species described (May: ~7 million). India: **2.4% land, 8.1% species**; 12 mega-diversity countries.
- **Latitudinal gradient**: tropics richest (Colombia ~1400 birds, Greenland 56): stable, less seasonal, more sunlight.
- **Species-area**: $\log S = \log C + Z \log A$; $Z = 0.1-0.2$ (0.6–1.2 for large areas).
- 784 extinctions in 500 years (IUCN 2004): dodo, quagga, Steller's sea cow.
- **Evil Quartet**: habitat loss (main cause), over-exploitation, **alien species** (Nile perch), **co-extinction**.
- **In situ**: 34 hotspots, biosphere reserves, national parks, **sacred groves**. **Ex situ**: zoos, seed banks, cryopreservation.

Key facts

- Why conserve: narrowly utilitarian (25% drugs), broadly utilitarian (Amazon ~20% O₂), ethical.
- India's hotspots: Western Ghats & Sri Lanka, Indo-Burma, Himalaya.
- Sacred groves: Khasi & Jaintia Hills, Aravalli Hills, Western Ghats.

Diagrams, maps & graphs to practise

- Species-area curve
- Pie chart of global species diversity

Exam focus: how to score

- Case studies: name each Evil Quartet threat with an example.
- Give two reasons why tropics have more species.
- In situ vs ex situ with two examples each.

★ Important questions from CBSE sample papers

- Green Valley X faces plant over-harvest, an alien grass, falling endemic trees and fire. Identify four threats; suggest an in-situ step. (SQP 2026-27, 5 marks)
- Why conserve biodiversity? Explain two causes of its loss. (SQP 2024-25, 5 marks)
- Give three reasons why ecologists give no figures for prokaryote diversity. (SQP 2023-24, 3 marks)

Remember: Evil Quartet: Habitat loss, Over-exploitation, Aliens, Co-extinction.