FREE EDITION · NOTES + 3 SAMPLE MCQS

CUET · BIOLOGY · CLASS XI · CODE 304

Plant Kingdom

CUET unit: Diversity in Living World → Plant Kingdom

By **UniDrill** · NCERT-grounded study material

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📌 Snapshot

- Kingdom Plantae (within Whittaker's Five-Kingdom system) covers Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms (NCERT §3, p. 23). Cyanobacteria (blue-green algae) — though once historically lumped with algae — are now placed in Monera, leaving Plantae for genuine eukaryotic photosynthesisers.
- Establishes the progression of classification systems — **artificial** (Linnaeus, equal weight to vegetative + sexual characters) → **natural** (Bentham & Hooker, external + internal anatomy, embryology, phytochemistry) → **phylogenetic** (current, based on evolutionary relationships) — supplemented by Numerical Taxonomy (computer-coded characters, all weighted equally), Cytotaxonomy (chromosome number/structure/behaviour), and Chemotaxonomy (chemical constituents of the plant) (NCERT §3 intro, pp. 23–24).
- Tracks the evolutionary trend from haploid-dominant gametophyte (algae and bryophytes) to diploid-dominant sporophyte (pteridophytes, gymnosperms, angiosperms), and from water-dependent fertilisation to the seed habit. Within this arc, heterospory in **Selaginella** and **Salvinia** is signposted as the textbook "precursor to the seed habit".
- Distinguishes the three algal classes by pigment, stored food, cell wall and flagella (Table 3.1, p. 27) — the highest-yield CUET object in the entire chapter — and walks the seed-plant story from naked seeds in gymnosperms (**Cycas**, **Pinus**, **Ginkgo**) to enclosed seeds in flowering plants (range **Wolffia** to **Eucalyptus**).
- CUET typically tests pigment/stored-food tables, ploidy of stages, examples of each group (**Funaria**, **Selaginella**, **Cycas**, **Pinus**, **Ginkgo**, **Volvox**, **Ulothrix**, **Spirogyra**, **Sargassum**, **Polysiphonia**, **Porphyra**, **Marchantia**, **Sphagnum**, **Equisetum**, **Salvinia**), and structural terms like archegonium, antheridium, prothallus, strobilus, gemma cup, protonema, coralloid root, mycorrhiza, pollen grain, and ovule.
- Angiosperms divide into dicots and monocots — detailed further in Chapter 5 (Morphology of Flowering Plants) and Chapter 6 (Anatomy).

📖 Detailed Notes

2.1 Core concepts

- **Classification systems evolved in three stages** — artificial systems (Linnaeus) used only gross morphology and androecium structure, gave equal weight to vegetative and sexual characters; natural systems (Bentham & Hooker) used external + internal features (anatomy, embryology, phytochemistry); phylogenetic systems are based on evolutionary relationships and are currently accepted (NCERT §3 intro, pp. 23–24).
- **Numerical Taxonomy** uses computers with codes assigned to all observable characters; **Cytotaxonomy** uses chromosome number/structure/behaviour; **Chemotaxonomy** uses chemical constituents of the plant (NCERT §3 intro, p. 24).
- **Algae** are chlorophyll-bearing, simple, thalloid, autotrophic and largely aquatic; also found on moist stones, soils, wood and in symbiosis (lichen with fungi; with animals like sloth bear) (NCERT §3.1, p. 24).
- **Algal reproduction**: vegetative — by fragmentation; asexual — by spores (zoospores most common, flagellated and motile); sexual — isogamous (similar gametes, flagellated as in Ulothrix or non-flagellated as in Spirogyra), anisogamous (dissimilar in size, Eudorina), oogamous (large non-motile female + small motile male, Volvox, Fucus) (NCERT §3.1, p. 24).
- **Economic importance of algae**: at least half of Earth's CO_2 fixation; primary producers of aquatic food cycles; Porphyra, Laminaria, Sargassum used as food; **algin** (brown algae) and **carrageen** (red algae) are commercial hydrocolloids; **agar** from Gelidium and Gracilaria; Chlorella — protein-rich food supplement used by space travellers (NCERT §3.1, p. 26).
- **Chlorophyceae (green algae)**: pigments chlorophyll a and b; storage as **starch** in **pyrenoids** (protein + starch) or oil droplets; cell wall — inner cellulose + outer pectose; examples — Chlamydomonas, Volvox, Ulothrix, Spirogyra, Chara (NCERT §3.1.1, p. 26).
- **Phaeophyceae (brown algae)**: chlorophyll a, c, carotenoids and xanthophylls; colour due to **fucoxanthin**; food stored as **laminarin** or **mannitol**; plant body = holdfast + stipe + frond; cellulose wall coated with **algin**; biflagellate pyriform zoospores with two unequal lateral flagella; examples — Ectocarpus, Dictyota, Laminaria, Sargassum, Fucus (NCERT §3.1.2, pp. 26–27).
- **Rhodophyceae (red algae)**: red colour due to **r-phycoerythrin**; mostly marine; food stored as **floridean starch** (similar to amylopectin/glycogen); sexual reproduction is **oogamous** with complex post-fertilisation development; flagella **absent**; examples — Polysiphonia, Porphyra, Gracilaria, Gelidium (NCERT §3.1.3, pp. 27–28).

- **Bryophytes** are "amphibians of the plant kingdom" — live on soil but need water for sexual reproduction; pioneer colonisers of bare rock; prevent soil erosion (NCERT §3.2, p. 29).
- **Bryophyte body plan**: thallus-like, attached by uni-/multicellular rhizoids; main plant body is **haploid gametophyte**; male sex organ = **antheridium** (produces biflagellate antherozoids); female = flask-shaped **archegonium** (single egg); zygote develops into a multicellular **sporophyte** attached to and dependent on the gametophyte; sporophyte cells undergo meiosis to release haploid spores (NCERT §3.2, p. 29).
- **Liverworts** — thalloid, dorsiventral (Marchantia); asexual reproduction by fragmentation or by **gemmae** in **gemma cups**; sporophyte = foot + seta + capsule (NCERT §3.2.1, pp. 29–30).
- **Mosses** — gametophyte has two stages: **protonema** (creeping, filamentous, develops from spore) and **leafy stage** (upright with spirally arranged leaves, bears sex organs); sporophyte = foot, seta, capsule (more elaborate than liverwort); Sphagnum yields peat used as fuel/packing material; examples — Funaria, Polytrichum, Sphagnum (NCERT §3.2.2, p. 30).
- **Pteridophytes** — first terrestrial plants with vascular tissues (xylem and phloem); sporophyte is the **dominant phase** and has true root, stem, leaves; leaves may be **microphylls** (Selaginella) or **macrophylls** (ferns); sporangia borne on **sporophylls**, which may form **strobili/cones** (Selaginella, Equisetum) (NCERT §3.3, p. 30).
- **Pteridophyte life cycle**: spores germinate to form a small free-living photosynthetic **prothallus** (gametophyte) bearing antheridia and archegonia; water is needed to transfer antherozoids; zygote develops into dominant sporophyte (NCERT §3.3, p. 32).
- **Homosporous vs heterosporous**: most pteridophytes are homosporous; Selaginella and Salvinia are **heterosporous** (produce macro- and microspores giving rise to female and male gametophytes respectively); female gametophyte retained on parent sporophyte — **precursor to seed habit** (NCERT §3.3, p. 32).
- **Pteridophyte classes**: Psilopsida (Psilotum); Lycopsida (Selaginella, Lycopodium); Sphenopsida (Equisetum); Pteropsida (Dryopteris, Pteris, Adiantum) (NCERT §3.3, p. 32).
- **Gymnosperms** (gymnos = naked, sperma = seeds) — ovules not enclosed in ovary wall; seeds remain naked after fertilisation; Sequoia among the tallest trees; **mycorrhiza** in Pinus; **coralloid roots** in Cycas associate with N_2-fixing cyanobacteria; conifer needles have reduced surface area, thick cuticle and sunken stomata (NCERT §3.4, p. 32).
- **Gymnosperm reproduction**: all are heterosporous; microsporangia on microsporophylls form **male strobili**; megasporangia (ovules) on megasporophylls form **female strobili**; Pinus bears both cones on same tree but Cycas has them on different trees; reduced male gametophyte = **pollen grain**; pollen carried by air

currents; pollen tube delivers male gametes to archegonia; ovules become naked seeds; male and female gametophytes are **not free-living**, retained on sporophyte (NCERT §3.4, p. 33).

- **Angiosperms** — flowering plants; pollen and ovules develop inside **flowers**; seeds enclosed in **fruits**; range from smallest Wolffia to tall Eucalyptus (>100 m); divided into **dicotyledons** and **monocotyledons** (NCERT §3.5, p. 34).

2.2 Definitions to memorise

Term	Definition	Page
Artificial classification	System based on a few morphological/sexual characters (e.g., Linnaeus); separates closely related species	23
Natural classification	System using external + internal features (anatomy, embryology, phytochemistry); Bentham & Hooker	23–24
Phylogenetic classification	System based on evolutionary relationships and common ancestry	24
Isogamy	Fusion of two gametes similar in size (Ulothrix, Spirogyra)	24
Anisogamy	Fusion of two gametes dissimilar in size (Eudorina)	24
Oogamy	Fusion of large non-motile female gamete with small motile male gamete (Volvox, Fucus)	24
Pyrenoid	Storage body in chloroplasts of green algae containing protein and starch	26
Fucoxanthin	Brown xanthophyll pigment of Phaeophyceae	26
Floridean starch	Stored food of red algae, similar to amylopectin and glycogen	27
Gametophyte	Haploid, gamete-producing main plant body (bryophyte)	29
Antheridium	Male sex organ producing biflagellate antherozoids	29
Archegonium	Flask-shaped female sex organ producing a single egg	29
Gemmae	Green multicellular asexual buds borne in gemma cups (liverworts)	29
Protonema	Creeping, filamentous first stage of moss gametophyte that develops from a spore	30
Sporophyll	Leaf-like appendage bearing sporangia	30
Strobilus / Cone	Compact aggregation of sporophylls (Selaginella, Equisetum)	30
Prothallus	Small, free-living, photosynthetic thalloid gametophyte of pteridophytes	32
Heterospory	Production of two kinds of spores — macro (megaspore) and micro (microspore)	32
Mycorrhiza	Fungal association with roots, seen in Pinus	32

Term	Definition	Page
Coralloid roots	Specialised Cycas roots associated with N_2-fixing cyanobacteria	32
Ovule	Nucellus + protective envelopes; bears the megaspore	33
Pollen grain	Reduced male gametophyte of gymnosperms/angiosperms	33

2.3 Diagrams / processes to remember

- **Figure 3.1, p. 25** — Algae: (a) green — Volvox (with daughter colonies), Ulothrix; (b) brown — Laminaria, Fucus (note air bladder, frond, midrib), Dictyota (with stipe, frond); (c) red — Porphyra, Polysiphonia.
- **Table 3.1, p. 27** — Algal classes: common name, pigments, stored food, cell wall, flagellar number/position, habitat. Highest-yield CUET table here.
- **Figure 3.2, p. 28** — Bryophytes: Marchantia female (archegoniophore) and male (antheridiophore) thalli with gemma cups and rhizoids; Funaria (gametophyte with leaves + main axis + rhizoids; sporophyte with capsule + seta); Sphagnum gametophyte.
- **Figure 3.3, p. 31** — Pteridophytes: Selaginella (leaves, stem, roots), Equisetum (strobilus, node, internode, branch, rhizome), fern, Salvinia.
- **Figure 3.4, p. 33** — Gymnosperms: Cycas, Pinus, Ginkgo (dwarf shoot, long shoot, seeds).
- **Figure 3.5, p. 34** — Angiosperms: a dicotyledon vs a monocotyledon.

2.4 Common confusions / NTA trap points

- **Cyanobacteria ≠ algae**. Blue-green algae are placed in Monera, NOT Plantae (NCERT §3 intro, p. 23). NTA likes to put "Nostoc / Anabaena" as a distractor under algae.
- **Pigment-class pairing**: r-phycoerythrin → red algae; fucoxanthin → brown algae; chlorophyll b → green algae. Mixing these is the favourite NTA trap.
- **Stored food**: green → starch; brown → laminarin/mannitol (NOT starch); red → floridean starch (similar to glycogen, NOT to true starch).
- **Dominant phase**: bryophytes — gametophyte dominant; pteridophytes/ gymnosperms/angiosperms — sporophyte dominant. Saying "moss sporophyte is dominant" is a classic wrong choice.
- **Cycas trivia**: pinnate leaves, coralloid roots with cyanobacteria, dioecious (male and female cones on different trees). Pinus is monoecious (both cones on same tree).
- **Heterosporous pteridophytes**: only Selaginella and Salvinia. Equisetum, Lycopodium, Pteris, Dryopteris are homosporous.
- **Sphagnum** uses — peat (fuel) and packing material because of water-holding capacity; not for food.

- **Isogamy/anisogamy/oogamy examples.** Isogamy: Ulothrix (flagellated) and Spirogyra (non-flagellated). Anisogamy: Eudorina. Oogamy: Volvox, Fucus. NTA frequently swaps these.
- **Algal cell walls.** Green: inner cellulose + outer pectose. Brown: cellulose coated with algin. Red: cellulose, pectin, polysulphate esters. Distractors that swap algin and agar are common (algin is in brown algal walls; agar is extracted from red algae).
- **Liverwort vs Moss asexual reproduction.** Liverworts use **gemmae** in gemma cups; mosses develop a **protonema** from the germinating spore. Flipping these two is a common NTA wrong choice.
- **Prothallus.** The free-living photosynthetic gametophyte of pteridophytes — not of bryophytes or gymnosperms. The bryophyte gametophyte is the thallus itself; the gymnosperm gametophyte is not free-living.
- **Seed habit precursor.** Heterospory + retention of female gametophyte on parent sporophyte (in Selaginella) is described in NCERT (§3.3, p. 32) as a "precursor to the seed habit" — direct-quote item.
- **Largest and smallest angiosperms.** Smallest: Wolffia; tallest mentioned: Eucalyptus (>100 m). For gymnosperms, Sequoia is the tallest tree (NCERT §3.4, p. 32).
- **Algal flagella count and insertion.** Brown algal zoospores are **biflagellate**, **pyriform**, with two **unequal lateral** flagella. Red algae have **no** flagella. NTA loves this fine-grained detail.

🎯 Practice MCQs

Q1. The classification system that gives equal weightage to vegetative and sexual characters and was proposed by Linnaeus is called:

A. Natural classification

B. Phylogenetic classification

C. Artificial classification

D. Numerical classification

Q2. Which one of the following pairs of pigment–stored food correctly describes Phaeophyceae?

A. Chlorophyll a, b — starch

B. Chlorophyll a, c and fucoxanthin — mannitol/laminarin

C. Chlorophyll a, d and phycoerythrin — floridean starch

D. Chlorophyll a, b and fucoxanthin — floridean starch

Q3. Read the following statements about Rhodophyceae and choose the correct option: (I) Sexual reproduction is oogamous and is followed by complex post-fertilisation developments. (II) The major red pigment is r-phycoerythrin. (III) Flagellated zoospores are the chief means of asexual reproduction. (IV) Food is stored as floridean starch.

A. I, II and III

B. I, II and IV

C. II, III and IV

D. I, III and IV

📊 PYQ Alignment

Plant Kingdom is one of the most heavily tested chapters under Unit I (Diversity in Living World) of CUET Biology, typically yielding 8–10 MCQs per year across CUET 2023–2025. NTA-style questions focus almost exclusively on the algal pigment/stored-food/cell-wall table, ploidy of life-cycle stages (gametophyte vs sporophyte dominance), examples linked to each class (especially Funaria, Marchantia, Selaginella, Equisetum, Cycas, Pinus, Ginkgo), heterospory, and distinctive features such as coralloid roots, mycorrhiza, gemmae and protonema — making rote of Table 3.1 and Figures 3.1–3.4 the single highest-yield revision target. See `/pyq/biology` for the full PYQ archive.

Plant Kingdom appeared in CUET (UG) Biology across 1 cycle(s) — 1 question(s) total. The questions below were extracted from official CUET (UG) papers and matched to this chapter by topic. See `/pyq/biology` for the full PYQ archive.

CUET 2025 — Actual PYQs from this chapter

Q.26 (CUET 2025) Arrange plant groups according to appearance on earth: (A) Angiosperms (B) Seed ferns (C) Rhynia-type plants (D) Psilophyton

- A)
- B)
- C)
- D)

Tests: aligns with chapter content Answer: Not in extracted key — verify against official NTA key