FREE NOTES · NCERT + NEET LEVEL

Plant Kingdom

Types of classification systems, algae (green, brown, red), bryophytes (liverworts, mosses), pteridophytes, gymnosperms, angiosperms, and plant life cycles with alternation of generations.

01 Classification systems
02 Algae
03 Classes of algae
04 Bryophytes
05 Pteridophytes: first vascular plants
06 Gymnosperms: naked seeds
07 Angiosperms & plant life cycles
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01 Classification systems

System	Basis
Artificial (Linnaeus)	Few vegetative/sexual characters (e.g. androecium)
Natural (Bentham & Hooker)	Natural affinities, internal + external features
Phylogenetic	Evolutionary relationships

Numerical taxonomy uses computers and all characters (equal weight). **Cytotaxonomy**: chromosome number, structure. **Chemotaxonomy**: chemical constituents.

02 Algae

Simple, chlorophyll-bearing, thalloid, autotrophic, mostly aquatic. Form: colonial (*Volvox*), filamentous (*Ulothrix*, *Spirogyra*), massive (kelps).

- **Vegetative** reproduction: fragmentation. **Asexual**: zoospores (flagellated).
- **Sexual**: isogamous (similar gametes, *Spirogyra* non-flagellated, *Ulothrix* flagellated), anisogamous (*Eudorina*), oogamous (*Volvox*, *Fucus*).
- Uses: half of total CO_2 fixation on earth; food (*Porphyra*, *Laminaria*, *Sargassum*); agar from *Gelidium*, *Gracilaria*; algin (brown), carrageen (red); *Chlorella* as protein supplement for space travellers.

03 Classes of algae

	Chlorophyceae (green)	Phaeophyceae (brown)	Rhodophyceae (red)
Pigments	Chl a, b	Chl a, c, **fucoxanthin**	Chl a, d, **r-phycoerythrin**
Stored food	Starch	Mannitol, laminarin	Floridean starch
Cell wall	Cellulose + pectose	Cellulose + algin	Cellulose, pectin, polysulphate esters
Flagella	2–8, equal, apical	2, unequal, lateral	Absent
Habitat	Fresh, brackish, salt water	Mostly marine	Mostly marine, deep water
Examples	*Chlamydomonas*, *Volvox*, *Ulothrix*, *Spirogyra*, *Chara*	*Ectocarpus*, *Dictyota*, *Laminaria*, *Sargassum*, *Fucus*	*Polysiphonia*, *Porphyra*, *Gracilaria*, *Gelidium*

04 Bryophytes: "amphibians of the plant kingdom"

- Live on land but need water for fertilisation. Damp, shady places. Important in plant succession on rocks; *Sphagnum* (peat) used as fuel and packing material.
- Plant body is **gametophyte** (dominant, haploid), with rhizoids; no true roots, stem, leaves.
- Sex organs: **antheridium** (male, biflagellate antherozoids), **archegonium** (female, flask-shaped, one egg).
- Zygote → **sporophyte** (foot, seta, capsule), dependent on the gametophyte; meiosis gives spores.
- **Liverworts**: thalloid (*Marchantia*), gemmae for asexual reproduction. **Mosses**: protonema stage then leafy stage (*Funaria*, *Polytrichum*, *Sphagnum*); elaborate spore dispersal.

05 Pteridophytes: first vascular plants

- First terrestrial plants with **xylem and phloem**. Ferns, horsetails (*Equisetum*), *Selaginella*, *Lycopodium*, *Psilotum*, *Pteris*, *Dryopteris*, *Adiantum*.
- Main plant body is the **sporophyte** (root, stem, leaves: microphylls or macrophylls).
- Sporangia on sporophylls; sometimes in **strobili**/cones.
- Spores → small free-living **prothallus** (gametophyte); needs water for fertilisation.
- Most homosporous; *Selaginella* and *Salvinia* are **heterosporous** (micro- and megaspores) ⇒ precursor of the seed habit.

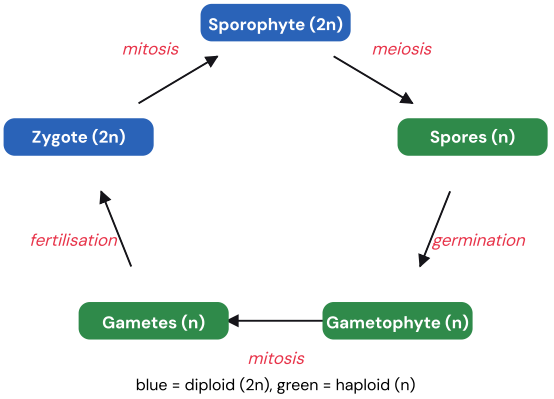
06 Gymnosperms: naked seeds

- Ovules not enclosed in an ovary; seeds exposed. Trees and shrubs; giant redwood *Sequoia* is among the tallest trees.
- Tap roots; **coralloid roots** of *Cycas* (with cyanobacteria), **mycorrhiza** in *Pinus*.
- Needle-like leaves with thick cuticle and sunken stomata (reduce water loss).
- Heterosporous: microsporophylls in male cones, megasporophylls in female cones. Gametophyte is not free-living. Pollen reaches ovule by wind; pollen tube carries gametes.
- Examples: *Cycas*, *Pinus*, *Ginkgo*, *Cedrus*.

07 Angiosperms & plant life cycles

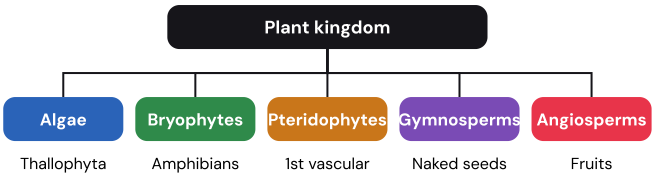
Flowering plants with seeds inside fruits. Dicots and monocots. Size from *Wolffia* (tiny) to *Eucalyptus* (over 100 m). **Double fertilisation**: one male gamete + egg ⇒ zygote; other + secondary nucleus ⇒ triploid endosperm.

Life cycle	Dominant phase	Example
Haplontic	Gametophyte (n); zygote only 2n	*Volvox*, *Spirogyra*, *Chlamydomonas*
Diplontic	Sporophyte (2n)	Seed plants, *Fucus*
Haplo-diplontic	Both multicellular	Bryophytes (n dominant), pteridophytes (2n dominant), *Ectocarpus*, *Polysiphonia*, kelps



Alternation of generations

08 Extra + tricks



Cryptogams (no seeds: algae → pteridophytes) vs phanerogams (seed plants)

- **Cryptogams** (hidden sex organs): algae, bryophytes, pteridophytes. **Phanerogams** (seed plants): gymnosperms, angiosperms.
- Pteridophyte classes: **Psilopsida** (*Psilotum*), **Lycopsida** (*Selaginella*, *Lycopodium*), **Sphenopsida** (*Equisetum*), **Pteropsida** (*Dryopteris*, *Pteris*, *Adiantum*).
- Gymnosperm uses: **taxol** (anti-cancer, *Taxus*), **ephedrine** (cough, *Ephedra*), resins, turpentine; *Ginkgo* = living fossil; *Zamia pygmaea* = smallest gymnosperm.
- *Azolla* (water fern) + *Anabaena* fixes nitrogen in paddy fields; *Sphagnum* holds water (packing of living material).
- Trick for algae pigments: **G-B-R** → Green: chl a, b; Brown: fucoxanthin; Red: phycoerythrin (red algae grow deepest).

09 Important Q&A

Q1. Why are bryophytes called amphibians of the plant kingdom?

They live on land but need water for the antherozoids to swim to the egg.

Q2. Which pteridophytes are heterosporous and why is this important?

Selaginella, *Salvinia*; retaining the megaspore led to the evolution of the seed habit.

Q3. Ploidy of: protonema, endosperm (angiosperm), prothallus, zygote.

n, 3n, n, 2n.

10 Common mistakes

- Saying the bryophyte main body is sporophyte (it is gametophyte).
- Mixing pigments: fucoxanthin = brown, phycoerythrin = red.
- Calling gymnosperm endosperm triploid (it is haploid, formed before fertilisation).
- Thinking pteridophytes have seeds.

11 Practice (NEET style)

1. Agar is obtained from?
2. Coralloid roots occur in?
3. First vascular plants?
4. Stored food of red algae?
5. Life cycle of *Ectocarpus*?

ANSWERS

1) *Gelidium*, *Gracilaria* · 2) *Cycas* · 3) Pteridophytes · 4) Floridean starch · 5) Haplo-diplontic

12 Quick revision: 5 minutes before the exam

ALGAE

- Green: starch; brown: fucoxanthin, laminarin; red: phycoerythrin, floridean starch.

BRYOPHYTES

- Gametophyte dominant.
- Need water; amphibians.

PTERIDOPHYTES

- First vascular; sporophyte dominant.
- Selaginella heterosporous.

SEED PLANTS

- Gymno: naked seeds.
- Angio: double fertilisation, 3n endosperm.

Have a doubt? Ask the AI Doubt Solver at padhaiadda.netlify.app, or take the mock test on this chapter.