

# CHAPTER 3

# PLANT KINGDOM

VEDA  
ACADEMY

CLASS 11<sup>TH</sup>

## NCERT EXERCISE AND SOLUTIONS - BIOLOGY

**Q. 1.** What is the basis of classification of algae?

**ANSWER:-**

Algae are categorized into three primary classes: Chlorophyceae, Phaeophyceae, and Rhodophyceae. These divisions are based on the following factors:

- Main photosynthetic pigments
- Type of stored food
- Composition of the cell wall
- Number and position of flagella

**Class I – Chlorophyceae**

- Common name:** Green algae
- Major pigments:** Chlorophylls a and b
- Stored food:** Starch
- Cell wall composition:** Cellulose
- Flagella number and position:** 2, equal and apical

**Class II – Phaeophyceae**

- Common name:** Brown algae
- Major pigments:** Chlorophylls a and c, fucoxanthin
- Stored food:** Mannitol and laminarin
- Cell wall composition:** Cellulose and algin
- Flagella number and position:** 2, unequal and lateral

**Class III – Rhodophyceae**

- Common name:** Red algae
- Major pigments:** Chlorophylls a and b, phycoerythrin
- Stored food:** Floridean starch
- Cell wall composition:** Cellulose, pectin, and polysulphate esters
- Flagella:** Absent



**Q. 2.** When and where does reduction division take place in the life cycle of a liverwort, a moss, a fern, a gymnosperm and an angiosperm?

**ANSWER:-**

**Liverwort:** In liverworts, the main plant body is haploid (gametophytic). It contains both male and female sex organs that produce gametes. The fusion of these gametes forms a zygote, which develops into a sporophyte on the gametophytic body. The sporophyte is differentiated into the foot, seta, and capsule, and within the capsule, reduction division occurs, producing numerous haploid spores.

**Moss:** In mosses, the primary protonema, developed in the first stage, gives rise to the secondary protonema, both of which are haploid (gametophytic). The secondary protonema produces sex organs that generate gametes, which fuse to form a zygote. The zygote then develops into a sporophyte, and reduction division in the capsule of the sporophyte leads to the formation of numerous spores.

**Fern:** In ferns, the main plant body is sporophytic. The leaves, known as sporophylls, bear sporangia. Reduction division occurs within the sporangia, resulting in the production of many spores.

**Gymnosperm:** In gymnosperms, the main plant body is sporophytic and produces two types of leaves: microsporophylls and megasporophylls. Reduction division in the microsporangia of the microsporophylls produces pollen grains, while in the megasporangia of the megasporophylls, megaspores are formed.

**Angiosperm:** In angiosperms, the main plant body is sporophytic and produces flowers. The male reproductive organ is the stamen, and the female reproductive organ is the pistil. Reduction division occurs in the anthers of the stamen, producing haploid pollen grains, and in the ovary of the pistil, generating eggs.

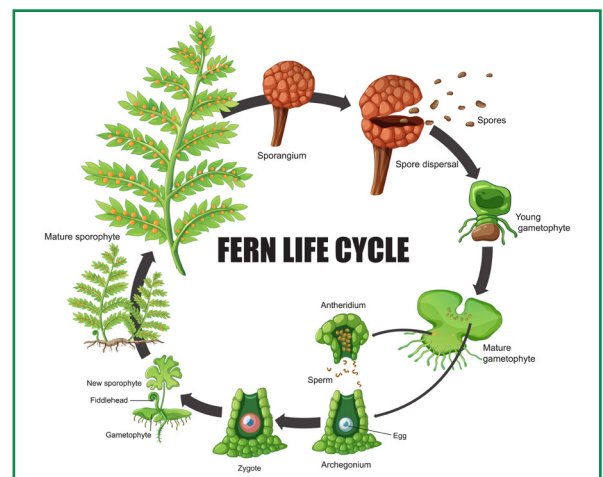
**Q. 3.** Name three groups of plants that bear archegonia. Briefly describe the life cycle of any one of them.

**ANSWER:-**

The archegonium is the female reproductive organ that produces the female gamete (egg). It is found in the life cycles of bryophytes, pteridophytes, and gymnosperms.

**Life cycle of a fern (Dryopteris):**

*Dryopteris* is a common fern with pinnately compound leaves, and its main plant body is sporophytic. Numerous sporangia are located on the lower surfaces of its mature leaves. Each sporangium contains spore mother cells that undergo meiosis to produce haploid spores. Upon maturing, these spores dehisce and germinate, forming a heart-shaped gametophyte known as the prothallus. The prothallus bears both male and female reproductive organs, the antheridia and archegonia, respectively. The antheridia produce sperm, which swim in water to reach the archegonia, where the



egg is located. Fertilization results in the formation of a zygote, which develops into an embryo. The embryo grows into a new sporophyte, which eventually emerges from the archegonium of the parent gametophyte.

- Q. 4. Mention the ploidy of the following: protonemal cell of a moss; primary endosperm nucleus in dicot, leaf cell of a moss; prothallus cell of a fern, gemma cell in *Marchantia*; meristem cell of monocot, ovum of a liverwort, and zygote of a fern.**

**ANSWER:-**

- Protonemal cell of a moss – Haploid
- Primary endosperm nucleus in a dicot – Triploid
- Leaf cell of a moss – Haploid
- Prothallus of a fern – Haploid
- Gemma cell in *Marchantia* – Haploid
- Meristem cell of a monocot – Diploid
- Ovum of a liverwort – Haploid
- Zygote of a fern – Diploid

- Q. 5. Write a note on economic importance of algae and gymnosperms.**

**ANSWER:-**

**Economic importance of algae**

Algae have various significant economic applications. They contribute to half of the total carbon dioxide fixation on Earth through photosynthesis, serving as primary producers in aquatic environments.

- Food source:** Several species of marine algae, such as *Porphyra*, *Sargassum*, and *Laminaria*, are edible. *Chlorella* and *Spirulina* are protein-rich and used as dietary supplements.
- Commercial importance:** Agar, derived from *Gelidium* and *Gracilaria*, is used in the production of jellies and ice cream. Carrageenan, sourced from red algae, is used as an emulsifier in products like chocolates, paints, and toothpaste.
- Medicines:** Red algae, such as *Corallina*, are utilized in the treatment of worm infections.

**Economic importance of gymnosperms**

- Construction purposes:** Coniferous trees such as pine and cedar provide softwood, which is widely used in construction and packaging.
- Medicinal uses:** *Taxol*, an anticancer drug, is derived from *Taxus*. Various species of *Ephedra* produce ephedrine, which is used in treating asthma and bronchitis.
- Food source:** The seeds of *Pinus gerardiana*, commonly known as chilgoza, are edible.
- Source of resins:** Resins, which are used commercially in making sealing wax and waterproof paints, are obtained from several species of *Pinus*. One such resin, turpentine, is derived from these conifers.



**Q. 6. Both gymnosperms and angiosperms bear seeds, then why are they classified separately?**

**ANSWER:-**

Gymnosperms and angiosperms are seed-bearing plants that both follow a diplontic life cycle.

In gymnosperms, the sporophylls are clustered to form compact cones. The microsporophylls are broad and do not have distinct filaments and anthers. The megasporophylls are woody and lack structures like the ovary, style, and stigma, leaving the ovules exposed. The female gametophyte consists of archegonia. Fertilization occurs when a male gamete fuses with a female gamete. The endosperm produced is haploid, and the seeds are exposed because no fruit is formed.

Angiosperms, or flowering plants, have sporophylls that aggregate into flowers, which include the perianth. The microsporophylls are stamens with pollen sacs that contain male gametes (pollen grains). The megasporophylls are rolled into carpels containing the ovary, style, and stigma. Ovules are enclosed within the ovary, and the archegonium is replaced by an egg apparatus. During fertilization, two male gametes enter the egg apparatus: one fertilizes the egg, while the other fuses with the diploid secondary nucleus to form a triploid endosperm. In angiosperms, seed development occurs within the fruits.

**Q. 7. What is heterospory? Briefly comment on its significance. Give two examples.**

**ANSWER:-**

Heterospory is a process where a plant produces two types of spores that differ in size. The smaller spore is called the microspore, while the larger spore is known as the megaspore. The microspore germinates to form the male gametophyte, and the megaspore germinates to form the female gametophyte. The male gametophyte produces male gametes, which travel to the female gametophyte to fuse with the egg. The zygote develops within the female gametophyte, and this retention and germination of the megaspore in the megasporangium ensures proper zygote development. The zygote eventually develops into the sporophyte. The evolution of the seed habit is linked to the retention of the megaspore, and heterospory is considered a significant evolutionary step, serving as a precursor to seed formation. Heterospory first evolved in pteridophytes like *Selaginella* and *Salvinia*.

**Q. 8. Explain briefly the following terms with suitable examples: -**

- (i) protonema
- (ii) antheridium
- (iii) archegonium
- (iv) diplontic
- (v) sporophyll
- (vi) isogamy

**ANSWER:-**

- (i) **Protonema:** The first stage in the moss life cycle, directly developing from the spore. It consists of creeping, green, branched, and often filamentous structures.



- (ii) **Antheridium:** The male sex organ found in bryophytes and pteridophytes, surrounded by a sterile cell jacket. It contains sperm mother cells, which produce male gametes.
- (iii) **Archegonium:** The female sex organ in bryophytes, pteridophytes, and gymnosperms. In bryophytes and pteridophytes, it typically has a swollen venter and a tubular neck, housing the female gamete, the egg.
- (iv) **Diplontic:** Referring to the life cycle of seed-bearing plants (gymnosperms and angiosperms). In these plants, the diploid sporophyte is the dominant, photosynthetic, and independent phase, while the gametophyte is represented by a single-celled or few-celled structure.
- (v) **Sporophyll:** In pteridophytes, the sporophytic plant body bears sporangia, which are supported by leaf-like appendages called sporophylls. In gymnosperms, microsporophylls and megasporophylls are found, bearing microspores and megaspores, respectively.
- (vi) **Isogamy:** A type of sexual reproduction involving the fusion of morphologically identical gametes. Although the gametes are the same size, they perform different functions. This form of reproduction is commonly seen in *Spirogyra*.

**Q. 9. Differentiate between the following: -**

- (i) red algae and brown algae
- (ii) liverworts and moss
- (iii) homosporous and heterosporous pteridophyte

**ANSWER:-**

**(i) red algae and brown algae**

Red Algae		Brown algae	
1.	Red algae are grouped under the class Rhodophyceae.	1.	Brown algae are grouped under the class Phaeophyceae.
2.	They contain floridean starch as stored food.	2.	They contain mannitol or laminarin as stored food.
3.	They contain the photosynthetic pigments chlorophylls a and d, and phycoerythrin.	3.	They contain the photosynthetic pigments chlorophylls a and c, and fucoxanthin.
4.	Their cell walls are composed of cellulose, pectin, and phycocolloids.	4.	Their cell walls are composed of cellulose and algin.
5.	Flagella are absent	5.	Two flagella are present

**(ii) liverworts and moss**

Liverworts		Moss	
1.	They have unicellular rhizoids.	1.	They have multicellular rhizoids.
2.	Scales are present very often	2.	Scales are absent
3.	They are generally thalloid, with dichotomous branching.	3.	They are foliage, with lateral branching.
4.	Gemma cups are present	4.	Gemma cups are absent
5.	Sporophyte has very photosynthetic tissue little	5.	Sporophyte has abundant photosynthetic tissue



**(iii) homosporous and heterosporous pteridophyte**

Homosporous pteridophytes		Heterosporous pteridophytes	
1.	They bear spores that are of the same type.	1.	They bear two kinds of spores - microspores and megaspores.
2.	They produce bisexual gametophytes.	2.	They produce unisexual gametophytes.

**Q. 10. Match the following (column I with column II)**

Column I	Column II
(a) <i>Chlamydomonas</i>	(i) Moss
(b) <i>Cycas</i>	(ii) Pteridophyte
(c) <i>Selaginella</i>	(iii) Algae
(d) <i>Sphagnum</i>	(iv) Gymnosperm

**ANSWER:-**

- (a) – (iii)
- (b) – (iv)
- (c) – (ii)
- (d) – (i)

**Q. 11. Describe the important characteristics of gymnosperms**

**ANSWER:-**

**Key characteristics of gymnosperms:**

- (a) The term “gymnosperm” refers to plants with exposed seeds (from Greek *gymnos* meaning naked and *sperma* meaning seed), meaning their seeds are not enclosed in fruits.
- (b) Gymnosperms are typically medium to tall trees or shrubs, with the giant redwood tree Sequoia being one of the tallest trees in the world.
- (c) Their root system is predominantly taproot-based. In *Cycas*, coralloid roots are present, which are associated with nitrogen-fixing cyanobacteria.
- (d) The stem can be either branched (as seen in *Pinus* and *Cedrus*) or unbranched (as in *Cycas*).
- (e) Leaves may be simple (as in *Pinus*) or compound (pinnate in *Cycas*). They are usually needle-like, with a thick cuticle and sunken stomata, which help reduce water loss.
- (f) Gymnosperms are heterosporous, producing two types of spores: microspores and megaspores.
- (g) Flowers are absent. Instead, microsporophylls and megasporophylls are organized into compact male and female cones.
- (h) Pollination is primarily wind-driven, with pollen grains reaching the ovule’s pollen chamber through the micropyle.
- (i) The male and female gametophytes rely on the sporophyte for development.
- (j) The seeds contain haploid endosperms and remain exposed, not enclosed in a fruit.

