Chapter-4 Plant Kingdom

Very Short Answer Questions

1. **What is the basis of classification of Algae?**

A: Pigments and types of stored food.

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

A: Liverwort --- sporogenous tissue inside the capsule.

Mosses --- sporogenous tissue inside the capsule.

Fern --- sporogenous tissue inside the sporangium.

Gymnosperm – sporogenous tissue of pollen sac and in the archesporial cell of nucellus.

Angiosperm -- sporogenous tissue of pollen sac and in the archesporial cell of nucellus.

3. **Differentiate between syngamy and triple fusion?**

A: Fusion of one of the male gamete with egg resulting in diploid zygote is syngamy.

Fusion of other male gamete with diploid secondary polar nucleus resulting in triploid primary endosperm nucleus is triple fusion.

4. **Differentiate between antheridium and archegonium?**

A: Antheridium is male sex organ. It is club shaped and produces flagellated antherozoids.

Archegonium is female sex organ. It is flask shaped. It produces a single large non motile female gamete called ovum or egg.

5. **What are the two stages found in the gametophyte of mosses? Mention the structures from which these two stages develop?**

A: The juvenile stage protonema and adult leafy stage gametophore.

Protonema directly develops from spore.

Gametophore develops from protonema as lateral adventitious buds.

6. **Name the stored food materials found in Phaeophyceae and Rhodophyceae?**

A: Phaeophyceae -- Mannitol and Laminarin.

Rhodophyceae – Floridean starch.

7. **Name the pigments responsible for brown colour of Phaeophyceae and red colour of Rhodophyceae?**

A: Brown colour in Phaeophyceae—Fucoxanthin.

Red colour in Rhodophyceae – r-phycoerythrin.

8. Name different methods of vegetative reproduction in Bryophytes?

A: Fragmentation and by Gemmae.

9. Name the integumented megasporangium found in Gymnosperms. How many female gametophytes are generally formed inside the megasporangium?

A: Ovule.

One.

10. Name the Gymnosperms which contain mycorrhiza and corolloid roots respectively?

A: *Pinus.*

Cycas.

11. Mention the ploidy of any four of the following?

a. Protonemal cell of a moss.

b. Primary endosperm nucleus in a dicot.

c. Leaf cell of a moss.

d. Prothallus of a fern.

e. Gemma cell in *Marchantia*.

f. Meristem cell of monocot.

g. Ovum of a liverwort.

h. Zygote of a fern.

A: a. Protonemal cell of a moss --- Haploid.

b. Primary endosperm nucleus in a dicot --- Triploid.

c. Leaf cell of a moss --- Haploid.

d. Prothallus of a fern --- Haploid.

e. Gemma cell in *Marchantia* --- Haploid.

f. Meristem cell of monocot ---Diploid.

g. Ovum of a liverwort ---- Haploid.

h. Zygote of a fern --- Diploid.

12. Name the four classes of Pteridophyta with one example each?

A: 1. Psilopsida. E.g *Psilotum.*

2. Lycopsida E.g *Lycopodium.*

3. Sphenopsida E.g *Equisetum.*

4. Pteropsida E.g *Pteris.*

13. What are the first organisms to colonise rocks? Give the generic name of the moss which provides peat?

A: Mosses along with Lichens.

Sphagnum.

14. Mention the fern characters found in *Cycas*?

A: Circinate vernation of young leaves.

Presence of ramenta.

Presence of archegonia.

Multiciliate male gametes.

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

A: Because these plants live in moist soil and are dependent on water for sexual reproduction.

16. Name an Alga which show?

a) Haplo-diplontic and

b) Diplontic types of life cycles.

A: a) Haplo-diplontic --- *Ectocarpus*, *Laminaria*

b) Diplontic --- *Fucu*

17. Give examples for unicellular, colonial and filamentous algae?

A: Unicellular --- *Chlamydomonas*

Colonial --- *Volvox*.

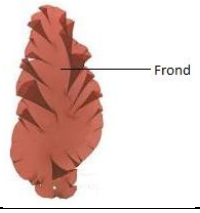
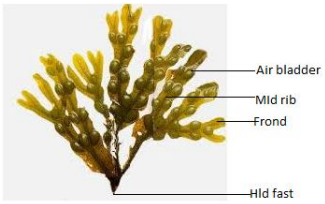
Filamentius – *Ulothrix*, *Spirogyra*.

Short Answer Questions

1. Differentiate between red algae and brown algae?

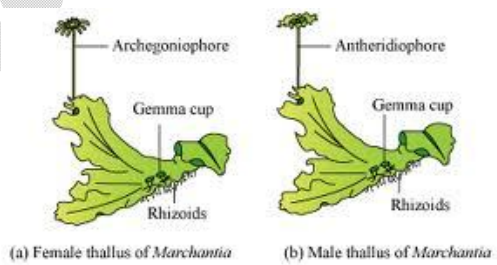
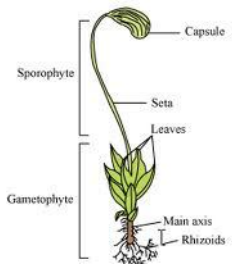
Red Algae	**Brown algae**
1. Majority of the red algae are marine with greater concentrations found in the warmer areas.	1. They are found primarily in marine habitats.
2. Cell walls show a polysaccharide called agar.	2. Cell walls show a gelatinous coating of **algin**.
3. The red thalli of most of the red algae are multicellular. Some of them have complex body organisation.	3. They show great variation in size and form. They range from simple branched, filamentous forms (*Ectocarpus*) to profusely branched forms. 4. They possess chlorophyll *a*, *c*, carotenoids and xanthophylls. Brown colour is due to xanthophyll pigment fucoxanthin.
4. They possess chlorophyll *a*, phycobilins. The predominant pigment is the red pigment, r-phycoerythrin .	5. Food is stored as complex carbohydrates, which may be in the form of laminarin or mannitol.
5. The food is stored as floridean starch which is very similar to amylopectin and glycogen in structure.	6. Asexual reproduction in most is by biflagellate zoospores that are pear-shaped and have two unequal laterally attached flagella.
6. They reproduce asexually by non-motile spores.	7. Sexual reproduction may be isogamous, anisogamous or oogamous.
7. Sexual reproduction is oogamous and accompanied by complex post fertilisation developments.	8. The gametes are pyriform (pear-shaped) and bear two laterally attached flagella.
8. Gametes are non-motile.	

A:

Porphyra	*Fucus*
	

2. Differentiate between liverworts and mosses.

A:

Liverworts	**Mosses**
1. Gametophyte is consisting of one stage.	1. Gametophyte consists of two stages. The first stage is the **protonema** stage. The second stage is the **leafy stage**.
2. The plant body of a liverwort is thalloid. The thallus is dorsiventral and closely appressed to the substrate.	2. The plant body is upright, slender axes bearing spirally arranged leaves. They are attached to the soil through multicellular and branched rhizoids.
3. Asexual reproduction is by fragmentation of thalli, or by the formation of specialised structures called **gemmae.**	3. Vegetative reproduction in mosses is by fragmentation and budding in the secondary protonema.
4. During sexual reproduction, male and female sex organs are produced either on the same or on different thalli.	4. In sexual reproduction, the sex organs antheridia and archegonia are produced at the apex of the leafy shoots.
5. Sporophyte is differentiated into a foot, seta and capsule.	5. Sporophyte, consisting of a foot, seta and capsule. The sporophyte in mosses is more elaborate than that in liverworts.
6. Spore dispersal mechanism is simple.	6. The mosses have an elaborate mechanism of spore dispersal.
7. The spores germinate to form free-living gametophytes.	7. Spores germinate into protonema.
Marchantia	***Funaria***
 (a) Female thallus of *Marchantia* (b) Male thallus of *Marchantia*	

3. What is meant by homosporous and heterosporous pteridophytes? Give two examples?

A: Function of the sporophyte is to produce spores. Spores are produced in the sporangium. The spore mother cell undergoes meiotic division to produce four haploid spores. Spores germinate into haploid gametophyte. Gametophyte produces sex organs.

If all the spores produced are of only one type it is called homosporous. Gametophytes developed from such a sporophytic plant cannot be distinguished into male or female gametophyte. They produce both kinds of sex organs on the same gametophyte (or monoecious). In the evolution it is a primitive condition.

If all the spores produced are of not same type but different types it is called heterosporous condition. Small spores are microspores which germinate into male gametophyte and large spores are macrospores which develop into female gametophyte. This condition is advanced as sexual dimorphism results in cross fertilization.

In evolution of plants Pteridophytes are intermediate between Bryophytes and Gymnosperms. All Bryophytes are homosporous and all Gymnosperms are heterosporous. In Pteridophytes primitive or earlier pteridophytes are homosporous and later pteridophytes are heterosporous.

E.g. *Dryopteris, Pteris* - Homosporous.

Selaginella, Salvinia – Heterosporous.

4. What is heterospory? Briefly comment on its significance. Give two examples?

A: If all the spores produced are of not same type but different types it is called heterosporous condition. Small spores are microspores which germinate into male gametophyte and large spores are macrospores which develop into female gametophyte.

Significance

- Heterospory condition is advanced as it results in development of male and female gametophytes separately.
- This sexual dimorphism results in cross fertilization.
- In evolution after meiosis out of four megaspores one survives. This increases better nutritional status for the surviving spore.
- Protection increases for the surviving spore by developing integuments.
- The gametophyte germinating from megaspore does not release outside and takes nutrition from sporophyte.

- Fertilization results in seed which can survive unfavourable conditions.
- Only one healthy plant can develop from the seed.

E.g. *Selaginella, Salvinia*.

5. Write a note on economic importance of Algae and Bryophytes?

Algae

1. Algae are useful in carbon dioxide fixation on earth through photosynthesis.

2. They increase the level of dissolved oxygen in their immediate environment.

3. Many species of *Porphyra, Laminaria* and *Sargassum* are used as food.

4. Certain marine brown and red algae produce large amounts algin (brown algae) and **carrageen** (red algae) which are used commercially.

5. Agar, obtained from *Gelidium* and *Gracilaria* are used to grow microbes and in preparations of ice-creams and jellies.

6. *Chlorella* and *Spirullina* are unicellular algae, rich in proteins and are used as food supplements even by space travellers.

Bryophyte

1. Bryophytes in general are of little economic importance but some mosses provide food for herbaceous mammals, birds and other animals.

2.Species of *Sphagnum*, a moss, provide peat that have long been used as fuel, and because of their capacity to hold water as packing material for trans-shipment of living material.

3. Mosses along with lichens are the first organisms to colonise rocks and hence, are of great ecological importance.

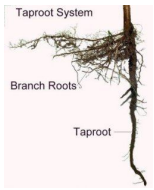
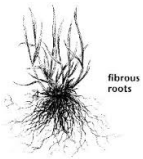
4. They decompose rocks making the substrate suitable for the growth of higher plants.

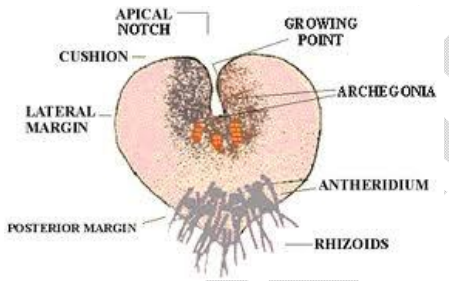
5. Since mosses form dense mats on the soil, they reduce the impact of falling rain and prevent soil erosion.

6. How would you distinguish monocots from dicots?

A:

Dicots	**Monocots**
1. Two cotyledons in the seeds	1. Single cotyledon in the seed.
2. Root system is tap root.	2. Root system is fibrous root system.
3. Leaves are with reticulate venation.	3. Leaves are with parallel venation.
4. Leaf base is of different types.	4. Leaf base is always sheathing.
	5. Flowers are trimerous.

5. Flowers are pentamerous. 6. Stem shows normal secondary growth.  	6. Stem shows no secondary growth or anomalous secondary growth.  



7. Give a brief account of prothallus?

A: The sporangia produce spores by meiosis in spore mother cells. The spores germinate to give rise to inconspicuous, small but multicellular, free-living, mostly photosynthetic thalloid gametophytes called **prothallus**.

In Pteridophytes these gametophytes require cool, damp, shady places to grow.

Because of this specific restricted requirement and the need for water for fertilisation, the spread of living pteridophytes is limited and restricted to narrow geographical regions.

In Gymnosperms prothallus grows inside the ovule and depends on sporophyte for nourishment.

Prothallus may be male or female (dioecious) or Monoecious.

In heterosporous condition it is dioecious. In homosporous it is monoecious.

The gametophytes bear male and female sex organs called antheridia and archegonia, respectively.

Water is required for transfer of antherozoids – the male gametes released from the antheridia, to the mouth of archegonium.

Fusion of male gamete with the egg present in the archegonium result in the formation of zygote.

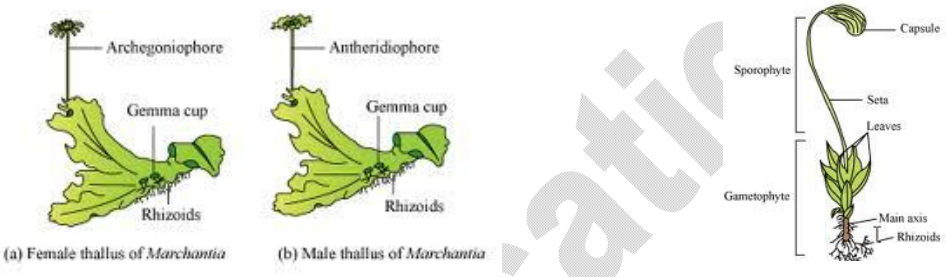
Zygote thereafter produces a multicellular well-differentiated sporophyte which is the dominant phase of the pteridophytes.

8. Draw labeled diagram of?

a) Female thallus and male thallus of a liverwort.

b) Gametophyte and sporophyte of *Funaria.*

A:



Long Answer Questions

1. Give the Important characters of Gymnosperms?

A: 1. The gymnosperms (*gymnos:* naked, *sperma* : seeds) are plants in which the ovules are not enclosed by any ovary wall and remain exposed, both before and after fertilisation.

2. The seeds that develop post-fertilisation, are not covered, i.e., are naked.

3. Gymnosperms include medium-sized trees or tall trees and shrubs.

4. The roots are generally tap roots. Roots in some genera have fungal association in the form of **mycorrhiza** *(Pinus)*, while in some others *(Cycas)* small specialized roots called coralloid roots are associated with N2- fixing cyanobacteria.

5. The stems are unbranched (*Cycas*) or branched (*Pinus, Cedrus*).

6. The leaves may be simple or compound. In *Cycas* the pinnate leaves persist for a few years.

7. The leaves in gymnosperms are well-adapted to withstand extremes of temperature, humidity and wind.

8. The gymnosperms are heterosporous; they produce haploid microspores and megaspores.

9. The two kinds of spores are produced within sporangia that are borne on sporophylls which are arranged spirally along an axis to form lax or compact strobili or **cones**.

10. The strobili bearing **microsporophylls** and **microsporangia** are called microsporangiate or **male strobili**.

11. The microspores develop into a male gametophytic generation which is highly reduced.

12. This reduced gametophyte is called a **pollen grain**. The developments of pollen grains take place within the microsporangia.

13. The cones bearing megasporophylls with ovules or **megasporangia** are called macrosporangiate or **female strobili**.

14. The male or female cones or strobili may be borne on the same tree (*Pinus*) or on different trees (*Cycas*).

15. The nucellus is protected by envelopes and the composite structure is called an **ovule**.

16. One of the megaspores enclosed within the **megasporangium** (nucellus) develops into a multicellular female gametophyte that bears two or more **archegonia** or female sex organs.

17. The multicellular female gametophyte is also retained within megasporangium.

18. In gymnosperms the male and the female gametophytes do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes.

19. Pollination is by wind and come in contact with the opening of the ovules borne on megasporophylls.

20. The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharges their contents near the mouth of the archegonia.

21. Following fertilisation, zygote develops into an embryo and the ovules into seeds.

2. Give an account of plant life cycles and alternation of generations.

A: In plants, both haploid and diploid cells can divide by mitosis.

This ability leads to the formation of different plant bodies - haploid and diploid.

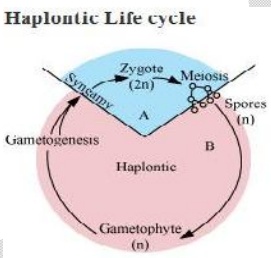
The haploid plant body produces gametes by mitosis. This plant body represents a gametophyte.

Following fertilisation the zygote also divides by mitosis to produce a diploid sporophytic plant body Haploid spores are produced by this plant body by meiosis. These in turn, divide by mitosis to form a haploid plant body once again.

Thus, during the life cycle of any sexually reproducing plant, there is an alternation of generations between gamete producing haploid gametophyte and spore producing diploid sporophyte.

However, different plant groups, as well as individuals representing them, differ in the following patterns:

1. <u>Haplontic</u>



Sporophytic generation is represented only by the one-celled zygote. There are no free-living sporophytes.

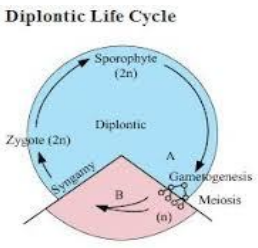
Meiosis in the zygote results in the formation of haploid spores. The haploid spores divide mitotically and form the gametophyte.

The dominant, photosynthetic phase in such plants is the free-living gametophyte.

This kind of life cycle is termed as **haplontic**.

E.g. *Volvox, Spirogyra* and some species of *Chlamydomomas.*

2. <u>Diplontic</u>



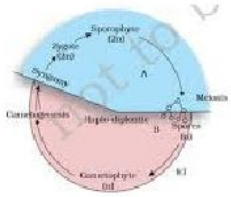
On the other extreme, is the type wherein the diploid sporophyte is the dominant, photosynthetic, independent phase of the plant.

The gametophytic phase is represented by the single to few-celled haploid gametophyte.

This kind of lifecycle is termed as **diplontic**.

All seed-bearing plants i.e. gymnosperms and angiosperms, follow this pattern.

3. Haplo-diplontic



Bryophytes exhibit an intermediate condition **(Haplo-diplontic)**; both phases are multicellular and often free-living. However, they differ in their dominant phases.

A dominant, independent, photosynthetic, thalloid or erect phase is represented by a haploid gametophyte and it alternates with the short lived multicelluler sporophyte totally or partially dependent on the gametophyte for its anchorage and nutrition.

All bryophytes represent this pattern.

4. Diplo-haplontic

In Pteridophytes the diploid sporophyte is represented by a dominant, independent, photosynthetic, vascular plant body. It alternates with multicellular, saprophytic/autotrophic, independent but short-lived haploid gametophyte.

Such a pattern is known as diplo-haplontic life cycle.

Interestingly, while most algal genera are haplontic, some of them such as *Ectocarpus*, *Polysiphonia*, kelps are haplo-diplontic. *Fucus*, an alga is diplontic.