Question 1:

What is the basis of classification of algae?

Answer

Algae are classified into three main classes – Chlorophyceae, Phaeophyceae, and Rhodophyceae. These divisions are based on the following factors:

(a) Major photosynthetic pigments present

(b) Form of stored food

(c) Cell wall composition

(d) Number of flagella and position of insertion

Class I – Chlorophyceae

Common name – Green algae

Major pigments – Chlorophylls a and b

Stored food – Starch

Cell wall composition – Cellulose

Flagella number and position – 28; equal and apical

Class II – Phaeophyceae

Common name– Brown algae

Major pigments – Chlorophylls a and c, and 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, and phycoerythrin

Stored food – Floridean starch

Cell wall – Cellulose, pectin, and polysulphate esters

Flagella number – Absent

Question 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 bears the male and female sex organs which produce gametes. These gametes fuse to form a zygote. The zygote develops on the gametophytic plant-body to form a sporophyte. The sporophyte is differentiated into the foot, seta, and capsule. Many haploid spores are produced as a result of the reduction division taking place inside the capsule.

Moss – In mosses, the primary protonema (developed in the first stage) develops into the secondary protonema. Both these stages are haploid or gametophytic. The secondary protonema bears the sex organs which produce gametes. These gametes fuse to form a zygote. The zygote develops into a sporophyte. Many spores are formed as a result of the reduction division taking place in the capsule of this sporophyte.

Fern – In ferns, the main plant-body is sporophytic. Its leaves are known as sporophylls and these bear the sporangia. Reduction division takes place in these sporangia, thereby producing many spores.

Gymnosperm – In gymnosperms, the main plant-body is sporophytic. They bear two types of leaves – microsporophylls and megasporophylls. Reduction division takes place in the microsporangia present on the microsporophylls (producing pollen grains) and on the megasporangia present on the megasporophylls (producing megaspores).

Angiosperm – In angiosperms, the main plant-body is sporophytic and bears flowers. The male sex organ in the flower is the stamen, while the female sex organ is the pistil. Reduction division takes place in the anthers of the stamen (producing haploid pollen grains) and in the ovary of the pistil (producing eggs).

Question 3:

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

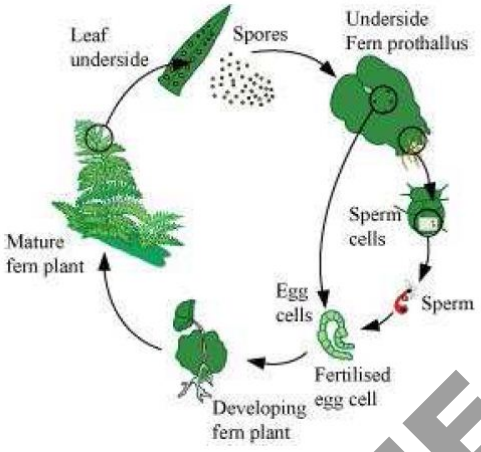
Answer

Archegonium is the female sex organ that produces the female gamete or egg. It is present in the life cycles of bryophytes, pteridophytes, and gymnosperms.

Life cycle of a fern (*Dryopteris*)

Dryopteris is a common fern with pinnately-compound leaves. The main plant-body is sporophytic. Many sporangia are borne on the lower surfaces of its mature leaves. Each sporangium has spore mother cells which undergo meiosis to produce haploid spores. On maturing, these spores dehisce and germinate to give rise to a heart-shaped gametophyte called prothallus.

The prothallus bears the male and female sex organs called antheridia and archegonia respectively. The antheridia produce sperms that swim in water to reach the archegonia. The egg is produced by the archegonia. As a result of fertilisation, a zygote is formed. The zygote forms an embryo, which in turn develops into a new sporophyte. The young plant comes out of the archegonium of the parent gametophyte.



Question 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

(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 a monocot – Diploid

(g) Ovum of a liverwort – Haploid

(h) Zygote of a fern – Diploid

Question 5:

Write a note on economic importance of algae and gymnosperms.

Answer

Economic importance of algae

Algae have diverse economic uses. They perform half of the total carbon dioxide-fixation on earth by photosynthesis, acting as the primary producers in aquatic habitats.

(a) Food source: Many species of marine algae such as *Porphyra*, *Sargassum*, and *Laminaria* are edible. *Chlorella* and *Spirulina* are rich in proteins. Thus, they are used as food supplements.

(b) Commercial importance: Agar is used in the preparation of jellies and ice-cream. It is obtained from *Gelidium* and *Gracilaria*. Carrageenin is used as an emulsifier in chocolates, paints, and toothpastes. It is obtained from the red algae.

(c) Medicines: Many red algae such as *Corallina* are used in treating worm infections.

Economic importance of gymnosperms

(a) Construction purposes: Many conifers such as pine, cedar, etc., are sources of the soft wood used in construction and packing.

(b) Medicinal uses: An anticancer drug Taxol is obtained from *Taxus*. Many species of *Ephedra* produce ephedrine, which can be used in the treatment of asthma and bronchitis.

(c) Food source: The seeds of *Pinus gerardiana* (known as chilgoza) are edible.

(d) Source of resins: Resins are used commercially for manufacturing sealing waxes and water-proof paints. A type of resin known as turpentine is obtained from various species of *Pinus*.

Question 6:

Both gymnosperms and angiosperms bear seeds, then why are they classified separately?

Answer

Gymnosperms and angiosperms are seed-producing plants with diplontic life cycles.

In gymnosperms, the sporophylls are aggregated to form compact cones. The microsporophylls are broad and are not distinguished into filaments and anthers. The megasporophylls are woody and lack the ovary, style, and stigma, because of which the ovules lie exposed. The female gametophyte consists of archegonia. The fertilisation process involves the fusion of a male gamete with the female gamete. Their endosperm is haploid. The produced seeds are naked as there is no fruit formation.

Angiosperms are also known as flowering plants. They have sporophylls that aggregate to form flowers with the perianth. The microsporophylls consist of stamens containing pollen sacs. These sacs bear the male gametes called pollen grains. The megasporophylls are delicate and rolled, forming carpels that contain the ovary, style, and stigma. The ovules are present inside the ovary. The archegonium is replaced by an egg apparatus. Two male gametes enter the egg apparatus at the time of fertilisation. One male gamete fertilises the egg and the other fuses with the diploid secondary nucleus to form an endosperm. The resulting endosperm is thus triploid. In addition, in angiosperms, the development of seeds takes place inside the fruits.

Question 7:

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

Answer

Heterospory is a phenomenon in which two kinds of spores are borne by the same plant. These spores differ in size. The smaller one is known as microspore and the larger one is known as megaspore. The microspore germinates to form the male gametophyte and the megaspore germinates to form the female gametophyte. The male gametophyte releases the male gametes and these reach the female gametophyte to fuse with the egg. The development of the zygote takes place inside the female gametophyte.

This retention and germination of the megaspore within the megasporangium ensures proper development of the zygote. The zygote develops into the future sporophyte. The evolution of the seed habit is related to the retention of the megaspore.

Heterospory is thus considered an important step in evolution as it is a precursor to the seed habit.

Heterospory evolved first in pteridophytes such as *Selaginella* and *Salvinia.*

Question 8:

Explain briefly the following terms with suitable examples:-

(i) protonema

(ii) antheridium

(iii) archegonium

(iv) diplontic

(v) sporophyll

(vi) isogamy

Answer

(i) Protonema – It is the first stage in the life cycle of a moss, developing directly from the spore. It consists of creeping, green, branched, and often filamentous structures.

(ii) Antheridium – It is the male sex organ present in bryophytes and pteridophytes and is surrounded by a jacket of sterile cells. It encloses the sperm mother cells, which give rise to the male gametes.

(iii) Archegonium – It is the female sex organ present in bryophytes, pteridophytes, and gymnosperms. In bryophytes and pteridophytes, it generally has a swollen venter and a tubular neck, and contains the female gamete called the egg.

(iv) Diplontic – It is the term used for the life cycles of seed-bearing plants (gymnosperms and angiosperms). In these plants, the diploid sporophyte is dominant, photosynthetic, and independent. The gametophyte is represented by a single-celled (or a few-celled) structure.

(v) Sporophyll – In pteridophytes, the sporophytic plant body bears sporangia. These sporangia are subtended by leaf-like appendages known as sporophylls. In gymnosperms, microsporophylls and megasporophylls are found. These bear microspores and megaspores respectively.

(vi) Isogamy – It is a type of sexual reproduction involving the fusion of morphologically-similar gametes. This means that the gametes are of the same size, but perform different functions. This type of reproduction is commonly observed in *Spirogyra*.

Question 9:

Differentiate between the following:-

(i)red algae and brown algae

(ii) liverworts and moss

(iii) homosporous and heterosporous pteridophyte

(iv) syngamy and triple fusion

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 little photosynthetic tissue	**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.

(iv) Syngamy and triple fusion

	Syngamy		Triple fusion
1.	It is the process of fusion of the male gamete with the egg in an angiosperm.	**1.**	It is the process of fusion of the male gamete with the diploid secondary nucleus in an angiosperm.
2.	A diploid zygote is formed as a result of syngamy.	**2.**	A triploid primary endosperm is formed as a result of triple fusion.

Question 10:

How would you distinguish monocots from dicots?

Answer

Monocots and dicots can be differentiated through their morphological and anatomical characteristics.

Characteristic	**Monocot**	**Dicot**
Morphology		
Roots	Fibrous roots	Tap roots
Venation	Generally parallel venation	Generally reticulate venation
Flowers	Trimerous flowers	Pentamerous flowers
Cotyledons in seeds	One	Two
Anatomy		
No. of vascular bundles in stem	Numerous	Generally 2 – 6
Cambium	Absent	Present
Leaves	Isobilateral	Dorsiventral

Question 11:

Match the followings (column **I** with column **II**)

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

Answer

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

Question 12:

Describe the important characteristics of gymnosperms.

Answer

Important features of gymnosperms:

1. The term gymnosperm refers to plants with naked seeds (*gymnos* – naked, *sperma* – seeds), i.e., the seeds of these plants are not enclosed in fruits.

2. The plant-body ranges from medium to tall trees and shrubs. The giant redwood tree *Sequoia* is one of the tallest trees in the world.

3. The root system consists of tap roots. The coralloid roots present in *Cycas* are associated with nitrogen-fixing cyanobacteria.

4. The stem can be branched (as in *Pinus* and *Cedrus*) or un-branched (as in *Cycas*).

5. The leaves can be simple (as in *Pinus*)or compound (pinnate in *Cycas)*. The leaves are needle-like, with a thick cuticle and sunken stomata. These help in preventing water loss.

6. Gymnosperms are heterosporous. They bear two kinds of spores – microspores and megaspores.

7. Flowers are absent. The microsporophylls and megasporophylls are arranged to form compact male and female cones.

8. Pollination occurs mostly through wind and pollen grains reach the pollen chamber of the ovule through the micropyle.

9. The male and female gametophytes are dependent on the sporophyte.

10. The seeds contain haploid endosperms and remain uncovered.