PLANT KINGDOM

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CLASS: XI **BIOLOGY**

CLASSIFICATION

1. Who proposed five kingdom system of classification? Name the five kingdoms.

Whittaker (1969) suggested the Five Kingdom classification. Monera, Protista, Fungi, Animalia and Plantae.

2. What is the basis of Artificial System of classification? Who proposed it?

This is the earliest systems of classification that used only morphological characters such as habit, colour, number and shape of leaves, etc. and also based on the androecium structure. This system was proposed by Linnaeus.

3. What are the Drawbacks of Artificial System of classification?

They separated the closely related species since they were based on a few characteristics.

The artificial systems gave equal weightage to vegetative and sexual characteristics; this is not acceptable since the vegetative characters are more easily affected by environment.

4. What is the basis of Natural system of classification? Who proposed it?

It is based on natural affinities among the organisms and consider not only the external features, but also internal features, like ultra- structure, anatomy, embryology and phytochemistry. It was proposed by George Bentham and Joseph Dalton Hooker.

5. What is the basis of phylogenetic system of classification?

Phylogenetic classification system is based on evolutionary relationships between the various organisms. This assumes that organisms belonging to the same taxa have a common ancestor.

6. Describe the following:

a) Numerical Taxonomy
b) Cytotaxonomy
c) Chemotaxonomy

Numerical Taxonomy

- **Numerical Taxonomy** is based on all observable characteristics which is now easily carried out using computers.
- Number and codes are assigned to all the characters and the data are then processed.
- In this way each character is given equal importance and at the same time hundreds of characters can be considered.

Cytotaxonomy

Cytotaxonomy is the classification based on cytological information like **chromosome number, structure and behavior.**

Chemotaxonomy

Chemotaxonomy is the classification based on the chemical constituents of the plants to resolve confusions.

ALGAE

1. What are algae?

Algae are chlorophyll-bearing, simple, thalloid, autotrophic and aquatic organisms living in both fresh water and marine water.

2. What is the habitat of algae?

They occur in a variety of other habitats: moist stones, soils and wood. Some of them are associated with fungi (lichen) and animals (e.g., on sloth bear).

3. How does the form of algae vary? Give examples.

Microscopic unicellular forms like *Chlamydomonas*

Colonial forms like *Volvox*

Filamentous forms like *Ulothrix* and *Spirogyra.*

Kelps form massive plant bodies, which may reach a **height of 100 metres.**

4. Describe the vegetative and asexual modes of reproductions which take place in algae?

Vegetative reproduction occurs by **fragmentation**. Each fragment develops into a thallus.

Asexual reproduction takes place by the production of different types of spores, the most common being the **zoospores.** They are flagellated (motile) and on germination gives rise to new plants.

5. Describe the three different kinds of sexual reproduction which takes place in algae?

Sexual reproduction takes place through fusion of two gametes. The three different types are as follows.

Isogamous

These gametes can be flagellated and similar in size (as in *Chlamydomonas)* or non-flagellated (non-motile) but similar in size (as in *Spirogyra).* Such reproduction is called isogamous.

Anisogamous

Fusion of two gametes dissimilar in size, as in some species of *Chlamydomonas* is termed as anisogamous.

Oogamous

Fusion between one large, non-motile (static) female gamete and a smaller, motile male gamete is termed oogamous, e.g., *Volvox, Fucus.*

6. Give an account on the economic importance of algae.

Carbon fixation:

Algae are useful to man in a variety of ways. At least **a half of the total carbon dioxide fixed** on earth is carried out by algae through photosynthesis.

Increase the level of dissolved oxygen

Being photosynthetic **they increase the level of dissolved oxygen** in their immediate environment.

Primary producers of energy-rich compounds:

They are the **primary producers of energy-rich compounds** which form the basis of the nutrient cycles of all aquatic animals.

Source of Food

Many species *of Porphyra, Laminaria* and *Sargassum* are among the 70 species of marine algae used as **food.**

Hydrocolloids: (water holding substances)

Certain marine brown and red algae produce large amounts of **hydrocolloids** (water holding substances), e.g., **algin** (brown algae) and **carrageen** (red algae) are used commercially.

Culture medium for microbe and ice creams and jellies:

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

Protein rich food:

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

Economic importance of algae			
1	Carbon fixation	½ of the total fixation	
2	Increase the level of dissolved oxygen		
3	Primary producers of energy-rich compounds	Food for all aquatic animals	
4	Source of Food for humans	Porphyra, Laminaria	Sargassum
5	Hydrocolloids	**Algin** (brown algae)	C**arrageen** (red algae)
6	Culture medium for microbes	Gelidium	Gracilaria
7	Protein rich food: Food supplements for space travellers.	Chlorella	Spirullina

7. Name the three main classes of algae.

The algae are divided into three main classes: **Chlorophyceae, Phaeophyceae** and **Rhodophyceae.**

8. Name some commonly found green algae.

The commonly found green algae are *Chlamydomonas, Volvox, Ulothrix, Spirogyra* and *Chara*.

9. Name some common members of Phaeophyceae

The common forms are *Ectocarpus, Dictyota, Laminaria, Sargassum* and *Fucus.*

10. Name the common members of Rhodophyceae.

The common members are: *Polysiphonia, Porphyra, Gracilaria* and *Gelidium.*

11. How are the members of chlorophyceae commonly called?

The members of chlorophyceae are commonly called **green algae.**

12. Describe the features of chlorophyceae.

- Green algae usually have a rigid **cell wall** made of an inner layer of **cellulose** and an outer layer of **pectose**.
- The plant body may be **unicellular, colonial** or **filamentous**.
- They are usually **grass green** due to the dominance of pigments **chlorophyll a and *b*.**
- The pigments are localised in definite chloroplasts.
- The chloroplasts may be discoid, plate-like, reticulate, cup-shaped, spiral or ribbon-shaped.
- Most of the members have one or more storage bodies called pyrenoids located in the chloroplasts. Pyrenoids contain protein besides starch.

- Some algae may store food in the form of **oil droplets**.

13. List the different kinds of chloroplasts seen in the members of chlorophyceae

The chloroplasts may be

- Discoid
- Plate-like
- Reticulate
- Cup-shaped
- Spiral or ribbon-shaped

14. Why are the members of Rhodophyceae commonly called red algae?

The members of Rhodophyceae are commonly called **red algae** because of the predominance of the red pigment, r-phycoerythrin in their body.

15. Differentiate between the following:

(i) Brown algae and Red algae

(ii) Liverworts and moss

S.No	**Brown algae**	**Red algae**
1	Brown algae are grouped under the class Phaeophyceae	Red algae are grouped under the class Rhodophyceae
2	The photosynthetic pigments are chlorophylls a, c and fucoxanthin	The photosynthetic pigments are chlorophylls a, d and phycoerythrin
3	Their cell walls are composed of cellulose and algin.	Their cell walls are composed of cellulose, pectin, and phycocolloids.
4	The reserve food is mannitol or laminarin	The reserve food is floridean starch
5	Two flagella are present	Flagella are absent

S.No	**Liverworts**	**Moss**
1	They have unicellular rhizoids.	They have multicellular rhizoids
2	They are thalloid and dorsiventrally flattened	They are foliage, with lateral branching
3	Gemma cups are present	Gemma cups are absent
4	Sporophyte has very little photosynthetic tissue	Sporophyte has abundant photosynthetic tissue

Bryophytes

1. Why are bryophytes known as amphibians of the plant kingdom? What is their habitat?

Bryophytes are also called **amphibians of the plant kingdom** because these plants can live in soil but are dependent on water for sexual reproduction.

They usually occur in **damp, humid and shaded localities**.

2. Name the two kinds of bryophytes? Where do they grow?

Bryophytes include mosses and liverworts that are found commonly growing in moist shaded areas in the hills.

3. Give common examples of mosses.

Funaria, Polytrichum and *Sphagnum.*

4. What are gemmae? How does asexual reproduction take place in liverworts?

Gemmae are green, multicellular, asexual buds, which develop in small receptacles called gemma cups located on the thalli.

Asexual reproduction in liverworts takes place by fragmentation of thalli or by **gemmae**. The gemmae become detached from the parent body and germinate to form new individuals.

5. How does vegetative reproduction take place in mosses?

Vegetative reproduction in mosses takes place by fragmentation and budding in the secondary protonema.

6. Describe the plant body of Bryophytes.

The plant body of bryophytes is more differentiated than that of algae.

It is thallus-like and prostrate or erect, and attached to the substratum by unicellular or multicellular **rhizoids.**

They lack true roots, stem or leaves. They may possess root-like, leaf-like or stem-like structures.

The main plant body of the bryophyte is haploid. It produces gametes, hence is called a **gametophyte.**

7. How does sexual reproduction take place in bryophytes?

The sex organs in bryophytes are multicellular. The male sex organ is called **antheridium.**

They produce biflagellate **antherozoids.** The female sex organ called **archegonium** is flask-shaped and produces a single egg.

The antherozoids are released into water where they come in contact with archegonium.

An antherozoid fuses with the egg to produce the zygote. Zygotes do not undergo reduction division immediately.

They produce a multicellular body called a **sporophyte.** The sporophyte is not free-living but attached to the photosynthetic gametophyte and derives nourishment from it.

Some cells of the sporophyte undergo reduction division (meiosis) to produce haploid spores. These spores germinate to produce gametophyte.

8. List the economic importance of bryophytes.

Some mosses provide **food for herbaceous mammals, birds and other animals.**

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

Mosses along with lichens are the first organisms to colonize rocks. They **decompose rocks** making the substrate suitable for the growth of higher plants.

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

9. What are liverworts? Give an example.

The thalloid plant body of bryophyte is known as **liverwort**. The thallus is dorsiventrally flattened. e.g., *Marchantia*

10. Describe the structure of sporophyte of moss.

The sporophyte is differentiated into a **foot, seta and capsule**. After meiosis, spores are produced within the capsule. These spores germinate to form free-living gametophytes.

11. What is the predominant stage of the life cycle of a moss?

The predominant stage of the life cycle of a moss is a gametophyte.

12. What is a protonema?

The first stage in the gametophyte of moss is the **protonema** stage, which develops directly from a spore. It is a creeping, green, branched and frequently **filamentous stage.**

13. What is the second stage in the life cycle of moss?

The second stage in the life cycle of moss is the **leafy stage,** which develops from the secondary protonema as a lateral bud. It consists of upright, slender axes bearing spirally arranged leaves. They are attached to the soil through multicellular and branched rhizoids. This stage bears the sex organs.

PTERIDOPHYTES

1. Name the first terrestrial vascular plants. Give examples.

Pteridophytes. They include horsetails and ferns.

2. What is the main plant body of pteridophyte?

The main plant body of pteridophyte is a **sporophyte** which is differentiated into true root, stem and leaves.

The leaves in pteridophytes are small (microphylls) as in *Selaginella* or large (macrophylls) as in ferns.

3. What are sporophyls?

The leaf-like appendages present in the sporophyte of ptridophytes are called **sporophylls.** The sporophylls contain sporangia which produce spores.

4. What is a prothallus?

The gametophyte of pteridophytes is called prothallus. It is a small but multicellular, photosynthetic thalloid structure produced by spore.

5. Why are pteridophytes limited and restricted to a narrow geographical region?

These gametophytes of pteridophytes require cool, damp, shady places to grow. Because of this specific restricted requirement and the need for water for fertilization, the spread of living pteridophytes is limited and restricted to narrow geographical regions.

6. How does sexual reproduction take place in pteridophytes?

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 results in the formation of zygote.

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

7. Define homosporous and heterosporous.

In majority of the pteridophytes all the spores are of similar kinds; such plants are called **homosporous.**

Genera like *Selaginella* and *Salvinia* which produce two kinds of spores, macro (large) and micro (small) spores are known as **heterosporous.**

8. Define megaspores and microspores.

The megaspores germinate and give rise to female gametophytes, and microspores germinate and give rise to female gametophytes.

The female gametophytes in these plants are retained on the parent sporophytes for variable periods.

9. Which event in pteridophytes is considered a precursor to the seed habit and an important step in evolution?

The development of the zygotes into young **embryos**, takes place within the female gametophytes. This event is a precursor to the **seed habit** considered an important step in evolution.

10. List the four classes of pteridophytes with examples.

	Classification of Pteridophytes	
No	**Classes**	**Examples**
1	Psilopsida	Psilotum
2	Lycopsida	Selaginella, Lycopodium
3	Sphenopsida	Equisetum
4	Pteropsida	Dryopteris, Pteris, Adiantum

GYMNOSPERMS

1. What are Gymnosperms?

The gymnosperms are naked seeded plants in which the ovules are not enclosed by ovary.

2. Name the tallest Gymnosperm.

The giant redwood tree *Sequoia* is one of the tallest tree species.

3. Define mycorrhiza and coralloid roots.

Roots of pinus get associated with fungi which are known as mycorrhiza. Roots of cycas get associated with nitrogen fixing cyanobacteria which are known as coralloid roots.

4. Give an example of pteridophyte, having branched and unbranched stem.

Cycas has unbranched stem. Pinus and Cedrus have branched stem.

5. How are the leaves of gymnosperms well-adapted to withstand extremes of temperature, humidity and wind?

They have thick cuticle and sunken stomata. In conifers, the needle-like leaves reduce the surface area.

6. Why are gymnosperms and pteridophytes known as heterosporous?

They produce two kinds of spores, the haploid microspores and megaspores within sporangia that are borne on sporophylls which are arranged spirally along an axis to form **compact strobili** or **cones.**

7. Describe the structure and function of male cone of Gymnosperms.

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

The microsporangia produce microspores which develop into a male gametophytic generation which is highly reduced and is confined only to a limited number of cells.

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

8. Describe the structure and function of female cone of Gymnosperms.

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

The megasporangia produce four megaspores. One of the megaspores develops into a multicellular female gametophyte that bears two or more archegonia or female sex organs.

9. How does reproduction take place in Gymnosperms?

The pollen grain is released from the microsporangium. They are carried in air currents and come in contact with the opening of the ovules borne on megasporophylls.

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

Following fertilization, zygote develops into an embryo and the ovules into seeds. These seeds are not covered.

ANGIOSPERMS

10. Name the smallest and the tallest angiosperms.

The smallest angiosperm is *Wolffia* and the tallest angiosperm is *Eucalyptus*, which grows over 100 metres.

11. What are the two classes of angiosperms? How are they classified?

The two classes of angiosperms are the **dicotyledons** and the **monocotyledons.** The dicotyledons are characterised by having two cotyledons in their seeds while the monocotyledons have only one.

12. What is a stamen?

The male sex organ in a flower is the stamen. Each stamen consists of a slender filament with an anther at the tip. The anthers, following meiosis, produce pollen grains.

13. What is a pistil?

The female sex organ in a flower is the pistil or the carpel. Pistil consists of an ovary enclosing one to many ovules.

14. Describe the female gametophyte of angiosperm.

The female gametophyte of angiosperm is highly reduced and termed as embryo sac present within ovules.

Each embryo-sac has:

- Three-celled **egg apparatus** - one **egg cell** and two **synergids**
- Three **antipodal** cells
- Two **polar nuclei.**

The polar nuclei eventually fuse to produce a diploid secondary nucleus.

15. How does sexual reproduction take place in angiosperms?

The pollen grains germinate on the stigma and the resulting pollen tubes grow through the tissues of stigma and style and reach the ovule.

The pollen tubes enter the embryo-sac where two male gametes are discharged. One of the male gametes fuses with the egg cell to form a zygote (syngamy).

The other male gamete fuses with the diploid secondary nucleus to produce the triploid primary endosperm nucleus (PEN).

Because of the involvement of two fusions, this event is termed as **double fertilization,** an event unique to angiosperms.

The zygote develops into an embryo and the PEN develops into endosperm which provides nourishment to the developing embryo. During these events the ovules develop into seeds and the ovaries develop into fruit.

16. What is alternation of generation?

During the life cycle of any sexually reproducing plant, the haploid gametophytic generation alternates with diploid sporophytic generation. This phenomenon is known as alternation of generation.

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

17. Describe the life cycle patterns in plant kingdom.

Diplontic Phase (Gymnosperms and Angiosperms)

- In Gymnosperms and Angiosperms 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 life cycle is termed as **diplontic.**
- All seed-bearing plants i.e. gymnosperms and angiosperms follow this pattern.

Haplo-diplontic Phase (Bryophytes and Pteridophytes)

Bryophytes

- Bryophytes and pteridophytes, interestingly, exhibit an intermediate condition **(Haplo-diplontic)**
- A dominant, independent, photosynthetic, thalloid or erect phase is represented by a haploid gametophyte and it alternates with the **short- lived multicellular sporophyte** totally or partially dependent on the gametophyte for its anchorage and nutrition.
- All bryophytes represent this pattern.

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 haplo-diplontic life cycle.
- All pteridophytes exhibit this pattern.

Haplontic Phase (Many Algae)

	Many Algae
Gametophyte	Dominant, photosynthetic, free-living gametophyte
	alternates with the
Sporophyte	Sporophytic generation is represented only by the **one-celled zygote**. There is no free-living sporophyte.
Examples	Volvox, Spirogyra and Chlamydomonas.

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

Haplo-diplontic Phase (Bryophytes and pteridophytes)

	Bryophytes
Gametophyte	Dominant, haploid gametophyte, independent, photosynthetic, thalloid or erect phase,
	alternates with the
Sporophyte	**Short- lived multicellular sporophyte** totally or partially dependent on the gametophyte for its anchorage and nutrition.

	Pteridophytes
Sporophyte	Diploid, dominant, independent, photosynthetic, vascular plant body
	alternates with the
Gametophyte	Multicellular, saprophytic/autotrophic, independent but short-lived & haploid