

Plant Kingdom

I. Answer the Following.

Question 1.

What is the basis of classification of algae?

Answer:

- Type of pigments.
- Nature of stored food.
- Composition of cell wall.

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:

- Occurs in **spore mother cells** during **sporophyte stage** in all.
- **Liverworts & Mosses:** Capsule/sporangium.
- **Ferns:** Sporangia.
- **Gymnosperms & Angiosperms:** Microspore and megaspore mother cells (pollen & ovule).

Question 3.

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

Answer:

Three groups of plants that bear archegonia:

1. Bryophytes (e.g., *Marchantia*, *Funaria*)
2. Pteridophytes (e.g., *Pteris*, *Selaginella*)
3. Gymnosperms (e.g., *Cycas*, *Pinus*)

Life cycle of Bryophytes (example: Moss – *Funaria*):

- The dominant phase is the **haploid gametophyte**, which is green and photosynthetic.
- The gametophyte produces **male sex organs (antheridia)** that release biflagellate antherozoids and **female sex organs (archegonia)** that produce eggs.
- Fertilization takes place in the presence of water, leading to the formation of a **diploid zygote** inside the archegonium.
- The zygote develops into a **sporophyte**, which remains attached to the gametophyte and is partially dependent on it.
- The sporophyte produces **haploid spores** through meiosis inside the capsule.
- These spores germinate to form a **new gametophyte** (protonema first, then leafy gametophore).

Thus, the life cycle of moss shows **alternation of generations** with a dominant gametophyte and a dependent sporophyte.

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:

Structure	Example	Ploidy	Explanation
Protonemal cell of a moss	<i>Funaria</i>	Haploid (n)	Part of the gametophyte generation.
Primary endosperm nucleus in dicot	<i>Pea</i>	Triploid (3n)	Formed after double fertilization (fusion of a sperm nucleus

			with two polar nuclei).
Leaf cell of a moss	<i>Funaria</i>	Haploid (n)	Belongs to the gametophyte plant body.
Prothallus cell of a fern	<i>Pteris</i>	Haploid (n)	Prothallus is the gametophyte of fern.
Gemma cell in <i>Marchantia</i>	<i>Marchantia</i>	Haploid (n)	Gemmae are vegetative reproductive bodies of gametophyte.
Meristem cell of monocot	<i>Wheat, Maize</i>	Diploid (2n)	Part of the sporophyte generation.
Ovum of a liverwort	<i>Marchantia</i>	Haploid (n)	Egg is a gamete, hence haploid.
Zygote of a fern	<i>Pteris</i>	Diploid (2n)	Formed after fusion of haploid gametes.

Question 5.

Write a note on economic importance of algae and gymnosperms.

Answer:

1. Economic importance of Algae:

- **Food:** Many algae such as *Porphyra*, *Laminaria*, and *Sargassum* are rich in proteins, vitamins, and minerals, and are used as human food in countries like Japan and China.

- **Hydrocolloids:** Red and brown algae yield agar, carrageenan, and algin which are widely used in food, textile, paper, and pharmaceutical industries.
- **Fertilizers:** Seaweeds like *Laminaria* and *Sargassum* are used as biofertilizers and soil conditioners, enriching the soil with minerals.
- **Industrial use:** Agar obtained from *Gelidium* and *Gracilaria* is used in microbial culture media, while alginates are used in ice creams, jellies, and cosmetics.
- **Biofuel and other uses:** Some algae are being explored for biofuel production. They also help in carbon dioxide fixation and oxygen release.

2. Economic importance of Gymnosperms:

- **Timber and wood products:** Trees like *Pinus* and *Cedrus* provide valuable softwood used in construction, furniture, and paper making.
- **Resins and oils:** *Pinus* yields resin and turpentine oil, used in paints, varnishes, medicines, and as fuel.
- **Edible seeds:** Seeds of *Pinus gerardiana* (chilgoza) are eaten, while *Cycas* seeds are used as food after processing.
- **Medicinal use:** *Ephedra* yields ephedrine, an important drug for asthma and respiratory ailments.
- **Ornamental plants:** Many gymnosperms like *Cycas*, *Araucaria*, and *Thuja* are grown as ornamentals in gardens.

Question 6.

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

Answer:

The seeds of gymnosperms are naked whereas the seeds of angiosperms are covered by fruits.

Question 7.

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

Answer:

- **Heterospory** is the production of **two different types of spores** by a plant:
 - **Microspores** – develop into male gametophytes (pollen grains).
 - **Megaspores** – develop into female gametophytes (embryo sac).

Significance of heterospory:

1. It is an important step in evolution from simple plants to seed habit.
2. It leads to the separation of male and female gametophytes.
3. It provides better protection and nourishment to the developing embryo inside the female gametophyte.
4. It is considered the **precursor to seed formation** in higher plants.

Examples:

- *Selaginella* (pteridophyte)
 - *Salvinia* (pteridophyte)
- (Heterospory is also seen in gymnosperms and angiosperms.)

Question 8.

Explain briefly the following terms with suitable examples:-

- (i) protonema
- (ii) antheridium
- (iii) archegonium
- (iv) diplontic

(v) sporophyll

(vi) isogamy

Answer:

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- **Timber and wood products:** Trees like *Pinus* and *Cedrus* provide valuable softwood used in construction, furniture, and paper making.
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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

Feature	Red algae (<i>Rhodophyceae</i>)	Brown algae (<i>Phaeophyceae</i>)
Pigments	Chlorophyll a, d, phycoerythrin (red)	Chlorophyll a, c, fucoxanthin (brown)
Storage product	Floridean starch	Laminarin, mannitol
Habitat	Mostly marine, deep waters	Mostly marine, cold waters
Examples	<i>Polysiphonia</i> , <i>Porphyra</i>	<i>Fucus</i> , <i>Laminaria</i>

- (ii) Liverworts and Moss

Feature	Liverworts	Mosses
Gametophyte	Thalloid, dorsiventral	Erect, leafy
Protonema	Absent	Present (first stage of gametophyte)

Sporophyte	Short-lived, less developed	Well developed, with capsule and seta
Example	<i>Marchantia</i>	<i>Funaria, Sphagnum</i>

(iii) Homosporous and Heterosporous Pteridophyte

Feature	Homosporous Pteridophyte	Heterosporous Pteridophyte
Spore type	Produce only one kind of spore	Produce two types of spores: microspores and megaspores
Gametophyte	Bisexual	Unisexual
Evolutionary status	Primitive condition	Advanced condition, precursor to seed habit
Example	<i>Pteris, Equisetum</i>	<i>Selaginella, Salvinia</i>

(iv) Syngamy and Triple fusion

Feature	Syngamy	Triple fusion
Definition	Fusion of male gamete with egg cell	Fusion of second male gamete with two polar nuclei
Result	Diploid zygote (2n)	Triploid primary endosperm nucleus (3n)
Occurs in	All sexual reproducing organisms	Only in angiosperms
Significance	Starts embryo development	Leads to endosperm formation for nourishment

Question 10.

How would you distinguish monocots from dicots?

Answer:

Character	Monocots	Dicots
Cotyledons	One (single)	Two
Leaf venation	Parallel venation	Reticulate (net-like) venation
Root system	Fibrous root system	Tap root system
Vascular bundles	Scattered in stem (no cambium, closed)	Arranged in a ring (with cambium, open)
Secondary growth	Absent	Usually present
Floral parts	Multiples of 3 (trimerous)	Multiples of 4 or 5 (tetramerous/pentamerous)
Examples	<i>Wheat, Maize, Grass, Sugarcane</i>	<i>Mango, Pea, Mustard, Sunflower</i>

Question 11.

Match the following (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	Answer
(a) Chlamydomonas	(iii) Algae	✓
(b) Cycas	(iv) Gymnosperm	✓
(c) Selaginella	(ii) Pteridophyte	✓
(d) Sphagnum	(i) Moss	✓

Question 12.

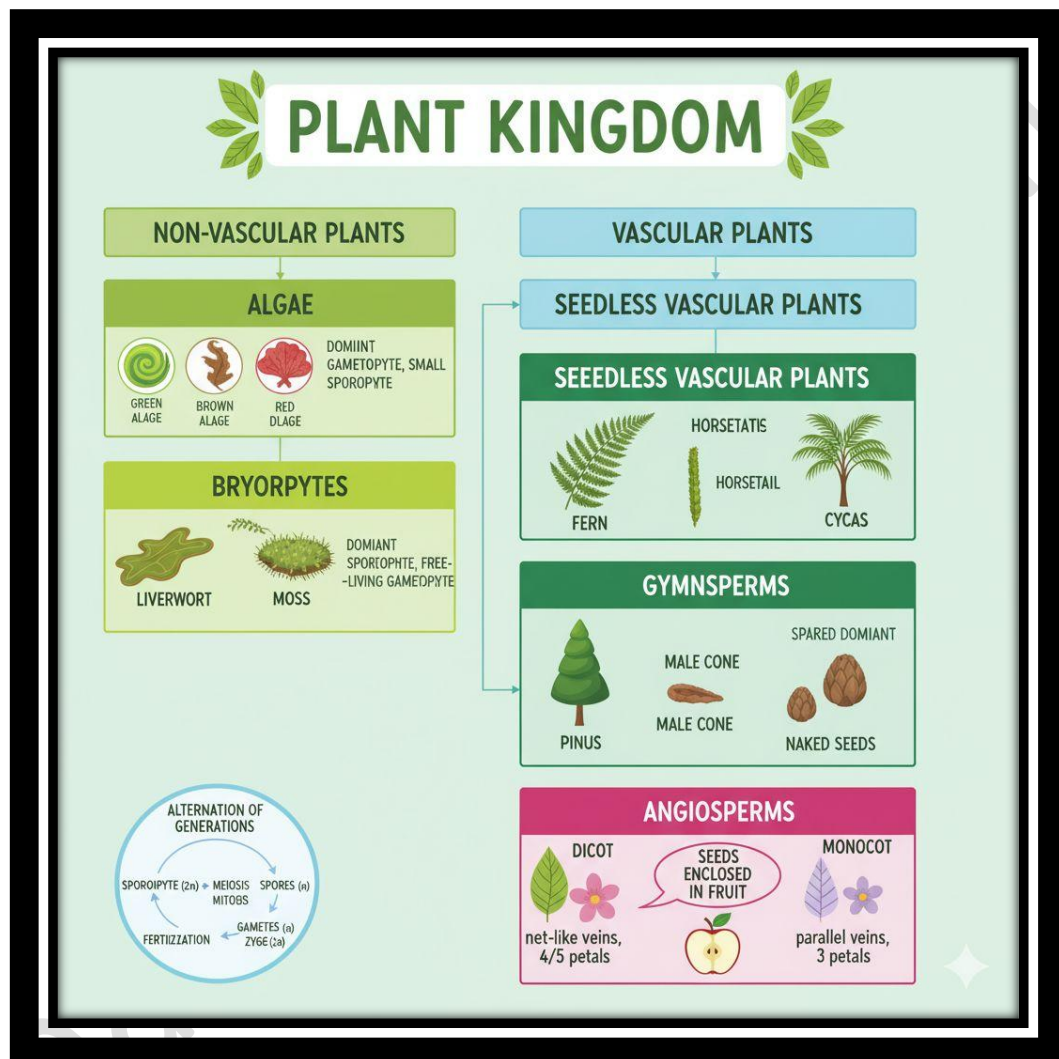
Describe the important characteristics of gymnosperms.

Answer:

The **gymnosperms** (naked seed plants) show the following important characteristics:

1. **Habitat & plant body:** They are mostly perennial, woody trees or shrubs (e.g., *Pinus*, *Cycas*). The sporophyte is the dominant and independent plant body.
2. **Vascular system:** They are vascular plants with well-developed xylem and phloem. Xylem has **tracheids only** (vessels absent, except in some).
3. **Leaves:** Leaves may be needle-like (as in *Pinus*) or pinnate (as in *Cycas*). They are often adapted to withstand extremes of environment.
4. **Reproduction:** They are **heterosporous**, producing microspores and megaspores.
5. **Cones:** Microspores are produced in **male cones** and megaspores in **female cones**. Sporophylls are arranged spirally to form strobili (cones).
6. **Gametophyte:** Male gametophyte is formed inside the pollen grain. Female gametophyte develops inside the megaspore and bears archegonia.
7. **Fertilization:** Pollen grains are carried by **wind (anemophilous)**. Fertilization involves **siphonogamy** (pollen tube carries male gametes to archegonium).

8. **Seeds:** They produce **naked seeds** (not enclosed in fruits), usually borne on scales of cones. Endosperm is haploid and formed before fertilization.
9. **Alternation of generations:** Dominant **sporophyte** alternates with highly reduced **gametophytes** (male and female).



Additional Questions & Answers – Plant Kingdom

Question 1.

Why are algae called “autotrophs of aquatic habitats”?

Answer:

They contain chlorophyll and perform photosynthesis, producing food and oxygen in aquatic ecosystems.

Question 2.

What are gemmae? In which plant are they found?

Answer:

Gemmae are small, multicellular, green, asexual reproductive bodies that can detach and grow into new plants.

- Found in **Marchantia (liverwort)**.

Question 3.

Why are bryophytes called “amphibians of the plant kingdom”?

Answer:

Because they live on land but require water for fertilization (movement of sperm to egg).

Question 4.

What is a prothallus?

Answer:

A short-lived, independent, haploid gametophyte of ferns (pteridophytes), bearing antheridia and archegonia.

Question 5.

Give two examples of homosporous and heterosporous pteridophytes.

Answer:

- **Homosporous:** Lycopodium, Equisetum.
- **Heterosporous:** Selaginella, Salvinia.

Question 6.

How are lichens useful to man?

Answer:

Uses of lichens:

- Indicators of air pollution.
- Source of dyes, perfumes, and medicines.
- Pioneer species in ecological succession.

Question 7.

Why are bryophytes considered “in between algae and

pteridophytes”?

Answer:

They are more advanced than algae (true multicellular gametangia, embryo development), but lack vascular tissues like pteridophytes.

Question 8.

What is the main difference between homosporous and heterosporous?

Answer:

- **Homospory:** Produces one type of spore → bisexual gametophyte.
- **Heterosporous:** Produces two spores (microspores + megaspores) → unisexual gametophytes.

Question 9.

Why are angiosperms the most successful plants?

Answer:

- Presence of flowers, fruits, double fertilization, efficient vascular tissues, and wide adaptability.

Question 10.

What are diatoms and why are they called “pearls of the ocean”?

Answer:

Diatoms are microscopic algae with siliceous cell walls. They form diatomaceous earth and contribute majorly to marine food chain → hence called pearls of the ocean.

Question 11.

Explain alternation of generations with an example.

Answer:

Alternation of generations = Life cycle alternates between **haploid gametophyte** and **diploid sporophyte**.

- Example: **Fern**

1. Sporophyte ($2n$) dominant → produces spores by meiosis.
2. Spores → haploid gametophyte (prothallus).
3. Gametophyte produces gametes.
4. Fertilization → diploid zygote → sporophyte.

Question 12. Describe the life cycle of an angiosperm.

Answer:

- Sporophytic phase dominant (plant body = diploid).
- Male gametophyte → pollen grains; female gametophyte → embryo sac.
- Double fertilization:
 - One gamete + egg → zygote ($2n$).
 - One gamete + two polar nuclei → endosperm ($3n$).
- Seed formation → embryo develops → enclosed in fruit.

Question 13.

Compare bryophytes, pteridophytes, gymnosperms and angiosperms (any 3 points).

Answer:

- **Bryophytes:** Amphibians of plant kingdom, no vascular tissues, gametophyte dominant.
- **Pteridophytes:** First vascular plants, sporophyte dominant, homosporous/heterosporous.
- **Gymnosperms:** Naked seeds, cones, wind pollination.
- **Angiosperms:** Seeds enclosed in fruits, flowers, double fertilization.

Question 14.

What are the main pigments and stored food in different algae?

Answer:

- **Chlorophyceae (Green algae):** Chlorophyll a, b; store starch.
- **Phaeophyceae (Brown algae):** Chlorophyll a, c, fucoxanthin; store mannitol, laminarin.
- **Rhodophyceae (Red algae):** Chlorophyll a, d, phycoerythrin; store floridean starch.

Question 15.

How do gymnosperms reproduce?

Answer:

- Male cone → microspores → pollen grains (male gametophyte).
- Female cone → megaspores → ovule with archegonia.
- Pollination by wind → fertilization → zygote.
- Embryo develops → naked seed (no fruit).