

Key Words

- **Thallus** : It refers to the plant body, which is not differentiated into root, stem and leaves, as in algae and lower bryophytes.
- **Phycocolloids** : These are the colloidal polysaccharides present in the outer layer of cell wall of red algae and brown algae.
- **Gemmae** : Gemmae are the multicellular structures produced by certain bryophytes : each gemma on separation grows into a new plant.
- **Protonema** : The spores grow into a new gametophyte on reaching a suitable moist surface produces thread like structure called protonema.
- **Carrageenin** : A chemical extracted from *Chondria*-red algae, used in drinks to give fake creaminess is known as Carrageenin.
- **Antheridium** : It is a structure in lower plants that produces male gametes called sperms.
- **Archegonia** : It is a structure in lower plants that produces female gametes called eggs.
- **Cryptogams** : These are the non-flowering plants; they do not produce flowers or seeds.
- **Agarophytes** : These are red algae, which yield agar, a phycocolloid. *e.g., Gelidium* and *Gracilaria*.
- **Tracheophytes** : These are those plants which have vascular tissues.



1 Mark Questions

- (A) Name the following :
- Q. 1. Who proposed natural classification system of Kingdom Plantae?
 Ans. George Bentham and Joseph Dalton Hooker.
- Q. 2. Name any two algae which belongs to Class Chlorophyceae.
 Ans. *Spirogyra*, *Ulothrix*.
- Q. 3. Name the first terrestrial plants which possess vascular tissues.
 Ans. Pteridophytes.
- Q. 4. Give the name of the pigment, which imparts colour to red algae.

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Ans. Phycoerythrin.

Q. 5. Name one dioecious liverwort.

Ans. *Marchantia*.

(B) Each of the following questions has four choices. Choose the correct option in each case :

Q. 1. The dominant phase in pteridophyta is :

- (A) Gametophyte (B) Sporophyte
(C) Bryophyte (D) None of these

Ans. Option (B) is correct.

Explanation: In pteridophyta, the main part body is a sporophyte which is differentiated into true root, stem and leaves. Each organ has well-differentiated vascular tissues .

Q. 2. The gelatinous substance which covers cellulosic cell wall in Phaeophyceae :

- (A) Chlorophyll (B) Phycoerythrin
(C) Xanthophyll (D) Algin

Ans. Option (D) is correct.

Explanation: In Phaeophyceae, the outer layer of cell wall contains gelatinous algin. Rest all are pigments present in the cell.

Q. 3. The sex organs in mosses are :

- (A) Oogamous gametes
(B) Megaspores and microspores
(C) Antheridia and archegonia
(D) Stamens and Ovaries

Ans. Option (C) is correct.

Explanation: The plant body of a moss is a leafy gametophyte which has multicellular and branched rhizoids. This stage bears the sex organs , antheridia and archegonia.

Q. 4. *Adiantum* belongs to the class :

- (A) Psilopsida (B) Lycopsida
(C) Sphenopsida (D) Pteropsida

Ans. Option (D) is correct.

Explanation: The pteridophytes are classified into four classes : Psilopsida, Lycopsida, Sphenopsida and Pteropsida. *Adiantum* belongs to pteropsida.

Q. 5. The structure that fixes the brown algae to the substratum are :

- (A) Holdfast (B) Rhizoids
(C) Thallus (D) Roots

Ans. Option (A) is correct.

Explanation: The brown algae attach themselves to the rough sea floor or to the rocks with finger like structures called holdfast.

Q. 6. *Equisetum* belongs to the class :

- (A) Psilopsida (B) Lycopsida
(C) Sphenopsida (D) Pteropsida

Ans. Option (C) is correct.

Explanation: The pteridophytes are classified into four classes : Psilopsida, Lycopsida, Sphenopsida and Pteropsida. *Equisetum* belongs to sphenopsida.

Q. 7. Who is known as the "Father of Indian Phycology" .

- (A) J. C. Bose
(B) Prof. M.O.P. Iyengar
(C) Prof. R. R. Mishra
(D) Prof. I. N. Mishra

Ans. Option (B) is correct.

Explanation: Prof. M.O.P. Iyengar was a famous Indian phycologist who worked on the structure, cytology, reproduction and taxonomy of Algae. He is known as the "father of Indian phycology" in India".

Q. 8. Iodine is obtained from which algae :

- (A) Red algae (B) Green algae
(C) Brown algae (D) Both (A) and (B)

Ans. Option (C) is correct.

Explanation: Brown algae is one of the important source of Iodine. *Fucus* and *Laminaria* are rich source of iodine.

(C) Answer the following questions :

Q. 1. How does vegetative reproduction occur in liverworts ?

Ans. Fragmentation and Gemmae formation.

Q. 2. Name the leaf-like photosynthetic organ of Phaeophyceae ?

Ans. Frond.

Q. 3. Mention the name given to the storage bodies of green algae. Where are they located ?

Ans. Pyrenoids. They are located in the chloroplasts.

Q. 4. Name a heterosporous Lycopsida.

Ans. *Selaginella*.

Q. 5. Name the characteristic pigments found in Brown algae.

Ans. Fucoxanthin- a xanthophyll, Carotene.



2 Marks Questions

Q. 1. Name the group of plants which are called the 'amphibians' of plant kingdom. Give a reason to justify your answer. (ISC Board 2020)

Ans. Bryophytes are called 'amphibians' of the plant kingdom, because these plants though live in soil but they need water for sexual reproduction. The sperm of bryophyte (antherozoids) are flagellate

and need water to swim to the eggs.

Q. 2. What is the basis of classification of algae ?

Ans. Algae are mainly classified on the basis of the kind of pigment present. The flagellation, the storage products and the kind of cell wall present are also taken into consideration.

Q. 3. How are red algae adapted to conditions at sea ?

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- Ans. (i) The red algae attach themselves to the rough sea floor or to the rocks with finger like structures called holdfast.
- (ii) As they have red and blue pigments, they can absorb the blue-green light that can go into the water at a much farther depth.



Commonly Made Error

- Students often get confused among green algae, brown algae and red algae and write incorrect adaptations.



Answering Tip



3 Marks Questions

- Q. 1. Name the three classes of Algae. Mention the major photosynthetic pigments of each class.
(ISC Board 2020)

Ans. Three classes of algae are :

- (i) **Chlorophyceae** : The members are commonly called green algae and occur both in marine and fresh water. The plant body appears grass - green in colour due to the predominance of chlorophyll-a and chlorophyll-b, they also possess carotene and xanthophyll.
- (ii) **Phaeophyceae** : The members are commonly called brown algae and are mostly marine occurring in warm seas/oceans. They possess pigments chlorophyll 'a' and 'c', carotene and xantho-phyll.
- (iii) **Rhodophyceae** : The members are commonly called red algae and mostly are marine. The characteristic red colour is due to the pigment, r-phycoerythrin and other pigments are chlorophyll a and b.

- Q. 2. Mention the economic significance of Bryophytes.



Ans. Economic significance of Bryophytes are :

- (i) *Sphagnum* provides peat, which has been used as fuel.
- (ii) Due to their water-holding capacity, species of *Sphagnum* are used as packing material for trans-shipment of living materials.
- (iii) Some mosses are the pioneer species to colonise rocks along with lichens and bring about ecological succession.

- Make a tabular chart for classes Chlorophyceae, Phaeophyceae and Rhodophyceae which help in understanding the differences among green algae, brown algae and red algae respectively.

- Q. 4. What is the significance of phycocolloids in brown algae ?

Ans. The phycocolloids present in cell wall prevent drying or freezing in winter as they can retain water. They also protect the cells during low tides and when the large waves beat them against the rocks.

- Q. 5. Why fern prothallus is monoecious ? Explain.

Ans. Ferns are homosporous which produces, the gametophytic stage. Antheridia and archegonia, the male and female sex organs respectively are borne on the same prothallus and hence fern prothallus is monoecious.

- (iv) Mosses form dense mats on the soil and prevent soil erosion by reducing the impact of falling rain water.



Commonly Made Error

- Students generally write abstract importance of Bryophytes. They do not mention the name of the plants from which the usefulness has been mentioned.



Answering Tip

- Students should clearly learn the name of the plant which is a source of usefulness.

- Q. 3. How green algae living in ancient areas were the ancestors of the first land plants ?

Ans. The green algae and the land plants have following common features :

- (i) Have same kind of chlorophyll and produce carbohydrates during photosynthesis.
- (ii) The cell wall contains cellulose.
- (iii) Both store food in the form of starch.

- Q. 4. State economic importance of Pteridophytes.

- Ans. (i) Rhizomes and petioles of a fern *Dryopteris* are used to obtain drugs. *Lycopodium* is used for treatment of rheumatism.
- (ii) Some pteridophytes like *Marsilea* are the sources of starch.
- (iii) Pteridophytes are ornamental plants as most of them are grown in garden for decoration and greenery in the environment.

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Q. 5. Explain sexual reproduction in *Ulothrix*. AI

Ans. Sexual reproduction in *Ulothrix* :

- (i) Mitotic divisions occur in the cells which form 8-64 isogametes.
- (ii) Isogametes swim away from the parent filament.
- (iii) Different strains of two gametes fuse to form diploid zygote.

Q. 6. Differentiate between *Thallophyta* and *Pteridophyta*.

Ans.

	Thallophyta	Pteridophyta
(i)	Plant body is thallus like which is not differentiated into roots, stem and leaves.	Plants have true roots, stem and leaves.
(ii)	No specialised system for conduction.	Vascular system is present.
(iii)	Includes Algae.	Includes ferns.

Q. 7. (a) Name two species of algae from which agar is obtained. AI

- (b) Which class of algae do they belong to ?
- (c) Mention the economic uses of Agar.

Ans. (a) *Gracilaria*, *Gelidium*

(b) Rhodophyceae

(c) Agar is used in bacterial cultures and in preparation of ice-creams and jellies. It is also used in the preparation of cosmetics.

Q. 8. Mention the important characteristics of Division *Bryophyta*. AI

Ans. (i) The plant body is thallus like and is not differentiated into root, stem or leaves.

(ii) They have thin root-like structures called rhizoids which anchor them to the ground.

(iii) They do not have specialised tissues for conduction of water and food.

(iv) The main plant body is haploid gametophyte.

(v) The sporophyte is attached and produces spores.

(vi) Water is required for fertilization.



5 Marks Questions

Q.1. Explain the life cycle of *Pteridophyte*.

Ans. In *pteridophyte*, the main plant body is sporophyte (2n). It produces sporangia. In sporangia, spore mother cell undergo meiotic division and produce haploid spores. In homosporous condition, spore on germination produce haploid bisexual gametophyte. In heterosporous condition,

microspore produce male gametophyte and macrospore produce female gametophyte. Gametophytes reproduce sexually by the formation of antheridia and archegonia, which produce antherozoids and eggs respectively. During fertilization, male and female gametes fuses and form zygote. Later, new sporophyte is formed from the zygote.

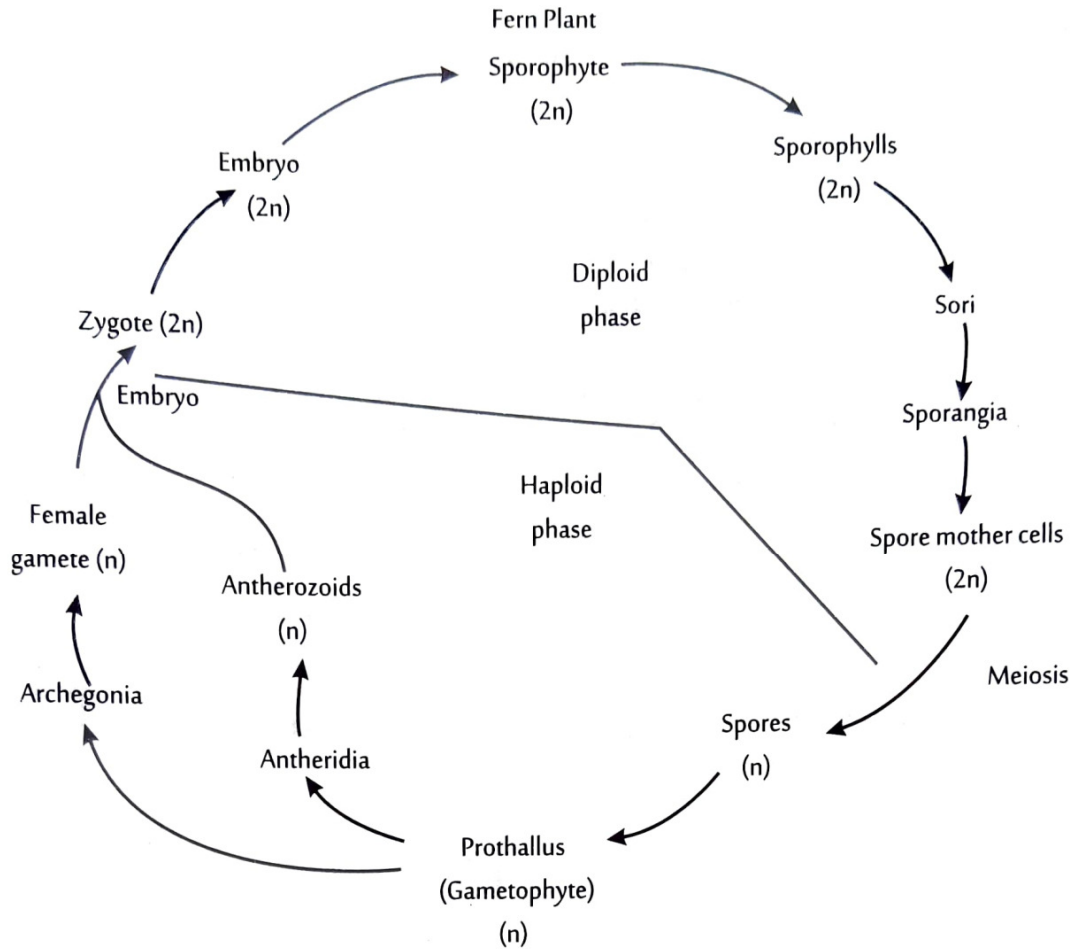


Fig. Life cycle of a Pteridophyte

Q. 2. Write the general characteristic features of Brown algae.

- Ans.** (i) Cell wall is made up of cellulose, fucinic acid and alginic acid.
(ii) Thylakoids are stacked in the form of three.
(iii) Photosynthetic pigments are chlorophyll a, and chlorophyll 'C'. Brown colour of the thallus is due to the presence of fucoxanthin pigment.
(iv) Reserve food materials are laminarin and mannitol.
(v) Reproduce vegetatively, asexually or sexually. Sexual reproduction is isogamy, anisogamy or oogamy.

Q.3. Explain sexual reproduction in Spirogyra with diagram.

Ans. Spirogyra reproduces sexually by conjugation :

- (i) Two filaments line up alongside and the adjacent cells get connected by short tubular outgrowths which fuse to form a conjugation tube.
(ii) The protoplasm of one cell (male) migrates through the tube and fuses with the other cell (female). A spherical or oval zygote is formed, which develops a thick wall around it and is termed as zygospore.
(iii) During favourable conditions, nucleus of the zygospore undergoes meiotic divisions forming 4 nuclei. Three degenerate and one gives rise to a haploid filament.

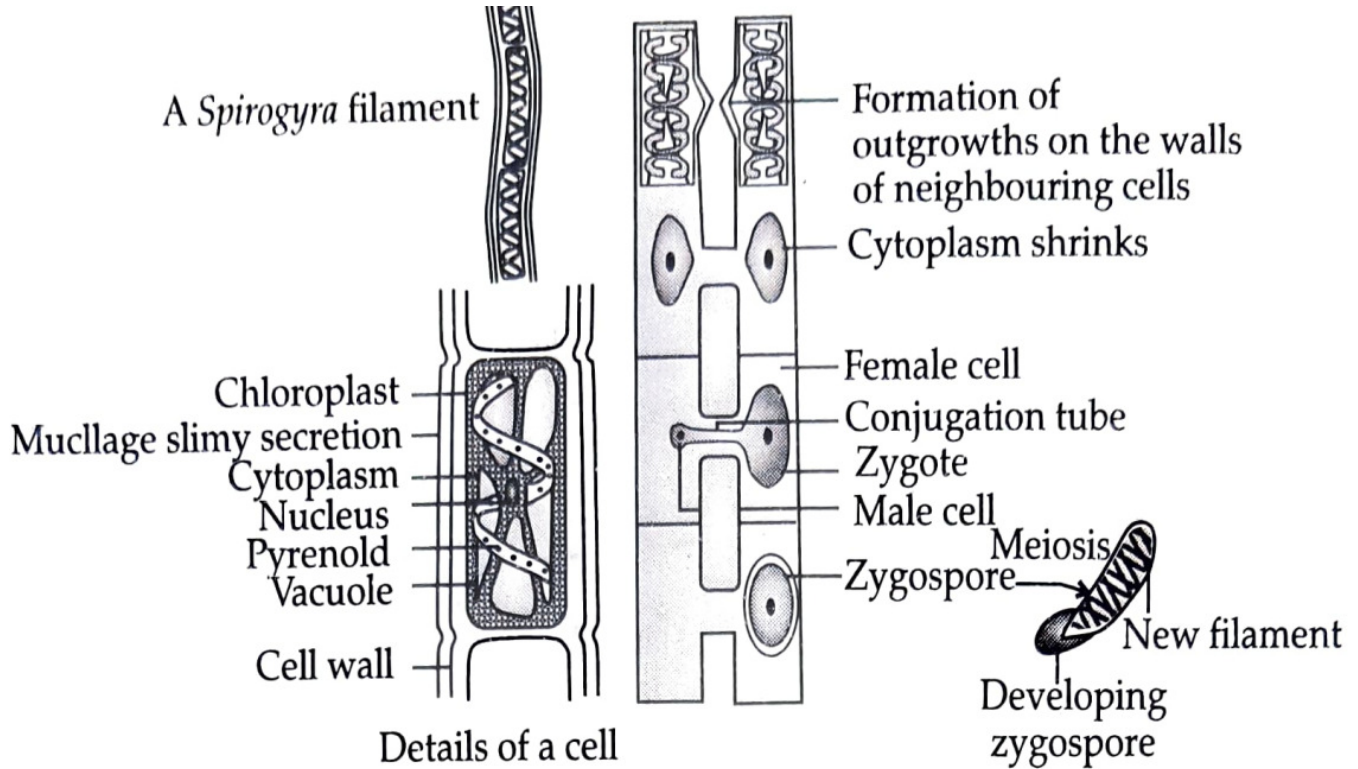


Fig. Structure and reproduction in *Spirogyra*

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1 Mark Questions

(A) Name the following :

Q. 1. The process of fusion of a male gamete with the female gamete.

Ans. Syngamy.

Q. 2. The female gamete in Gymnosperm.

Ans. Archegonium

Q. 3. Roots formed in cycas by nitrogen fixing cyanobacteria.

Ans. Coralloid roots.

Q. 4. The tallest tree species in Gymnosperm.

Ans. Sequoia

Q. 5. The reproductive structures in Angiosperms.

Ans. Flowers.

Q. 6. The structure formed when second male gamete fuses with the secondary nucleus.

Ans. Triploid primary endosperm nucleus.

Q. 7. The covering of an ovule of an angiosperm.

Ans. Integuments.

(B) Each of the following questions has four choices. Choose the correct option in each case:

Q. 1. The smallest angiospermic plant is :

- (A) Eucalyptus (B) Cycas
(C) Wolffia (D) Pinus

Ans. Option (C) is correct.

Explanation: Wolffia is a member of the Lemnaceae has about 11 species which include the smallest flowering angiosperm on earth.

Q. 2. The ovules are naked in the division :

- (A) Bryophyta (B) Gymnosperm
(C) Pteridophyta (D) Angiosperm

Ans. Option (B) is correct.

Explanation: In gymnosperms, ovules are naked without any covering and hence remain exposed. The seeds, which develop after fertilization, are also naked.

Q. 3. The dominant phase in the life cycle of Gymnosperm is :

- (A) Gametes (B) Gametophyte
(C) Spores (D) Sporophyte

Ans. Option (D) is correct.

Explanation: In gymnosperms, the plant body represents the sporophyte, rather than the gametophyte. A typical sporophyte has a stem along with roots and leaves which bears the reproductive structures. It is the dominant phase of their life cycle.

Q. 4. The structure formed when two polar nuclei fuse in the embryo sac :

- (A) Endosperm (B) Zygote
(C) Secondary nucleus (D) Ovule

Ans. Option (C) is correct.

Explanation: The central cell of an embryo sac contains two polar nuclei. At the time of fertilization these two nuclei fuse together to form diploid secondary nucleus.

Q. 5. The place where ovules are borne in gymnosperms :

- (A) Sporophyll
(B) Megasporophyll
(C) Microsporophyll
(D) None of these

Ans. Option (B) is correct.

Explanation: The gymnosperms are heterosporous. They produce haploid microspores and megaspores within sporangia. The microspores develop into pollen grain and megaspores are in an ovule. Ovules are borne on megasporophyll.

Q. 6. In Cycas, vegetative reproduction occurs through :

- (A) leaf (B) Bulbils
(C) Corals (D) Seeds

Ans. Option (B) is correct.

Explanation: The method of vegetative reproduction in Cycas occurs through bulbils. The bulbils develop from the axil of the scaly leaves.

Q. 7. The functional megaspore gives rise to _____ in angiosperms.

- (A) ovule (B) endosperm
(C) embryo sac (D) embryo

Ans. Option (C) is correct.

Explanation: The functional megaspore give rise to embryo sac in which embryo is formed after fertilization. Megaspore is present inside the ovule.

(C) Answer the following questions :

Q. 1. When does meiosis occur in a diplontic life cycle ?

Ans. During spore formation.

Q. 2. Where are the pollen grains formed in gymnosperms ?

Ans. In the microsporangia.

Q. 3. Mention three parts of pistil.

Ans. Stigma, Style and Ovary.

Q. 4. Where fertilization occurs in Gymnosperm ?

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Ans. In the archegonia.

Q. 5. Why Gymnosperms are heterosporous ?

Ans. Because they produce microspores in the male cones and megaspores in the female cones.

2 Marks Questions

Q. 1. Why gymnosperms and angiosperms are classified separately when they both bear seeds ? AI

Ans. Because, in case of gymnosperms the seeds are naked, i.e., the seeds are not produced inside the fruit but in case of angiosperms the seeds are enclosed inside the fruit.

Q. 2. Mention the differences between syngamy and triple fusion.

Ans. The differences between syngamy and triple fusion are :

Syngamy	Triple Fusion
(i) It is the process of fusion of a male gamete with the female gamete.	It is the process of fusion of two polar nuclei (into a secondary nucleus) and a male gamete in the embryo sac.
(ii) It results in a diploid zygote.	It results in a endosperm.



Commonly Made Error

- Students often get confused between the terms syngamy and triple fusion. Many of them write opposite differences.



Answering Tips

- Students should learn the differences between the two in tabular form for easy understanding and retention.

Q. 3. Explain the tap root system in gymnosperms. AI

Ans. (i) Roots of *Pinus* have symbiotic association with fungi called mycorrhiza.

(ii) Roots of *Cycas* have small specialised roots called coralloid roots which are associated with nitrogen-fixing cyanobacteria.

Q. 4. What are the advantages of seeds in plants ? AI

Ans. The advantages of seeds in plants are as follows :

- A seed is a fertilized ovule which is well protected by many layers of cell.
- The food stored around the seed can be used by the developing zygote at the time of germination.
- A seed can remain dormant till the conditions are suitable.

Q. 6. Mention the two classes of division Angiosperm.

Ans. Monocotyledons and Dicotyledons

(iv) Seed is modified in many ways to bring out dispersal.

Q. 5. Differentiate between Dicotyledonous and Monocotyledonous plants. AI

Ans. Differences between Dicotyledonous and Monocotyledonous plants :

Dicotyledonous plants	Monocotyledonous plants
(i) They have tap root system.	They have fibrous root system.
(ii) Flower parts are in multiples of four or five.	Flower parts are in multiples of three.
(iii) Leaves have reticulated venation.	Leaves have parallel venation.
(iv) Seeds have two cotyledons.	Seeds have single cotyledons.



Commonly Made Error

- Students often write opposite answers for dicotyledonous and monocotyledonous plants. Many of them forget to mention the number of cotyledons which is an important difference between the two.



Answering Tip

- Students should learn the differences between the dicots and monocots in tabular form. Experiment when performed in laboratory will make easy for students to understand difference.

Q. 6. List the economic importance of gymnosperms. AI

Ans. Economic importance of Gymnosperms are :

- Commercial timbers are obtained from *Pinus* and *Cedrus*.
- Conifers provide large amount of softwood for construction, packing, paper industry, plywood and particle board.
- Ephedrine - a drug from conifer *Ephedra* is used for respiratory ailments.
- Cycads have palm like leaves and used for ornamental purpose.

 **3 Marks Questions**

Q. 1. Double fertilization is unique to angiosperm. Explain.

Ans. Double fertilization is unique to angiosperms :

- (i) In this phenomenon, two male gametes are discharged by a pollen tube into the embryo sac of an ovule.
- (ii) One male gamete fuses with the female gametes to form a zygote; this fusion is called syngamy.
- (iii) A second male gamete fuses with the secondary nucleus to form the primary endosperm nucleus, this is called triple fusion.



Commonly Made Error

- Students often miss the terms like syngamy and triple fusion.



Answering Tip

- Students should remember that zygote forms in syngamy and in triple fusion, there is a formation of primary endosperm nucleus.

Q. 2. Mention the changes that occur in angiosperms after fertilisation.

Ans. The changes that occur in angiosperms after fertilization are :

- (i) The ovules develop into the seeds. The seed contains the embryo or the potential plant.
- (ii) The ovary develops into the fruit.
- (iii) The ovary wall forms the fruit wall called pericarp.

Q. 3. What is heterospory ? Briefly comment on its significance. Give two examples of heterosporous plants.

Ans. Heterospory is the phenomenon in which a plant produces two types of spores, namely microspores and megaspores.

Significance of heterospory :

- (i) In heterosporous plants, microspores give rise to male gametophyte and megaspores give rise to female gametophyte.
- (ii) The female gametophyte is retained on the parent plant and the development of zygote takes place within the female gametophyte.
- (iii) This leads to formation of seeds, heterospory is the forerunner of seed habit.

Examples of heterosporous plants : All gymnosperms and all angiosperms.



Commonly Made Error

- Students generally get confused between the biological terms like homospory and heterospory.



Answering Tip

- Students should remember that gymnosperms and angiosperms show heterospory, because they produce two types of spores. Learn the concept of homospory and heterospory carefully with proper examples.

Q. 4. Explain diplontic life cycle.

Ans. (i) In diplontic life cycle, the diploid sporophyte is the dominant photosynthetic independent phase of plant body. The haploid phase is represented by gametes only.

(ii) In gametic meiosis, instead of immediately dividing meiotically to produce haploid cells, the zygote divides mitotically to produce a multicellular diploid individual.

(iii) Cells from the diploid individuals then undergo meiosis to produce haploid cells or gametes.

(iv) Haploid cells may divide again (by mitosis) to form more haploid cells, as in many yeasts, but the haploid phase is not the predominant life cycle phase.

(v) In most diplonts, mitosis occurs only in the diploid phase, i.e., gametes usually form quickly and fuse to produce diploid zygotes.

(vi) Main plant body is diploid (sporophyte $2n$).
Example – All seed-bearing plants, gymnosperms, and angiosperms.

Q. 5. Write the general characters of class coniferopsida.

Ans. (i) Plants are large and profusely branched with excurrent habit or conical canopy.

(ii) Roots are tap roots and roots are associated with mycorrhiza.

(iii) Leaves are simple and needle like.

(iv) Plants are monoecious but male and female cones are produced on separate branches.

(v) Ovules have ovuliferous scales.

(vi) Ex: *Pinus*, *Cedrus*, *Sequoia*, etc.

5 Marks Questions

Q. 1. List the distinguishing features of angiosperm.

- Ans. (i) Main plant body is sporophyte and is differentiated into root, stem and leaves.
 (ii) Primary roots arise from radicle. Shoot arises from plumule.
 (iii) Stem has nodes and internodes. Stem and roots show secondary growth.
 (iv) Leaves arise from only nodes. They show reticulate or parallel venations.
 (v) Flowers are formed by the aggregation of 4 whorl of appendages.
 (vi) Double fertilization and triple fusion is seen. Endosperm is post fertilization, structure and is the triploid.
 (vii) After fertilization, ovary develops into fruit and ovules develop into seed.

Q. 2. Explain alternation of generation. Draw the flow diagram of all types of patterns of life cycle. [A1]

Ans. It is alternate production of haploid gametophyte and a diploid sporophytic generation in the life cycle. Haploid gametophyte reproduces sexually by producing male and female sex organs. Gametophyte produces gametes by undergoing mitotic division. Fusion of two haploid gametes leads to the formation of a diploid zygote. Zygote grows into diploid sporophyte generation. Sporophyte produces spores by meiosis. Haploid spores on germination produce a haploid gametophyte.

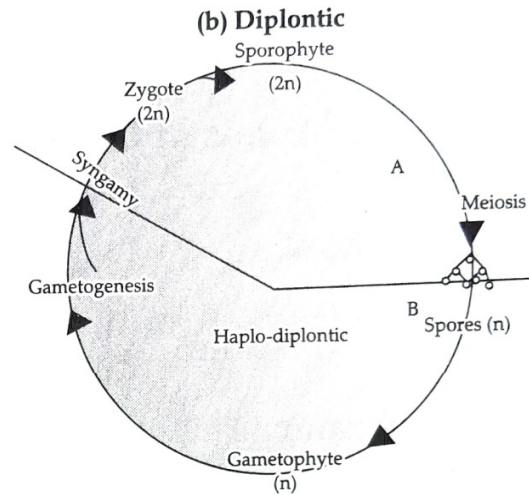
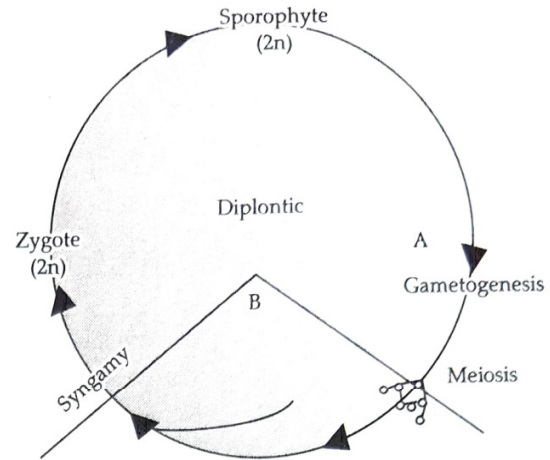
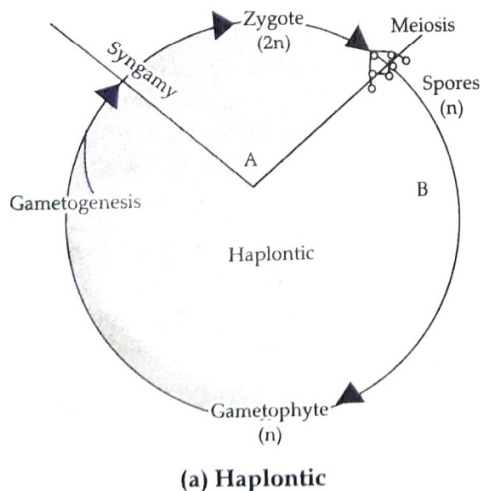


Fig. Life cycle patterns

Q. 3. Explain fertilization and development of seed in angiosperms. [A1]

Ans. Pollen grains are brought to the surface of stigma of the pistil during pollination. Each pollen grain germinates forming a pollen tube that carries two male gametes to the embryo sac, growing through the tissues of stigma and style. One of the male gamete fuses with the female gamete to form the zygote (syngamy) and the second male gamete fuses with the secondary nucleus to form the triploid primary endosperm nucleus (PEN). Since, there are two fusions in an ovule during fertilization, this phenomenon is called double fertilization. After fertilization, synergids and antipodal cell degenerate. The zygote develops into embryo and the primary endosperm nucleus develops into endosperm. The ovule gradually transforms into a seed and the ovary becomes the fruit.