3

Plant Kingdom

Multiple Choice Questions (MCQs)

Q. 1 Cyanobacteria are classified under

(a) Protista (b) Plantae (c) Monera (d) Algae

Thinking Process

Cyanobacteria are also known as blue green algae. These are primitive prokaryotes.

Ans. *(c)* **Monera** Kingdom–Monera is one group which exclusively includes all forms of bacteria. All bacteria are prokaryotes and do not have well defined nucleus and other cell organelles.

The other options Protista, Algae and Plantae include eukaryotic and unicellular or multicellular organism.

Q. 2 Fusion of two motile gametes which are dissimilar in size is termed as

(a) oogamy (b) isogamy (c) anisogamy (d) zoogamy

Ans. *(c)* **Anisogamy** Sexual reproduction is lower group of plants like algae exhibit great variation in mode of sexual and asexual reproduction. Some algae produce gametes which are not similar in shape, size and structure, when they fuse, it is called Anisogamy. *e.g., Chlamydomonas*.

The other options are incorrect because oogamy is the fusion of big oospore female with small male gamete. Isogamy is fusion of similar gametes. Zoogamy is sexual reproduction of animals.

Q. 3 Holdfast, stipe and frond constitutes the plant body in case of

(a) Rhodophyceae (b) Chlorophyceae
(c) Phaeophyceae (d) All of these

Ans. *(c)* **Phaeophyceae** In the members of class–Phaeophyceae, the plant body is usually attached to the substratum by a hold fast and has a stalk called stipe and a leaf like photosynthetic organ called frond.

Q. 4 A plant shows thallus level; of organisation. It shows rhizoids and is haploid. It needs water to complete its life cycle because the male gametes are motile. Identify the group to which it belongs to

(a) pteridophytes (b) gymnosperms (c) monocots (d) bryophytes

Ans. *(d)* **Bryophyta** is a group of plants which have gametophytic haploid thalloid body. The motile male gamete are produced in special male reproductive structure called antheridia.

These gametes need thin film of water to move and reach to the female reproductive organ called archegonia. Whereas, pteridophytes, gymnosperm and monocots show division of labour and their body shows higher level of organisation.

Q. 5 A prothallus is

(a) a structure in pteridophytes formed before the thallus develops
(b) a sporophytic free living structure formed in pteridophytes
(c) a gametophyte free living structure formed in pteridophytes
(d) a primitive structure formed after fertilisation in pteridophytes

Ans. *(c)* **Prothallus** is usually a gametophytic stage in the life of a Pteridophyte. Spore germinates to form a prothalium, it is short lived inconspicuous heart shaped structure with a number of rhizoids developed beneath and sex organs, archegonium and antheridium.

Q. 6 Plants of this group are diploid and well adapted to extreme conditions. They grow bearing sporophylls in compact structures called cones. The group in reference is

(a) monocots (b) dicots (c) pteridophytes (d) gymnosperms

Ans. *(d)* **Gymnosperms** include medium sized trees or tall trees and shrubs. Leaves of these plants are well adapted to with stand extremes of temperature, humidity and wind. Reproductive organs are usually in the form of cones or strobili.

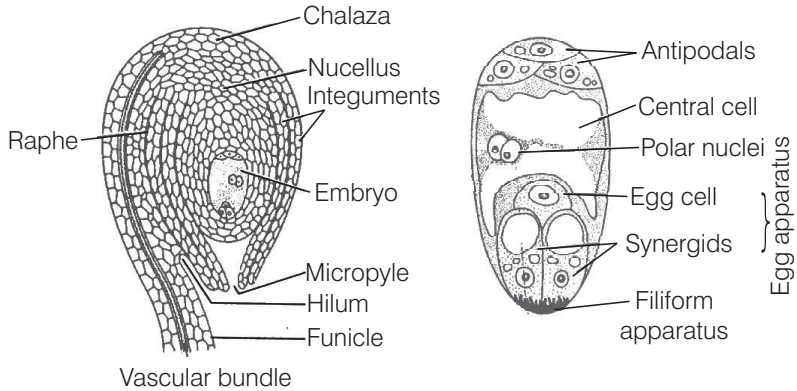
The male cone are made up of microsporophyll and female cones are made up of megasporophyll. The presence of sporophyll (micro and megasporophyll) shows the development of seed habit but seeds develop from naked ovule and are not covered.

Other examples are incorrect because monocots and dicots belong to angiosperms which have well developed covered seeds. Whereas, pteridophytes do not have microsporphylls and are not adapted to the above said conditions.

Q. 7 The embryo sac of an angiosperm is made up of

(a) 8 cells (b) 7 cells and 8 nuclei
(c) 8 nuclei (d) 7 cells and 7 nuclei

Ans. *(b)* **Embryo sac** in angiosperm is a female gametophyte. It contains 2 synergids, 1 egg cell, 3 antipodal cells and one secondary nucleus.



Structure of female gametophyte of an angiosperm

Q. 8 If the diploid number of a flowering plant is 36. What would be the chromosome number in its endosperm?

(a) 36 (b) 18 (c) 54 (d) 72

Thinking Process

The ploidy of an angiospermic plant is 2n. Reduction division (meiosis) occurs at the time of gamete formation to produce male and female gametes, i.e., pollen and egg cell. Since, the double fertilisation is feature of angiosperms, related to the ploidy of endosperm.

Ans. *(c)* **Endosperm** is a product of triple fusion. One male nuclei (n=18) fuses with diploid secondary nucleus ($2n$=36), so it becomes triploid structure ($3n$=54). So, ploidy of endosperm is ($3n$) and chromosomes will be 54.

Q. 9 Protonema is

(a) haploid and is found in mosses (b) diploid and is found in liverworts
(c) diploid and is found in pteridophytes (d) haploid and is found in pteridophytes

Thinking Process

Mosses and liverworts and simplest terrestrial plants evolved from algal ancesters. Protonema is one cell thick, filamental structure developed in early developmental stage of bryophyte which resemble with filamentous algae.

Ans. *(a)* The germination of **haploid** spores of mosses produced by sporophyte after reduction division these haploid spores when germinate, form the Protonema. This structure later develops into an independent gametophytic plant.

Q. 10 The giant redwood tree (*Sequoia sempervirens*) is a/an

(a) angiosperm (b) free fern (c) pteridophyte (d) gymnosperm

Ans. *(d)* *Sequoia sempervirens* is a gymnspermic plant. It is a group of plants having thick, woody, branched stems. These plants also have some xeric adaptations which help them survive in adverse climatic conditions.

The other examples are incorrect because **pteridophytes** is primitive group, no tree is included in this. **Ferns** are included in Pteridophytes. **Angiosperms** are different form gymnosperms in seed habit and adaptations.

Very Short Answer Type Questions

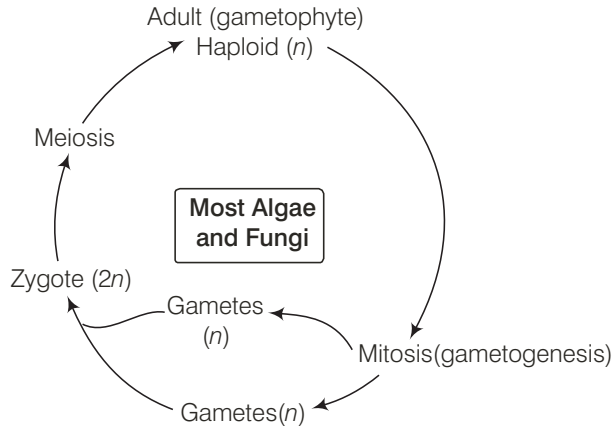
Q. 1 Food is stored as floridean starch in Rhodophyceae. Mannitol is the reserve food material of which group of algae?

Ans. The members of Phaeophyceae (brown algae) store mannitol as a reserve food material.

Q. 2 Give an example of plants with

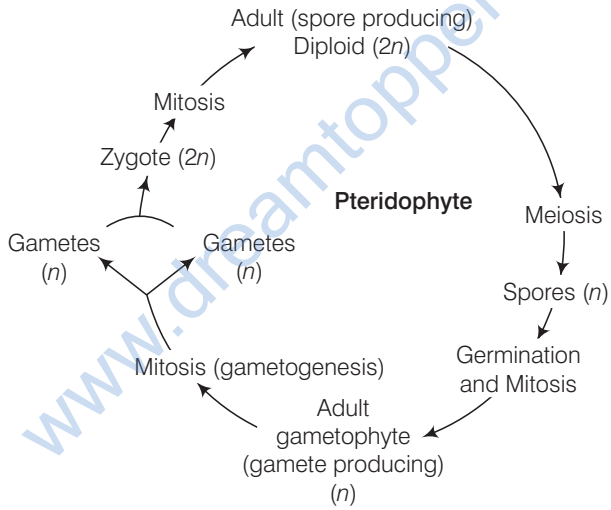
(a) haplontic life cycle
(b) diplontic life cycle
(c) haplo diplontic life cycle

Ans. (a) **Haplontic life cycle** It is exhibited by *Volvox*, *Spirogyra* and *Chlamydomonas*. The dominant photosynthetic phase in these plants is gamotophytic phase which develops from a haploid spores after a mitotic cell division of zygote.



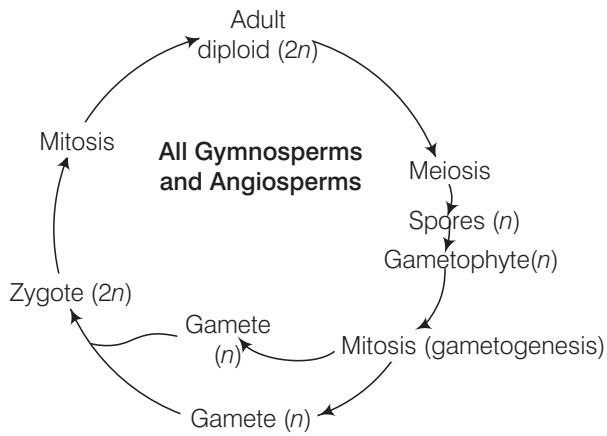
Haplontic life cycle

(b) **Diplontic life cycle** is found in gymnosperms and angiosperms. The dominant phase is diploid sporophyte plant develop from zygote.



Diplontic life cycle

(c) **Haplodiplontic life cycle** It is an intermediate conditions exhibited by bryophytes and pteridophytes. Here haploid gametophytic stage alternates with diploid sporophytic stage.



Haplodiplontic life cycle

Q. 3 The plant body in higher plants is well differentiated and well developed. Roots are the organs used for the purpose of absorption. What is the equivalent of roots in the less developed lower plants?

Ans. Roots are represented by root like structure called rhizoids in less developed lower plants (bryophytes and pteridophytes). The plant tissue system in these is not differentiated into true leaf, stem and roots as it is found in higher plants (gymnosperm and angiosperm).

Q. 4 Most algal genera show haplontic life style. Name an alga which is

(a) Haplo diplontic (b) Diplontic

Thinking Process

In plants both haploid and diploid cells can divide by mitosis. This ability leads to the formation of different plant body—haploid or diploid. Haploid plant body produces gametes by mitosis. This plant body is gametophyte.

Ans. Haplo diplontic type of life cycle is exhibited by *Ectocarpus*, *Polysiphonia* and *Kelps*. Here, diploid saprophytic phase alternate with haploid gametophytic phase.
In *Fucus*, the main plant body is saprophytic and it shows diplontic type of life cycle.

Q. 5 In bryophytes male and female sex organs are called ..... and ..... .

Ans. In bryophytes the male sex organ is antheridium and female sex organ is archegonium. The gametophyte (n) in bryophyte bears the primiture sex organs in the form of **antheridium** (male) which produce flagellate antherozoids which are male gamete and need thin film of water to swim and reach female reproductive organ (archegonium).

Archegonia is female part which has single egg cell. Both these reproductive parts are born on male and female, anthridiophore and archegoniophores borne on haploid gametophyte.

Short Answer Type Questions

Q. 1 Why are bryophytes called the amphibians of the plant kingdom?

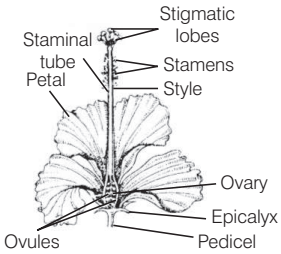
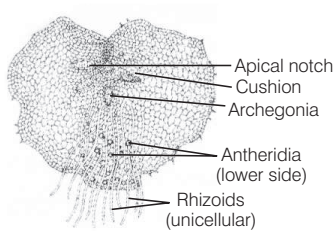
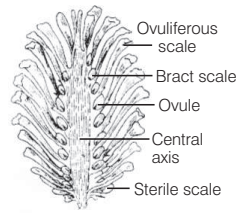
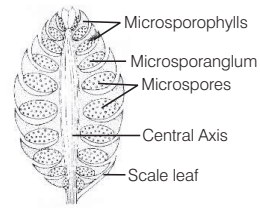
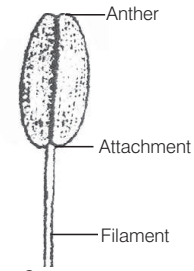
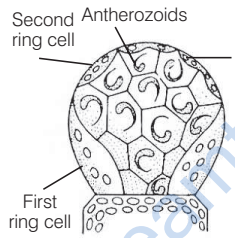
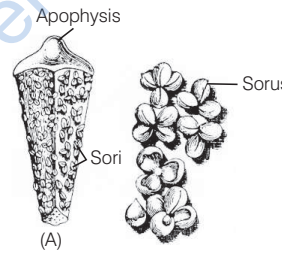
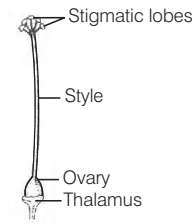
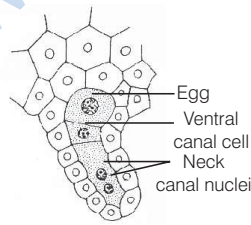
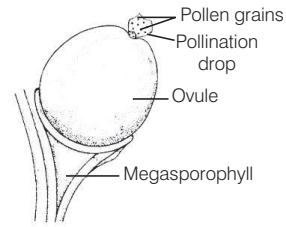
Thinking Process

Amphibians can live their life in water as well as on terrestrial habitat. Think of plant and animal species that can live this mode of life.

Ans. Bryophytes are amphibian of plant kingdom. It is a group of primitive plant having a dominant gametophytic plant body. These plants can live in soil but depend on water for movement of male gametes called antherozoids to reach archegonium (female organ having egg cell) so that fertilisation can take place.

Q. 2 The male and female reproductive organs of several pteridophytes and gymnosperms are comparable to floral structures of angiosperms. Make an attempt to compare the various reproductive parts of pteridophytes and gymnosperms with reproductive structures of angiosperms.

Ans. *The structures are as given*

Angiosperm	Pteridophyte	Gymnosperm	
 Flower showing different parts	 Gametophyte bearing antheridia (♂) and archegonia (♀)	 Female cone	 Male cone
Reproductive Structure			
 Stamen	 Antheridium with antherozoids	 Microsporophyll bearing microspore (pollen)	
Male Reproductive Organ			
 Carpel	 Archegonium	 Megasporophyll-bearing ovule	

Q. 3 Heterospory, *i.e.,* formation of two types of spores—microspores and megaspores is a characteristic feature in the life cycle of a few members of pteridophytes and all spermatophytes. Do you think heterospory has some evolutionary significance in plant kingdom?

Thinking Process

Formation of two types of spores is an evolutionary advancement of sexuality in plant over primitive form of plants .

Ans. Heterospory is production of spores of two different sizes and sexes by the sporophytes of land plants. *Two types of spores are produced by heterosporic plants.*

Small spores are microspores which germinate into male gametophyte and large spores are macrospores which develop into female gametophyte.

In evolution of plants pteridophytes are intermediate between bryophytes and gymnosperms. All bryophytes are homosporous and all gymnosperms are heterosporous. This condition is advanced as sexual dimorphism result in cross fertilisation.

Primitive or earlier pteridophytes are homosporous later pteriodophytes are heterosporous *e.g., Dryopteris*, *Pteris*-homosporous *Selaginella*, *Salvinia*-heterosporous.

Q. 4 How far does *Selaginella* one of the few living members of Lycopodiales (pteridophytes) fall short of seed habit?

Ans. **Seed habit** The differentiation of spores into microspores and megaspores and their dependence on the parent sporophyte for the nutrition, are the certain features in the life cycle of *Selaginella*, which have been considered as the essential pre-requite for formation of seed, the characteristic of spermatophyte.

The evolution of heterospory and seed habits in Selaginella is evident by the following characters

(i) Reduction to a single functional megaspore per sporangium.
(ii) Retention and germination of megaspore within megasporangium
(iii) Development of protective layer and nutritive tissue called tapetum is present.
(iv) Development of embryosac with in the sporangium.
(v) Modification of distal end of mega sporangium to capture pollen grain.
(vi) Pollination and siphonogamy.
(vii) Temporary suspension of growth of embryo (dormancy period).

Q. 5 Each plant or group of plants has some phylogenetic significance in relation to evolution *Cycas*, one of the few living members of gymnosperms is called as the 'relic of past'. Can you establish a phylogenetic relationship of *Cycas* with any other group of plants that justifies the above statement?

Thinking Process

Similarity between phylogenetic characters of two plants shows that advanced group of plants have evolved from the primitive one.

Ans. *Cycas* **as the relic of past** *Cycas* is an evergreen plant which looks like a palm. It has unbranched stem and large compound leaf. It exhibit phylogenetic relationship with pteridophyte. *Its evolutionary characters are*

(i) Slow growth.
(ii) Shedding of seed when the embryo is still immature.
(iii) Little secondary growth and manoxylic wood.
(iv) Leaf like megasporophyllus.
(v) Flagellate sperms even when pollen tube is present.
(vi) Persistent leaf bases.
(vii) Circinate ptysix.
(viii) Arrangement of microsporangia is well defined archegonia.

Q. 6 The heterosporous pteridophyte show certain characteristics, which are precursor to the seed habit in gymnosperms. Explain.

Thinking Process

Presence of seed and woody stem is the characteristic feature of gymnosperms. The development of seed plants have evolved from few plants like Selaginella (pteridophyte) whose life cycle clearly shows the development of seed habit. Compare the life cycle of this pteridophyte with Cycas.

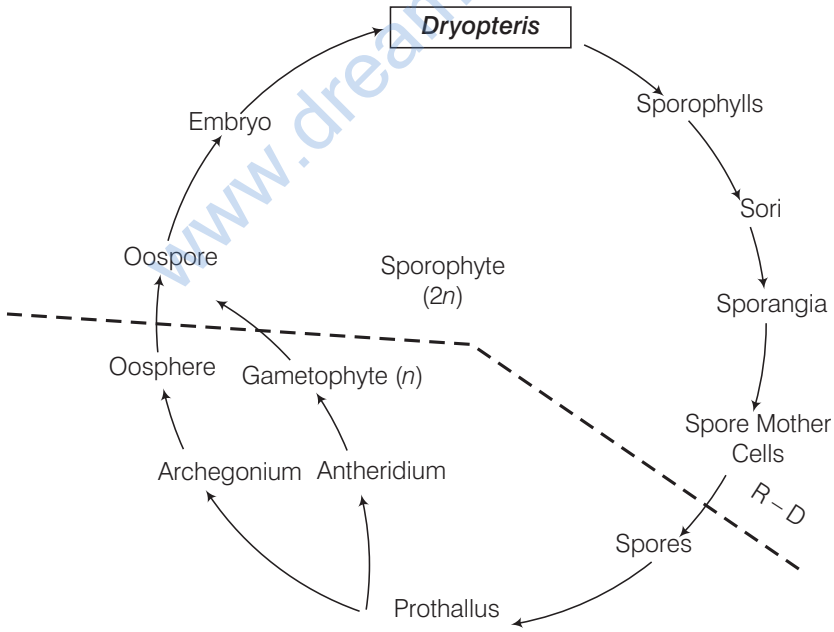
Ans. Heterospory, *i.e.,* production of two types of spores smaller microspores and larger megaspore was first reported in *Selaginella* a pteridophyte. In *Selaginella*, the smaller microspores are destined to produce male gametophytes and the larger megaspores to female gametophyte.

The male gametophyte produces male gametes, whereas the female gametophyte produces archegonia and also provides nourishment to the developing embryo.

The phenomenon of heterospory, thus lead to the reduction of gametophyte, *in situ* germination of spores, retention of megagametophyte in the megasporangia and finally to the seed development. Thus, the heterospory in *Selaginella* forms the base for seed habit development in gymnosperms.

Q. 7 Comment on the life cycle and nature of a fern prothallus.

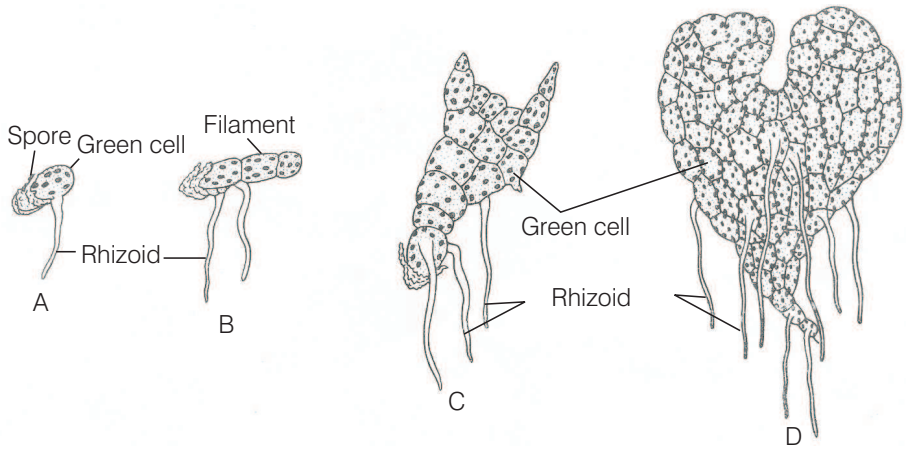
Ans. The life cycle of fern (*Dryopteris*) clearly shows the alternation of generation. The gametophytic stage (*n*) alternates with the sporophytic stage (2*n*) figure given shows its complete life cycle.



Topographical representation of life cycle of fern

Prothallus The prothallus of the fern is multicellular, free living, thalloid, haploid and autotrophic structure. It develops from the spores produced by sporophyte after reduction division.

These spore germinate with a germtube with an apical cell and forms a filament of 3-6 cells and one or two rhizoids at the base which later develops into gametophytic plant.



Different stages in the germination of a spore and development of prothallus

Q. 8 How are the male and female gametophytes of pteridophytes and gymnosperms different from each other?

Ans. *The male and female gametophytes of pteridophytes and gymnosperms different from each other are*

Male Gametophyte of Pteridophyte	Male Gametophyte of Gymnosperm
A distinct male gametophyte may not be present.	A male gametophyte is always present.
It contains an antheridium.	An antheridium is not found.
Male gametes are flagellated.	Male gametes may or may not be flagellated.
Male gametes reach the female gamete by swimming in a film of water.	Male gametes reach the female gamete through a pollen tube. Water is not required.

Female Gametophyte of Pteridophyte	Female Gametophyte of Gymnosperm
A distinct female gametophyte may or may not be present.	A distinct gametophyte is always present.
It is largely independent.	Female gametophyte does not leave the parent plant.
It is not enclosed is an ovule.	It is enclosed inside an ovule.

Q. 9 In which plant will you look for mycorrhiza and corolloid roots? Also explain what these terms mean.

Thinking Process

Symbiosis is a phenomenon of interaction of two living organisms in such a way that both the associated partners derive some benefit from each other in such a way that both co-exist and flourish well.

Ans. Mycorrhiza (*Myco's* = fungus, *rize* = roots) is a symbiotic association between fungus and the roots of vascular plants. The fungus colonizes the roots of the host either intra or inter cellularly. It helps in the nutrient absorption from soil for the plant. Mycorrhizal associations are present in conifers, *i.e.*, *Pinus, Cedrus, Abies* and *Picea*.

Coralloid roots is develop in *Cycas*. It is produced in clusters at the base of the stem and protrudes out over the ground. It is dichotomously branched and greenish in colour. It contains algal zone in cortex. This algal zone contains blue green algae like *Anabaena* and *Nostoc* which grow in symbiotic association with coralloid roots.

Long Answer Type Questions

Q. 1 Gametophyte is a dominant phase in the life cycle of a bryophyte. Explain.

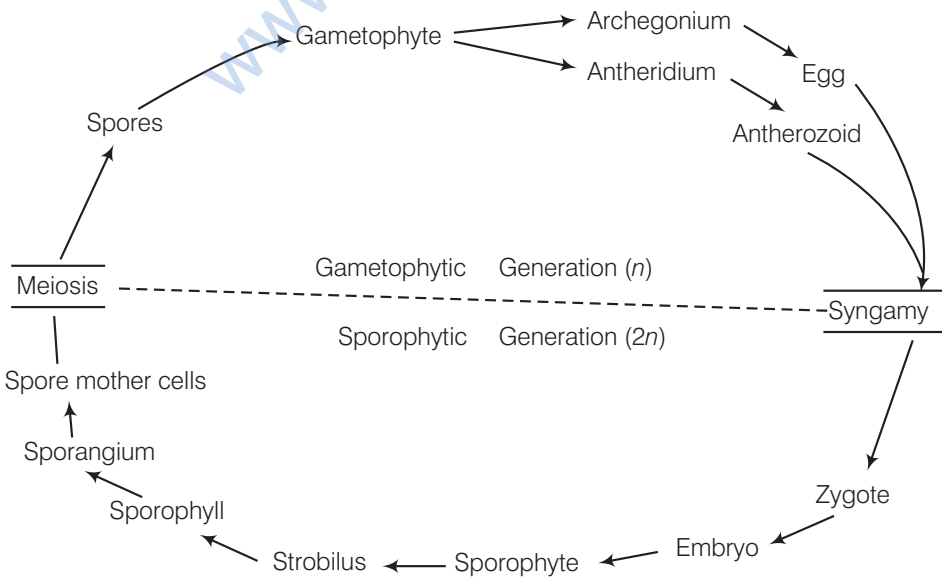
Ans. Gametophyte is a haploid multicellular adult stage in a bryophyte's life cycle. It bears male reproductive structure (antheridia) and female reproductive structure called archegonia, and thus produce haploid gametes antherozoids (male gamete) and egg cell (female gamete) respectively.

In mosses, liverworts and hornworts the gametophyte is a dominant form and thus most familiar phase of life cycle of the bryophyte. The moss gametophyte originate from a haploid spore. Initial phase of growth forms protonema in moss.

The protonema further develops into a main plant body of bryophyte which is thallus like prostrate and erect, attached to substratum by unicellular or multicellular rhizoids. They may possess root like, leaf like or stem like structures.

Q. 2 With the help of a schematic diagram describe the haplo diptontic life cycle pattern of a plant group.

Ans. **Haplo diplontic life cycle** (is also referred as diplohaplontic, diplo biontic or dibiontic) shows **multicellular** diploid and haploid stages as dipicted in the following figure.



Schematic diagram represent the life cycle of a pteridophyte (homosporous one) **haplo-diplontic type of life cycle**

Life Cycle of a Pteridophyte *The life cycle of a pteridophyte consists of two morphologically distinct phases*

(i) The gametophytic phase

(ii) The sporophytic phase

These two phases come one after another in the life cycle of a pteridophyte. This phenomenon is called **alternation of generation**. The gametophyte is haploid with single set of chromosomes. It produces male sex organs antheridia and female sex organs archegonia.

(i) The antheridia may be embedded or projecting type. Each antheridium has single layered sterile jacket enclosing a mass of androcytes.

(ii) The androcytes are flask-shaped, sessile or shortly stalked and differentiated into globular venter and tubular neck.

(iii) The archegonium contains large egg, which is non-motile.

(iv) The antherozoids after liberation from antheridium, reaches up to the archegonium fuses with the egg and forms a diploid structure known as zygotes.

(v) The diploid zygote is the first cell of sporophytic generation. It is retained inside the archegonium and forms the embryo.

(vi) The embryo grows and develop to form sporophyte which is differentiated into roots, stem and leaves.

(vii) At maturity the plant bears sporangia, which encloses spore mother cells.

(viii) Each spore mother cell gives rise to four haploid spores which are usually arranged in tetrads.

(ix) The sporophytic generation ends with the production of spores.

(x) Each spore is the first cell of gametophytic generation. It germinates to produce gametophyte and completes its life cycle.

Q. 3 Lichen is usually cited as an example of 'symbiosis' in plants where an algal and a fungal species live together for their mutual benefit. Which of the following will happen if algal and fungal partners are separated from each other?

(a) Both will survive and grow normally and independent from each other.

(b) Both will die

(c) Algal component will survive while the fungal component will die.

(d) Fungal component will survive while algal partner will die.

Based on your answer how do you justify this association as symbiosis?

Ans. ***(b)*** Is correct, lichen is a symbiotic association between an alga and a fungi, which live together for their mutual benefit. If both are separated from each other then they will die. The fungus holds water, provides protection and ideal housing to the alga.

The alga in turn supplies carbohydrate food for the fungus. If the alga is capable of fixing nitrogen (*e.g.*, *Nostoc*), it supplies fixed nitrogen to the fungus.The kind of mutual interdependence helps lichens to grow on dry, barren rocks, where the other plants fail to exist. Morever, the algae or the fungi alone cannot grow in such places. Thus, both the partners cannot survive without each other.

Q. 4 Explain why sexual reproduction in angiosperms is said to take place through double fertilisation and triple fusion. Also draw a labelled diagram of embryo sac to explain the phenomena.

Thinking Process

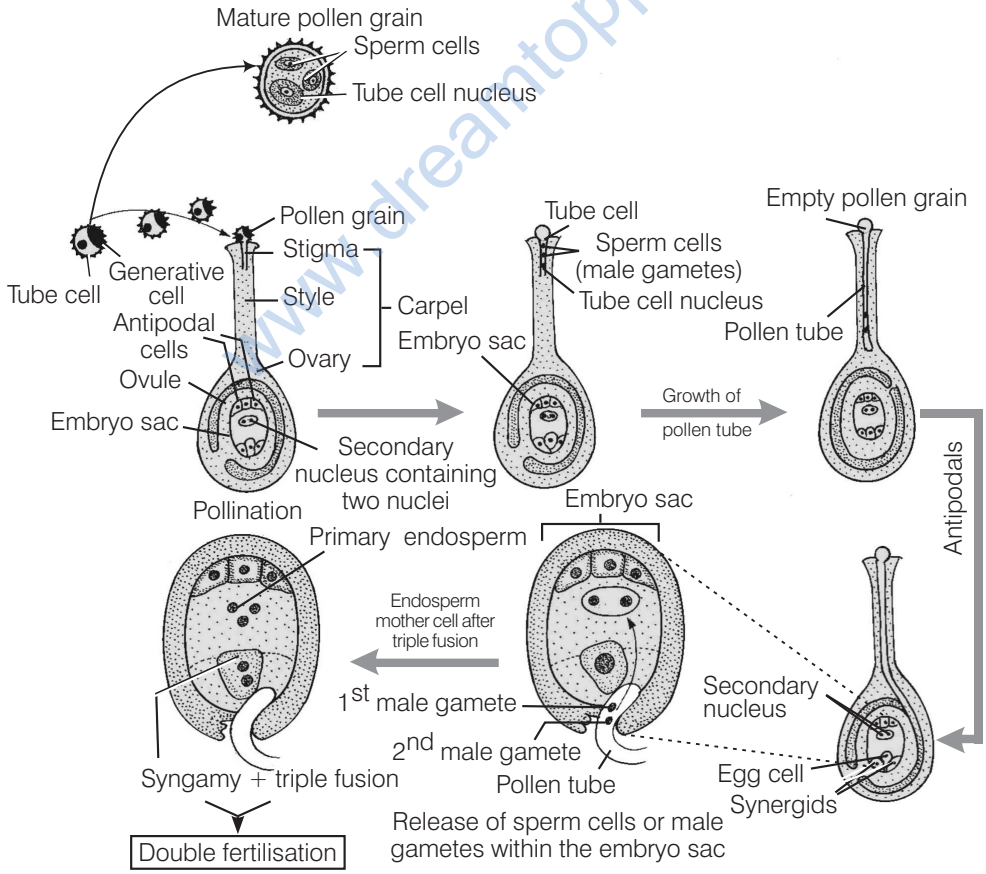
Double fertilisation and triple fusion is characteristic feature of all angiosperms. It is an advancement in sexual reproductions.

Ans. An angiospermic plants sexually reproduces by the formation of male and female gametes. The male gamete is a pollen which contain two male nuclei and female gamete is egg cell produced in ovule (female gametophyte).

The pollen grains germinate on the stigma of a flower and the resulting pollen tube grow through the tissues of stigma and style and reach near the egg apparatus. The two male gametes are discharged within the embryo sac. One of the male gamete fuses with the egg cell to form a diploid zygote.

This fusion is known as **fertilisation** or **syngamy**. The second male gamete fuses with the diploid secondary nucleus and forms the triploid Primary Endosperm Nucleus (PEN). This fusion is known as triple fusion.

Because of the involvement of two fusion, this event in angiosperms is termed as **double fertilisation.** The zygote then develops into embryo and PEN develops into endosperm which provides nourishment to the developing embryo.



The process of fertilisation and double fertilisation

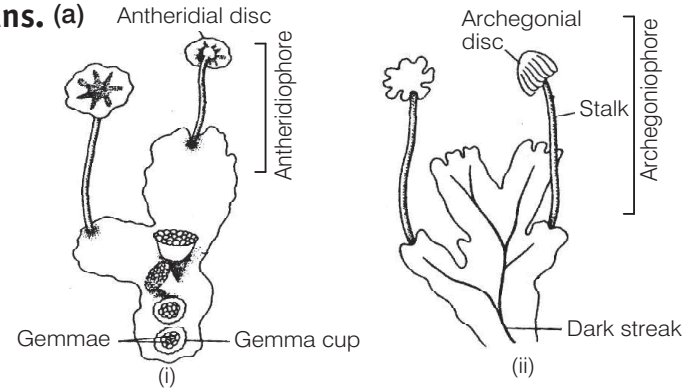
Q. 5 Draw labelled diagrams of

(a) Female and male thallus of a liverwort.

(b) Gametophyte and sporophyte of *Funaria*.

(c) Alternation of generation in angiosperm.

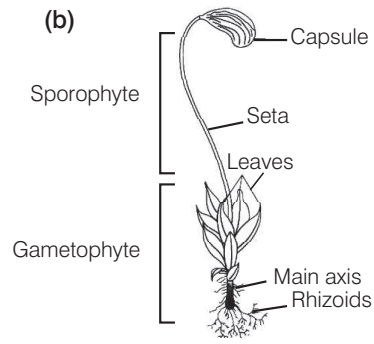
Ans. (a)



Liverworts (i) Male thallus of *Marchentia polymorpha*

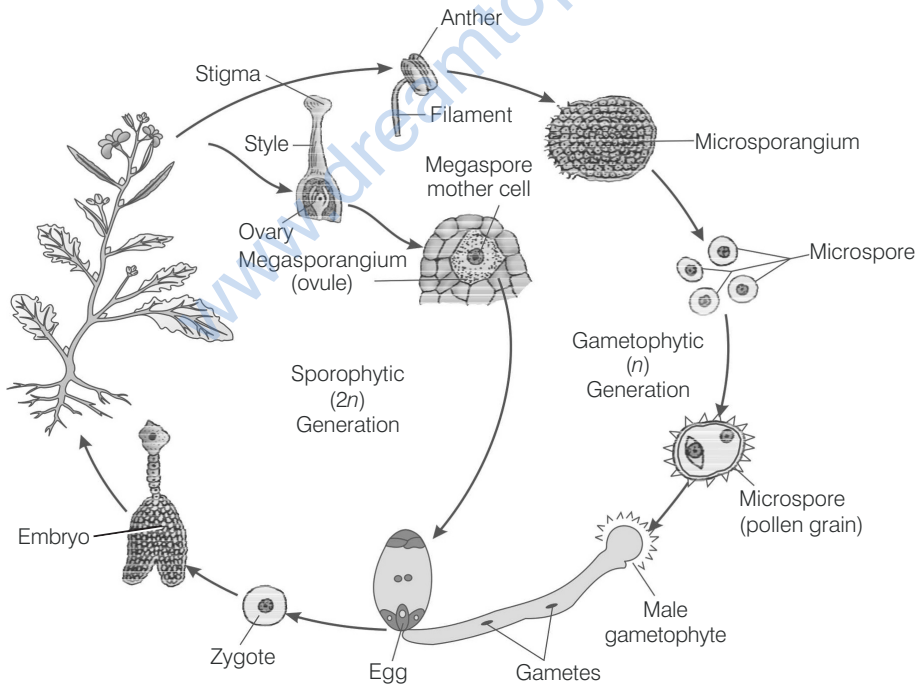
(ii) Female thallus of *Marchentia polymorpha*

(b)



Funaria
(gametophyte and sporophyte)

(c)



Life cycle of an angiosperm showing alteration of generation