

EXAM
DRILL

Plant Kingdom

ANSWERS

1. (b)
2. (d): Root is not common between *Funaria* and *Selaginella*. *Funaria* is a bryophyte and has archegonium, embryo, flagellated sperms which are also present in *Selaginella*. *Selaginella* is a pteridophyte and it has root which are absent in *Funaria*.
3. (d)
4. (a): The sperm of fern is multiciliated and spirally coiled.
5. (c): Embryo stage is absent in algae.
6. *Marchantia* is dioecious and it has separate male thallus and female thallus therefore it is considered as heterothallic plant.
7. (i) Psilopsida (ii) Lycopside
(iii) Sphenopsida (iv) Pteropsida
8. A juvenile autotrophic filamentous stage of mosses is called protonema.
9. Mannitol is stored food in *Fucus*.
10. Fucoxanthin provides brown colour in *Sargassum*.
11. (b)

OR

- (b)
12. (c): Male gametes are flagellated in pteridophytes to reach the female gamete by swimming in a thin film of water. Pollen tube formation does not occur in pteridophytes.
13. (b)
14. (d): Pteridophytes are known as vascular cryptogams and possess sporophytic plant body with vascular tissue. Bryophytes are non-vascular cryptogams and have gametophytic plant body without vascular tissue.
15. (i) (c)
(ii) (a)
(iii) (c): In pteridophytes, spore is a haploid structure, which develops after meiosis of spore mother cell. On germination, it gives rise to a green haploid prothallus (gametophyte) which is monoecious, i.e., has both antheridia (male sex organs) and archegonia (female sex organs).
(iv) (b)

(v) (a): Both plant A and B, *Selaginella* and *Salvinia* respectively are heterosporous i.e., produce two types of spores, microspores and megaspores.

16. (i) (c): Bryophytes are divided into liverworts, hornworts and mosses. Liverworts may be thallose or foliose, but mosses are always leafy.

(ii) (a): Bryophytes are usually found in damp, humid and shaded localities.

(iii) (b)

(iv) (a): Bryophytes show two morphologically distinct heteromorphic generations, i.e. gametophytic and sporophytic generations. Gametophytic generation is the dominant phase of life cycle and in general the term 'plant body' is used to represent this phase.

(v) (d): In bryophytes, the zygote develops into a multicellular, undifferentiated structure called embryo. The embryo develops within venter of archegonium. By further segmentation and differentiation it finally develops into a full fledged sporophyte called sporogonium.

17. Anisogamy is fusion of two motile gametes dissimilar in size. It is observed in some species of *Chlamydomonas*.

18. Differences between bryophytes and pteridophytes are as follows :

S.No.	Bryophytes	Pteridophytes
(i)	The dominant phase is a gametophyte.	The dominant phase is a sporophyte.
(ii)	The plant body is thalloid.	The plant body has true roots, stem and leaves.
(iii)	Vascular tissues are absent.	Vascular tissues are present.
(iv)	Sporophyte is dependent on gametophyte.	Sporophyte has independent existence.

19. Differences between male gametophytes of pteridophytes and gymnosperms are as follows :

S.No.	Male gametophyte of Pteridophytes	Male gametophyte of Gymnosperms
(i)	A distinct male gametophyte may not be present.	A distinct male gametophyte is always present.

(ii)	It contains an antheridium.	An antheridium is not formed.
(iii)	Male gametes are flagellated.	Male gametes can be flagellated or nonflagellated.
(iv)	Male gametes reach the female gamete by swimming in a thin film of water.	Male gametes reach the female gamete through a pollen tube. Water is not required.

20. Bryophytes are non-vascular land plants that mostly grow in moist and cold habitats. They depend on moisture for their reproductive stage. They are world wide in distribution and are found in tropical, temperate, sub-arctic and arctic regions.

21. (a) Antheridium : The male sex organ of cryptogams (bryophytes and pteridophytes) is known as antheridium. It produces the male gametes or antherozoids. It may consist of a single cell or it may have a wall that is made up of one or several layers forming a sterile jacket around the developing gametes.

(b) Archegonium : The multicellular flask shaped female sex organ of bryophytes, pteridophytes and many gymnosperms is known as archegonium. Its dilated base called the venter contains the female gamete or egg or oosphere. The cells of the narrow neck of archegonium liquify to allow the male gametes to swim towards the oosphere.

22. The green algae show diverse forms of thalli ranging from unicellular to colonial to filamentous forms. The unicellular form is represented by the flagellated (Motile) genera, *Chlamydomonas* and non motile genera *Chlorella*. The cells of the colonial form *Volvox* are bound together by protoplasmic connections. Filamentous unbranched form is represented by *Oedogonium* whereas branched filamentous forms are *Cladophora*, *Pithophora* and *Fritschella*. The marine alga-*Ulva* is pseudoparenchymatous and leaf-like.

23. Palmella stage is a method of asexual reproduction in green algae. In palmella stage, a large number of near naked cells devoid of flagella lie inside a mass of mucilage. The stage develops in response to toxic chemicals and unfavourable water conditions.

24. In gymnosperms, seed is formed from ovule after fertilisation. It is formed of outer fleshy layer, testa and inner stony layer tegmen. The seed of gymnosperms comprises of three generations :

(a) Parent sporophyte represented by integuments and nucellus.

(b) Gametophyte represented by endosperm.

(c) Second sporophyte represented by embryo.

The germination of seed may be epigeal or hypogeal. Viviparous germination is seen in *Ephedra trifurcata*.

25. Phylogentic classification is based on the evolutionary relationship amongst species. This is achieved by performing DNA analysis between the organisms concerned and its probable ancestors. However, it may happen that many a times DNA samples of the ancestors may not be available due to extinction and absence of fossil records. Also, it is easier to identify and differentiate organisms based on their morphological characteristics than genetic. Hence, phylogenetic classification is difficult to achieve.

OR

Differences between gametophyte and sporophyte are :

S. No.	Gametophyte	Sporophyte
(i)	It is haploid phase of life cycle.	It is diploid phase of life cycle.
(ii)	It is specialized to produce gametes.	It produces spores called meiospores.
(iii)	All divisions are mitotic.	Meiosis occurs during formation of meiospores.
(iv)	It is sexual generation.	It is asexual generation.
(v)	Fusion of gametes produces zygote.	Meiospores form gametophytes.
(vi)	It is formed by germination of a meiospore.	It is formed by growth of a zygote.

26. Seed habit has developed in pteridosperms or Cycadofilicales. It is a group intermediate between cycads and ferns. The habit made the seed plants independent of the requirement of external sources of water at the time of fertilisation. In seedless vascular plants, the gametophyte must develop on moist soil with a thin sheet of water. The latter is required for the swimming of sperms for reaching female sex organs. As a result, seedless vascular plants could never become true land plants.

27. Differences between liverworts and mosses are as follows:

S. No.	Liverworts	Mosses
(i)	Branching is generally dichotomous.	Branching is lateral and extra-axillary.
(ii)	Seta develops rapidly towards the maturity of spores.	Seta grows slowly over a long period and fully developed before the spores mature.
(iii)	Capsule often possesses elaters.	Elaters are absent.
(iv)	Peristome teeth are absent.	Peristome teeth occur towards the apical region of the capsule.
(v)	Columella is generally absent.	Capsule contains a sterile columella.

28. There are no biochemical, cytological or morphological similarities between land plants and algae except the green ones or chlorophyta. There are various evidences that favour the chlorophycean origin of land plants. These are:

- Both green algae and land plants possess the same type of chlorophylls, *a* and *b*.
- The carotenoid pigments are similar in the two groups.
- Cell wall of both the groups contain similar cellulose and pectic compounds.
- Starch is the common storage carbohydrate in them.
- The flagella are similar in the motile forms of the two.

29. Ferns are pteridophytes that bear sporangia in sori on the leaves which show circinate ptyxis in the young condition. The general characteristics of ferns are :

- The stem is underground rhizome in most of the ferns. Some primitive ferns have above-ground stem with tree-like habit.
- Leaves are large and are called fronds. Leaves may be simple or pinnately compound. In a pinnately compound leaf, the lamina is divided laterally into leaflets.
- Leaves or their leaflets show open furcate venation in which veins branch dichotomously without forming interconnections.
- Younger parts of stem, young leaves, petiole and rachis of mature leaves possess hairs or scales calledramenta. Ramenta protect them from mechanical injury and desiccation.
- The gametophyte is thalloid and called prothallus. It develops a young sporophytic plant body from inside the female sex organ.
- The life cycle has a regular alternation of a dominant sporophyte and an inconspicuous gametophyte. This is called heterologous or heteromorphic alternation of generations. Some common ferns are *Adiantum caudatum* (walking fern), *Dryopteris* (male shield fern), *Salvinia* (aquatic fern).

Comparison of different characteristics of different classes of algae is as follows :

Class	Structure (a)	Occurrence (b)	Major pigments (c)	Reserve food material (d)	Reproduction (e)		
					Vegetative	Asexual	Sexual
Chlorophyceae , (Green algae) <i>e.g., Spirogyra, Ulothrix</i>	Unicellular to heterotrichous filaments. Cellulosic cell wall. Starch sheathed pyrenoids. Motile cells with 2-4 equal flagella.	Mostly fresh water a few marine. A marked tendency towards terrestrial habitat.	Chl. <i>a</i> and <i>b</i> , carotenes and xanthophyll	True starch and sugar	Fragmen- tation or fission	Zoospores	Isogamous to advanced oogamous
Phaeophyceae (Brown algae), <i>e.g., Fucus, Sargassum</i>	Simple filamentous to bulky parenchymatous with giant size, external and internal differentiation, motile cells with 2 lateral flagella.	Mostly marine	Fucoxanthin, flavoxanthin, carotenoids, chl. <i>a</i> and <i>c</i> .	Laminarin, mannitol	Fragmen- tation is most common.	Zoospores, tetraspores etc.	Isogamous to oogamous

30. (i) a—Male thallus of *Marchantia*

b—*Funaria*

c—*Sphagnum*

(ii) *Marchantia* is a liverwort while *Funaria* and *Sphagnum* are mosses. These three belongs to division Bryophyta.

(iii) *Sphagnum* (c) is used as packing material for trans-shipment of living materials because of its capacity to hold water.

OR

(a) Pine trees possess special ducts filled with aromatic, antiseptic, sticky, semifluid substance called resin which exudes and seals the damaged or injured areas of plants. Due to presence of resin, it is very difficult to extinguish fire in pine forests. The resins also protects the trees from attack of microbes and insects.

(b) Conifer trees are specially adapted to protect themselves from freezing. They have thick bark to protect against the cold. They are cone-shaped, with flexible branches that help them to cope with heavy snow fall. Pine cones protect the seeds during the harsh winter. The thin waxy needle-like leaves reduce water loss and do not accumulate much snow.

(c) All the cycads are strictly dioecious, *i.e.*, microsporophylls and megasporophylls are produced on separate plants. The male plants of *Cycas* produce microsporophylls and female plants produce megasporophylls. Therefore, only female plants of *Cycas* produce seeds but not the males.

31. (i) A—Chlorophyceae

B—Mannitol, Laminarin

C—Chl. *a*, Chl. *d*, Phycoerythrin

D—Starch

(ii) *Ectocarpus*, *Dictyota*

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

OR

Rhodophyceae (Red algae) e.g., <i>Polysiphonia</i> , <i>Porphyra</i>	Simple filamentous to complex forms. Motile cells not known.	Few freshwater, others are marine.	Phycoerythrin, phycocyanin, allophycocyanin, carotenoids, chl. <i>a</i> and <i>d</i> .	Floridean starch	Uncommon, except unicellular ones	Monospores, carpospores, polyspores etc.	Advanced oogamous type producing special carpospores.
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32. Characteristic features of Class Phaeophyceae are as follows :

- (i) The phaeophycean members are commonly called as 'brown algae'.
- (ii) Brown algae are aquatic and mostly marine.
- (iii) They show great variation in size and form. They range from simple branched, filamentous forms as in *Ectocarpus* to profusely branched forms as kelps.
- (iv) Cell wall is composed of cellulose, pectose and phycocolloids.
- (v) The plant body is usually attached to the substratum by a holdfast.
- (vi) Photosynthetic pigments are chlorophyll-*a*, and *c*, carotene, xanthophyll. The brown colour of brown algae is due to an accessory golden brown pigment called fucoxanthin.
- (vii) Laminarin and mannitol are the reserved food materials.
- (viii) Fucosan vesicles are usually present in the cells.
- (ix) The plant body has a stalk, the stipe and leaf like photosynthetic organ called as the frond.
- (x) Vegetative reproduction takes place by fragmentation
- (xi) Sexual reproduction may be isogamous, anisogamous or oogamous. Union of gametes may take place in water or within the oogonium (oogamous species). The gametes are pyriform (pear-shaped) and bear two laterally attached flagella of unequal length.
- (xii) The common forms are *Ectocarpus*, *Dictyota*, *Laminaria*, *Sargassum* and *Fucus*.

OR

General characteristics of pteridophytes or seedless vascular plants can be described as follows:

- (i) They grow in a variety of habitats but mostly they are terrestrial plants that thrive well in abundant moisture and shade while some flourish well in xeric conditions.
- (ii) The sporophytic plant body is differentiated into true roots, stem and leaves, though some of the primitive members may lack true roots and well developed leaves.
- (iii) Leaves can be microphyllous, *i.e.*, small without forming

leaf gaps in vascular supply or macrophyllous, *i.e.*, large forming leaf gaps.

- (iv) The branching of the stem may be dichotomous type or monopodial.
- (v) Pteridophytes show presence of vascular tissues; xylem and phloem. In xylem, true vessels are absent while, in phloem, companion cells and sieve tubes are absent.
- (vi) The vascular system of pteridophytes varies in different groups showing stelar system ranging from simple protostele, siphonostele or a dictyostele.
- (vii) The sporophyte reproduces asexually by means of spores, produced in small capsules called sporangia. Leaves bearing sporangia are called sporophylls.
- (viii) The diploid spore mother cells or sporocytes within the sporangia undergo meiosis or reduction division to form spores. These spores may be similar as in majority of pteridophytes called homosporous, *e.g.*, *Lycopodium* and *Dryopteris* or different with two types of spores (microspores and megaspores) called heterosporous, *e.g.*, *Selaginella*, *Salvinia*.
- (ix) Spores upon germination give rise to haploid gametophytes or prothallus bearing multicellular, jacketed sex organs.
- (x) Gametophytes formed from homosporous are monoecious (both antheridium and archegonium are borne on same prothallus) while those formed from heterosporous are dioecious (antheridium and archegonium develop on separate male and female prothallus).

- (xi) Antheridia are small and sessile comprising of androcytes, each of which produces a motile antherozoid. Archegonia are partially embedded and consist of 4-rowed neck.
- (xii) Water is essential for fertilisation, as it assists in carrying bi-or multiflagellate sperms to archegonia.
- (xiii) The young sporophyte is dependent on gametophyte during its early years.
- (xiv) Pteridophytes exhibit alternate succession of sporophytic and gametophytic generations.

33. Comparative account of different classes of Bryophytes is as follows :

S. No.	Features	Hepaticopsida	Anthocerotopsida	Bryopsida
1.	Common name	Liverworts	Hornworts	Mosses
2.	Gametophytic plant body	May be thallose or foliose Aseptate rhizoids	Thallose Aseptate rhizoids	Thalloid protonema and leafy gametophore. Obliquely septate rhizoids.
3.	Sex organs	Present on dorsal surface of thallus	Present on dorsal surface of thallus.	Develop from the superficial cells at the apex of leafy gametophore.
4.	Sporophyte or sporogonium	Differentiated into foot, seta and capsule	Foot, short-meristematic region and capsule.	Foot, seta and capsule.
5.	Elaters	Generally present but absent in some plants like <i>Riccia</i>	Pseudoelaters are present in the capsule	Absent
6.	Sporogenous tissue	Develops from endothecium	Develops from amphithecium and endothecium forms sterile columella.	Develops from outer layer of endothecium. Inner layer forms sterile columella.
7.	Dehiscence of capsule	Irregular	Irregular	Regular
8.	Examples	<i>Riccia</i> , <i>Marchantia</i> , <i>Sphaerocarpos</i> etc.	<i>Anthoceros</i> , <i>Notothylas</i> , <i>Megaceros</i> , etc.	<i>Sphagnum</i> , <i>Polytrichum</i> , <i>Funaria</i> , etc.

OR

(a) *Cycas* is dioecious with distinct male and female plants. The plants bear terminal cones.

(i) Male cone is oval, thick, 20-80 cm long stalked structure which replaces the growing point of the plant. Further growth of male plant is carried out by a lateral bud, so that stem axis of male plant is sympodial. Male cone has a number of densely crowded spirally arranged microsporophylls. Each microsporophyll has a flat fertile proximal region and a distal bent sterile region or apophysis. The fertile region bears a number of microsporangia or pollen sacs arranged in sori. Microspores or pollen grains are boat-shaped.

(ii) Female cone is loose, consisting of a rosette of brown megasporophylls. Each megasporophyll bears 2-12 reddish ovules in the middle fertile part. Their terminal sterile part may show remains of foliar structure. Ovules of *Cycas* are the largest, 6-7 cm in diameter. Each ovule has a shallow micropylar beak at the tip. Ovule is covered by a 3-layered integument. Internally, the ovule contains nucellus and female

gametophyte or endosperm with 2-8 archegonia. Archegonium has a neck of 2-4 cells, a venter canal cell and an egg or oosphere. The egg is the largest in plant kingdom.

(b) Conifers are dominant constituents of north temperate flora due to the following reasons:

(i) In the temperate areas, conifers have an advantage over angiospermic trees. While the angiospermic trees shed their leaves during autumn-winter period, the conifers remain evergreen. They continue to manufacture their food during this period when other plants are in a state of hibernation because of the absence of leaves.

(ii) Conifers has a number of xerophytic characters which help in conserving water. They are, thus, able to tide over the winter period when the soil becomes frozen and water availability is very little. Mycorrhizae allow them to get water and minerals.

(iii) Enzymes of conifers are functional even at -35°C , temperature at which they become inactivated in other plants.

