CHAPTER › 03

Plant Kingdom

NEET *KEY NOTES*

- Plant kingdom includes all multicellular, eukaryotic, photosynthesising organisms, grouped as algae, bryophytes, pteridophytes, gymnosperms and angiosperms.
- Plants were classified on the basis of different characters.
- The various systems used in classification of plants are
  - **Artificial system of classification** It was given by **Linnaeus** and based on morphological characters.
  - **Natural system of classification** It was developed by **Bentham** and **Hooker** and based on natural affinities among the organisms. It was based on both external and internal features like anatomy, structure and embryology. It is the most common system of classification followed.
  - **Phylogenetic system of classification** It was given by **Engler** and **Prantl** and based on evolutionary relationships of an organism. It is also known as **Hutchinson's system.**
- Classification done on the basis of chemical constituents of plant is known as **chemotaxonomy**.
- **Numerical taxonomy** includes classification on the basis of observed characters.
- **Cytotaxonomy** is based on cytological information like chromosome number, structure, behaviour and types of chromosomes.

Algae

- These are chlorophyll bearing, simple, thalloid, autotrophic and mostly aquatic organisms (both freshwater and marine water).
- These include unicellular forms like *Chlamydomonas,* colonial forms like *Volvox*, filamentous like *Ulothrix* and *Spirogyra*.
- Algae reproduce vegetatively by fragmentation and asexually by zoospores, aplanospores, akinetes, etc.
- Sexual reproduction in algae occurs through fusion of two gametes. These gametes could be
  - **Isogamous** Both gametes are similar in size and non-motile, e.g. *Spirogyra.*
  - **Anisogamous** Both gametes dissimilar in size, e.g. *Chlamydomonas*.
  - **Oogamous** Fusion between one large female gamete and a smaller motile male gamete, e.g. *Volvox* and *Fucus.*
- Algae play an important role in carbon dioxide fixation on earth through photosynthesis thereby increasing the level of O_2 in the environment. They are chief primary producers.
- About 70 species of marine algae like *Porphyra*, *Laminaria* and *Sargassum* are used as food.
- Algae are used commercially for various products like
  - **Algin** from brown algae.
  - **Carrageenan** from red algae.
  - **Agar** from *Gelidium* and *Gracilaria*.
- *Spirulina* and *Chlorella* are used by space travellers.

The algae are divided into three main classes which are as follows

Class–Chlorophyceae (Green Algae)

- Members of Chlorophyceae are unicellular, colonial or filamentous.
- They are green due to the presence of **chlorophyll-*a* and *b*** pigments localised in definite chloroplast.
- Shape of the chloroplast varies like discoid, plate-like, reticulate, cup-shaped, spiral or ribbon-shaped.
- Algae store food in the form of starch in a specialised structures called **pyrenoids** located in chloroplast. Food may be stored in the form of oil droplets in some algae.
- Inner layer of cell wall is made up of cellulose, while outer layer is made up of pectose.

- Vegetative reproduction occurs through fragmentation. Asexual reproduction is done by zoospores by zoosporangia.
- Sexual reproduction occurs through different modes like isogamous, anisogamous or oogamous, e.g. *Volvox, Ulothrix, Spirogyra, Chlamydomonas* and *Chara*.

Class–Phaeophyceae (Brown Algae)

- Members of Phaeophyceae are brown in colour due to the presence of **fucoxanthin** pigment.
- They range from simple branched, filamentous forms to profusely branched forms like kelps, which reach up to a height of 100 metres.
- They have gelatinous coating outside the, cellulosic cell wall called **algin**.
- Cell contains chloroplast (plastid), centrally located vacuole and nucleus.
- Plant body is differentiated into **holdfast** (substratum), **stripe** (stalk) and **frond** (photosynthetic organ).
- Asexual reproduction occurs through biflagellate zoospores (having unequal laterally attached flagella).
- Sexual reproduction may be **oogamous, isogamous** or **anisogamous**. Union of gametes takes place in water within oogonium in case of oogamous species, e.g. *Sargassum, Fucus, Ectocarpus, Dictyota and Laminaria*.

Class–Rhodophyceae (Red Algae)

- Members of Rhodophyceae are red due to the presence of pigment ***r*-phycoerythrin**. These are usually marine, occur close to the surface of water as well as in deep oceans.
- They reproduce vegetatively through fragmentation.
- They reproduce sexually and asexually through non-motile spores/gametes. Sexual reproduction is oogamous.

Divisions of Algae and their Main Characteristics

Characteristics	Class–Chlorophyceae	Class–Phaeophyceae	Class–Rhodophyceae
Common name	Green algae	Brown algae	Red algae
Major pigments	Chlorophyll-*a, b*	Chlorophyll-*a, c,* fucoxanthin	Chlorophyll-*a, d, r*-phycoerythrin
Stored food	Starch	Mannitol, laminarin	Floridean starch
Cell wall	Cellulose	Cellulose and algin	Cellulose, pectin and polysulphate esters
Flagellar number and position of insertions	2-8, equal, apical	2, unequal, lateral	Absent
Habitat	Freshwater, brackish water, salt water	Freshwater (rare), brackish water, salt water	Freshwater (some), brackish water, salt water (most)

Bryophytes

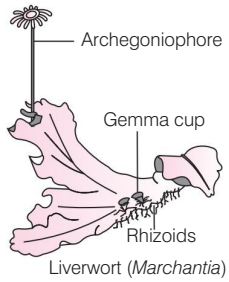
- They are commonly found in moist shaded areas in the hills.
- These are known as **amphibians of plant kingdom** as they can live in soil as well as water and are dependent on water for sexual reproduction (for movement of gametes).
- In bryophytes, the main plant body is **gametophyte**, which produces gametes. It is thalloid (i.e. lacks roots, stems and leaves) and prostrate or erect and attached to the substratum by **rhizoids**.
- Sex organs are multicellular and jacketed. The male sex organ is **antheridium**, while female sex organ is **archegonium**.
- Antheridium produces biflagellate **antherozoids.** Female sex organ produces one **egg**.
- Antherozoids are released in water where they come in contact of archegonium and egg cell. It fuses with egg cell to produce the zygote.
- Zygote undergoes mitotic division and gives rise to **sporophyte** (2*n*). Sporophyte remains attached to the gametophyte and takes nourishment from it.
- Sporophyte undergoes reductional division or meiosis to produce haploid spores. These later germinate and give rise to haploid gametophyte.
- Bryophytes are used as food source. These are capable of preventing soil erosion and also form ecological succession links.
- Bryophytes are divided into **liverworts** and **mosses**.

Liverworts

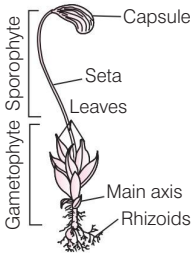
- The plant body is thalloid, e.g. *Marchantia*.
- Leafy members have tiny appendages usually grown in moist, damp, shady habitats.
- They reproduce asexually by the formation of specialised structure called **gemmae** or through fragmentation of thalli.
- Gemmae are asexual buds, which originate from small receptacles called **gemma cups**.
- Sexual reproduction occurs by the fusion of antherozoids and egg, which are produced in antheridium and archegonium, respectively.
- Both male and female sex organs may be present on same thalli or different thalli.
- Zygote gives rise to sporophyte, which is differentiated into **foot, seta** and **capsule**. Some cells of capsule undergo meiosis and give rise to haploid spores. These spores give rise to gametophyte (*n*).

Mosses

- The predominant stage in the life cycle of a moss is the gametophyte, which consists of two substages, i.e. **protonema** and **leafy stage**.
- Juvenile stage of moss is **protonema**. It consist of slender, green, branching system of filaments.
- **Leafy stage** develops from the secondary protonema as lateral bud. It bears the sex organs.
- Vegetative reproduction takes place by fragmentation and budding in the secondary protonema.
- Mosses provide food for herbivores, used as packing material, fuel (e.g. *Sphagnum*), they decompose rocks and colonies them along with lichens, etc.



Liverwort (*Marchantia*)



Moss (*Funaria*)

Pteridophytes

- Pteridophytes are called **vascular cryptogams**, also known as **seedless vascular plants**.
- They produce spores rather than seeds, e.g. horsetails (*Equisetum*), ferns (*Selaginella*) and club moss (*Lycopodium*).
- These are found near the marshy, cool and damp places.
- In pteridophytes, the main plant body is a sporophyte (2*n*), which is differentiated into true root, stem and leaves.
- Leaves may be small (microphylls) as in *Selaginella* or large (macrophylls) as in ferns.
- Sporophyte bears sporangia which consist of leaf-like appendages called **sporophylls**. These sporophylls may be widely scattered in a plant or may be clustered in definite areas and structures called **strobili** or **cones**, e.g. *Selaginella*.
- The spores produced can be of similar kind (homosporous) or can be of two kinds (heterosporous), i.e. macro (large) and micro (small).
- The spores germinate to give rise to inconspicuous, small but multicellular free-living, mostly photosynthetic thalloid gametophyte called **prothallus**.
- Gametophyte can grow only in cool, damp and shady places which has restricted the spread of pteriodphytes to a narrow geographical range.
- The gametophytes bear male and female sex organs called **antheridia** and **archegonia**, respectively.
- The male gamete of pteridophyte swims to archegonium, where zygote is formed after fertilisation. The zygote produces a sporophyte (dominant phase).
- The zygote develops into young embryo within female gametophyte. This event is called a precursor to **seed habit** and is considered an important step in evolution.
- Pteridophytes are used for medicinal purposes and as soil-binders. They are also grown as ornamentals.
- Pteridophytes are divided into four classes, i.e. **Psilopsida** (*Psilotum*), **Lycopsida** (*Selaginella, Lycopodium*), **Sphenopsida** (*Equisetum*) and **Pteropsida** (*Dryopteris*, *Pteris, Adiantum*).

Gymnosperms

- In gymnosperms, the ovules are not enclosed by any ovary wall and remain exposed both before and after fertilisation. Thus, naked seeds are formed post-fertilisation and no fruit formation occurs.
- Plants possess tap root system but in some forms, **coralloid roots** (plant roots associated with endosymbionts such as blue-green alga, e.g. *Cycas*) or **mycorrhiza** (e.g. *Pinus*). The stems are aerial, erect, woody, branched or unbranched.
- Leaves are usually dimorphic, i.e. leaves are of two types *viz*, large green foliage leaves and small brown scale leaves.
- The gymnosperms are heterosporous, i.e. produce microspores and megaspores in a compact strobili or **cones**.
- The strobili bearing **microsporophylls** and **microsporangia** are called microsporangiate or **male strobili**. These develop into a highly reduced male gametophyte which produce **pollen grains**.
- The cones bearing **megasporophylls** with ovules or **megasporangia** are called macrosporangiate or **female strobili**.
- **Ovules** or megasporangia borne on megasporophylls consist of nucellus from which a megaspore mother cell develops.
- One megaspore out of four develops into female gametophyte bearing two or more **archegonia** (female sex organs).
- The pollen grains of gymnosperms germinate and release male gamete into the ovule, where it forms zygote after fertilisation . The zygote develops into embryo and ovules into seeds (naked).

Angiosperms

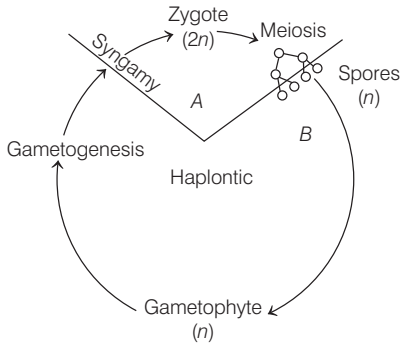
- Unlike the gymnosperms where the ovules are naked, in the angiosperms or flowering plants, the pollen grains and ovules are developed in specialised structures called **flowers**.

- The flower consists of the male sex organs, called the **stamen** and female sex organ, called the **pistil** or **carpel**.
- Each stamen consists of a **filament** and an **anther** (produces pollen grain). The pistil consists of an **ovary** enclosing one to many ovules, a long slender **style** and a **stigma** (structure where pollen grain lands after pollination).
- Each ovule has a megaspore mother cell which forms four haploid megaspores by meiosis. Out of which, one divides to form an embryo sac and others degenerate.
- The pollens reach the stigma of a flower through agencies such as wind, water, insects, etc. This is known as **pollination**.
- Each embryo sac has 3-celled egg apparatus having 1-**egg cell**, 2-**synergids**, 3-**antipodal cells** and 2-**polar nuclei**.
- The pollen tube carrying the microspore (pollen grains) enters the embryo sac. One male gamete fuses with egg cell (**syngamy**) and other fuses with diploid secondary nucleus (**triple fusion**) forming primary endosperm nucleus. Due to the occurrence of two processes simultaneously, this is called **double fertilisation**.
- The zygote develops into embryo and primary endosperm nucleus provides nourishment to the growing embryo.
- The synergids and antipodals develop after fertilisation. Also, the ovaries develop into fruit and ovules develop into seeds.
- The angiosperms are classified into two classes–**Dicotyledons** and **Monocotyledons**.
- **Dicotyledons** have two cotyledons in their seed, reticulate venation in leaves and flowers with 4 or 5 members in each whorl.
- **Monocotyledons** have one cotyledon, parallel venation in leaves and flowers with 3 members in each whorl.

Plant Life Cycle and Alternation of Generations

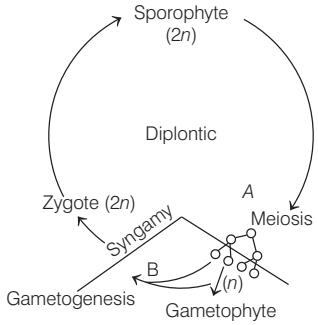
- Sexually reproducing plants show alternation of generations between haploid gametophyte and diploid sporophyte. However, different plant groups as well as individuals may show different patterns of life cycles, **haplontic, diplontic** and **intermediate** (haplo-diplontic). These can be explained as

1. **Haplontic life cycle** is followed by algae such as *Spirogyra*, *Volvox*, etc. In this cycle, gametophyte is dominant and sporophyte is represented by single-celled **zygote**. Zygote undergoes meiosis to form haploid spores. These spores give rise to haploid gametophyte after a mitotic cell division. Most algal generas are haplontic with a few exceptions such as *Ectocarpus, Polysiphonia*, kelps (haplo-diplontic) and *Fucus* (diplontic).



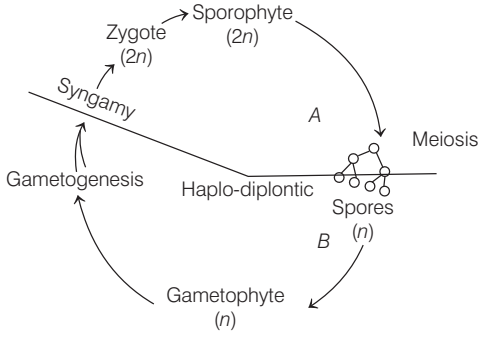
Haplontic life cycle

2. **Diplontic life cycle** is followed by seed bearing plants, i.e. gymnosperms and angiosperms.
Dominant phase is sporophyte, gametophytic phase is represented by the single to few-celled gametophyte.



Diplontic life cycle

3. **Haplo-diplontic life cycle** is followed by bryophytes and pteridophytes. In this case, sporophytic as well as gametophytic phase is multicellular. In bryophytes, gametophytic phase is dominant, which alternates with short-lived sporophyte partially or totally dependent on gametophytes for anchorage and nutrition, while in pteridophytes, sporophytic phase is dominant and alternates with short-lived gametophytic phase.



Haplo-diplontic life cycle

Mastering NCERT

MULTIPLE CHOICE QUESTIONS

TOPIC 1 ~ *Introduction about Plants*

1 Kingdom–Plantae includes
(a) algae, bryophytes and pteridophytes
(b) algae, bryophytes, pteridophytes, gymnosperms and angiosperms
(c) algae, fungi, pteridophytes, gymnosperms and angiosperms
(d) algae, pteridophytes, gymnosperms and angiosperms

2 The earliest system of classification given by …*A*…, based on gross superficial morphological traits was called …*B*…. Here, *A* and *B* are
(a) Linnaeus, natural classification
(b) Whittaker, natural classification
(c) Linnaeus, artificial classification
(d) Whittaker, artificial classification

3 Natural system of classification was based upon
(a) structural embryology (b) phytochemistry
(c) anatomy (d) All of these

4 Phylogenetic system of classification is based upon
(a) evolutionary relationship of organisms
(b) cytological information
(c) structural embryology
(d) All of the above

5 Phylogenetic system of classification was given by
(a) Engler and Prantl (b) Aristotle
(c) Linnaeus (d) Bentham and Hooker

6 Phylogenetic system of classification is also known as
(a) Artificial system of classification
(b) Hutchinson's system of classification
(c) Natural system of classification
(d) Whittaker's system of classification

7 Classification done on the basis of cytological information, chromosome structure and their behaviour, is known as
(a) molecular classification
(b) cytotaxonomy
(c) chemotaxonomy
(d) karyotaxonomy

8 Classification on the basis of chemical constituents of plants is known as
(a) molecular taxonomy
(b) chemical taxonomy
(c) chemotaxonomy
(d) chemosynthetic classification

9 Classification on the basis of all observed characters is known as
(a) number and codes taxonomy
(b) numerical taxonomy
(c) countable taxonomy
(d) numerical information taxonomy

TOPIC 2 ~ *Algae*

10 Algae are
(a) chlorophyll bearing autotrophs
(b) simple and thalloid
(c) Both (a) and (b)
(d) heterotroph

11 Algae occur in/on
(a) fresh and marine water (b) moist stones
(c) moist soil and wood (d) All of these

12 An example of colonial alga is ***NEET 2017***
(a) *Chlorella* (b) *Volvox* (c) *Ulothrix* (d) *Spirogyra*

13 Algae include unicellular forms like ...*A*..., filamentous forms like ...*B*... and colonial forms like ...*C*... . Here, *A, B* and *C* refer to
(a) A–*Chlamydomonas*, B–*Volvox*, C–*Ulothrix*
(b) A–*Ulothrix*, B–*Volvox*, C–*Chlamydomonas*
(c) A–*Volvox*, B–*Ulothrix*, C–*Chlamydomonas*
(d) A–*Chlamydomonas*, B–*Ulothrix*, C–*Volvox*

14 In algae, vegetative reproduction mainly takes place by
(a) budding (b) akinetes
(c) fragmentation (d) heterocyst

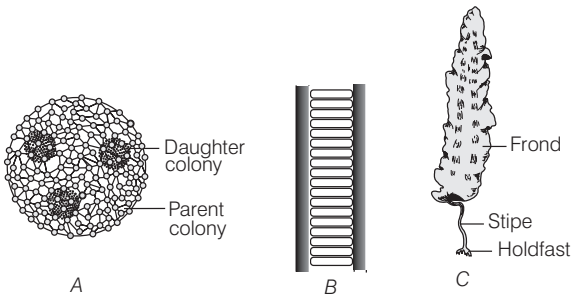
15 In algae, asexual reproduction occurs by the production of different types of spores. The most common type of spore is
(a) aplanospore (b) endospore
(c) zoospore (d) oospore

16 Which of the following type(s) of sexual reproduction is/are present in algae?
(a) Isogamy (b) Anisogamy
(c) Oogamy (d) All of these

17 Anisogamous means both gametes are
(a) similar in size and non-motile
(b) dissimilar in size
(c) similar in size and motile
(d) dissimilar in morphology

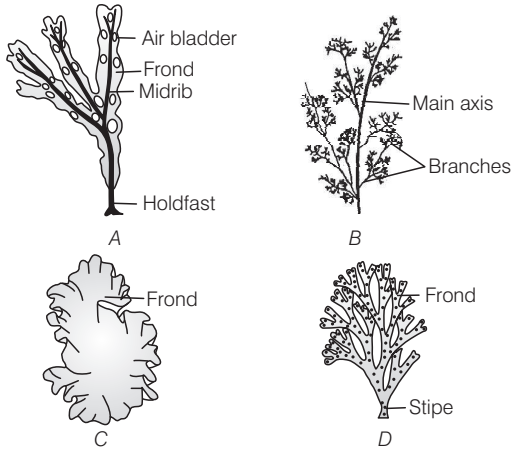
18 Oogamous means
(a) fusion between female and male gametes of similar size
(b) fusion between one large female gamete and a smaller non-motile male gamete
(c) fusion between one large female gamete and a smaller motile male gamete
(d) fusion between one smaller female gamete and a large motile male gamete

19 Identify the given figures of algae and select the correct option.



(a) A–*Chlamydomonas*, B–*Chara*, C–*Volvox*
(b) A–*Volvox*, B–*Ulothrix*, C–*Laminaria*
(c) A–*Chara*, B–*Laminaria*, C–*Volvox*
(d) A–*Porphyra*, B–*Polysiphonia*, C–*Fucus*

20 Identify the given figures of algae and select the correct option.



(a) A–*Volvox*, B–*Chlamydomonas*, C–*Chara*, D–*Porphyra*
(b) A–*Fucus*, B–*Polysiphonia*, C–*Porphyra*, D–*Dictyota*
(c) A–*Fucus*, B–*Dictyota*, C–*Porphyra*, D–*Polysiphonia*
(d) A–*Dictyota*, B–*Porphyra*, C–*Fucus*, D–*Polysiphonia*

21 Which of the following groups of marine algae is used as food?
(a) *Chlamydomonas*, *Volvox* and *Gracilaria*
(b) *Porphyra*, *Laminaria* and *Sargassum*
(c) *Laminaria* and *Gracilaria*
(d) *Porphyra* and *Chlamydomonas*

22 Agar, one of the commercial products obtained from red algae is used
(a) to grow microbes
(b) in preparations of ice-creams and jellies
(c) Both (a) and (b)
(d) in sizing textiles and papers

23 Agar-agar is obtained from
(a) *Chlorella* (b) *Spirogyra*
(c) *Ulothrix* (d) *Gelidium*

24 An alga, which can be employed as food for human being is ***CBSE-AIPMT 2014***
(a) *Ulothrix* (b) *Chlorella*
(c) *Spirogyra* (d) *Polysiphonia*

25 The alga used in space research is
(a) *Cephaleuros* (b) *Gelidium*
(c) *Chlorella* (d) *Gracilaria*

26 People recovering from long illness are often advised to include the alga *Spirulina* in their diet because it
(a) makes the food easy to digest
(b) is rich in proteins
(c) has antibiotic properties
(d) restores the intestinal microflora

27 The members of Chlorophyceae are commonly called
(a) red algae (b) brown algae
(c) green algae (d) blue-green algae

28 The members of Chlorophyceae are usually green due to the presence of pigments
(a) chlorophyll-*a* (b) chlorophyll-*b*
(c) chlorophyll-*a* and *b* (d) chlorophyll-*c*

29 Which type of chloroplasts are present in the members of class–Chlorophyceae?
(a) Discoid and plate-like
(b) Reticulate and cup-shaped
(c) Spiral or ribbon-shaped
(d) All of the above

30 Shape of chloroplast of *Ulothrix* is ***JIPMER 2018***
(a) star-shaped (b) band-shaped
(c) girdle-shaped (d) spiral-shaped

31 Storage bodies, pyrenoids in the chloroplast contain
(a) protein and starch
(b) carbohydrate and protein
(c) polysaccharide and protein
(d) starch and lipid

32 How many pyrenoids are present in the members of class–Chlorophyceae?
(a) One (b) Two
(c) One to many (d) Pyrenoids are absent

33 Pyrenoids are made up of
(a) core of starch surrounded by sheath of protein
(b) core of protein surrounded by fatty sheath
(c) proteinaceous centre and starchy sheath
(d) core of nucleic acid surrounded by protein sheath

34 The members of Chlorophyceae usually have a rigid cell wall made up of
(a) cellulose (outer layer) and algin (inner layer)
(b) pectose (inner layer) and peptidoglycan (outer layer)
(c) cellulose (inner layer) and pectose (outer layer)
(d) chitin (inner layer) and pectose (outer layer)

35 In green algae, vegetative reproduction takes place by
(a) fragmentation (b) different types of spores
(c) Both (a) and (b) (d) conidia

36 Which one of the following shows isogamy with non-flagellated gametes?
(a) *Sargassum* (b) *Ectocarpus*
(c) *Ulothrix* (d) *Spirogyra*

37 Eyespot is seen in ***JIPMER 2018***
(a) *Chlamydomonas* (b) *Ulothrix*
(c) *Spirogyra* (d) *Polysiphonia*

38 Zygotic meiosis is characteristic of ***NEET 2017***
(a) *Marchantia* (b) *Fucus*
(c) *Funaria* (d) *Chlamydomonas*

39 Palmella stage is present in ***JIPMER 2018***
(a) *Aspergillus* (b) *Cystopus*
(c) *Chlamydomonas* (d) None of these

40 The members of brown algae are found primarily in
(a) freshwater habitat (b) marine habitat
(c) terrestrial habitat (d) on moist rock

41 Kelp (branched form) and *Ectocarpus* (filamentous form) belong to
(a) green algae (b) brown algae
(c) red algae (d) blue-green algae

42 The members of brown algae have
(a) chlorophyll-*a*, chlorophyll-*b* and xanthophylls
(b) chlorophyll-*a*, chlorophyll-*c* and xanthophylls
(c) fucoxanthin and phycoerythrin
(d) chlorophyll-*a* and chlorophyll-*d*

43 In brown algae, brown colour is due to the presence of
(a) carotenoids (b) fucoxanthin
(c) phycoerythrin (d) chlorophyll

44 In brown algae, food is stored in the form of
(a) mannitol (b) laminarian starch
(c) Both (a) and (b) (d) algin

45 If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?
(a) Types of pigments present in the cell
(b) Nature of stored food materials in the cell
(c) Structural organisation of thallus
(d) Chemical composition of the cell wall

46 The cells of brown algae contain plastids with centrally located ...*A*... and ...*B*... .
Fill in the blanks by choosing the correct option for *A* and *B*.
(a) A–vacuole; B–nucleus
(b) A–Golgi body; B–nucleoid
(c) A–pyrenoid; B–carrageen
(d) A–pyrenoid; B–nucleus

47 Holdfast, stipe and frond constitute the plant body in case of
(a) *Volvox* (b) *Chara*
(c) *Laminaria* (d) *Chlamydomonas*

48 In brown algae, asexual reproduction takes place by
(a) aplanospores (apple-shaped and non-motile)
(b) biflagellated gametes (pear-shaped and have two unequal flagella)
(c) endospores (round and have one flagellum)
(d) multiflagellate gametes and are sickle-shaped

49 Heterotrichous thallus is shown by which organism? ***JIPMER 2018***
(a) *Chlamydomonas* (b) *Ectrocarpus*
(c) *Spirogyra* (d) *Volvax*

50 Photosynthetic pigment(s) of class–Rhodophyceae (red algae) is/are
(a) chlorophyll-*a* and *b*
(b) chlorophyll-*a* and *c*
(c) chlorophyll-*a* only
(d) chlorophyll-*a* and *d*

51 Members of class–Rhodophyceae are known as red algae due to the presence of red pigment
(a) *r*-phycoerythrin (b) *r*-xanthophyll
(c) chlorophyll-*a* (d) fucoxanthin

52 Phycoerythrin is present in
(a) *Polysiphonia* (b) *Laminaria*
(c) Kelps (d) *Chlamydomonas*

53 Floridean starch is reserve food in
(a) Phaeophyceae
(b) Chlorophyceae
(c) Rhodophyceae
(d) Cyanophyceae

54 Which one is wrongly matched?
(a) Gemma cups – *Marchantia* ***NEET (National) 2018***
(b) Biflagellate zoospores – Brown algae
(c) Uniflagellate gametes – *Polysiphonia*
(d) Unicellular organism – *Chlorella*

55 Which one is a parasitic agla? ***JIMPER 2018***
(a) *Oedogonium*
(b) *Cephaleuros*
(c) *Spirogyra*
(d) *Cladophora*

56 Which of the following is not matched?
(a) *Chlamydomonas* – Unicellular flagellated
(b) *Laminaria* – Flattened leaf-like thallus
(c) *Chlorella* – Unicellular non-flagellated
(d) *Volvox* – Colonial form, non-flagellated

57 Read carefully the table and fill up the blanks.

Classes	Major Pigments	Stored Food	Cell Wall	Flagellar Number and Position of Insertions
Chlorophyceae	*A*	Starch	Cellulose	2-8, equal, apical
Phaeophyceae	Chlorophyll-*a* and *c*, fucoxanthin	Mannitol, laminarin	*C*	2, unequal, lateral
Rhodophyceae	Chlorophyll-*a* and *d*, phycoerythrin	*B*	Cellulose	*D*

A, B, C and *D* in the above table refers to

	A	B	C	D
(a)	Chlorophyll- *a* and *d*	Starch and laminarin	Cellulose	2-10, equal, apical
(b)	Chlorophyll-*a* and *c*	Mannitol and starch	Cellulose and algin	2-8, equal, lateral
(c)	Chlorophyll-*a* and *b*	Floridean starch	Cellulose and algin	Not present
(d)	Chlorophyll-*a* and *b*	Mannitol and floridean starch	Cellulose	Not present

TOPIC 3 ~ *Bryophytes*

58 Bryophytes are the oldest (most primitive) plant type in terms of evolution, these include
(a) liverworts and mosses
(b) lycopods and mosses
(c) lycopods and liverworts
(d) liverworts and *Volvox*

59 Bryophytes mostly occur in
(a) dry area
(b) terrestrial area
(c) humid, damp and shaded localities
(d) in water

60 Bryophytes are also called 'amphibians of the plant kingdom' because
(a) water is essential for reproduction
(b) they occur only in water
(c) these plants can live in soil, but are dependent on water for sexual reproduction
(d) water is essential for spore formation

61 Mosses (Bryophytes) occur in moist places because
(a) they cannot grow on land
(b) their gametes fuse in water
(c) they lack vascular tissue
(d) they lack root and stomata

62 The plant body of bryophytes is thallus-like, prostrate or erect and attached to substratum with the help of
(a) unicellular or multicellular root
(b) unicellular or multicellular rhizoids
(c) multicellular roots
(d) unicellular roots

63 Which of the following plant groups lacks true roots, stem and leaves?
(a) Angiosperms (b) Gymnosperms
(c) Pteridophytes (d) Bryophytes

64 The main plant body of bryophytes is ...*A*... .
It produces ...*B*..., hence is called a ...*C*... .
Fill in the blanks by choosing the correct option for *A, B* and *C*.
(a) A–diploid, B–spores, C–sporophyte
(b) A–haploid, B–gametes, C–gametophyte
(c) A–diploid, B–endospores, C–sporophyte
(d) A–haploid, B–conidia, C–gametophyte

65 Bryophytes reproduce by
(a) vegetative reproduction
(b) sexual reproduction
(c) asexual reproduction
(d) Both (a) and (b)

66 Gametophytic generation is dominant stage in the life cycle of
(a) pteridophytes (b) angiosperms
(c) gymnosperms (d) bryophytes

67 In bryophytes, antheridium produces ...*A*... and female sex organ archegonium produces ...*B*... . Here *A* and *B* refer to
(a) A–uniflagellate antherozoids; B–two eggs
(b) A–biflagellate antherozoids; B–one egg
(c) A–non-motile antherozoids; B–one egg
(d) A–non-motile antherozoids; B–two eggs

68 The only positive evidence of aquatic ancestry of byrophyte is
(a) thread-like protonema
(b) green colour
(c) some forms are still aquatic
(d) ciliated sperms

69 Choose the incorrect option for bryophytes.
(a) Archegonium – Flask-shaped female sex organ
(b) Antheridium – Unicellular female gametes
(c) Antherozoids – Biflagellate male gamete
(d) All of the above

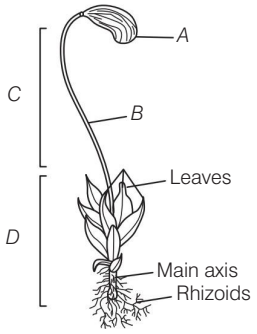
70 Peat moss is
(a) *Funaria* (b) fern (c) algae (d) *Sphagnum*

71 The plant having capacity of absorbing water, used to replace cotton and used as a fuel is
(a) *Marchantia* (b) *Riccia*
(c) *Sphagnum* (d) *Funaria*

72 Mosses along with lichen are of great ecological importance because
(a) they colonise barren rocks and decompose rock
(b) of their contribution to prevent soil erosion
(c) of their contribution in ecological succession
(d) All of the above

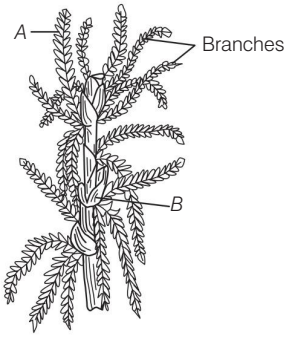
73 In which way, mosses affect the quality of soil?
(a) Prevent soil erosion
(b) Add nutrients to the soil
(c) Promotes soil degradation
(d) They do not affect soil in any way

74 In given figure *A*, *B*, *C* and *D* represent



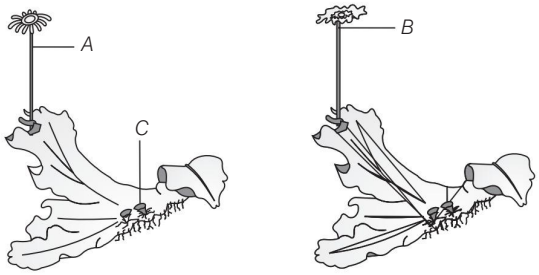
(a) A–Apophysis, B–Capsule, C–Sporophyte, D–Gametophyte
(b) A–Capsule, B–Seta, C–Sporophyte, D–Gametophyte
(c) A–Apophysis, B–Seta, C–Gametophyte, D–Sporophyte
(d) A–Apophysis, B–Capsule, C–Gametophyte, D–Sporophyte

75 *A* and *B* in given figure represent



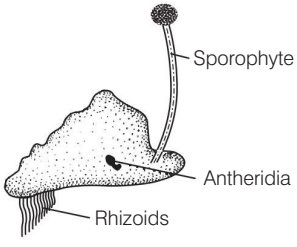
(a) A–Gametophyte branch, B–Sporophyte branch
(b) A–Antheridial branch, B–Archegonial branch
(c) A–Archegonial branch, B–Antheridial branch
(d) A–Sporophyte branch, B–Gametophyte branch

76 Observe the diagrams given below and choose the correct option for *A*, *B* and *C*.



(a) A–Antheridiophore, B–Archegoniophore, C–Endospore
(b) A–Archegoniophore, B–Antheridiophore, C–Gemma cup
(c) A–Antheridiophore, B–Archegoniophore, C–Gemma cup
(d) A–Archegoniophore, B–Antheridiophore, C–Seta cup

77 Which of the following is showing the correct ploidy level of labelled organs of plant in the given figure?



(a) Sporophyte – Diploid (2*n*) (b) Antheridia – Haploid (*n*)
(c) Rhizoids – Haploid (*n*) (d) All of these

78 Which group of plants constitute the lower bryophytes?
(a) Liverworts (b) Mosses
(c) Anthocerotales (d) Jungermanniales

79 Which of the following liverworts has thalloid plant body?
(a) *Marchantia* (b) *Funaria*
(c) *Sphagnum* (d) *Pogonatum*

80 In liverworts, asexual reproduction takes place by
(a) gemmae and fragmentation of thalli
(b) fragmentation and zoospores
(c) gemmae formation and spores formation
(d) isogamy and anisogamy

81 Gemmae are asexual buds, which originate from small receptacles called gemma cups. These are found in
(a) *Funaria* (b) *Marchantia*
(c) Fern (d) *Sphagnum*

82 In the life cycle of mosses, the gametophyte has two stages (*A* and *B*). These stages can be called
(a) A – Protonema; B – Leafy stage
(b) A – Protonema; B – Sporogonium
(c) A – Sporophyte; B – Gametophyte
(d) A – Zygote; B – Spore mother cell

83 The protonema is a stage in the life cycle of
(a) *Riccia* (b) *Funaria*
(c) All bryophytes (d) *Pinus*

84 Secondary protonema
(a) formed by spore germination
(b) formed by other vegetative part of plant
(c) develops into leafy gametophyte
(d) Both (b) and (c)

85 If the leaf of *Funaria* has 5 chromosomes, the primary protonema will have
(a) 10 chromosomes (b) 5 chromosomes
(c) 15 chromosomes (d) 20 chromosomes

86 Mosses are highly developed among all the bryophytes. These are
(a) green
(b) leafy
(c) upright and radial in symmetry
(d) All of the above

87 Mosses are attached to substratum by
(a) roots (b) capsule
(c) rhizoids (d) main axis

88 In mosses, vegetative reproduction takes place by
(a) fragmentation and budding in the secondary protonema
(b) gemmae formation and endospore formation
(c) gemmae and tubers formation
(d) protonema

89 In moss, the sporophyte is differentiated into
(a) seta and capsule
(b) foot and seta
(c) foot, seta and capsule
(d) protonema, foot and capsule

90 In which of the following, the gametangia surrounded by a sterile jacket will be found?
(a) Fungi (b) Angiosperms
(c) Bryophytes (d) Algae

91 *Funaria*, *Polytrichum* and *Sphagnum* are the examples of
(a) liverworts (b) ferns
(c) mosses (d) pteridophytes

92 In a moss, the sporophyte
(a) is partially parasitic on the gametophyte
(b) produces gametes that give rise to the gametophyte
(c) arises from a spore produced from the gametophyte
(d) manufactures food for itself, as well as for the gametophyte

93 The moss plant is
(a) sometimes gametophyte and sometimes sporophyte
(b) predominantly gametophyte with sporophyte attached to it
(c) gametophyte
(d) sporophyte

94 *Buxbaumia aphylla* is a classical example of
(a) parasitic bryophyte
(b) saprophytic bryophyte
(c) symbiotic bryophyte
(d) nitrogen-fixing form

95 The unique feature of bryophytes in comparison to other green plant groups is that
(a) they produce spores
(b) they lack vascular tissue
(c) they lack roots
(d) their sporophyte is attached to the gametophyte

96 Which one is wrong in respect to bryophytes?
(a) Water is essential for sexual reproduction
(b) The presence of antheridium
(c) The presence of ciliated sperms
(d) The presence of autotrophic, independent sporophyte

97 Which of the following is true about bryophytes?
(a) They are thalloid
(b) They contain chloroplast
(c) They possess archegonia
(d) All of the above

98 If the chromosome number in the leaf of *Funaria* is 20, what will be the chromosome number in the spores?
(a) 10 (b) 40
(c) 20 (d) 5

TOPIC 4~ *Pteridophytes*

99 Horsetails and ferns belong to
(a) gymnosperms (b) bryophytes
(c) mosses (d) pteridophytes

100 Pteridophytes mostly occur in
(a) cool, damp and shady places
(b) hot and sunny places
(c) dry and humid areas
(d) water

101 Which of the following plant group is considered as first terrestrial plant to possess vascular tissues xylem and phloem?
(a) Bryophytes (b) Pteridophytes
(c) Gymnosperms (d) Angiosperms

102 Pteridophytes are also known as
(a) cryptogams (b) vascular cryptogams
(c) amphibious plants (d) phanerogams

103 Sporophytic generation is dominant phase in the life cycle of
(a) *Marchantia* (b) ferns (c) mosses (d) liverworts

104 In pteridophyte, the sporophyte consists of leaf-like appendages called
(a) megaphylls (b) sporophylls
(c) thalli (d) sporangia

105 The leaves in pteridophytes are small as in
(a) *Volvox* (b) *Marsilia* (c) *Selaginella* (d) *Azolla*

106 Select the correct sequential arrangement of reproductive structures in pteridophytes.
(a) Sporophyll → Strobili → Sporangia → Spore mother cell → Spores
(b) Strobili → Sporophyll → Sporangia → Spores
(c) Spores → Sporophyll → Sporangia → Strobili
(d) Spores → Sporangia → Sporophyll → Strobili

107 In bryophytes and pteridophytes, transport of male gametes requires ***NEET 2016***
(a) insects (b) birds (c) water (d) wind

108 In pteridophytes, spore germinates to give rise to
(a) thalloid gametophyte called prothallus
(b) thalloid sporophyte called prothallus
(c) thalloid sporocarp
(d) thalloid, photosynthetic sporophyte

109 Mosses and ferns are found in moist and shady places because both
(a) require the presence of water for fertilisation
(b) do not need sunlight for photosynthesis
(c) depend for their nutrition on microorganisms, which can survive only at low temperature
(d) cannot compete with sun-loving plants

110 Prothallus of the fern produces
(a) spores (b) gametes
(c) Both (a) and (b) (d) cones

111 Which of the following are homosporous? ***AIIMS 2019***
(a) *Salvinia, Equisetum* (b) *Salvinia, Lycopodium*
(c) *Selaginella, Salvinia* (d) *Lycopodium, Equisetum*

112 In homosporous pteridophyte, the gametophyte is
(a) vascular
(b) monoecious
(c) dioecious
(d) may be monoecious or dioecious

113 Which of the following pteridophytes is heterosporous in nature?
(a) *Selaginella* and *Salvinia* (b) *Adiantum* and *Equisetum*
(c) *Psilotum* and *Lycopodium* (d) *Adiantum* and *Psilotum*

114 Heterospory is the production of
(a) sexual and asexual spores
(b) large and small spores
(c) haploid and diploid alike spores
(d) diploid and tetraploid alike spores

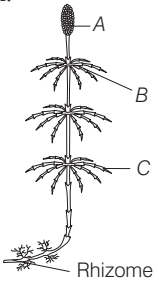
115 Seed habit is linked to
(a) homospory (b) heterospory
(c) parthenocarpy (d) parthenogenesis

116 From evolutionary point of view, retention of the female gametophyte with developing young embryo on the parent sporophyte for some time, is first observed in ***NEET (National) 2019***
(a) mosses (b) pteridophytes
(c) gymnosperms (d) liverworts

117 Which of the following group of pteridophytes belong to class–Pteropsida?
(a) *Equisetum* and *Psilotum* (b) *Lycopodium* and *Adiantum*
(c) *Selaginella* and *Pteris* (d) *Pteris* and *Adiantum*

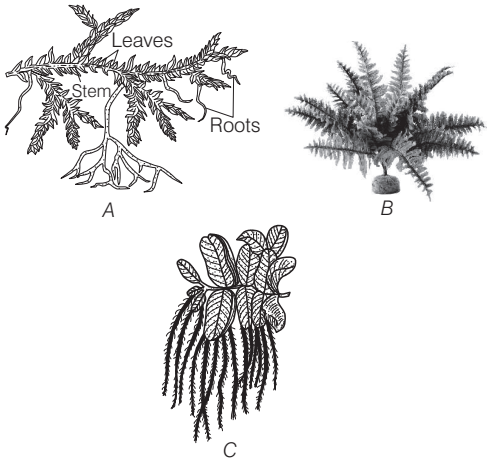
118 Sporophyte is parasitic over gametophyte. This statement is true for
(a) pteridophytes (b) algae
(c) byrophytes (d) gymnosperms

119 Identify *A*, *B* and *C* in the following figure and choose the correct option.



(a) A–Strobilus, B–Node, C–Leaves
(b) A–Strobilus, B–Node, C–Branch
(c) A–Sporophyll, B–Node, C–Internode
(d) A–Sporophyll, B–Internode, C–Node

120 Go through the following figures and identify these plants (*A*, *B* and *C*).



(a) A–*Equisetum*, B–*Selaginella*, C–Fern
(b) A–*Selaginella*, B–Fern, C–*Salvinia*
(c) A–Fern, B–*Salvinia*, C–*Equisetum*
(d) A–*Salvinia*, B–*Equisetum*, C–Fern

121 Two very distinct generations are found in the life cycle of
(a) bacteria (b) *Spirogyra*
(c) *Volvox* (d) ferns

122 Which plant group has vascular tissue, produces spores, but does not have seeds?
(a) Bryophyta (b) Pteridophyta
(c) Gymnosperms (d) Angiosperms

123 …… a pteridophyte is also known as the walking fern. ***CBSE-AIPMT 2014***
(a) *Equisetum* (b) *Psilotum*
(c) *Adiantum* *(d) Lycopodium*

TOPIC 5~ *Gymnosperms*

124 Gymnosperms are characterised by
(a) multiflagellate sperms (b) naked seeds
(c) winged seeds (d) seeds inside fruits

125 Conifers are adapted to tolerate extreme environmental conditions because of ***NEET 2016***
(a) broad hardy leaves (b) superficial stomata
(c) thick cuticle (d) the presence of vessels

126 In gymnosperms, the pollen chamber represents
(a) a cell in the pollen grain in which the sperms are formed
(b) a cavity in the ovule in which pollen grains are stored after pollination
(c) an opening in the megagametophyte through which the pollen tube approaches the egg
(d) the microsporangium in which pollen grains develop

127 In which of the following gametophyte is not independent and free-living? ***CBSE-AIPMT 2015***
(a) *Funaria* (b) *Marchantia*
(c) *Pteris* (d) *Pinus*

128 Which of the following gymnosperm has coralloid roots associated with N_2-fixing cyanobacteria?
(a) *Pinus* (b) *Cycas*
(c) *Cedrus* (d) *Ginkgo*

129 Which one is not the feature of *Cycas*?
(a) Unbranched stem
(b) Pinnate leaves
(c) The male or female cones may be borne on the different trees
(d) Archegonium is absent

130 In gymnosperms, the leaves are well-adapted to withstand extremes of temperature, humidity and wind. Which is/are the xeric character(s) of conifers?
(a) Needle-like leaves
(b) Thick cuticle
(c) Sunken stomata
(d) All of the above

131 Cycads are
(a) homosporous and dioecious
(b) homosporous and monoecious
(c) heterosporous and dioecious
(d) heterosporous and monoecious

132 Zooidogamy is found in ***JIPMER 2019***
(a) *Cedrus* (b) *Pinus*
(c) *Cycas* (d) Both (b) and (c)

133 Select the mismatch. ***NEET 2017***
(a) *Pinus* – Dioecious
(b) *Cycas* – Dioecious
(c) *Salvinia* – Heterosporous
(d) *Equisetum* – Homosporous

134 In *Pinus*, male cone bears a large number of
(a) ligules (b) anthers
(c) microsporophylls (d) megasporophylls

135 Microsporangia in gymnosperms are produced
(a) on the middle portion of microsporophyll
(b) on the lowerside of microsporophyll
(c) on the middle portion of megasporophyll
(d) at the extreme tip of microsporophyll

136 In gymnosperms, the microspores develop into a male gametophyte generation, which
(a) is highly reduced and confined to only a limited number of cells
(b) is highly developed
(c) has an independent life
(d) Both (a) and (c)

137 In gymnosperms, the reduced gametophyte is called
(a) endospore (b) pollen grain
(c) ovule (d) aplanospore

138 Megasporophyll is the term used in gymnosperm to denote
(a) carpel (b) leaves
(c) female cone (d) stamens

139 The cones bearing megasporophylls with ovules are called
(a) male strobili (b) female strobili
(c) megasporangia (d) microsporangia

140 In gymnosperms, the nucellus is protected by envelops and this composite structure is known as
(a) ovule (b) ovary (c) anther (d) strobili

141 Megaspore mother cell divides ...*A*... to give rise ...*B*... megaspores.
Identify *A* and *B* and choose the correct option.
(a) A–mitotically; B–two (b) A–meiotically; B–four
(c) A–amitotically; B–four (d) A–dinomitotically; B–two

142 In gymnosperms, one of the megaspores develops into multicellular structure called …… that bears two or more archegonia.
(a) male gametophyte (b) female gamete
(c) female gametophyte (d) male gamete

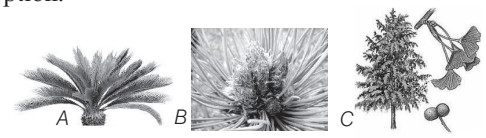
143 In gymnosperms, the multicellular female gametophyte is retained within
(a) microsporangium (b) megasporangium
(c) male gametophyte (d) archegonia

144 Choose the correct pattern of arrangement of reproductive structures of gymnosperms.
(a) Spores → Sporophylls → Sporangia → Strobili
(b) Spores → Sporangia → Sporophylls → Strobili
(c) Sporangia → Sporophylls → Spores → Strobili
(d) Spores → Sporangia → Strobili → Sporophylls

145 In gymnosperms, pollination takes place by
(a) water (b) air
(c) insects (d) animals

146 In gymnosperms, dominant phase is
(a) sporophyte (b) gametophyte
(c) haploid (d) triploid

147 Identify the figures A, B and C and choose the correct option.



(a) A–*Cycas*, B–*Ginkgo*, C–*Pinus*
(b) A–*Cycas*, B–*Pinus*, C–*Ginkgo*
(c) A–*Ginkgo*, B–*Cycas*, C–*Pinus*
(d) A–*Pinus*, B–*Cycas*, C–*Ginkgo*

148 'Chilgoza' a gymnospermic seed that is eaten as dry fruit is produced by
(a) *Pinus roxburghii* (b) *Pinus gerardiana*
(c) *Ginkgo biloba* (d) *Cedrus deodara*

149 Sago starch is obtained from
(a) *Cedrus* (b) *Taxus* (c) *Pinus* (d) *Cycas*

TOPIC 6~ *Angiosperms*

150 Angiosperms are also called
(a) seedless plants (b) fruitless plants
(c) flowering plants (d) All of these

151 In angiosperms, the pollen grains and ovules are produced in a special structure called
(a) fruit (b) seed
(c) flower (d) lamina

152 In angiosperms, seeds are enclosed by
(a) flowers (b) fruits
(c) ovule (d) perianth

153 Angiosperms differ from gymnosperms in having
(a) fruits (b) cotyledons
(c) tracheids (d) broad leaves

154 Smallest flowering plant is
(a) *Ginkgo* (b) *Wolffia* (c) tulip (d) sweet bay

155 The tallest tree species is
(a) *Pinus* (b) *Cedrus*
(c) *Sequoia* (d) *Eucalyptus*

156 Angiospermic plants are divided into
(a) dicot
(b) monocot
(c) Both (a) and (b)
(d) heartwood plants and sapwood plants

157 Reproductive parts of an angiospermic plant are
(a) stamen (b) pistil
(c) Both (a) and (b) (d) shoot

158 Stamen consists of
(a) filament and anther (b) style and stigma
(c) filament and pistil (d) anther and pistil

159 Carpel consists of
(a) style and ovary (b) style, stigma and ovary
(c) style, anther and pistil (d) anther, style and stigma

160 Eight nucleated female gametophyte is found in
(a) bryophytes (b) gymnosperms
(c) angiosperms (d) pteridophytes

161 Embryo sac consists of angiosperm has
(a) one egg cell
(b) two synergids
(c) three antipodal and two polar nuclei
(d) All of the above

162 Egg apparatus of angiosperms consists of
(a) one synergid and two egg cells
(b) two synergids and one egg cell
(c) one central cell, two polar nuclei and three antipodal cells
(d) one egg cell, two polar nuclei and three antipodal cells

163 Which of the following is incorrect with respect to angiosperms?
(a) Endosperm — Triploid (b) Megaspore — Diploid
(c) Pollen grain — Haploid (d) Synergid — Haploid

164 Each cell of angiospermic embryo sac is
(a) diploid (b) triploid (c) tetraploid (d) haploid

165 Transfer of pollen grain from anther to the stigma of ovary is called
(a) autogamy (b) pollination
(c) syngamy (d) allogamy

166 Pollen tube carries
(a) two male gametes (b) one male gamete
(c) three sperms (d) four sperms

167 In flowering plants, meiosis occurs at the time of
(a) formation of buds
(b) germination of seeds
(c) formation of root primordia
(d) formation of pollen grains

168 Double fertilisation occurs among
(a) algae (b) bryophytes
(c) angiosperms (d) gymnosperms

169 Double fertilisation is ***NEET 2018***
(a) fusion of two male gametes with one egg
(b) fusion of one male gamete with two polar nuclei
(c) fusion of two male gametes of pollen tube with two different eggs
(d) syngamy and triple fusion

170 Triple fusion in angiosperm is the fusion of second male gamete with
(a) two polar nuclei (secondary nucleus)
(b) two antipodal cells
(c) one antipodal cell
(d) antipodal cell and one synergid cell

171 Endosperm formation begins with
(a) the establishment of the suspensor
(b) the fusion of the antipodals
(c) the fertilisation of the polar nuclei
(d) the syncytial development of the embryo

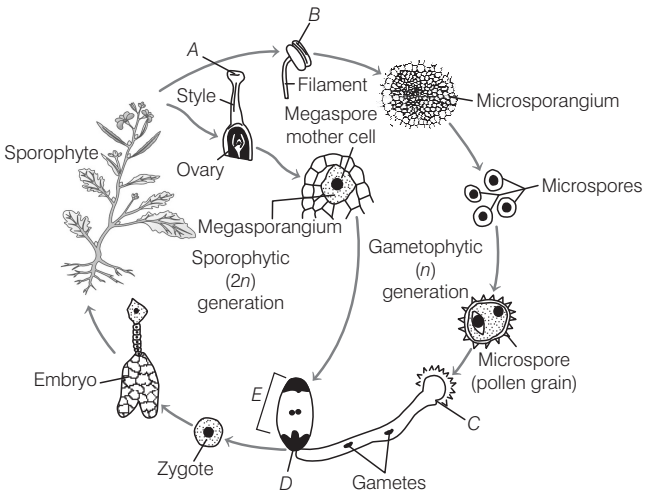
172 The endosperm in angiosperms develops from
(a) zygote (b) secondary nucleus
(c) chalazal polar nucleus (d) micropylar polar nucleus

173 In the angiosperm ovule, central cell of the embryo sac prior to the triple fusion, contains
(a) a single haploid nucleus
(b) one diploid nucleus
(c) two haploid polar nuclei
(d) one diploid and one haploid nuclei

174 After fertilisation, the ovary and ovules, respectively develop into
(a) fruit, seed coat (b) seed coat, integuments
(c) fruit and seeds (d) seeds and fruit

175 In angiosperms, endosperm is
(a) haploid (b) diploid
(c) triploid (d) None of these

176 The diagram represents the life cycle of angiosperm. Choose the correct combination for labellings (*A*-*E*).



(a) A–Anther, B–Stigma, C–Egg, D–Male gametophyte, E–Ovule
(b) A–Ovule, B–Stigma, C–Male gametophyte, D–Anther, E–Ovule
(c) A–Male gametophyte, B–Stigma, C–Anther, D–Egg, E–Ovule
(d) A–Stigma, B–Anther, C–Male gametophyte, D–Egg, E–Ovule

177 Male gametophyte with least number of cells is present in ***CBSE-AIPMT 2014***
(a) *Pteris* (b) *Funaria*
(c) *Lilium* (d) *Pinus*

TOPIC 7~ *Plant Life Cycles and Alternation of Generations*

178 In the alternation of generations, the sporophytic generation is ...*A*... and the gametophytic generation is ...*B*... . Here, *A* and *B* refer to
(a) A–2*n*; B–*n*
(b) A–*n*; B–2*n*
(c) A–*n*; B–*n*
(d) A–2*n*; B–2*n*

179 The dominant photosynthetic, free-living phase in haplontic life cycle is
(a) sporophyte
(b) gametophyte
(c) Both (a) and (b)
(d) None of the above

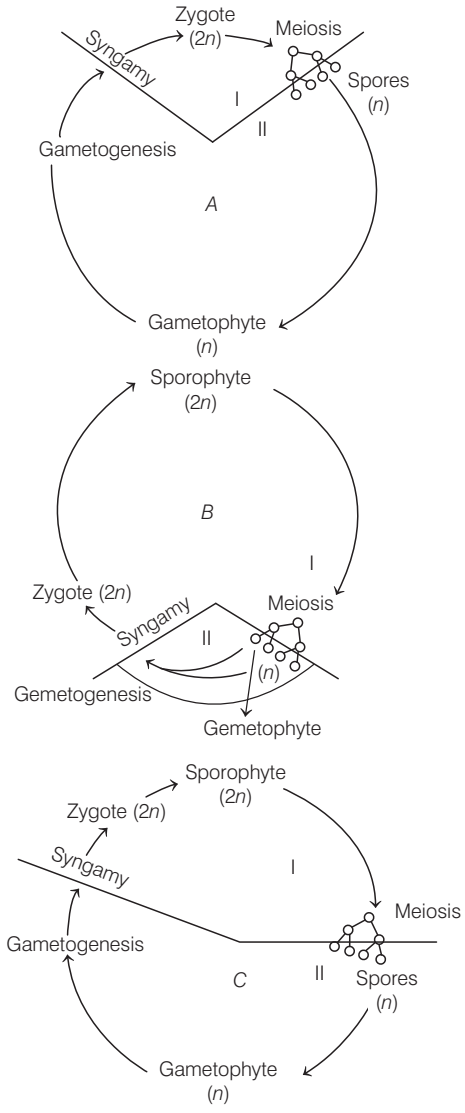
180 Choose the incorrect option for haplontic life cycle
(a) Sporophytic generation is represented only by the one-celled zygote
(b) There are no free-living sporophytes
(c) Mitosis in the zygote results in the formation of haploid spores
(d) The haploid spores divide mitotically and form the gametophyte

181 Choose the correct option about diplontic life cycle.
(a) It occurs in seed bearing plants like gymnosperms and angiosperms
(b) The diploid sporophyte is dominant, photosynthetic, independent phase of the plant
(c) The gametophytic, phase is represented by the single to few-celled haploid gametophyte
(d) All of the above

182 Haplo-diplontic life cycle is followed by
(a) bryophytes and pteridophytes
(b) algae and bryophytes
(c) angiosperms and gymnosperms
(d) bryophytes and gymnosperms

183 Life cycle of *Ectocarpus* and *Fucus*, respectively are ***NEET 2017***
(a) haplontic, diplontic
(b) diplontic, haplo-diplontic
(c) haplo-diplontic, diplontic
(d) haplo-diplontic, haplontic

184 Which of the following correctly represents the type of life cycle patterns from the options given?



(a) A–Haplontic, B–Diplontic, C–Haplo-diplontic
(b) A–Diplontic, B–Haplontic, C–Haplo-diplontic
(c) A–Haplo-diplontic, B–Diplontic, C–Haplontic
(d) A–Diplontic, B–Haplo-diplontic, C–Haplontic

NEET

SPECIAL TYPES QUESTIONS

I. Assertion and Reason

Direction (Q. No. 185-194) *In each of the following questions, a statement of Assertion (A) is given followed by corresponding statement of Reason (R).*
Of the statements, mark the correct answer as

(a) If both A and R are true and R is the correct explanation of A.
(b) If both A and R are true, but R is not the correct explanation of A.
(c) If A is true, but R is false.
(d) If A is false, but R is true.

185 **Assertion** (A) Artificial system of classification separated closely related species.

Reason (R) Artificial system gave equal weightage to vegetative and sexual characteristics.

186 **Assertion** (A) Algae are the primary producers of many food cycles.

Reason (R) Half of the total carbon dioxide-fixation on earth is carried out by algae.

187 **Assertion** (A) Red algae contributes in development of coral reefs.

Reason (R) Red algae secrete and deposit calcium carbonate over their walls.

188 **Assertion** (A) Bryophytes are the amphibians of plant kingdom.

Reason (R) They are found in swamps and the areas, where water and land meet.

189 **Assertion** (A) Bryophytes are a class of kingdom–Plantae.

Reason (R) Algae, fungi, lichens and mosses are included in bryophytes.

190 **Assertion** (A) The life cycle of *Funaria* is called diplo-haplontic.

Reason (R) In *Funaria*, there is alternation of haploid gametophytic and diploid sporophytic phases, one becoming parent of the other.

191 **Assertion** (A) *Lycopodium* and *Selaginella* are heterosporous.

Reason (R) In heterosporous condition, two kinds of spores are produced by the plant.

192 **Assertion** (A) Production of two types of spores is a pre-requisite of seed habit. ***AIIMS 2019***

Reason (R) In pteridophytes, *Lycopodium* is precursor of seed habit.

193 **Assertion** (A) Heterospory and retention of female gametophyte are responsible for origin of seed habit in *Selaginella*. ***AIIMS 2019***

Reason (R) *Psilotum* is a living fossil.

194 **Assertion** (A) Fertilisation in *Cycas* is called zooidogamy.

Reason (R) Fertilisation in *Cycas* takes place by the formation of pollen tube.

II. Statement Type Questions

195 Identify the correct statement for artificial system of classification.
(a) Artificial system was based on natural affinities present among the organisms
(b) It was proposed by Engler and Prantl
(c) The artificial system gave equal weightage to the vegetative and sexual characteristics
(d) It considers both the external features and internal features like anatomy, embryology, etc.

196 Read carefully the given statements about algae and identify the incorrect option.
(a) The plant body is simple and thalloid
(b) Mainly aquatic, i.e. both freshwater and marine
(c) Reproduction may be vegetative, asexual and sexual
(d) *Volvox* and *Ulothrix* are the colonial form of algae

197 Which one of the following statements is incorrect? ***NEET 2016***
(a) Algae increase the level of dissolved oxygen in the immediate environment
(b) Algin is obtained from red algae and carrageenan from brown algae
(c) Agar-agar is obtained from *Gelidium* and *Gracilaria*
(d) *Laminaria* and *Sargassum* are used as food

198 Which one of the following statements is incorrect? ***CBSE-AIPMT 2015***
(a) Algin and carrageenan are products of algae
(b) Agar-agar is obtained from *Gelidium* and *Gracilaria*
(c) *Chlorella* and *Spirulina* are used as space food
(d) Mannitol is stored food in Rhodophyceae

199 Which of the statements given below are correct about green algae?

(a) Green algae are green due to the presence of chlorophyll-*a* and *b* pigments localised in chloroplast

(b) Algae store food in the form of starch in a specialised structure called pyrenoids located in chloroplast. Food may be stored in the form of oil droplets

(c) Vegetative reproduction occurs through cell division, fragmentation, stolons and tubers

(d) All of the above

200 Identify the statement that correctly explains why rhodophytes exhibit a red colour.

(a) Most rhodophytes grow at great depths, chlorophyll can only absorb light specifically in the red area of the spectrum

(b) The wavelengths of light that are absorbed by chlorophyll are passed to phycoerythrin (a red pigment) present in algae

(c) Phycoerythrin absorbs all the light waves

(d) Light reaching the greatest depth in water is in the blue-green region of the spectrum, which is absorbed by phycoerythrin

201 Which of the statements given below are correct about brown algae?

(a) The largest kelps are *Nereocystis* and *Macrocystis*

(b) Brown algae have gelatinous coating outside the cellulosic cell wall called algin

(c) Food obtained from *Laminaria saccharina* is known as 'kombu'

(d) All of the above

202 Which of the following statements about bryophytes are incorrect?

(a) The sperms are biflagellate

(b) The sperms are released into water and fuse with the egg to produce the zygote outside the body

(c) Zygotes undergo reduction division immediately

(d) Both (b) and (c)

203 Which of the statements is incorrect about *Marchantia*?

(a) Plant body is a thallus-like structure, closely attached to substrate

(b) Sporophyte is differentiated into foot, seta and capsule

(c) Gemma cup located on the thalli

(d) None of the above

204 Which of the statements given below are correct about protonema?

(a) Juvenile stage of moss is protonema

(b) It consists of slender, green, branching system of filaments

(c) Develops directly from a spore

(d) All of the above

205 Which one of the following is a correct statement? ***NEET 2013***

(a) Pteridophyte's gametophyte has a protonemal and leafy stage

(b) In gymnosperms, female gametophyte is free-living

(c) Antheridiophores and archegoniophores are present in pteridophytes

(d) Origin of seed habit can be traced in pteridophytes

206 Which of the statements given below are incorrect about pteridophytes?

(a) They are called vascular cryptogams

(b) They produce seeds rather than spores

(c) They are used for medicinal purposes

(d) They are used as soil binders

207 Identify the incorrect statement with regards to the gymnosperms.

(a) In gymnosperms, ovules remain exposed, before and after fertilisation

(b) The giant redwood tree *Sequoia* is tallest gymnospermic tree

(c) The gymnosperms are homosporous

(d) Leaves in gymnosperms are well-adapted to withstand extreme environmental conditions

208 Select the correct statement. ***NEET 2016***

(a) *Salvinia*, *Ginkgo* and *Pinus* all are gymnosperms

(b) *Sequoia* is one of the tallest trees

(c) The leaves of gymnosperms are not well-adapted to extremes of climate

(d) Gymnosperms are both homosporous and heterosporous

209 Which one of the following statements is correct ? ***NEET 2018***

(a) Horsetails are gymnosperms

(b) *Selaginella* is heterosporous, while *Salvinia* is homosporous

(c) Ovules are not enclosed by ovary wall in gymnosperms

(d) Stems are usually unbrancned in both *Cycas* and *Cedrus*

210 Read the following statements (I-IV) and answer the question, which follows them.

I. In liverworts, mosses and ferns gametophytes are free-living.

II. Gymnosperms and some ferns are heterosporous.

III. Sexual reproduction in *Fucus, Volvox* and *Albugo* is oogamous.

IV. The sporophyte in liverworts is more elaborate than that in mosses.

How many of the above statements are correct? ***NEET 2013***

(a) One

(b) Two

(c) Three

(d) Four

211 Consider the following statements.

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

II. *Chlorella* and *Chlamydomonas* are used in sewage disposal ponds.

III. Some species of marine algae like *Porphyra*, *Laminaria* and *Sargassum* are used as food.

IV. *Volvox* forms spherical colonies made of non-motile cells.

Which of the statements given above are correct?

(a) I and II (b) I and III (c) II and III (d) I, II and III

212 Consider the following statements regarding reproduction in class–Chlorophyceae.

I. Asexual reproduction is mainly by flagellated zoospores produced in zoosporangia.

II. The sexual reproduction shows considerable variation in the type and formation of sex cells and it may be isogamous, anisogamous and oogamous.

Choose the correct option.

(a) I is true, but II is false (b) I is false, but II is true
(c) Both I and II are true (d) Both I and II are false

213 Consider the following statements about sexual reproduction in brown algae.

I. Sexual reproduction may be oogamous, isogamous or anisogamous.

II. Union of gametes takes place in water or within the oogonium.

III. The gametes are pear-shaped and bear two laterally attached flagella.

Which of the statements given above are correct?

(a) I and II (b) I and III
(c) II and III (d) I, II and III

214 Consider the following statements.

I. In red algae, vegetative reproduction takes place by fragmentation.

II. In red algae, the food is stored as floridean starch, which is very similar to amylopectin and glycogen in structure.

III. Cell wall of red algae consists of chitin.

Which of the statements given above are correct?

(a) I and II (b) I and III (c) II and III (d) All of these

215 Consider the following statements.

I. They reproduce asexually by non-motile spores and sexually by non-motile gametes.

II. In this class, sexual reproduction is oogamous and accompanied by complex post-fertilisation developments.

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

The above characteristics belong to which class of algae?

(a) Chlorophyceae (b) Phaeophyceae
(c) Both (a) and (b) (d) Rhodophyceae

216 Choose the correct statements for the sporophyte of bryophytes.

I. Sporophyte is multicellular, not free-living, but attached to the gametophyte for nourishment.

II. Some cells of the sporophyte undergo meiosis to produce haploid spores.

III. These spores germinate to produce gametophyte.

(a) I and II (b) I and III
(c) II and III (d) I, II and III

217 Consider the following statements.

I. The liverworts grow usually in moist, shady habitats such as banks of streams, marshy ground, damp soil, bark of trees and deep in the woods.

II. The leafy members of liverworts have tiny leaf-like appendages in two rows on the stem-like structures.

Choose the correct option.

(a) I is true, but II is false (b) I is false, but II is true
(c) Both I and II are true (d) Both I and II are false

218 Choose the correct statements about liverworts.

I. In liverworts, sexual reproduction occurs by the fusion of antherozoids and egg, which are produced in antheridium and archegonium, respectively.

II. Both male and female sex organs may be present on same thallus or different thalli.

III. Zygote gives rise to sporophyte, which is differentiated into foot, seta and capsule.

IV. Some cells of capsule undergo meiosis and give rise to haploid spores.

(a) I, II and III (b) II, III and IV
(c) I, III and IV (d) I, II, III and IV

219 In mosses, the second gametophytic stage is leafy stage. Consider the following statements about leafy stage.

I. Leafy stage is produced from the secondary protonema as a lateral bud.

II. They consist of upright, slender axis bearing spirally arranged leaves.

III. They are attached to the soil through multicellular rhizoids.

IV. This leafy stage bears the sex organ.

Which of the statements given above are correct?

(a) I, II and III (b) I, III and IV
(c) II, III and IV (d) I, II, III and IV

220 Read the following five statements (I-V) and select the option with all correct statements.

CBSE-AIPMT 2015

I. Mosses and lichens are the first organisms to colonise a bare rock.
II. *Selaginella* is a homosporous pteridophyte.
III. Coralloid roots in *Cycas* have VAM.
IV. Main plant body in bryophytes is gametophytic, whereas in pteridophytes, it is sporophytic.
V. In gymnosperms, male and female gametophytes are present within sporangia located on sporophyte.

(a) I, III and IV (b) II, III and IV
(c) I, IV and V (d) II, III and V

221 Read the following statements carefully.

I. *Funaria* possesses unicellular and unbranched rhizoids.
II. Gemmae are asexual buds, which originate from small receptacles called gemma cups.
III. The *Sphagnum* plants have magnificant property of retaining water.

Which of the statements given above are correct?

(a) I, II and III (b) I and III
(c) II and III (d) I and II

222 Consider the following statements.

I. The plants have magnificant property of retaining water. They can withhold water two hundred times more than their own weight. Hence, they are widely used by gardeners to keep cut plant parts moist during transportation and propagation.
II. They grow as semiaquatic or submerged plants in acidic marshes. The older portions of plants die, but do not decay due to peculiar germicidal properties.

The above statements belong to which of the following bryophytic plant?

(a) *Pogonatum* (b) *Funaria*
(c) *Sphagnum* (d) *Marchantia*

223 Consider the following statements about bryophytes.

I. The tea prepared from *Polytrichum commune* is used to dissolve kidney and gall bladder stones.
II. Many chemical products such as alcohol, ammonium sulphate, paraffin, brown dye, etc., can be obtained from peat.

Choose the correct option.

(a) I is true, but II is false
(b) I is false, but, II is true
(c) Both I and II are true
(d) Both I and II are false

224 Consider the following statements regarding heterospory.

I. Genera like *Selaginella* and *Salvinia*, which produce two kinds of spores, macro (large) and micro (small) spores, are known as heterosporous.
II. The megaspores and microspores germinate and give rise to female and male gametophyte, respectively.
III. The female gametophytes in these plants are retained on the parent sporophytes for variable periods.
IV. The development of the zygotes into young embryos takes place within the female gametophytes.
V. This event is a precursor to the seed habit and is considered an important step in evolution.

Which of the statements given above are correct?

(a) I, II and III (b) II, IV and V
(c) III, IV and V (d) I, II, III, IV and V

225 Consider the following statements regarding gymnosperms and choose the correct statements.

I. In gymnosperms, the male and female gametophytes have an independent existence.
II. The multicellular female gametophyte is retained within the megasporangium.
III. The gymnosperms are heterosporous.

Of these statements

(a) I and II are true, but III is false
(b) I and III are true, but II is false
(c) II and III are false, but I is true
(d) II and III are true, but I is false

226 Angiospermic plants are characterised by

I. Double fertilisation
II. Triploid endosperm
III. Diploid endosperm

Choose the correct option from the following regarding above statements.

(a) I and II are correct
(b) I and III are correct
(c) II and III are correct
(d) I, II and III are correct

227 Consider the following statements about the gametophytic stage.

I. Generation that produces the gametes.
II. Generation that produces the spores.
III. Generation that produces vascular tissue.
IV. The diploid generation.

Choose the correct statements given above.

(a) Only I (b) I and II
(c) II and III (d) I, II, III and IV

III. Matching Type Questions

228 Match the following columns.

	Column I (Classification system)		Column II (Given by)
A.	Natural system of classification	1.	Bentham and Hooker
B.	Artificial system of classification	2.	Linnaeus
C.	Phylogenetic system of classification	3.	Englar and Prantl

Codes

	A	B	C		A	B	C
(a)	2	1	3	(b)	3	1	2
(c)	2	3	1	(d)	1	2	3

229 Match the following columns.

	Column I (Algae)		Column II (Body structure)
A.	*Ulothrix*	1.	Kelp
B.	*Volvox*	2.	Filamentous
C.	*Chlamydomonas*	3.	Colonial form
D.	Some giant marine forms	4.	Unicellular

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	3	4	1	2
(c)	4	1	2	3	(d)	2	3	4	1

230 Match the following columns.

	Column I (Reproduction type)		Column II (Characteristics)
A.	Isogamous	1.	Fusion between male (small) and female gamete (large)
B.	Anisogamous	2.	Both gametes are dissimilar in size
C.	Oogamous	3.	Both gametes are similar in size and non-motile

Codes

	A	B	C		A	B	C
(a)	3	2	1	(b)	1	2	3
(c)	2	1	3	(d)	3	1	2

231 Match the following columns.

	Column I (Products)		Column II (Algae)
A.	Algin	1.	*Chlorella*
B.	Carrageenan	2.	*Gracilaria*
C.	Agar	3.	Red algae
D.	Protein supplement	4.	Brown algae

Codes

	A	B	C	D		A	B	C	D
(a)	1	4	3	2	(b)	2	1	4	3
(c)	4	3	2	1	(d)	3	2	1	4

232 Match the following columns.

	Column I (Types of chloroplast)		Column II (Algae)
A.	Cup-shaped	1.	*Ulothrix*
B.	Girdle-shaped	2.	*Oedogonium*
C.	Stellate	3.	*Chlamydomonas*
D.	Reticulate	4.	*Zygnema*

Codes

	A	B	C	D		A	B	C	D
(a)	2	4	3	1	(b)	3	1	4	2
(c)	3	4	2	1	(d)	4	3	1	2

233 Match the following columns about classification of Pteridophyta.

	Column I (Pteridophyte class)		Column II (Examples)
A.	Psilopsida	1.	*Dryopteris, Pteris, Adiantum*
B.	Lycopsida	2.	*Equisetum*
C.	Sphenopsida	3.	*Selaginella*
D.	Pteropsida	4.	*Psilotum*

Codes

	A	B	C	D		A	B	C	D
(a)	4	3	2	1	(b)	3	2	1	4
(c)	2	1	4	3	(d)	3	1	2	4

234 Match the following columns.

	Column I (Products)		Column II (Gymnosperm)
A.	Sagopalm	1.	*Ephedra*
B.	Chilgoza	2.	*Pinus gerardiana*
C.	Ephedrine drug	3.	*Cycas revoluta*
D.	Cedar wood oil	4.	*Juniperus virginiana*

Codes

	A	B	C	D		A	B	C	D
(a)	4	2	1	3	(b)	3	2	1	4
(c)	3	4	1	2	(d)	2	3	1	4

235 Match the following columns.

	Column I (Plant group)		Column II (Examples)
A.	Red algae	1.	*Marchantia*
B.	Liverwort	2.	*Pinus*
C.	Walking fern	3.	*Polysiphonia*
D.	Gymnosperm	4.	*Adiantum*

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	4	3	(b)	2	4	3	1
(c)	2	3	1	4	(d)	3	1	4	2

236 Match the following columns.

	Column I		Column II
A.	Polar nuclei + male gamete	1.	Double fertilisation
B.	Ovule	2.	Fruits
C.	Ovary	3.	Seed
D.	Syngamy + triple fusion	4.	Endosperm

Codes

	A	B	C	D		A	B	C	D
(a)	1	4	3	2	(b)	4	3	2	1
(c)	3	2	1	4	(d)	4	3	1	2

237 Match the following columns.

	Column I (Plant life cycle)		Column II (Plant groups)
A.	Haplontic life cycle	1.	Bryophytes and pteridophytes
B.	Diplontic life cycle	2.	Gymnosperms and angiosperms
C.	Haplo-diplontic life cycle	3.	*Volvox*, *Spirogyra* and *Chlamydomonas*

Codes

	A	B	C		A	B	C
(a)	3	1	2	(b)	1	2	3
(c)	2	3	1	(d)	3	2	1

NCERT & NCERT Exemplar

MULTIPLE CHOICE QUESTIONS

NCERT

238 The group of plants that bear archegonia is /are
(a) mosses (b) liverworts
(c) pteridophytes (d) All of these

239 Match the following columns and choose the correct option.

	Column I (Plants)		Column II (Categories)
A.	*Chlamydomonas*	1.	Moss
B.	*Cycas*	2.	Pteridophyte
C.	*Selaginella*	3.	Algae
D.	*Sphagnum*	4.	Gymnosperm

Codes

	A	B	C	D		A	B	C	D
(a)	1	2	3	4	(b)	3	4	2	1
(c)	4	3	2	1	(d)	1	3	2	4

NCERT Exemplar

240 Holdfast, stipe and frond constitute the plant body in case of
(a) Rhodophyceae (b) Chlorophyceae
(c) Phaeophyceae (d) All of these

241 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.
(a) Pteridophyta (b) Gymnospermae
(c) Monocotyledonae (d) Bryophyta

242 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

243 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

244 Fusion of two motile gametes, which are dissimilar in size is termed as
(a) oogamy (b) isogamy (c) anisogamy (d) zoogamy

245 Identify the correct statements from those given below.
I. The sporophyte in liverworts is more elaborate than that in mosses.
II. Life cycle of all seed bearing plants is diplontic.
III. Life cycle of any sexually reproducing plant has alternation of generations between haplontic, diplontic or intermediate.
IV. In angiosperms, male sex organ (stamen) and female sex organ (pistil) are borne in a flower.
(a) I and II (b) II, III and IV
(c) I, III and IV (d) All are correct

246 A prothallus is
(a) a structure in pteridophytes formed before the thallus develops
(b) a sporophytic free-living structure formed in pteridophytes
(c) a gametophytic free-living structure formed in pteridophytes
(d) a primitive structure formed after fertilisation in pteridophytes

247 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

248 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

249 The giant redwood tree (*Sequoia sempervirens*) is a/an
(a) angiosperm (b) free fern
(c) pteridophyte (d) gymnosperm

Answers

› Mastering NCERT with MCQs

1 (b)	2 (c)	3 (d)	4 (a)	5 (a)	6 (b)	7 (b)	8 (c)	9 (b)	10 (c)
11 (d)	12 (b)	13 (d)	14 (c)	15 (c)	16 (d)	17 (b)	18 (c)	19 (b)	20 (b)
21 (b)	22 (c)	23 (d)	24 (b)	25 (c)	26 (b)	27 (c)	28 (c)	29 (d)	30 (c)
31 (a)	32 (c)	33 (c)	34 (c)	35 (c)	36 (d)	37 (a)	38 (d)	39 (c)	40 (b)
41 (b)	42 (b)	43 (b)	44 (c)	45 (a)	46 (a)	47 (c)	48 (b)	49 (b)	50 (d)
51 (a)	52 (a)	53 (c)	54 (c)	55 (b)	56 (d)	57 (c)	58 (a)	59 (c)	60 (c)
61 (b)	62 (b)	63 (d)	64 (b)	65 (d)	66 (d)	67 (b)	68 (d)	69 (b)	70 (d)
71 (c)	72 (d)	73 (a)	74 (b)	75 (b)	76 (b)	77 (d)	78 (a)	79 (a)	80 (a)
81 (b)	82 (a)	83 (b)	84 (d)	85 (b)	86 (d)	87 (c)	88 (a)	89 (c)	90 (c)
91 (c)	92 (a)	93 (b)	94 (b)	95 (d)	96 (d)	97 (d)	98 (c)	99 (d)	100 (a)
101 (b)	102 (b)	103 (b)	104 (b)	105 (c)	106 (a)	107 (c)	108 (a)	109 (a)	110 (b)
111 (d)	112 (b)	113 (a)	114 (b)	115 (b)	116 (b)	117 (d)	118 (a)	119 (b)	120 (b)
121 (d)	122 (b)	123 (c)	124 (b)	125 (c)	126 (b)	127 (d)	128 (b)	129 (d)	130 (d)
131 (c)	132 (c)	133 (a)	134 (c)	135 (d)	136 (a)	137 (b)	138 (a)	139 (b)	140 (a)
141 (b)	142 (c)	143 (b)	144 (b)	145 (b)	146 (a)	147 (b)	148 (b)	149 (d)	150 (c)
151 (c)	152 (b)	153 (a)	154 (b)	155 (d)	156 (c)	157 (c)	158 (a)	159 (b)	160 (c)
161 (d)	162 (b)	163 (b)	164 (d)	165 (b)	166 (a)	167 (d)	168 (c)	169 (d)	170 (a)
171 (c)	172 (b)	173 (c)	174 (c)	175 (c)	176 (d)	177 (c)	178 (a)	179 (b)	180 (c)
181 (d)	182 (a)	183 (c)	184 (a)						

› NEET Special Types Questions

185 (a)	186 (b)	187 (a)	188 (a)	189 (c)	190 (a)	191 (d)	192 (c)	193 (b)	194 (b)
195 (c)	196 (d)	197 (b)	198 (d)	199 (d)	200 (b)	201 (d)	202 (d)	203 (d)	204 (d)
205 (d)	206 (b)	207 (c)	208 (b)	209 (c)	210 (c)	211 (d)	212 (c)	213 (d)	214 (a)
215 (d)	216 (d)	217 (c)	218 (d)	219 (d)	220 (c)	221 (c)	222 (c)	223 (c)	224 (d)
225 (d)	226 (a)	227 (a)	228 (d)	229 (d)	230 (a)	231 (c)	232 (b)	233 (a)	234 (b)
235 (d)	236 (b)	237 (d)							

› NCERT & NCERT Exemplar Questions

238 (d)	239 (b)	240 (c)	241 (d)	242 (b)	243 (c)	244 (c)	245 (b)	246 (c)	247 (d)
248 (a)	249 (d)								

Answers & Explanations

2 (*c*) Carolus Linnaeus proposed the artificial system of classification. It was based on assessment of only gross superficial morphological characters like habit, colour, shape, etc., and vegetative characters.

5 (*a*) Phylogenetic system of classification was given by Engler and Prantl for the first time. It was based on evolutionary and genetic relationships of organisms.

6 (*b*) Phylogenetic system of classification is also known as Hutchinson's system of classification. John Hutchinson was a botanist in Kew Botanical Garden. He gave more detailed phylogenetic system of classification after Engler and Prantl, thus this system of classification is also known Hutchinson's system of classification (1926-1934).

9 (*b*) Numerical taxonomy, is based on all observable characteristics of an organism. Number and codes are assigned to all the characters and then the data is processed using computers.

In this way, each character is given equal importance and at the same time hundreds of characters can be considered together.

10 (*c*) Algae are chlorophyll bearing, simple, thalloid and autotrophic organism. Their body is thalloid, i.e. it is not differentiated into root, stems or leaves. Algae are photoautotrophic, i.e. perform autotrophic mode of nutrition by performing photosynthesis due to the presence of chlorophyll in their chloroplast.

11 (*d*) Option (d) is correct. Algae are predominantly aquatic and occur in both marine as well as freshwater habitats. Some are terrestrial and grow in moist places like moist stones, soils and wood. Some of them also occur in association with fungi (lichen) and animals (e.g. on sloth bear).

12 (*b*) *Volvox* is a freshwater, green, hollow ball-like colonial alga. Its colony has a fixed number of cells (500-60,000) and is called coenobium.

14 (*c*) In algae, vegetative reproduction mainly takes place by fragmentation where the parent body breaks into multiple, small-sized fragments. Each of these fragments then grows and develops into new organisms. Algae also perform asexual and sexual modes of reproduction. Asexually algae reproduce by means of motile or non-motile spores. Sexual reproduction occurs through fusion of two gametes.

15 (*c*) Algae produce different types of spores, the most common being the zoospores. These are motile, flagellated and give rise to new plants on germination.

17 (*b*) Anisogamous means fusion of two morphologically dissimilar gametes, which may be motile or non-motile, e.g. in *Eudorina.*

18 (*c*) Oogamous means fusion of a large non-motile (static) female gamete or ovum with a smaller motile gamete (except in Rhodophyceae), e.g. in *Chlamydomonas*, *Fucus*, *Chara* and *Volvox*.

19 (*b*) The correct option is (b).

A– *Volvox*– Colonial algae with parent and daughter colony.

B– *Ulothrix*–Filamentous algae.

C– *Laminaria*–Brown algae having frond, stipe and holdfast.

20 (*b*) The correct option is (b). As A and B are *Fucus* and *Polysiphonia*, respectively. These are brown algae. C and D are *Porphyra* and *Dictyota*, respectively. These are red algae.

22 (*c*) Agar is a jelly-like substance, commercially obtained from algal species, like *Gelidium* and *Gracilaria*. Agar is used to grow microbes *in vitro* and in the preparation of ice-creams and jellies.

24 (*b*) *Chlorella* is a potential food source because it is high in protein and other essential nutrients. When dried, it contains about 45% protein, 20% fat, 20% carbohydrate, 5% fibres and 10% minerals and vitamins.

25 (*c*) *Chlorella* is used for purifying air in space ships. It is also used as food supplements by space travellers.

26 (*b*) *Spirulina* (a blue-green alga) is a rich source of protein, many vitamins, especially B-complex and minerals. Hence, doctors often advise the patients to take *Spirulina* in their diet for recovery.

27 (*c*) The members of class–Chlorophyceae are commonly called green algae due to the dominance of chlorophyll pigment localised in chloroplast in their cells which gives them greenish appearance.

29 (*d*) In class–Chlorophyceae, the cells possess one or more chloroplasts. The shape of chloroplasts may be

Cup-shaped — *Chlamydomonas*

Spiral — *Spirogyra*

Reticulate — *Chlamydomonas reticulata*

Disc-shaped — *Chara*

30 (*c*) The chloroplast of *Ulothrix* is girdle-shaped, containing one or more pyrenoids. *Ulothrix* is a freshwater alga growing on substratum like rocks, sand, etc.

32 (*c*) Most of the members of Chlorophyceae have one to many storage bodies called pyrenoids located in the chloroplasts. Pyrenoids contain protein besides starch.

33 (*c*) Pyrenoids are proteinaceous bodies present within the chloroplast. These mainly synthesise and store starch. In members of Chlorophyceae, pyrenoid has a central protein and a surrounding starch sheath.

34 (*c*) The members of class–Chlorophyceae usually have a two layered rigid cell wall made up of cellulose and pectose. Inner layer of cell wall is made up of cellulose, while outer layer is made up of pectose.

36 (*d*) Isogamy with non-flagellated gametes is seen in *Spirogyra*. It can reproduce both by sexual and asexual (vegetative) means.

37 (*a*) Eyespot is seen in *Chlamydomonas*. It is a microscopic, eukaryotic, unicellular, pyriform, biflagellate alga. The alga possesses a cup-shaped chloroplast with a red eyespot or stigma and a pyrenoid for storing starch.

38 (*d*) Zygotic meiosis is represented in the haplontic life cycle of many algae including *Chlamydomonas*. In such a life cycle, all cells are haploid except zygote. This is because meiosis occurs in the zygote itself, resulting into four haploid cells that give rise to haploid plants.

Other options like *Fucus* exhibit diplontic cycle, while *Marchantia* and *Funaria* both exhibit haplo-diplontic cycle.

39 (*c*) Plamella stage is present in *Chlamydomonas*, as a means of asexual reproduction. During adverse condition, parent *Chlamydomonas* forms a colony of hundreds and thousands of daughter cells in an aggregate, which are immobile and non-flagellated. All cells of such palmella stage develop flagella and become mobile and escape from the colonial aggregate when favourable conditions arise.

40 (*b*) Most of the members of brown algae are marine, except three–*Pleurocladia, Heribaudiella* and *Bodanella*, which are found in freshwater habitats.

41 (*b*) Brown algae show great variation in size and form. They range from simple branched, filamentous forms (*Ectocarpus*) to profusely branched forms as represented by kelps, which may reach a height of 100 metres.

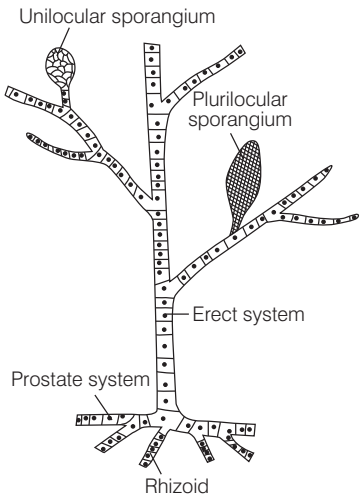
43 (*b*) Brown algae vary in colour from olive green to various shades of brown depending upon the amount of the xanthophyll pigment, fucoxanthin present in them.

44 (*c*) In brown algae, food is stored as complex carbohydrates, which may be in the form of laminarin or mannitol.

45 (*a*) Types of pigments present in the cell impart distinct colours to the algal body hence, it is the most important character for classification of algae.

47 (*c*) *Laminaria* is an example of class–Phaeophyceae (brown algae). Their plant body is usually attached to the substratum by a holdfast and has a stalk, the stipe and leaf-like photosynthetic organ, the frond. Other examples, i.e. *Volvox*, *Chara* and *Chlamydomonas* are green algae.

49 (*b*) A heterotrichous thallus is one which is differentiated into a well-developed prostrate and an upright (erect) regions. It is shown by *Ectocarpus*, a filamentous marine brown alga.



Ectocarpus

52 (*a*) Phycoerythrin is present in *Polysiphonia* (red algae), which is the characteristic red colour pigment present in them. *Laminaria* is brown algae, kelps and *Chlamydomonas* are green algae.

54 (*c*) Option (c) is wrongly matched. This can be corrected as

Polysiphonia is a red algae. There gametes are non-motile, i.e. without flagella.

Rest of the options are correct.

55 (*b*) *Cephaleuros* is a parasitic thalloid green alga. Its common name is red rust. This alga is parasitic on some economic important plants of the tropics and subtropics, e.g. tea, guava, mango, coffee, etc. It damages the area with algal growth on leaves, kills the new shoots and disfigure fruit.

56 (*d*) Option (d) is wrongly matched and this can be corrected as

Volvox is a freshwater green alga. It occurs in colonies or coenobium (in definite number or group), surrounded by a pellicle (gelatinous glycoprotein) layer. Each pyriform-shaped cell has two long, similar and smooth flagella, i.e. flagellated.

58 (*a*) Bryophytes are the oldest (most primitive) plant type in terms of evolution, these include liverworts and mosses. The fossil records of these plants, so far been found dated back to almost 500 million years ago. Among bryophytes liverworts appeared first and mosses appeared later.

61 (*b*) Mosses grow in moist and humid places because they require water for fertilisation. The antherozoids (male gametes) are released into water where they swim and reach the archegonium (female sex organ). An antherozoid then fuses with the egg to produce the zygote which later forms a multicellular body called sporophyte.

62 (*b*) The plant body of bryophytes is multicellular, thallus- like, prostate or erect and fixed to soil by unicellular or muticellular rhizoids. These rhizoids are extensions of lower epidermal cells and are similar in function like of root hairs in vascular plants.

63 (*d*) True roots, stem and leaves having vascular supply are absent in bryophytes, but root-like, non-vascular rhizoids leaf-like and stem-like structures are present.

65 (*d*) Bryophytes show vegetative and sexual reproductions. Vegetatively, they reproduce by fragmentation of thallus and sexually by gametes.

66 (*d*) The life cycle of bryophytes consists of two distinct phases.

(i) The gametophytic phase (*n*)

(ii) The sporophytic phase (2*n*)

The haploid gametophyte is dominant, long lived green and independent, whereas the diploid sporophyte is short lived and dependent upon the gametophyte.

68 (*d*) The only positive evidence for aquatic ancestry of bryophyte is ciliated sperms. Each sperm usually consists of minute, slender, spirally curved body furnished with two long, terminal whiplash type flagella.

69 (*b*) Option (b) is incorrect and can be corrected as

Antheridium is multicellular male sex organ in bryophytes. It produces biflagellated male gametes, i.e. antherozoids.

70 (*d*) The older dead parts of *Sphagnum* are slowly carbonised, compressed and fossilised over thousands of years to produce a dark spongy moss called peat.

71 (*c*) *Sphagnum*, a moss, provides peat that has been long used as fuel. It is also used as packing material for trans shipment of living material, because of its capacity to hold water.

72 (*d*) Bryophytes show considerable economic importance. They colonise barren rocks along with lichens and decompose rocks (ecological succession). When they grow on rocks, they help in soil formation. Some bryophytes also work as soil binders when they grow in aggregations forming dense mats on the soil. This reduces the impact of rainfail thus, preventing soil erosion.

73 (*a*) Mosses prevent soil erosion. Mosses are ecologically important as they serve as significant soil cover and prevent soil erosion by binding soil with their tiny rhizoids. Their carpet like growth particularly in slopy areas also facilitate easier percolation of water.

74 (*b*) In the given figure, the labels are as follows

A–Capsule–It is a pear-shaped structure situated at the top of seta. Its function is production and dispersal of spores.

B–Seta–It is a long slender stalk-like structure bearing capsule at top.

C–Sporophyte–It is the plant body bearing spores producing structure.

D–Gametophyte–It is the plant body on which male and female gametes producing structures are borne.

76 (*b*) The given figure is of *Marchantia* (thallus).

The correct labels are as follows

A–Archegoniophore–A stalk-like structure on which archegonium are borne.

B–Antheridiophore–A stalk-like structure (gametophore) that bears antheridia.

C–Gemma cup–These are special vegetative, small cup shaped structures borne along the midrib on the dorsal surface of gametophyte of some bryophytes.

77 (*d*) The given plant body with antheridia, rhizoids and stalk-like sporophyte shows that it is a bryophyte. In a bryophyte, sporophyte is diploid ($2n$) formed from zygote. Antheridium is male sex organ which is haploid (n). It produces haploid male gametes. Rhizoids are haploid as they are the part of main plant body which is haploid in bryophytes.

78 (*a*) Liverworts constitute lower bryophytes. Bryophytes include liverworts and mosses. Out of these two liverworts are very small plants. The body is thallus-like dorsiventral and closely appressed to the substratum. Whereas, mosses are also small plants, but are have creeping and branched.

Thus, liverworts are called lower bryophytes not mosses.

79 (*a*) *Marchantia* is a liverwort with dorsiventral lobed thallus-like plant body. Rest options are mosses.

80 (*a*) Liverworts reproduce asexually by the formation of specialised structure called gemmae or through fragmentation of thalli. Gemmae are asexual buds, which originate from small receptacles called gemma cups located on the thalli.

82 (*a*) The predominant stage of the life cycle of a moss is the gametophyte, which consists of two stages. The first stage is (A) protonema stage, which develops directly from a spore. The second stage is (B) leafy stage, which develops from the secondary protonema as a lateral bud.

83 (*b*) The protonema is a stage in the life cycle of *Funaria.* Protonema is the creeping green branched and frequently filamentous juvenile stage of moss. It results from the germination of spores. Other options like *Pinus* is a gymnosperm and all bryophytes do not show protonema. This stage is only found in mosses. Thus, *Riccia* (liverwort) does not have protonema stage.

84 (*d*) Primary protonema is formed by spore germination whereas secondary protonema is formed by other vegetative part of plant like leaf, stem, rhizoids rather than spores. The secondary protonema is developed into the leafy gametophytes as the part of vegetative reproduction in mosses.

85 (*b*) The main plant body of *Funaria* is gametophyte which is haploid. The leafy stage and protonema stage are the part of gametophytic plant body, therefore will have same ploidy. Thus, if the leaf of *Funaria* has 5 chromosomes, the primary protonema will also have 5 chromosomes.

87 (*c*) Rhizoids are meant for the purpose of attachment or anchorage to the substratum in mosses. On the lower portion of leafy gametophore of moss, numerous branched multicellular rhizoids with oblique septa are present.

89 (*c*) In moss, the sporophyte is differentiated into foot, seta and capsule. Capsule bears spores, which give rise to gametophyte after meiosis, e.g. *Funaria, Polytrichum* and *Sphagnum*.

90 (*c*) In bryophytes, the sex organs (gametangia) are multicellular and jacketed. The jacket constituted by sterile cells around the sex cells (i.e. sperm and an egg) is an adaptation towards the life on land.

92 (*a*) In mosses, the sporophyte developing from the embryo is a simple structure without rhizoids and is differentiated into foot, seta and capsule. It is parasitic (partially or wholly) on the gametophyte as it is attached and is nutritionally dependent upon the gametophyte.

93 (*b*) In mosses, the haploid gametophyte is dominant, long lived, green and independent, whereas the diploid sporophyte is short lived and attached to the gametophyte as it is dependent on it for nutrition.

94 (*b*) *Buxbaumia aphylla* is a saprophytic bryophyte as it does not produce abundant chlorophyll for photosynthesis. Its nutritional needs are met by fungi that grow within the plant.

96 (*d*) Option (d) is incorrect and can be corrected as Bryophytes are autotrophic, but their sporophyte is dependent on gametophyte.

97 (*d*) All the statements are true. Bryophyta is a group of embryo producing plants, which do not bear fruits, seeds and any vascular tissue. Plant body is thalloid and green (due to the presence of chloroplast). Male sex organ is antheridium and female sex organ is archegonium.

98 (*c*) Cells of sporophyte undergo meiosis to produce haploid cells called spores. As these spores are haploid in nature, it means each spore further divides to develop into the multicellular haploid generation of a plant. Thus, the number of chromosomes in leaf as well as in the spore will be same, i.e. $n = 20$.

100 (*a*) Pteridophytes mostly occur in cool, damp and shady places. Pteridophytes are fundamentally terrestrial plants, but they are dependent on an external source of water for completion of their life cycle.

101 (*b*) Pteridophytes are considered as first terrestrial plants to possess vascular tissues, xylem and phloem. All their vegetative parts possess vascular tissues (i.e. xylem and phloem) organised in definite groups.

102 (*b*) Pteridophytes are called vascular cryptogams because among cryptogams, (i.e. the non-seed bearing plants) the vascular strands are present only in pteridophytes.

103 (*b*) Dominant phase in ferns is sporophyte ($2n$), which is differentiated into root, stem and leaf.

104 (*b*) In pteridophytes, the sporophyte consists of leaf-like appendages called sporophylls. Sporophylls in cluster forms a distinct compact structure called strobili or cones, e.g. *Selaginella* and *Equisetum*.

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

107 (*c*) In several primitive simple plants–like algae, bryophytes and pteridophytes, water is the medium through which male gametes are transferred to the female reproductive organ or gamete to bring about fertilisation.

108 (*a*) In pteridophytes (ferns), the haploid spores germinate to form an inconspicuous, small but multicellular, free-living and mostly photosynthetic prothallus. It is monoecious, i.e. bears both the antheridia or male sex organ (♂) and archegonia or female sex organ (♀).

110 (*b*) Prothallus of the fern produces gametes. In ferns, spores germinate to give rise to thalloid gametophyte called prothallus. These gametophytes bear sex organs which produce gametes. Therefore, prothallus produces gametes.

111 (*d*) *Lycopodium, Equisetum, Psilotum* are homosporous. Those plants which produce only one kind of spores are called homosporous.

112 (*b*)The spores are homosporous and germinate to produce independent cushion-like monoecious gametophyte.

113 (*a*) *Salvinia* and *Selaginella* are example of heterosporous plants that produce two kinds of spores, i.e. a macrospore and microspore.

114 (*b*) Heterospory is the production of two kinds of spores, large (mega) and small (micro) spores in some pteridophytes.

116 (*b*) From the evolutionary point of view, pteridophytes were the first to show the retention of female gametophyte with young embryo on the parent sporophyte for some time. It also represents the origin of seed habit during the course of evolution of seed plants.

119 (*b*) The given figure is of *Equisetum*. Its correct labels are as follows

A–Strobilus–Reproductive structure bearing many sporophylls.

B–Node–The place on which branches arises.

C-–Branch

121 (*d*) Ferns exhibit alternation of dominant sporophyte generation with an inconspicuous gametophyte generation (heteromorphic).

122 (*b*) Pteridophytes are vascular cryptogams. They generally produce spores, but do not produce seeds or flowers.

123 (*c*) *Adiantum* is called walking fern. The name is derived from the fact that new plantlets grow wherever the arching leaves of the parent plant body touch the ground, creating a walking effect.

124 (*b*) Gymnosperms are plants in which the ovules are not enclosed by any ovary wall and remain exposed. Thus, the seeds that develop post-fertilisation are not covered or are naked. This is a characteristic feature of gymnospermic plants.

125 (*c*) Conifers are gymnosperms. Their leaves show xerophytic adaptations. The leaves are like needle with thick-walled, single-layered epidermal cells covered with thick cuticle. This enables them to tolerate extreme climatic conditions.

127 (*d*) In *Pinus* (Gymnosperms), the gametophyte does not have an independent free-living existence. They remain within the sporangia retained on the sporophytes.

128 (*b*) Coralloid roots are developed in *Cycas*. It contains an algal zone in the cortex region of roots. This algal zone contains N_2 - fixing cyanobacteria like *Nostoc, Anabaena,* which grow in symbiotic association with the coralloid roots.

129 (*d*) The stems are unbranched in *Cycas*. In *Cycas*, leaves are reduced and pinnate, the male or female cones or strobili are borne on different trees. In *Cycas*, the archegonia are embedded in the female gametophytes and open into the archegonial chamber.

130 (*d*) The leaves of gymnosperms are well-adapted to withstand extremes of temperature, humidity and wind. Their xeric adaptations include a thick cuticle, sclerified epidermal cells, needle-like leaves, sunken stomata, a sclerotic hypodermis, tightly packed mesophyll, an endodermis, few or no lateral veins and centrally located vascular tissue.

131 (*c*) Cycads are heterosporous and dioecious. Dioecious plants are unisexual, having male and female reproductive organs on different individuals (plants).

132 (*c*) Zooidogamy is found in *Cycas*. It is a type of plant reproduction in which male gametes called antherozoids, reach the female gametes called archegonium, by swimming in a path of water. It is also found in algae, bryophytes, pteridophytes and some gymnosperms.

133 (*a*) Among the given options, option (a) is mismatched. *Pinus* is a monoecious plant as it bears male and female cones on the same plant.

134 (*c*) In *Pinus*, each male cone consists of an elongated axis, bearing a number of spirally arranged microsporophylls. On the underside of which two microsporangia develop and get filled with microspores (pollen grains).

135 (*d*) Microsporangia are produced at the extreme tip of microsporophyll. Microsporangia is a sporangium that produces spores that give rise to male gametophyte.

136 (*a*) In gymnosperms, microspores develop into a male gametophytic generation, which is highly reduced and is confined to only a limited number of cell. This reduced gametophyte is called a pollen grain. Its development takes place in microsporangia.

139 (*b*) The cones bearing megasporophylls with ovules are called female strobili or megasporangia or macrosporangiate.

140 (*a*) In gymnosperms, the nucellus is protected by envelops and this composite structure is called ovule. Each ovule is actually the female spore-producing organ surrounded by a protective envelope called integuments.

142 (*c*) In gymnosperms, megaspores develop into multicellular structure called female gametophyte that bears two or more archegonia or female sex organs.

144 (*b*) Option (b) is correct. Gymnosperms are heterosporous, i.e. they produce haploid microspores and megaspores. The two kinds of spores are produced within sporangia that are borne on sporophylls which are arranged spirally along an axis to form lax or compact strobili or cones. Two types of sporophylls, microsporophylls and megasporophylls are usually aggregated to form distinct cones or strobili, pollen cones (male cones) and seed cones (female cones), respectively. Thus, option (b) correctly represents the arrangement of reproductive structures in gymnosperm.

145 (*b*) In gymnosperms, pollen grains are released from microsporangium and carried with the help of air currents. It comes in contact with opening of ovule borne on megasporophylls.

146 (*a*) In gymnosperms, the dominant phase is sporophyte. Gymnosperms are heterosporous plants that produce haploid megaspores and microspores. These spore bearing plants are called sporophytes.

149 (*d*) Sago is a kind of starch obtained from cortex and pith of stem and seeds of *Cycas*.

Wood of *Taxus* is heaviest amongst softwood and is used in making bows of archery. Resins are obtained from many species of *Pinus*. Essential oils are obtained from *Cedrus*, *Tsugo*, *Juniperus*, *Dicea*, etc.

150 (*c*) Division/Phylum–Angiospermae is sometimes called division–Anthophyta (*Anthe*–flower; *phyto*–plant) because the common name for this group is the 'flowering plants'.

153 (*a*) Angiosperm seeds are enclosed by fruits whereas gymnosperms have naked seeds. Thus, angiosperms differ from gymnosperms in having fruits.

154 (*b*) The smallest flowering plant in the plant kingdom is aquatic plant called *Wolffia*. It is commonly known as watermeal or duckweed.

155 (*d*) The tallest tree species among the given is *Eucalyptus*, which is approximately 100 metres high.

156 (*c*) Angiosperms are divided into two classes Dicotyledons and Monocotyledons based on the number of cotyledons in their seeds. Dicotyledons have two cotyledons in their seed and monocotyledons have one.

157 (*c*) In angiosperms, flower bears male and female sex organs. Male sex organ is stamen. Anther produces pollen grains. Female sex organ is carpel, also known as pistil/gynoecium.

160 (*c*) Embryo sac is the female gametophyte in the angiosperms. It is 7-celled and 8-nucleate structure.

161 **(***d*) An ideal embryo sac contains 7-celled and 8-nuclei. 3 cells are present at the micropylar end and form egg apparatus, middle cell forms egg cell and rest two laterally occurring cells forms the synergids. One cell is present in the centre of embryo sac, known as central cell and contains two nuclei. The rest three cells are present at chalazal end and known as antipodal cells.

163 (*b*) Option (b) is incorrect. This can be corrected as Megaspore also called macrospores, are a type of spore that is present in heterosporous plant. Megaspores are haploid cells which produce female gametophyte after division.

165 (*b*) Pollen grains from anther after dispersal reach to the stigma of ovary with the help of various agents like wind, insects, etc. This process is known as pollination.

166 (*a*) Pollen tube carries two male gametes and discharges them into the embryo sac. In angiosperms, pollen grain reaches to embryo sac through pollen tube after its germination on stigma.

167 (*d*) As the anther in angiosperm grows each of its cell goes through meiotic divisions, forming a tetrad. These cells are called microspores. Each one of these microspores eventually becomes a pollen grain.

169 (*d*) Double fertilisation is the fusion of two male gametes to two different cells of the same female gametophyte. It consists of following two events

(i) **Syngamy** Fusion of the egg nucleus with one male gamete is called syngamy.

(ii) **Triple fusion** It is the fusion of second male gamete and secondary nucleus.

172 (*b*) Endosperm in angiosperms develops as a fusion product of secondary nucleus with male gamete. Secondary nucleus is a diploid structure formed by the fusion of haploid chalazal polar nucleus and haploid micropylar polar nucleus. Zygote is formed by the fusion of a male gamete with egg.

173 (*c*) In the angiosperm ovule, central cell of the embryo sac prior to the triple fusion, contains two haploid polar nuclei. Triple fusion in angiosperm is the fusion of second sperm with two polar nuclei or the secondary nucleus, which results in the formation of a triploid primary endosperm nucleus.

174 (*c*) After fertilisation, the ovules develops into seeds while ovary develops into fruits.

177 (*c*) *Lilium* (angiosperm) possesses the male gametophyte with least number of cells.

The number of cells in male gametophyte shows the pattern of reduction from bryophytes to angiosperms. In angiosperms, it is reduced to about 2-3 celled and called as pollen grains. The number of cells in male gametophyte decreases in the following order

Funaria > *Pteris* > *Pinus* > *Lilium*

178 (*a*) In the alternation of generations, the sporophytic generation is 2*n* (diploid) and the gametophytic generation is *n* (haploid).

179 (*b*) In plants with haplontic life cycle, the dominant, photosynthetic phase is represented by the free-living gametophyte while sporophyte generation is represented by a single-celled zygote only.

180 (*c*) Option (c) is incorrect. It can be corrected as

Meiosis in the zygote results in the formation of haploid spores.

182 (*a*) Haplo-diplontic life cycle is an intermediate condition followed by bryophytes and pteridophytes. In this case, sporophytic as well as gametophytic phase are multicellular.

184 **(***a*) A–**Haplontic**–The dominant multicellular phase is gametophytic or haploid.

B–**Diplontic**–The dominant multicellular phase is diploid or sporophytic.

C–**Haplo-diplontic**–The gametophytic (multicellular) and sporophytic (multicellular) both phases are dominant.

185 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Artificial system separated the closely related species since they were based on a few characteristics like habit, colour, number and shape of leaves. They were based mainly on vegetative characters or on the androecium structure.

It gave equal weightage to vegetative and sexual characterstics of an organism. This is not acceptable since we know that often the vegetative characters are more easily affected by environment.

186 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Algae are of paramount important as primary producers of energy rich compounds which form the basis of the food cycles of all aquatic animals. Many species of *Porphyra, Laminaria* and *Sargassum* are among the 70 species of marine algae used as food.

Algae also perform CO_2-fixation on earth through photosynthesis. They increase the level of dissolved oxygen in their immediate environment.

187 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Coral reefs are formed by the accumulation of calcareous exoskeletons of coral animals, calcareous red algae and molluscs. In some species of red algae (coralline algae), cell walls become hardened with calcium carbonate. These are important for coral reef formation.

188 (*a*) Both Assertion and Reason are true and Reason is the correct explanation of Assertion.

Bryophytes are the dwellers of transitional habitat between the aquatic and terrestrial habitats. It is represented by the swamps and the areas where water and land meet. It is also called as amphibious zone where mosses, liverworts and hornworts collectively called bryophytes are inhabiting. Since, bryophytes usually grow in amphibious situation and cannot complete their life cycle without external water, are called the amphibians of plant kingdom.

189 (*c*) Assertion is true, but Reason is false.

Bryophytes are a class of kingdom–Plantae. It includes various mosses and liverworts, that are found in moist shaded areas in hilly regions.

Reason can be corrected as

Algae, fungi, lichens are not included in bryophytes.

190 (*a*) Assertion and Reason are true and Reason is the correct explanation of Assertion.

In the life cycle of *Funaria*, two distinct phases occur. One of these is represented by a haploid, independent, leafy moss plant (gametophyte) which alternates with the other, represented by diploid, leafless sporogonium (short-lived sporophyte), which is totally or partially dependent on the leafy gametophyte for its nutrition.

191 (*d*) Assertion is false, but Reason is true. Assertion can be corrected as

Lycopodium is homosporous pteridophyte, i.e. they produce similar kind of spores, while *Selaginella, Stylies, Isoetes, Salvinia, Azolla, Pilularia, Regnellidium* and *Marsilia* are heterosporous pteridophytes, i.e. the spores produced by them one of two kinds macro (large) and micro (small) spores.

192 (*c*) Assertion is true, but Reason is false and it can be corrected as

Production of two different types of spores is called heterospory. It is an important pre-requisite of evolutionary development in the vascular plants. It

ultimately leads to seed development. In pteridophytes, *Selaginella* plant (not *Lycopodium*) is the precursor of the seed habit, as it is well-marked in them. In *Lycopodium*, homosporous spores are produced, i.e. all spores are of similar kind.

193 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Selaginella is a pteridophyte. In them two kinds of spores, macro (large) and micro (small) spores are produced. This phenomenon is called heterospory. The megaspores and microspores germinate and give rise to female and male gametes, respectively. The female gametophytes in these plants are retained on the parent sporophytes for variable periods. The development of the zygotes into young embryos take place within the female gametophytes. This event is a precursor to the seed habit and considered an important step in evolution.

Psilotum is a pteridophytic plant also known for having primitive pteridophytic characters, so is known as living fossil.

194 (*b*) Both Assertion and Reason are true, but Reason is not the correct explanation of Assertion.

Cycas is a gymnospermic plant in which fertilisation process is called zooidogamy as male gemetes or sperms swim through thin film of water to reach egg cell. Fertilisation in *Cycas* may also take place by siphonogamy, i.e. pollen tube is formed through which male nucleus passes.

195 (*c*) Statement in option (c) is correct. Other options are incorrect and can be corrected as

- Artificial system of classification was given by Linnaeus.
- It was based on only gross superficial morphological characters such as habit, colour, number and shape of leaves, etc.
- Natural system was based on natural affinities present among organisms also considering both external and internal features.

196 (*d*) Statement in option (d) is incorrect and can be corrected as

Ulothrix is a filamentous alga and *Volvox* is a colonial form.

Rest of the statements are correct.

197 (*b*) Statement in option (b) is incorrect and can be corrected as

Algin is extracted from brown algae, e.g. *Laminaria*, etc., is a hydrocolloid used in shaving creams, jellies, flameproof plastic, etc. Carrageenan is extracted from red algae like *Chondrus* and used as emulsifier and clearing agent.

Rest of the statements are correct.

198 (*d*) Statement in option (d) is incorrect and can be corrected as

Mannitol is stored food in Phaeophyceae (not in Rhodophyceae). The floridean starch is stored carbohydrate of red algae.

Rest of the statements are correct.

202 (*d*) Statements in options (b) and (c) are incorrect with respect to bryophytes. These statements can be corrected as

- In bryophytes, each sperm usually consists of minute, slender, spirally curved body furnished with two long, terminal whiplash type flagella. The sperms are liberated from antheridia, swim in a film of water and attracted towards the archegonium.
- They enter into the archegonia and fertilise the egg and form zygote. Zygotes do not undergo reduction division immediately. They produce a multicellular body called a sporophyte in which meiosis occurs to form haploid spores.

Rest of the statements are correct.

205 (*d*) Statement in option (d) is correct. Other statements are incorrect and can be corrected as

- In mosses (bryophytes), protonema and leafy stage is present.
- In gymnosperms, gametophytes are not free-living.
- Antheridiophores and archegoniophores are present in bryophytes.

206 (*b*) Statement in option (b) is incorrect and can be corrected as

Pteridophytes are spore forming, non-seed bearing, non-flowering vascular plants.

Rest of the statements are correct.

207 (*c*) Statement in option (c) is incorrect. It can be corrected as

The gymnosperms are heterosporous, they produce haploid microspores and megaspores.

Rest of the statements are correct.

208 (*b*) Statement in option (b) is correct. *Sequoia* is one of the tallest tree species, known as red wood tree. It is a gymnospermic plant.

Other statements are incorrect and can be corrected as

Salvinia is an angiosperm, but *Ginkgo* and *Pinus* are gymnosperms. Gymnosperms leaves are well-adapted to extremes of climate and are heterosporous.

209 (*c*) Statement in option (c) is correct. Other statements are incorrect and can be corrected as

- Horsetail is the common name of *Equisetum.*
- Pteridophytes like *Selaginella* and *Salvinia* are heterosporous and possess two types of spores, i.e. microspores and megaspores.
- *Cycas* has an unbranched columnar stem while *Cedrus* possess branched stem.

210 (*c*) Statements I, II and III are correct. Statement IV is incorrect and can be corrected as

The sporophyte in mosses is more elaborate than in liverworts.

211 (*d*) Statements I, II and III are correct. Statement IV is incorrect and can be corrected as

Volvox is a colonial green alga with motile cells.

214 (*a*) Statements I and II are correct. Statement III is incorrect and can be corrected as

In red algae, the cell wall is made up of cellulose, pectic compounds and certain mucopolysaccharides called phycocolloids.

220 (*c*) Statements I, IV and V are correct. Other statements are incorrect and can be corrected as

- *Selaginella* species are creeping or ascendant plants and produce heterospores (megaspores and microspores).
- Coralloid roots are developed in *Cycas*. It develops as cluster at base of stem. It is dichotomously branched and greenish-brown in colour. It contains *Nostoc* and *Anabaena,* which grow in symbiotic association with coralloid root.

221 (*c*) Statements II and III are correct. Statement I is incorrect and can be corrected as

The rhizoids in *Funaria* arise from the basal region of the stem, which function as roots. These are multicellular and branched.

225 (*d*) Statement I is incorrect and can be corrected as

In gymnosperms, the sporophytic phase is dominant and the gametophytic phase is dependent on sporophyte.

Rest of the statements are correct.

226 (*a*) Angiospermic plants are characterised by double fertilisation and triploid endosperm. This can be explained as

In angiosperms, one male gamete fuses with ovum to form diploid zygote and the second male gamete fuses with diploid secondary nucleus to form the triploid primary endosperm nucleus, which develops into endosperm. This process is called double fertilisation. The endosperm provides nutrition to the developing embryo.

227 (*a*) Statement I is correct. Gametophyte is gamete bearing, haploid, multicelled stage of many plants.

Other statements are incorrect and can be corrected as

- Gametophytic stage is haploid generation.
- Sporophytic stage produces spores.
- Gametophytic stage is not related with vascular tissue production.

238 (*d*) All the three groups of plants, i.e. mosses, liverworts and pteridophytes bear archegonia as their female sex organ.

240 (*c*) Option (c) is correct as

In the members of class–Phaeophyceae, the plant body is usually attached to the substratum by a holdfast and has a stalk called stipe and a leaf-like photosynthetic organ called frond.

241 (*d*) Bryophyta is a group of plants, which have gametophytic haploid thalloid body. The motile male gametes 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.

242 (*b*) The embryo sac of an angiosperm is made up of 7 cells and 8 nuclei. These 7 cells include two synergids, three antipodal cells, one egg cell and one central cell. The 8 nuclei are of each mentioned cell except two polar nuclei of central cell.

243 (*c*) Endosperm is a product of triple fusion. One male nucleus ($n=18$) 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.

245 (*b*) Statements II, III and IV are correct. Statement I is incorrect and can be corrected as

The sporophyte in mosses is more elaborate than that in liverworts.

246 (*c*) Prothallus is a gametophytic free-living structure in the life of a pteridophytes. Spores of pteridophyte germinates to give rise to a short-lived inconspicuous, small but multicellular, heart-shaped, free-living, mostly photosynthetic thalloid gametophytes called prothallus.

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

The plant body is diploid with dominant sporophytic phase. They show diplontic life cycle.

248 (*a*) A protonema is a thread-like chain of cells that forms the first stage (the haploid phase) of the life cycle of mosses.

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