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DISHA™ Publication Inc

DISHA Publication Inc.

A-23 FIEE Complex, Okhla Phase II

New Delhi-110020

Tel: 49842349/ 49842350

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Free Sample Contents

Class XI

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ISBN - 978-9362254931

MRP- 1000/-

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NOTE* These Topics are in new NCERT, but not in the new NEET 2024 Syllabus. These Topics have been retained in the book so as to match NCERT and any future amendments in NEET.
Questions on these Topics have also been marked with a * in the respective Exercises of the Chapters.

Botany

3 Plant Kingdom

Trend Analysis NEET

	NEET	Remarks
Number of Questions from 2024-18	21	2-3 Questions every year
Weightage	3.2%	

			NEET	
Year	Topic Name	Concept Used	No. of Questions	Difficulty Level
2024	Algae	Phaeophyceae	1	Difficult
2023	Bryophytes/ Pteridophytes/ Gymnosperms	Reproduction/ Reproduction/ Pinus	3	Easy/ Difficult
2022	Algae/ Pteridophyta	Classification of algae/ Reproduction	4	Easy/ Difficult
2021	Algae/ Bryophytes/ Pteridophytes	Reserve food Material/ Spores/ Phaeophyceae	4	Easy/ Average
2020	Algae/ Pterido Phytes/ Gymnosperms	Rhodophyceae/ Reproduction	5	Easy/ Average/ Difficult
2019	Gymnosperms/ Pteridophyte	Pinus/ General characteristics of Pteridophytes	2	Average/ Difficult
2018	Gymnosperms/ Bryophytes	Features of Gymnosperms/ Reproduction	2	Average/ Difficult

NCERT ONE-LINERS
(Important Points to Remember)

3.0 Introduction

- **Whittaker (1969)** wherein he suggested the Five Kingdom classification viz. **Monera**, **Protista**, **Fungi**, **Animalia** and **Plantae**.
- Fungi, and members of the Monera and Protista having cell walls have now been excluded from Plantae though earlier classifications placed them in the same kingdom.
- So, the **cyanobacteria** that are also referred to as **blue green algae** are not 'algae' any more.
- The earliest systems of classification used only gross superficial morphological characters such as habit, colour, number and shape of leaves, etc. They were based mainly on vegetative characters or on the androecium structure (system given by Linnaeus). Such systems were **artificial;** they separated the closely related species since they were based on a few characteristics.
- The artificial systems gave equal weightage to vegetative and sexual characteristics; this is not acceptable since we know that often the vegetative characters are more easily affected by environment. **NEET 2013**
- As against this, **natural classification systems** developed, which were based on natural affinities among the organisms and consider, not only the external features, but also internal features, like ultrastructure, anatomy, embryology and phytochemistry. Such a classification for flowering plants was given by **George Bentham** and **Joseph Dalton Hooker**.
- At present **phylogenetic classification systems** based on evolutionary relationships between the various organisms are acceptable.
- **Numerical Taxonomy** is based on all observable characteristics.
- Number and codes are assigned to all the characters and the data are then processed. In this way each character is given equal importance and at the same time hundreds of characters can be considered.
- **Cytotaxonomy** that is based on cytological information like chromosome number, structure, behaviour and **chemotaxonomy** that uses the chemical constituents of the plant to resolve confusions, are also used by taxonomists these days.

3.1 Algae

- **Algae** are chlorophyll-bearing, simple, thalloid, autotrophic and largely aquatic (both fresh water and marine) organisms.
- They occur in a variety of other habitats: moist stones, soils and wood.
- Some of them also occur in association with fungi (**lichen**) and animals (e.g., on **sloth bear**).

- The form and size of algae is highly variable, ranging from colonial forms like *Volvox* and the filamentous forms like *Ulothrix* and *Spirogyra* **NEET 2017**
- A few of the marine forms such as **kelps**, form massive plant bodies.
- The algae reproduce by vegetative, asexual and sexual methods.
- Vegetative reproduction is by **fragmentation**. Each fragment develops into a thallus.
- Asexual reproduction is by the production of different types of spores, the most common being the **zoospores**.
- They are flagellated (motile) and on germination gives rise to new plants.
- Sexual reproduction takes place through fusion of two gametes.
- These gametes can be flagellated and similar in size (as in *Ulothrix*) or non-flagellated (non-motile) but similar in size (as in *Spirogyra*). Such reproduction is called **isogamous**.
- Fusion of two gametes dissimilar in size, as in species of *Eudorina* is termed as **anisogamous**.
- Fusion between one large, nonmotile (static) female gamete and a smaller, motile male gamete is termed **oogamous**, e.g., *Volvox*, *Fucus*.

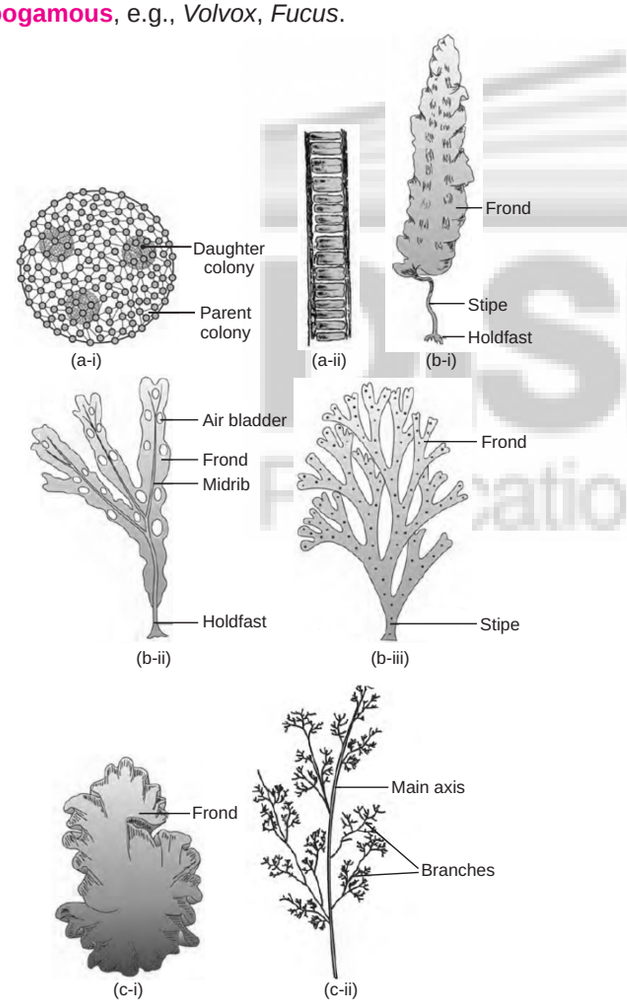


Fig. : Algae :
(a) Green algae (i) Volvox (ii) Ulothrix
(b) Brown algae (i) Laminaria (ii) Fucus (iii) Dictyota
(c) Red algae (i) Porphyra (ii) Polysiphonia

- Algae are useful to man in a variety of ways. At least a half of the total carbon dioxide fixation on earth is carried out by algae through photosynthesis.
- Being photosynthetic they increase the level of dissolved oxygen in their immediate environment.
- They are of paramount importance 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.
- Certain marine brown and red algae produce large amounts of **hydrocolloids** (water holding substances), e.g., **algin** (brown algae) and **carrageen** (red algae) which are used commercially. **AIPMT 2012 & NEET 2021**
- **Agar**, one of the commercial products obtained from *Gelidium* and *Gracilaria* are used to grow microbes and in preparations of ice-creams and jellies.
- *Chlorella* a unicellular alga rich in proteins is used as food supplement even by space travellers.
- The algae are divided into three main classes: **Chlorophyceae, Phaeophyceae** and **Rhodophyceae**.

Chlorophyceae

- The members of chlorophyceae are commonly called **green algae**. The plant body may be unicellular, colonial or filamentous. They are usually grass green due to the dominance of pigments chlorophyll *a* and *b* **AIPMT 2014**
- The pigments are localised in definite chloroplasts. The chloroplasts may be discoid, plate-like, reticulate, cup-shaped, spiral or ribbon-shaped in different species.
- Most of the members have one or more storage bodies called **pyrenoids** located in the chloroplasts. Pyrenoids contain protein besides starch.
- Some algae may store food in the form of oil droplets. Green algae usually have a rigid cell wall made of an inner layer of cellulose and an outer layer of pectose.
- Vegetative reproduction usually takes place by fragmentation or by formation of different types of spores.
- Asexual reproduction is by flagellated zoospores produced in zoosporangia. The sexual reproduction shows considerable variation in the type and formation of sex cells and it may be isogamous, anisogamous or oogamous. Some commonly found green algae are: *Chlamydomonas, Volvox, Ulothrix, Spirogyra* and *Chara*.

Phaeophyceae

- The members of phaeophyceae or **brown algae** are found primarily in marine habitats. They 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.
- They possess **chlorophyll a, c, carotenoids** and **xanthophylls**. **NEET 2024**
- They vary in colour from olive green to various shades of brown depending upon the amount of the **xanthophyll pigment**, **fucoxanthin** present in them.
- Food is stored as complex carbohydrates, which may be in the form of laminarin or mannitol. The vegetative cells have a cellulosic wall usually covered on the outside by a gelatinous coating of **algin**. **NEET 2021, 2024**

- The protoplast contains, in addition to plastids, a centrally located vacuole and nucleus. The plant body is usually attached to the substratum by a **holdfast**, and has a stalk, the **stipe** and leaf like photosynthetic organ – the **frond**.
- Vegetative reproduction takes place by fragmentation. Asexual reproduction in most brown algae is by biflagellate zoospores that are pear-shaped and have two unequal laterally attached flagella. **NEET 2024**
- Sexual reproduction may be **isogamous**, **anisogamous** or **oogamous**. Union of gametes may take place in water or within the oogonium (oogamous species). **NEET 2024**
- The gametes are pyriform (pear-shaped) and bear two laterally attached flagella. The common forms are *Ectocarpus, Dictyota, Laminaria, Sargassum* and *Fucus*.

Rhodophyceae

- The members of rhodophyceae are commonly called **red algae** because of the predominance of the red pigment, **r-phycoerythrin** in their body. Majority of the red algae are marine with greater concentrations found in the warmer areas.
- They occur in both well-lighted regions close to the surface of water and also at great depths in oceans where relatively little light penetrates.
- The red thalli of most of the red algae are multicellular.
- Some of them have complex body organisation.
- The food is stored as **floridean starch** which is very similar to **amylopectin** and **glycogen** in structure. **NEET 2020**
- The red algae usually reproduce vegetatively by fragmentation. They reproduce asexually by non-motile spores and sexually by non-motile gametes.
- Sexual reproduction is oogamous and accompanied by complex post fertilisation developments. The common members are: *Polysiphonia, Porphyra, Gracilaria* and *Gelidium*.

Table 3.1 : Divisions of Algae and their Main Characteristics

Classes	Common Name	Major Pigments	Stored Food	Cell Wall	Flagellar Number and Position of Insertions	Habitat
Chlorophyceae	Green algae	Chlorophyll a, b	Starch	Cellulose	2-8, equal, apical	Fresh water, brackish water, salt water
Phaeophyceae	Brown algae	Chlorophyll a, c, fucoxanthin	Mannitol, laminarin	Cellulose and algin	2, unequal, lateral	Fresh water (rare) brackish water, salt water
Rhodophyceae	Red algae	Chlorophyll a, d, phycoerythrin	Floridean starch	Cellulose, pectin and poly sulphate esters	Absent	Fresh water (some), brackish water, salt water (most)

3.2 Bryophytes

- **Bryophytes** include the various mosses and liverworts that are found commonly growing in moist shaded areas in the hills.

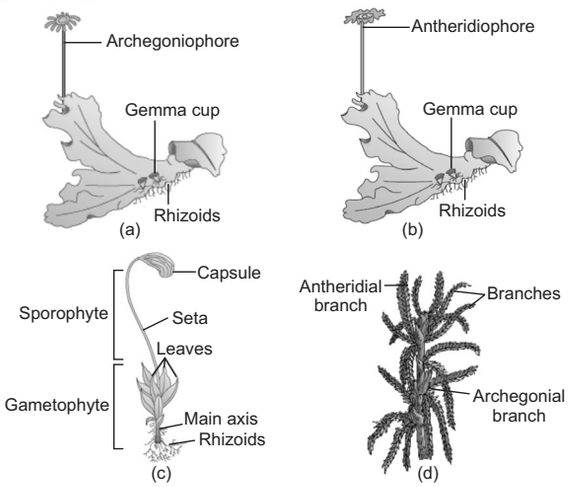


Fig.: Bryophytes: A liverwort – Marchantia (a) Female thallus (b) Male thallus Mosses – (c) Funaria, gametophyte and sporophyte (d) Sphagnum gametophyte

- Bryophytes are also called **amphibians** of the plant kingdom because these plants can live in soil but are dependent on water for sexual reproduction. They usually occur in damp, humid and shaded localities. **AIPMT 2012 & 2015**
- They play an important role in plant succession on bare rocks/soil.
- The plant body of bryophytes is more differentiated than that of algae. It is thallus-like and prostrate or erect, and attached to the substratum by unicellular or multicellular rhizoids.
- They lack true roots, stem or leaves. They may possess root-like, leaf-like or stem-like structures.
- The main plant body of the bryophyte is haploid. It produces gametes, hence is called a **gametophyte**.
- The sex organs in bryophytes are multicellular. The male sex organ is called **antheridium**. They produce biflagellate **antherozoids**. The female sex organ called **archegonium** is flask-shaped and produces a single egg. **AIPMT 2014**
- The antherozoids are released into water where they come in contact with archegonium. An antherozoid fuses with the egg to produce the zygote. Zygotes do not undergo reduction division immediately. They produce a multicellular body called a **sporophyte**.
- The sporophyte is not free-living but attached to the photosynthetic gametophyte and derives nourishment from it. Some cells of the sporophyte undergo reduction division (meiosis) to produce haploid spores. These spores germinate to produce gametophyte.

- Bryophytes in general are of little economic importance but some mosses provide food for herbaceous mammals, birds and other animals. Species of *Sphagnum*, a moss, provide peat that have long been used as fuel, and as packing material for trans-shipment of living material because of their capacity to hold water.
- **Mosses** along with lichens are the first organisms to colonise rocks and hence, are of great ecological importance. They decompose rocks making the substrate suitable for the growth of higher plants.
- Since mosses form dense mats on the soil, they reduce the impact of falling rain and prevent soil erosion. The bryophytes are divided into liverworts and mosses.

Liverworts

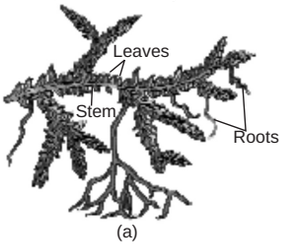
- The liverworts grow usually in moist, shady habitats such as banks of streams, marshy ground, damp soil, bark of trees and deep in the woods.
- The plant body of a liverwort is thalloid, e.g., *Marchantia*. The thallus is dorsiventral and closely appressed to the substrate. The leafy members have tiny leaf-like appendages in two rows on the stem-like structures.
- Asexual reproduction in liverworts takes place by fragmentation of thalli, or by the formation of specialised structures called **gemmae** (sing. gemma). NEET 2021
- Gemmae are green, multicellular, asexual buds, which develop in small receptacles called **gemma cups** located on the thalli.
- The gemmae become detached from the parent body and germinate to form new individuals.
- During sexual reproduction, male and female sex organs are produced either on the same or on different thalli. The sporophyte is differentiated into **a foot**, **seta** and **capsule**. After meiosis, spores are produced within the capsule. These spores germinate to form free-living gametophytes.

Mosses

- The predominant stage of the life cycle of a moss is the gametophyte which consists of two stages. The first stage is the **protonema** stage, which develops directly from a spore. It is a creeping, green, branched and frequently filamentous stage. NEET 2023
- The second stage is the **leafy stage**, which develops from the secondary protonema as a lateral bud. They consist of upright, slender axes bearing spirally arranged leaves.
- They are attached to the soil through multicellular and branched rhizoids. This stage bears the sex organs.
- Vegetative reproduction in mosses is by fragmentation and budding in the secondary protonema.
- In sexual reproduction, the sex organs antheridia and archegonia are produced at the apex of the leafy shoots.
- After fertilisation, the zygote develops into a sporophyte, consisting of a foot, seta and capsule
- The sporophyte in mosses is more elaborate than that in liverworts.
- The capsule contains spores.
- Spores are formed after meiosis.
- The mosses have an elaborate mechanism of spore dispersal. Common examples of mosses are *Funaria, Polytrichum* and *Sphagnum*.

3.3 Pteridophytes

- The Pteridophytes include **horsetails** and **ferns**. Pteridophytes are used for medicinal purposes and as soil-binders. They are also frequently grown as ornamentals.
- They are the first terrestrial plants to possess vascular tissues – **xylem** and **phloem**.
- The pteridophytes are found in cool, damp, shady places though some may flourish well in sandy-soil conditions.
- Pteridophytes, the main plant body is a sporophyte which is differentiated into true root, stem and leaves.
- These organs possess well-differentiated vascular tissues. The leaves in pteridophyta are small (microphylls) as in *Selaginella* or large (macrophylls) as in ferns.
- The sporophytes bear sporangia that are subtended by leaf-like appendages called **sporophylls**.
- In some cases sporophylls may form distinct compact structures called **strobili** or **cones** (*Selaginella, Equisetum*). NEET 2020
- The sporangia produce spores by meiosis in spore mother cells. The spores germinate to give rise to inconspicuous, small but multicellular, free-living, mostly photosynthetic thalloid gametophytes called **prothallus**.
- These gametophytes require cool, damp, shady places to grow.
- Because of this specific restricted requirement and the need for water for fertilisation, the spread of living pteridophytes is limited and restricted to narrow geographical regions.
- The gametophytes bear male and female sex organs called **antheridia** and **archegonia**, respectively. Water is required for transfer of antherozoids – the male gametes released from the antheridia, to the mouth of archegonium.
- Fusion of male gamete with the egg present in the archegonium result in the formation of zygote.
- Zygote thereafter produces a multicellular well-differentiated sporophyte which is the dominant phase of the pteridophytes. In majority of the pteridophytes all the spores are of similar kinds; such plants are called **homosporous**.
- Genera like *Selaginella* and *Salvinia* which produce two kinds of spores, macro (large) and micro (small) spores, are known as **heterosporous**. NEET 2021, 2023
- The megaspores and microspores germinate and give rise to female and male gametophytes, respectively.
- The female gametophytes in these plants are retained on the parent sporophytes for variable periods. NEET 2019
- The development of the zygotes into young embryos take place within the female gametophytes. This event is a precursor to the **seed habit** considered an important step in evolution. NEET 2019
- The pteridophytes are further classified into four classes: Psilopsida (*Psilotum*); Lycopsida (*Selaginella, Lycopodium*), Sphenopsida (*Equisetum*) and Pteropsida (*Dryopteris, Pteris, Adiantum*).



(a)

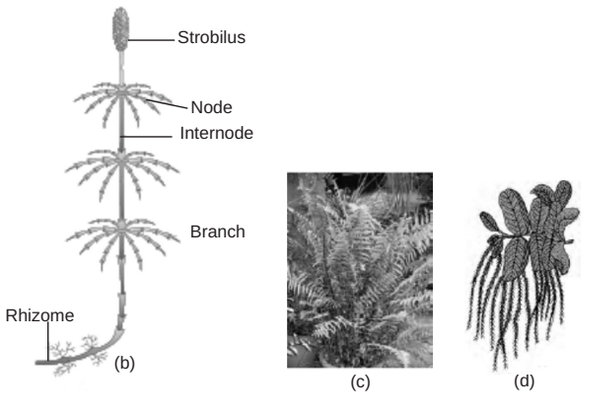


Fig.: Pteridophytes : (a) *Selaginella* (b) *Equisetum* (c) *Fern* (d) *Salvinia*

3.4 Gymnosperms

- The gymnosperms (*gymnos* : naked, *sperma* : seeds) are plants in which the ovules are not enclosed by any ovary wall and remain exposed, both before and after fertilisation.
- The seeds that develop post-fertilisation, are not covered, *i.e.,* are naked. Gymnosperms include medium-sized trees or tall trees and shrubs.
- One of the gymnosperms, the giant redwood tree *Sequoia* is one of the tallest tree species. The roots are generally tap roots. **NEET** 2016
- *Roots* in some genera have *fungal association* in the form of *mycorrhiza (Pinus)*, while in some others (*Cycas*) small specialised roots called **coralloid roots** are associated with N_2- fixing cyanobacteria. **NEET** 2019
- The stems are unbranched (*Cycas*) or branched (*Pinus, Cedrus*). The leaves may be simple or compound. In *Cycas* the pinnate leaves persist for a few years. **NEET** 2019
- The leaves in gymnosperms are well-adapted to withstand extremes of temperature, humidity and wind. In conifers, the needle-like leaves reduce the surface area.
- Their thick cuticle and sunken stomata also help to reduce water loss.
- The gymnosperms are heterosporous; they produce haploid microspores and megaspores. **NEET** 2016 & 2017
- 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**.
- The strobili bearing **microsporophylls** and **microsporangia** are called microsporangiate or **male strobili**.
- The microspores develop into a male gametophytic generation which is highly reduced and is confined to only a limited number of cells.
- This reduced gametophyte is called a **pollen grain**. The development of pollen grains take place within the microsporangia. The cones bearing megasporophylls with ovules or megasporangia are called **macrosporangiate** or **female strobili**.
- The male or female cones or strobili may be borne on the same tree (*Pinus*).
- However, in *cycas* male cones and megasporophylls are borne on different trees. The megaspore mother cell is differentiated from one of the cells of the nucellus.
- The nucellus is protected by envelopes and the composite structure is called an **ovule**. **NEET** 2018
- The ovules are borne on megasporophylls which may be clustered to form the female cones. **NEET** 2018
- The megaspore mother cell divides meiotically to form four megaspores.
- One of the megaspores enclosed within the **megasporangium** develops into a multicellular female gametophyte that bears two or more **archegonia** or female sex organs. **NEET** 2023
- The multicellular female gametophyte is also retained within megasporangium.
- Unlike bryophytes and pteridophytes, in gymnosperms the male and the female gametophytes do not have an independent free-living existence. **AIPMT** 2015
- They remain within the sporangia retained on the sporophytes.
- The pollen grain is released from the microsporangium. They are carried in air currents and come in contact with the opening of the ovules borne on megasporophylls.
- The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.
- Zygote develops into an embryo and the ovules into seeds. These seeds are not covered.

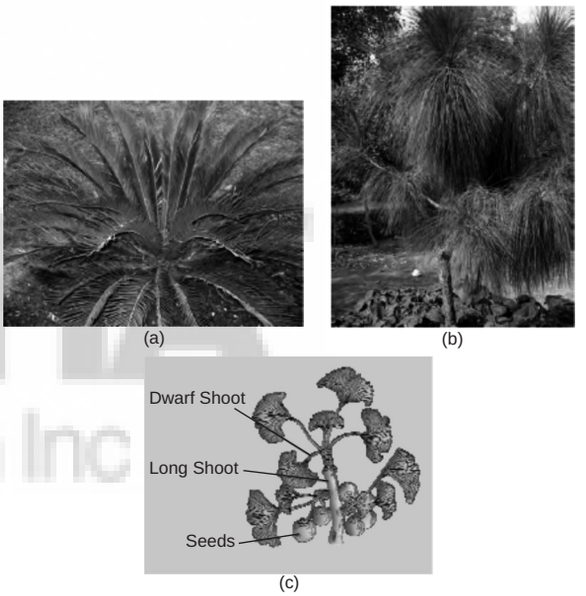


Fig.: Gymnosperms: (a) *Cycas* (b) *Pinus* (c) *Ginkgo*

Included in NCERT but not in NMC NEET Syllabus

3.5 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. In angiosperms, the seeds are enclosed in fruits. The angiosperms are an exceptionally large group of plants occurring in wide range of habitats. They range in size from the smallest Wolffia to tall trees of Eucalyptus (over 100 metres). They provide us with food, fodder, fuel, medicines and several other commercially important products. They are divided into two classes : the dicotyledons and the monocotyledons.

(a)

(b)

Fig.: Angiosperms : (a) A dicotyledon (b) A monocotyledon

Tips/Tricks/Techniques ONE-Liners
(Exam Special)

- *Spirullina* – BGA and *chorella* is used as a source of food and O_2 by space travellers.
- Algin protects seaweeds against dessication and shocks.
- Gaidukov's effect is found in both red algae and blue green algae.
- Mossess along with *lichens* are the first organisms to colums rocks hence are of great ecological importance.
- *Ephedra* and *taxus* are medicinal gymnosperms.
- The angiosperms are divided into two classes - the dicotyledons and the monocotyledons.

Exercise 1 : NCERT Based Topic-wise MCQs

3.0 Introduction

1. Classification of plants proposed by Carolus Linnaeus was artificial because it was based on
NCERT Page-29 / N-23
(a) only a few morphological characters.
(b) evolutionary tendencies which are diverse.
(c) anatomical characters which are adaptive in nature.
(d) physiological traits alongwith morphological characters.

2. Chemotaxonomy is connected with
NCERT Page-30 / N-24
(a) classification of chemicals found in plants.
(b) uses the chemical constituent of plant for classification.
(c) application of chemicals on herbarium sheets.
(d) use of statistical methods in chemical yielding plants.

3. Cytological information like chromosome number, structure, behaviour are related with
NCERT Page-30 / N-24
(a) numerical taxonomy
(b) cytotaxonomy
(c) chemotaxonomy
(d) all of these

4. Phylogenetic classification system is based on the
NCERT Page-30 / N-24
(a) morphological characters of various organisms.
(b) anatomical characters of various organisms.
(c) physiological characters of various organisms.
(d) evolutionary relationships between various organisms.

5. The natural system of classification for flowering plants was given by
NCERT Page-30 / N-23
(a) Carolus Linnaeus
(b) Bentham and Hooker
(c) Engler and Prantl
(d) R. H. Whittaker

6. Artificial systems gave equal weightage to vegetative and sexual characteristics; this is not acceptable because often _____ characters are more easily affected by environment.
NCERT Page-30 / N-23
(a) vegetative (b) sexual
(c) anatomical (d) physiological

7. Each character is given equal importance and at the same time hundreds of characters can be considered in
NCERT Page-30 / N-24
(a) cytotaxonomy (b) morphotaxonomy
(c) chemotaxonomy (d) numerical taxonomy

8. Select the incorrect pair. NCERT Page-30 / N-24
(a) Numerical taxonomy – All observable characteristics
(b) Cytotaxonomy – Cytological information
(c) Chemotaxonomy – Chromosome number and structure
(d) Cladistic taxonomy – Origin from a common ancestor

3.1 Algae

9. Mannitol is the stored food in NCERT Page-33 / N-27
(a) *Chara*
(b) *Porphyra*
(c) *Fucus*
(d) *Gracilaria*

10. *Ulothrix* can be described as a NCERT Page-30 / N-26
(a) non-motile colonial alga lacking zoospores
(b) filamentous alga lacking flagellated reproductive stages
(c) membranous alga producing zoospores
(d) filamentous alga with flagellated reproductive stages

11. Alginates (alginin), used as highly efficient gauze in internal operations are obtained from cell walls of NCERT Page-32 / N-26
(a) Cyanophyceae
(b) Phaeophyceae
(c) Rhodophyceae
(d) All of these

12. Why rhodophyta exhibit a red colour ? NCERT Page-33 / N-27
(a) Since most rhodophyta grow at great depths, the chlorophyll can only absorb light in the red area of the spectrum.
(b) The wavelengths of light that are absorbed by chlorophyll are passed to phycoerythrin (a red pigment).
(c) Red pigment of rhodophyta absorbs all the light waves.
(d) The light reaching the greatest depth in water is in the blue-green region of the spectrum, is absorbed by phycoerythrin.

13. Algin, carrageen and proteins are obtained from NCERT Page-33 / N-26
(a) red algae, brown algae, green algae respectively.
(b) brown algae, red algae, green algae respectively.
(c) red algae, green algae, brown algae respectively.
(d) green algae, brown algae, red algae respectively.

14. Pyrenoids in green algal cells are related to NCERT Page-32 / N-26
(a) starch formation
(b) protein storage
(c) general metabolism
(d) enzyme secretion

15. Which one of the following statements concerning the algae is incorrect ? NCERT Page-30 / N-24
(a) Most algae are photosynthetic.
(b) Algae can be classified according to their pigments.
(c) All algae are filamentous.
(d) *Spirogyra* does not produce zoospores.

16. Which of the following example belong to the same class of algae? NCERT Page-32 / N-26
(a) *Chara*, *Fucus*, *Polysiphonia*
(b) *Volvox*, *Spirogyra*, *Chlamydomonas*
(c) *Porphyra*, *Ectocarpus*, *Ulothrix*
(d) *Sargassum*, *Laminaria*, *Gracilaria*

17. A research student collected certain alga and found that its cells contained both chlorophyll *a* and chlorophyll *d* as well as phycoerythrin. On the basis of his observation, the students conclude that the alga belongs to NCERT Page-33 / N-27
(a) rhodophyceae (b) bacillariophyceae
(c) chlorophyceae (d) phaeophyceae

18. If you are asked to classify the various algae into distinct groups then which of the following characters you should choose for the classification?
(a) Nature of habitat NCERT Page-33 / N-23
(b) Structural organization of thallus
(c) Chemical composition of the cell wall
(d) Types of pigments present in the cell

19. Which of the following pairs is incorrectly matched? NCERT Page-33 / N-27
(a) Chlorophyceae – Major pigments are chl *a* and *b*.
(b) Phaeophyceae – Cell wall is made up of cellulose and algin.
(c) Rhodophyceae – Stored food is mannitol.
(d) Chlorophyceae – Cell wall is made up of cellulose.

20. A student was given a sample to observe under the microscope. He observed and found that the sample is the most common type of spore involved in asexual reproduction in algae. Identify the spore. NCERT Page-30 / N-24
(a) Zoospore (b) Endospore
(c) Hypnospore (d) None of these

21. In class phaeophyceae, the plant body is usually attached to the substratum by a ___A___ and has a stalk, the ___B___ and leaf like photosynthetic organ-the ___C___. NCERT Page-31 / N-26
(a) A – holdfast, B – stipe, C – frond
(b) A – stipe, B – holdfast, C – frond
(c) A – frond, B – stipe, C – holdfast
(d) A – stipe, B – frond, C – holdfast

3.2 Bryophytes

22. A bryophyte suddenly started reproducing partheno-genetically. The number of chromosomes of the second generation compared to parent plant will be
(a) same (b) one-half
(c) double (d) triple

23. A bryophyte differs from pteridophytes in having
(a) archegonia. NCERT Page-35 / N-29
(b) lack of vascular tissue.
(c) swimming antherozoids.
(d) independent gametophytes.

24. Protonema NCERT Page-36 / N-30
(a) is a stage of gametophytic generation.
(b) is a creeping, green, branched and develops directly from a spore.
(c) Filamentous stage.
(d) All of the above

25. Mosses are of great ecological importance because of NCERT Page-35 / N-30
(a) its contribution to prevent soil erosion.
(b) its contribution in ecological succession.
(c) its capability to remove CO from the atmosphere.
(d) both (a) and (b)

26. Mosses do not have 'true leaves' because their leaf-like structures lack NCERT Page-35 / N-30
(a) starch in their chloroplast.
(b) vascular tissues.
(c) chlorophyll.
(d) cellulose in their cell walls.

27. Bryophytes resemble algae in the following aspects NCERT Page-35 / N-29
(a) filamentous body, presence of vascular tissues and autotrophic nutrition
(b) differentiation of plant body into root, stem and leaves and autotrophic nutrition
(c) thallus like plant body, presence of root and autotrophic nutrition
(d) thallus like plant body, lack of vascular tissues and autotrophic nutrition

28. You are given an unknown plant to study in the laboratory. You find that it has chlorophyll, no xylem. Its multicellular sex organs are enclosed in a layer of jacket cells. Its gametophyte stage is free living. The plant probably belongs to NCERT Page-35 / N-29
(a) chlorophyceae (b) bryophyte
(c) pteridophyte (d) gymnosperm

29. Moss peat is used as a packing material for sending flowers and live plants to distant places because
(a) it reduces transpiration. NCERT Page-35 / N-30
(b) it serves as a disinfectant.
(c) it is easily available.
(d) it is hygroscopic.

30. The unique feature of bryophytes compared to other plant groups is that NCERT Page-34 / N-29
(a) they produce spores.
(b) they lack vascular tissues.
(c) they lack roots.
(d) their sporophyte is attached to the gametophyte.

31. In bryophytes, male and female sex organs are called _____ and _____ respectively. NCERT Page-35 / N-29
(a) microsporangia; macrosporangia
(b) male strobili; female strobili
(c) antheridia; archegonia
(d) androecium; gynoecium

32. Protonema and leafy stage are the predominant stage of the life cycle of NCERT Page-36 / N-30
(a) moss
(b) dicots
(c) liverwort
(d) gymnosperm

33. Which of the following statement(s) is/are correct about mosses? NCERT Page-35 & 36 / N-30
(a) The predominant stage of its life cycle is the gametophyte which consists of two stages – protonema and leafy stages.
(b) Leafy stage are attached to the soil through multi-cellular and branched rhizoids.
(c) Sex organs-antheridia and archegonia are produced at the apex of the leafy shoots.
(d) All of the above

3.3 Pteridophytes

34. Fern plant is a NCERT Page-36 / N-30
(a) haploid gametophyte
(b) diploid gametophyte
(c) diploid sporophyte
(d) haploid sporophyte

35. Which one of the following is a correct statement? NCERT Page-35 / N-30
(a) Pteridophyte 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.

36. Which of the following statements is incorrect? NCERT Page-36 / N-30
(a) Pyrenoids contain protein besides starch.
(b) Sexual reproduction may be isogamous, oogamous and anisogamous in green and brown algae.
(c) Some of the members of algae also occur in association with fungi (lichen) and animals (eg, on sloth bear).
(d) The leaves in pteridophyta are small (macrophyll) and large (microphyll) Horsetails and ferns.

37. The heterosporous pteridophyte belonging to the class lycopsida is NCERT Page-38 / N-32
(a) *Selaginella* (b) *Psilotum*
(c) *Equisetum* (d) *Pteris*

38. Which of the following pteridophytes belong to class pteropsida? NCERT Page-38 / N-32
(a) *Equisetum* and *Psilotum*
(b) *Lycopodium* and *Adiantum*
(c) *Selaginella* and *Pteris*
(d) *Pteris* and *Adiantum*

39. Which one of the following is the major difference between mosses and ferns? NCERT Page-37 / N-32
(a) Ferns lack alternation of generation while mosses show the same.
(b) Mosses are facultative aerobes while ferns are obligate aerobes.
(c) Vascular bundles of ferns show xylem vessels while those of mosses lack it.
(d) Sporophytes of ferns live much longer as compared to the sporophytes of mosses.

40. The spreading of living pteridophytes is limited and restricted to narrow geographical region because
NCERT Page-38 / N-32
(a) gametophytic growth needs cool, damp and shady places.
(b) it requires water for fertilization.
(c) due to absence of stomata in leaf and absence of vascular tissue.
(d) both (a) and (b)

3.4 Gymnosperm

41. *Cycas* and *Adiantum* resemble each other in having
NCERT Page-38 / N-32
(a) seeds (b) motile sperms
(c) cambium (d) vessels

42. Fruits are not formed in gymnosperms because of
(a) absence of pollination. NCERT Page-38 / N-33
(b) absence of seed.
(c) absence of fertilization.
(d) absence of ovary.

43. _____ represent the reproductive organs amongst gymnosperms. NCERT Page-39 / N-33
(a) Prothallus (b) Capsules
(c) Setae (d) Cones

3.5 Angiosperms

44. Dicotyledons and monocotyledons are the classes of
NCERT Page-40 / N-34
(a) Gymnosperrms (b) Algae
(c) Pteridophytes (d) Angiosperms

45. In the flowering plants, the pollen grains and ovules are developed in specialised structures called
NCERT Page-40 / N-34
(a) Flowers (b) Leaf
(c) Root (d) Bud

Exercise 2 : NCERT Exemplar & Past Years NEET

NCERT Exemplar Questions

1. Fusion of two motile gametes which are dissimilar in size is termed as NCERT Page-30 / N-24
(a) oogamy (b) isogamy
(c) anisogamy (d) zoogamy

2. Holdfast, stipe and frond constitutes the plant body in case of NCERT Page-31 / N-25
(a) Rhodophyceae (b) Chlorophyceae
(c) Phaeophyceae (d) All of these

3. A plant shows thallus level of organisation. It shows rhizoids and is haploid. It needs water to complete its life cycle because the male gametes are motile. Identify the group to which it belongs to
NCERT Page-34, 35 / N-28, 29
(a) pteridophytes (b) gymnosperms
(c) monocots (d) bryophytes

4. A prothallus is NCERT Page-38 / N-32
(a) a structure in pteridophytes formed before the thallus develops
(b) a sporophytic free living structure formed in pteridophytes
(c) a gametophyte free living structure formed in pteridophytes
(d) a primitive structure formed after fertilisation in pteridophytes

5. 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
NCERT Page-38 / N-33
(a) monocots (b) dicots
(c) pteridophytes (d) gymnosperms

6. Protonema is NCERT Page-36 / N-30
(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

7. The giant redwood tree (*Sequoia sempervirens*) is a/an
NCERT Page-38 / N-32
(a) angiosperm (b) free fern
(c) pteridophyte (d) gymnosperm

Past Years NEET

8. In bryophytes and pteridophytes, transport of male gametes requires NCERT Page-35 & 36 / N-29, 30 | 2016, C
(a) Wind (b) Insects
(c) Birds (d) Water

9. Select the correct statement
NCERT Page-38 / N-32 | 2016, C
(a) Gymnosperms are both homosporous and heterosporous
(b) *Salvinia*, *Ginkgo* and *Pinus* all are gymnosperms
(c) *Sequoia* is one of the tallest trees
(d) The leaves of gymnosperms are not well adapted to extremes of climate

10. An example of colonial alga is
NCERT Page-30 / N-26 | 2017, C
(a) *Volvox* (b) *Ulothrix*
(c) *Spirogyra* (d) *Chlorella*

11. Zygotic meiosis is characteristic of 2017, C
(a) *Fucus* (b) *Funaria*
(c) *Chlamydomonas* (d) *Marchantia*

12. Select the mismatch NCERT Page-38 / N-32 | 2017, C
(a) *Cycas* – Dioecious
(b) *Salvinia* – Heterosporous
(c) *Equisetum* – Homosporous
(d) *Pinus* – Dioecious

13. Winged pollen grains are present in 2018, C
(a) Mustard (b) *Cycas*
(c) *Pinus* (d) Mango

14. Which of the following statements is correct?
NCERT Page-38, 39 / N-30, 31 | 2018, C
(a) Ovules are not enclosed by ovary wall in gymnosperms
(b) *Selaginella* is heterosporous, while *Salvinia* is homosporous
(c) Stems are usually unbranched in both Cycas and *Cedrus*
(d) Horsetails are gymnosperms

15. Pinus seed **cannot** germinate and establish without fungal association. This is because:
NCERT Page-38 / N-32 | 2019, C
(a) its embryo is immature.
(b) it has obligate association with mycorrhizae.
(c) it has very hard seed coat.
(d) its seeds contain inhibitors that prevent germination.

16. 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:
NCERT Page-37 / N-30 | 2019, C
(a) Liverworts (b) Mosses
(c) Pteridophytes (d) Gymnosperms

17. Which of the following pairs is of unicellular algae?
(a) *Gelidium* and *Gracilaria* 2020, C
(b) *Anabaena* and *Volvox*
(c) *Chlorella* and *Spirulina*
(d) *Laminaria* and *Sargassum*

18. Strobili or cones are found in
NCERT Page-36 / N-33 | 2020, C
(a) *Pteris* (b) *Marchantia*
(c) *Equisetum* (d) *Salvinia*

19. Floridean starch has structure similar to
NCERT Page-33 / N-27 | 2020, S
(a) Amylopectin and glycogen
(b) Mannitol and algin
(c) Laminarin and cellulose
(d) Starch and cellulose

20. Phycoerythrin is the major pigment in
NCERT Page-33 / N-27 | PH-II 2020
(a) Brown algae (b) Red algae
(c) Blue green algae (d) Green algae

21. Male and female gametophytes do not have an independent free living existence in:
NCERT Page-39 / N-33 | PH-II 2020
(a) Bryophytes (b) Pteridophytes
(c) Algae (d) Angiosperms

22. Which of the following algae produce Carrageen?
NCERT Page-33 / N-26 | 2021, C
(a) Blue-green algae (b) Green algae
(c) Brown algae (d) Red algae

23. Which of the following algae contains mannitol as reserve food material? NCERT Page-33 / N-26 | 2021, C
(a) *Ulothrix* (b) *Ectocarpus*
(c) *Gracilaria* (d) *Volvox*

24. Gemmae are present in NCERT Page-35 / N-29 | 2021, C
(a) Some Liverworts (b) Mosses
(c) Pteridophytes (d) Some Gymnosperms

25. Genera like Selaginella and Salvinia produce two kinds of spores. Such plants are known as:
NCERT Page-38 / N-32 | 2021, C
(a) Heterosporous (b) Homosorus
(c) Heterosorus (d) Homosporous

26. Hydrocolloid carrageen is obtained from:
NCERT Page-32 / N-26 | 2022, C
(a) Phaeophyceae and Rhodophyceae
(b) Rhodophyceae only
(c) Phaeophyceae only
(d) Chlorophyceae and Phaeophyceae

27. Which of the following is incorrectly matched?
NCERT Page-32 & 33 / N-26, 27 | 2022, S
(a) *Ulothrix* - Mannitol
(b) *Porphyra* - Floridian Starch
(c) *Volvox* - Starch
(d) *Ectocarpus* - Fucoxanthin

28. Match the plant with the kind of life cycle it exhibits:
NCERT Page-38 & 39 / N-26, 30, 32 | 2022, C

List-I		List-II	
A.	Spirogyra	I.	Dominant diploid sporophyte vascular plant, with highly reduced male or female gametophyte
B.	Fern	II.	Dominant haploid free-living gametophyte
C.	Funaria	III.	Dominant diploid sporophyte alternating with reduced gametophyte called prothallus
D.	Cycas	IV.	Dominant haploid leafy gametophyte alternating with partially dependent multicellular sporophyte

Choose the **correct** answer from the options given below:
(a) (A)-(ii),(B)-(iii), (C)-(iv), (D)-(i)
(b) (A)-(iii), (B)-(iv), (C)-(i), (D)-(ii)
(c) (A)-(ii), (B)-(iv), (C)-(i), (D)-(iii)
(d) (A)-(iv), (B)-(i), (C)-(ii), (D)-(iii)

29. Match List -I with List -II :
NCERT Page-32, 36, 38 | PH-II 2022

List-I	List-II
(A) *Chlamydomonas*	(i) Moss
(B) *Cycas*	(ii) Pteridophyte
(C) *Selaginella*	(iii) Alga
(D) *Sphagnum*	(iv) Gymnosperm

Choose the correct answer from the options given below.
(a) (A) - (ii), (B) - (iii), (C) - (i), (D) - (iv)
(b) (A) - (iii), (B) - (i), (C) - (ii), (D) - (iv)
(c) (A) - (iii), (B) - (iv), (C) - (ii), (D) - (i)
(d) (A) - (iii), (B) - (ii), (C) - (i), (D) - (iv)

30. Given below are two statements : One labelled as Assertion A and the other labelled as Reason R:

NCERT Page-36 / N-30 | 2023

Assertion A : The first stage of gametophyte in the life cycle of moss is protonema stage.

Reason R : Protonema develops directly from spores produced in capsule.

In the light of the above statements, choose the most appropriate answer from options given below:

(a) Both A and R are correct and R is the correct explanation of A
(b) Both A and R are correct but R is NOT the correct explanation of A
(c) A is correct but R is not correct
(d) A is not correct but R is correct

31. Identify the pair of heterosporous pteridophytes among the following :

NCERT Page-38 / N-32 | 2023

(a) *Lycopodium* and *Selaginella*
(b) *Selaginella* and *Salvinia*
(c) *Psilotum* and *Salvinia*
(d) *Equisetum* and *Salvinia*

32. Given below are two statements : One labelled as Assertion A and the other labelled as Reason R :

NCERT Page-39 / N-33 | 2023

Assertion A : In gymnosperms the pollen grains are released from the microsporangium and carried by air currents.

Reason R : Air currents carry the pollen grains to the mouth of the archegonia where the male gametes are discharged and pollen tube is not formed.

In the light of the above statements, choose the correct answer from the options given below :

(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true but R is NOT the current explanation of A
(c) A is true but R is false
(d) A is false but R is true

33. Read the following statements and choose the set of correct statements:

NCERT Page-N-26, 27 | 2024

In the members of Phaeophyceae,

A. Asexual reproduction occurs usually by biflagellate zoospores.
B. Sexual reproduction is by oogamous method only.
C. Stored food is in the form of carbohydrates which is either mannitol or laminarin.
D. The major pigments found are chlorophyll a, c and carotenoids and xanthophyll.
E. Vegetative cells have a cellulosic wall, usually covered on the outside by gelatinous coating of algin.

Choose the correct answer from the options given below:

(a) A, B, C and D only (b) B, C, D and E only
(c) A, C, D and E only (d) A, B, C and E only

Exercise 3 : Matching, Statement & Assertion Reason Type

Match the Following

1. Match the column-I with column-II and choose the correct option.

NCERT Page-29 & 30 / N-23, 24

Column-I (System of classification)		Column-II (Characteristics)	
A.	Artificial system of classification	I.	Based on few morphological characters
B.	Natural system of classification	II.	Based on evolutionary relationships between the various organisms
C.	Phylogenetic system of classification	III.	Based on natural affinities among the organisms and consider external as well as internal features.
D.	Numerical Faxonomy	IV.	Carried out using computer

(a) A – II; B – I; C – III; D – IV
(b) A – I; B – III; C – II; D – IV
(c) A – III; B – II; C – I; D – IV
(d) A – I; B – II; C – III; D – IV

2. Match the following columns.

NCERT Page-35,36 & 38 / N-29, 30

Column-I		Column-II	
A.	*Chlorella*	I.	Pteropsida
B.	*Adiantum*	II.	Marine algae
C.	*Sargassum*	III.	Moss
D.	Prothallus	IV.	Pteritophyta
		V.	Unicellular alga rich in proteins

(a) A – II; B – V; C – I; D – III
(b) A – V; B – IV; C – III; D – II
(c) A – V; B – I; C – II; D – IV
(d) A – III; B – II; C – I; D – V

3. Match the following NCERT Page-38 / N-32

Column-I (Classes)		Column-II (Examples)	
A.	Psilopsida	I.	*Dryopteris, Pteris, Adiantum*
B.	Lycopsida	II.	*Equisetum*
C.	Sphenopsida	III.	*Selaginella*
D.	Pteropsida	IV.	*Lycopodium*
		V.	*Psilotum*

(a) A – V; B – III; C – II; D – I
(b) A – I; B – II; C – III; D – IV
(c) A – IV; B – III; C – II; D – I
(d) A – III; B – V; C – I; D – II

4. Match column-I with column-II and choose the correct option. NCERT Page-30,36 & 38 / N-26, 27, 29 & 30

Column-I		Column-II	
A.	Phaeophyceae	I.	Have an elaborate mechanism of spore dispersal
B.	Rhodophyceae	II.	First terrestrial plant with vascular tissue-phloem and xylem
C.	Mosses	III.	Asexual reproduction by biflagellate zoosposes
D.	Pteridophytes	IV.	Polysiphonia, Porphyra, Gracilaria

(a) A – III; B – IV; C – I; D – II
(b) A – IV; B – III; C – I; D – II
(c) A – IV; B – III; C – II; D – I
(d) A – IV; B – I; C – III; D – II

5. Match the column-I with column-II and select the correct answer using the codes given below. NCERT Page-30,36 & 38 / N-24, 30, 34

Column-I (Group of Plant Kindgdom)		Column-II (Examples)	
A.	Algae	I.	*Solanum tuberosum*
B.	Fungi	II.	*Equisetum*
C.	Angiosperm	III.	*Cycas*
D.	Pteridophyte	IV.	*Chlamydomonas*
		V.	*Rhizopus*

(a) A – V; B – IV; C – I; D – II
(b) A – IV; B – V; C – I; D – II
(c) A – IV; B – I; C – V; D – II
(d) A – IV; B – I; C – V; D – III

6. Match the column-I with column-II and choose the correct option. NCERT Page-36,37 & 38 / N-29, 30, 34

Column-I		Column-II	
A.	Amphibian of the plant kingdom	I.	*Sphagnum*
B.	Specialized structures in liverworts for asexual reproduction	II.	Angiosperms
C.	Monocotyledons and dicotyledons	III.	Bryophytes
D.	A plant which has capacity to holding water	IV.	Gemmae

(a) A – III; B – IV; C – I; D – II
(b) A – III; B – IV; C – II; D – I
(c) A – IV; B – III; C – II; D – I
(d) A – III; B – II; C – IV; D – I

7. Select the correct match of the feature present in column I with its respective terms given in column II. NCERT Page-30,32 & 38 / N-24, 29, 30, 32, 34

Column-I (features)		Column-II (term)	
A.	Presence of tap roots and coralloid roots	I.	Bryophyte
B.	The synergids and antipodal cells degenerates after fertilization	II.	Pteridophytes
C.	The food is stored as floridean starch which is very similar to amylopectin and glycogen in structure	III.	Red algae
D.	Presence of sporophyte which is not free living but attached to the photosynthetic gametophytes and derives nourishment from it	IV.	Angiosperms
		V.	Gymnosperms

(a) A – I; B – II; C – III; D – IV
(b) A – III; B – V; C – II; D – IV
(c) A – III; B – I; C – V; D – II
(d) A – V; B – IV; C – III; D – I

Two Statement Type Questions

DIRECTION: *Read the statements carefully and answer the question on the basis of following options.*

(a) Both Statement I and Statement II are incorrect
(b) Statement I is correct but Statement II is incorrect
(c) Statement I is incorrect but Statement II is correct
(d) Both Statement I and Statement II are correct

8. **Statement I:** The pteridophytes are found in cool, damp, shady places
Statement II: In pteridophytes, the main plant body is a sporophyte. NCERT Page-36 / N-30

9. **Statement I:** Bryophytes are known as amphibians of the plant kingdom.
Statement II: The dominant phase in all Byophytes is gametophyte. NCERT Page-35 / N-29

10. **Statement I:** In numerical taxonomy observable characters are not given equal importance.
Statement II: More than 20 characters can't be studied at a time in numerical taxonomy. NCERT Page-30 / N-24

11. **Statement I:** Bryophytes are amphibians of plant kingdom.
Statement II: They live in soil but depend on water for sexual reproduction. NCERT Page-35 / N-29

12. **Statement I:** Main plant body of bryophytes is sporophytic.
Statement II: Main plant body of pteridophytes is gametophytic. NCERT Page-35, 36 / N-29, 30

Four/Five Statement Type Questions

13. Which of the following statement(s) about algae is/are correct? NCERT Page-32 / N-24
(i) Algae are chlorophyll bearing simple, thalloid, heterotrophic and aquatic (both fresh water and marine) organisms.
(ii) Algae reproduce by vegetative means only.
(iii) Fusion of two gametes dissimilar in size is termed as oogamous.
(iv) A few of the massive forms of algae such as kelps, form massive plant bodies.
(v) Algae are not useful to man.
(a) Only (i) (b) Both (i) and (v)
(c) Only (iv) (d) All of these

14. Which of the following statement(s) is/are correct about gemmae? NCERT Page-35 / N-29
(i) These are specialised structures by which asexual reproduction take place in liverworts.
(ii) They are green, multicellular and asexual buds.
(iii) They develop in small receptacles called gemma cups.
(iv) They detach from parent body and germinate to form new individuals.
(a) (i) and (ii) only
(b) (ii) and (iii) only
(c) (i), (ii) and (iii) only
(d) All of these

15. Refer to the following statement(s) and identify the group of plant which is being described by the given statements? NCERT Page-35 / N-29
(i) They include various mosses and liverworts that are found commonly growing in moist shaded areas in the hills.
(ii) They lack true roots, stem or leaves.
(iii) The main plant body is haploid.
(iv) They produce a multicellular body sporophyte which is not free living but attached to the photosynthetic gametophyte and derives nourishment from it.
(v) Its plant body is more differentiated than that of algae.
(a) Algae (b) Fungi
(c) Bryophytes (d) Pteridophytes

16. Which of the following group of plant is being described by the given statements? NCERT Page-38, 39 / N-32, 33
(i) They are plants in which the ovules are not enclosed by any ovary wall and remain exposed before and after fertilization.
(ii) The giant red wood tree *Sequoia* is one of the tallest tree species of the group.
(iii) The roots are generally tap roots.
(iv) They are heterosporous and they produce haploid microspores and megaspores.
(v) Roots in some genera have fungal association.
(a) Algae (b) Bryophytes
(c) Gymnosperms (d) Pteridophytes

17. Which of the following statements with respect to gymnosperms and angiosperms is/are correct? NCERT Page-38, 39, 40 / N-32, 33, 34
(i) The process of double fertilization is present in gymnosperms.
(ii) Angiosperms range in size from microscopic *Wolffia* to tall trees of *Sequoia.*
(iii) In gymnosperms, the seeds are not covered.
(iv) In gymnosperms, the male and female gametophytes have an independent free living existence.
Of the above statements
(a) (i) and (ii) (b) (iii) only
(c) (ii) and (iii) (d) (iii) and (iv)

18. Choose the correct statement about liverworts. NCERT Page-35, 36 / N-29, 30
(i) In liverworts, the antheridium and archegonium produce the antherozoid and the egg which fuse during sexual reproduction.
(ii) Both male and female sex organs may be present on same thalli or different thalli.
(iii) A sporophyte is formed from the zygote which is differentiated into the foot, seta and capsule.
(iv) Meiosis occurs in some cells of the capsule giving rise to haploid spores.
(v) The spores germinate to form free - living sporophytes.
(a) (i) and (v) only (b) (i), (ii) and (iii) only
(c) (iii) and (iv) only (d) (i), (ii), (iii) and (iv)

19. The correct statements about bryophytes are: NCERT Page-35 / N-29
(i) Sex organ in bryophytes are multicellular
(ii) The sperms are released into water which swim through water to fuse with the egg to produce the zygote outside the body.
(iii) Immediate reduction division occurs in zygotes.
(iv) A multicellular body called a sporophyte is then produced.
(v) The sporophyte is not -free living but attached to photosynthetic gametophyte.
(a) (i), (ii) and (iii) only (b) (i), (ii) and (iv), (v)
(c) (i) and (iv) only (d) (iii) and (iv) only

20. In mosses, the second gametophytic stage is leafy stage. Consider and choose the correct statements about leafy stage. NCERT Page-36 / N-30

(i) They consist of upright, slender axes bearing spirally arranged leaves.
(ii) This leafy stage bears the sex organs.
(iii) They are attached to the soil through multicellular rhizoids.
(iv) Leafy stage is produced from the secondary protonema as a lateral bud.

(a) (i) and (ii) only (b) (i), (iii) and (iv) only
(c) (iii) and (iv) only (d) (i), (ii), (iii) and (iv)

21. How many of the following statements is/are correct ? NCERT Page-36 / N-30

(i) In *Equisetum,* the female gametophyte is retained on the parent sporophyte.
(ii) In *Ginkgo,* male gametophyte is not independent.
(iii) The sporophyte in *Riccia* is more developed than that in *Polytrichum.*
(iv) Sexual reproduction in *Volvox* is isogamous.

(a) Two (b) Three
(c) Four (d) One

Assertion & Reason Questions

DIRECTION: *These questions consist of two statements, each printed as Assertion and Reason. While answering these questions, you are required to choose any one of the following four responses.*

(a) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
(b) (A) is correct but (R) is not correct
(c) (A) is not correct but (R) is correct
(d) Both (A) and (R) are correct and (R) is the correct explanation of (A)

22. **Assertion :** *Chlorella* could be utilised to keep the air pure in space vehicles.
Reason : The space travellers feed on *Chlorella* soup. NCERT Page-32 / N-26

23. **Assertion:** The colour of brown algae varies from olive green to brown.
Reason: In brown algae, fucoxanthin is responsible for colour variation. NCERT Page-32 / N-26

24. **Assertion:** Archegonium is the female sex organ in bryophytes.
Reason: Algae also possess the archegonium. NCERT Page-35 / N-29

25. **Assertion:** Liverworts fail to spread to a new locality through fragmentation.
Reason: Gemmae are helpful in propagating liverworts in different locality. NCERT Page-35 / N-29

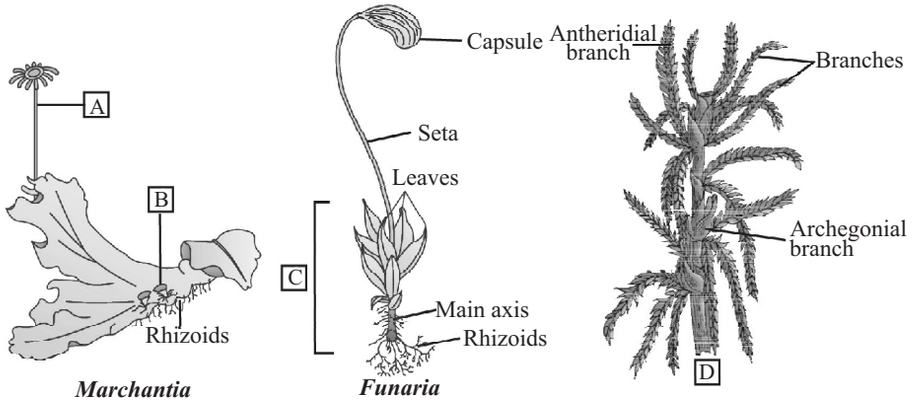
26. **Assertion:** *Selaginella* and *Salvinia* are homosporous.
Reason: In *Selaginella* and *Salvinia*, different kind of spores are produced. NCERT Page-38 / N-32

Exercise 4 : Skill Enhancer MCQs

1. Deep in the tropical rain forest, a botanist discovered an unusual plant with vascular tissues, stomata, a cuticle, flagellated sperm, cone-like reproductive structures bearing seeds, and an alternation-of-generations life cycle. He was very excited about this discovery because it would be rather unusual for a plant to have both

(a) a cuticle and flagellated sperm.
(b) vascular tissues and alternation of generations.
(c) seeds and flagellated sperm.
(d) alternation of generations and seeds

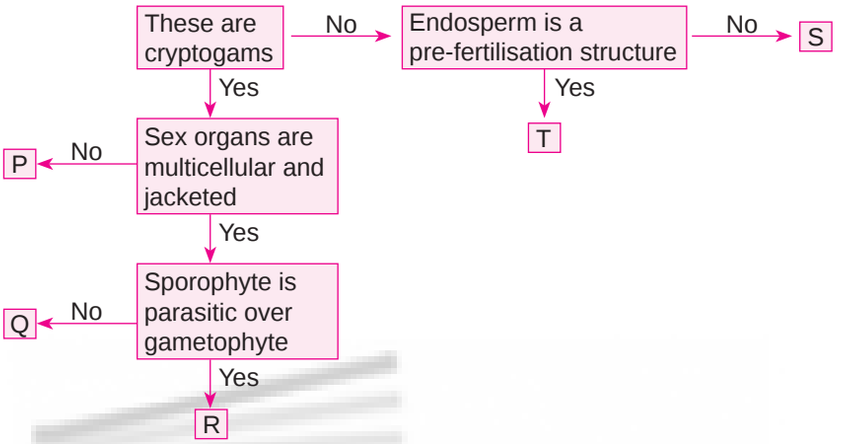
2. The given figures represent the examples of bryophytes. In them few structures/parts are marked as A, B, C and D.



Identify the option which shows the correct labelling of A, B, C and D.

S. No.	A	B	C	D
(a)	Gemma cup	Archegoniophore	Sporophyte	*Sphagnum*
(b)	Archegoniophore	Gemma cup	Gametophyte	*Sphagnum*
(c)	Archegonia	Antheridia	Gemma cup	*Sphagnum*
(d)	Antheridia	Archegonia	Gemma cup	*Sphagnum*

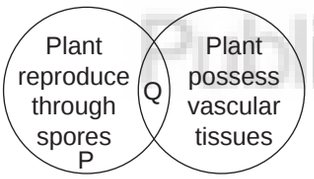
3. Refer to the given flow chart regarding different groups of kingdom plantae.



Which of the following is true regarding P,Q, R, S and T?

(a) Examples of group 'P' include *Riccia, Marchantia, Sphagnum* etc.
(b) Members of group 'R' can be both homosporous as well as heterosporous.
(c) Group 'Q' includes seedless vascular plants having sporophytic plant body.
(d) Group 'S' is more ancient than group 'T' and formed a dominant vegetation on earth same 200 million years back in Mesozoic era.

4. Refer to the given Venn diagram and select the correct option regarding P and Q



(a) P could be an alga or a bryophyte whereas Q could be a pteridophyte.
(b) True roots, stems and leaves are present in P but absent in Q.
(c) Anthridium in Q is sessile whereas that in P (If present is stalked)
(d) P is exclusively xerophytic whereas Q is amphibious by nature.

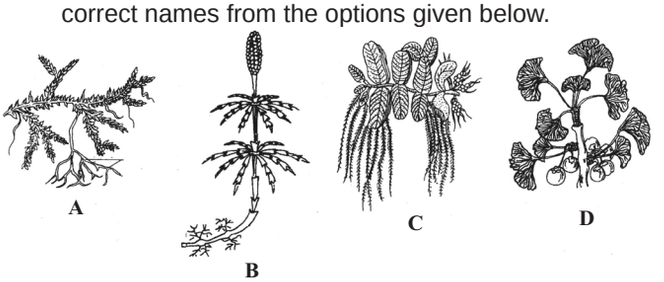
5. Refer the given table

	Vascular tissue	Seeds	Fruits
Plant W	✓	✓	✓
Plant X	×	×	×
Plant Y	✓	×	×
Plant Z	✓	✓	×

Identify plants W, X, Y & Z and select the incorrect option regarding them.

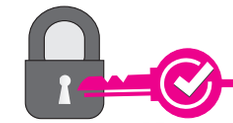
(a) X could be a moss wherein capsule consists of peristome teeth and sterile columnella.
(b) Y could be a fern whose stems are used in scouring and polishing metals.
(c) Z could be a conifer which possesses triploid endosperm as a post-fertilisation structure.
(d) W could be a dicot that undergoes double fertilisation.

6. Identify the plants (A, B, C and D) and choose their correct names from the options given below.



S. No.	A	B	C	D
(a)	*Equisetum*	*Ginkgo*	*Selaginella*	*Lycopodium*
(b)	*Selaginella*	*Equisetum*	*Salvinia*	*Ginkgo*
(c)	*Funaria*	*Adiantum*	*Salvinia*	*Riccia*
(d)	*Chara*	*Marchantia*	*Fucus*	*Pinus*

7. Refer to the statement and answer the question.
"They usually reproduce vegetatively by fragmentation and asexually by non - motile spores and sexually by non - motile gametes."
Identify the group of plants and its example.
(a) Mosses, *Funaria*
(b) Red algae, *Polysiphonia*
(c) Brown algae, *Laminaria*
(d) Pteridophytes, *Selaginella*



Answer Keys

Exercise-1 (NCERT Based Topic-wise MCQs)																			
1	(a)	**6**	(a)	**11**	(b)	**16**	(b)	**21**	(a)	**26**	(b)	**31**	(c)	**36**	(d)	**41**	(b)		
2	(b)	**7**	(d)	**12**	(b)	**17**	(a)	**22**	(a)	**27**	(d)	**32**	(a)	**37**	(a)	**42**	(d)		
3	(b)	**8**	(c)	**13**	(b)	**18**	(d)	**23**	(b)	**28**	(b)	**33**	(d)	**38**	(d)	**43**	(d)		
4	(d)	**9**	(c)	**14**	(a)	**19**	(c)	**24**	(a)	**29**	(d)	**34**	(c)	**39**	(d)	**44**	(d)		
5	(b)	**10**	(d)	**15**	(c)	**20**	(a)	**25**	(d)	**30**	(d)	**35**	(d)	**40**	(d)	**45**	(a)		
Exercise-2 (NCERT Exemplar & Past Years NEET)																			
1	(c)	**5**	(d)	**9**	(c)	**13**	(c)	**17**	(c)	**21**	(d)	**25**	(a)	**29**	(c)	**33**	(c)		
2	(c)	**6**	(a)	**10**	(a)	**14**	(a)	**18**	(c)	**22**	(d)	**26**	(b)	**30**	(a)				
3	(d)	**7**	(d)	**11**	(c)	**15**	(b)	**19**	(d)	**23**	(b)	**27**	(a)	**31**	(b)				
4	(c)	**8**	(d)	**12**	(d)	**16**	(c)	**20**	(b)	**24**	(a)	**28**	(a)	**32**	(c)				
Exercise-3 (Matching, Statement & Assertion Reason Type)																			
1	(b)	**4**	(a)	**7**	(d)	**10**	(a)	**13**	(c)	**16**	(c)	**19**	(b)	**22**	(a)	**25**	(a)		
2	(c)	**5**	(b)	**8**	(d)	**11**	(d)	**14**	(d)	**17**	(b)	**20**	(d)	**23**	(d)	**26**	(c)		
3	(a)	**6**	(b)	**9**	(d)	**12**	(a)	**15**	(c)	**18**	(d)	**21**	(a)	**24**	(b)				
Exercise-4 (Skill Enhancer MCQs)																			
1	(c)	**2**	(b)	**3**	(c)	**4**	(a)	**5**	(c)	**6**	(b)	**7**	(b)						

3 Plant Kingdom

EXERCISE - 1

1. **(a)** Plant classification proposed by Carolus Linneaus was artificial because it was based on a few morphological characters such as habit, colour, number and shape of leaves, etc.

2. **(b)** Chemotaxonomy is based on chemical products particularly secondary metabolites. Various families of plants have been identified on the basis of **raphides** (Crystals of calcium oxalates).

3. **(b)** Cytotaxonomy is the classification of organisms based on cellular structure and function, especially on the structure and number of chromosomes.

4. **(d)** Phylogenetic system of classification indicates the evolutionary as well as genetic relationships among organisms. It is based on fossil record, biochemical, anatomical, morphological, embryological, physiological, genetics, karyotype and other studies.

5. **(b)** The natural system of classification for higher plants was given by **Bentham** and **Hooker** in their ***Genera Plantarum*** (1862 - 1883). The characters employed in this system include those of study of form (morphology), internal structure (anatomy), development (embryology), reproduction, cell structure (cytology), life processes, (physiology), behaviour and biochemistry.

6. **(a)**

7. **(d)** Numerical taxonomy evaluates resemblances and differences or primitiveness and advancement through statistical methods based on a large number of characters obtained from all disciplines of biology. This is followed by assigning them number and code of computer like plus (+) and minus (–) followed by computer analysis. In this way, each character is given equal importance and at the same time hundreds of characters can be considered.

8. **(c)** Chemotaxonomy is based upon the characteristics of various contituents of organisms.

9. **(c)** **10.** **(d)** **11.** **(b)**

12. **(b)** Rhodophyta are commonly called as red algae because of the predominance of the red pigment (r – phycoerythrin) in their body. They occur in both well lighted regions close to the surface of water and also at great depths in ocean where relatively little light penetrates. They exhibit a red colour because the wavelengths of light that are absorbed by chlorophyll are passed to phycoerythrin.

13. **(b)** Certain marine brown and red algae produce large amounts of hydrocolloids (water holding substances), e.g., **algin** (brown algae) and **carrageen** (red algae) which are used commercially. *Chlorella* and *Spirullina* are unicellular green algae, which are rich in proteins and used as food supplements.

14. **(a)** Pyrenoids are the rounded bodies found in the chloroplast of green algae and are the centres of conversion of glucose to starch and also collection of starch.

15. **(c)** Algae are defined as chlorophyllous, thalloid avascular plants with no cellular differentiation. The size and form of algae is highly variable. Not all the algae are filamentous. The size ranges from the microscope unicellular forms to colonial forms and to the filamentous forms.

16. **(b)** *Chlamydomonas*, *Volvox, Ulothrix, Spirogyra* and *Chara* are green algae. The common forms of brown algae are *Ectocarpus*, *Dictyota*, *Laminaria, Sargassum* and *Fucus*. *Polysiphonia, Porphyra, Gracilaria* and the *Gelidium* are members of red algae.

17. **(a)** In green algae (chlorophyceae), the photosynthetic pigments are chlorophyll *a* and *b*, carotenes and xanthophylls. In phaeophyceae (brown algae), the pigments are chlorophyll *a, c* and carotenes and fucoxanth. Rhodophyceae are red algae and contain the major pigment as chlorophyll a and phycoerythrin. Phycoerythrin gives red colour to rhodophyceae.

18. **(d)** The classification of algae can be visually done easily on the basis of colours, due to the presence of different pigments inside them.

19. **(c)** Rhodophyceae is red algae in which food is stored as floridean starch which is very similar to amylopectin and glycogen in structure.

20. **(a)** Asexual reproduction (in algae) is by the production of different types of spores, and the most common type is zoospore. Zoospores are flagellated (motile) and on germination give rise to new plants.

21. **(a)** In class phaeophyceae, the plant body is usually attached to the substratum by a **holdfast** (A), and has a stalk, the **stipe** (B) and leaf like photosynthetic organ - the **frond** (C).

22. **(a)** The number of chromosomes of the second generation will be same because no reduction division take place.

23. **(b)** Bryophytes completely lack vascular tissue system and absorb water by generally body surface. Whereas pteridophytes are the first terrestrial plants to possess vascular tissues -xylem and phloem.

24. **(a)** A protonema is a creeping, green, filamentous, thread-like chain of cells which is produced by the germination of the spores and forms the earliest stage (the haploid phase) of a bryophyte life cycle. When a moss first grows from the spore, it grows as a protonema which develops into a leafy gametophore.

25. **(d)** Mosses along with lichens are the first organisms to colonise rocks and hence, are of great ecological importance. They decompose rocks making the substrate suitable for the growth of higher plants. Since mosses form dense mats on the soil, they reduce the impact of falling rain and prevent soil - erosion.

26. **(b)** Mosses are non-vascular plants which means they cannot transport water and nutrients to the aerial parts of the plant.

27. **(d)** Bryophytes have thallus like body and lack vascular tissue.

28. **(b)** According to the features described, the unknown plant belongs to bryophytes. Bryophytes refer to a group of plants comprising the mosses, liverworts, and hornworts. They do not have a true vascular system and are unable to pull water and nutrients up from the ground at any significant distance. This distinguishes bryophytes from ferns and flowering plants.

29. **(d)** Species of *Sphagnum*, a moss, provides peat that have long been used as a packing material for sending flowers and live plants to distant places because it is hygroscopic.

30. **(d)** In bryophytes, zygotes donot undergo reduction division immediately. They produce a multicellular body called a sporophyte. The sporophyte is not a free-living but attached to the photosynthetic gametophyte and derives nourishment from it.

31. **(c)** In bryophytes, sex organs are of two types, male antheridium and female archegonium. They are multicellular and jacketed, *i.e*., covered by jacket of sterile cells.

32. **(a)** The predominant stage of the moss is the presence of gametophyte which consists of two stages – the first stage is protonema and the second stage is leafy stage. Protonema stage develops directly from the spores and leafy stage develops from the secondary protonema as a lateral bud.

33. **(d)** All the given statements are correct.

34. **(c)** Fusion of male gamete with the egg results in the formation of zygote. This zygote produces a multi-cellular well differentiated sporophyte which is the dominant phase of the pteridophytes.

35. **(d)** Gametophyte of bryophytes bears protonemal and leafy stage. In gymnosperm, female gametophyte is not free living. Antheridiophores and archegoniophores are present in *Marchantia* which is a bryophyte. Origin of seed habit started in pteridophyte.

36. **(d)** The leaves in gymnosperms are well adapted to withstand extremes of temperature, humidity and wind. In conifers, the needle like leaves reduces surface area. Their thick cuticle and sunken stomata also help to reduce water loss.

37. **(a)** *Selaginella* is a member of lycopsida, which produce two kinds of spores-macro (large) and micro (small) spores. Thus, known as heterosporous pteridophytes.

38. **(d)** Pteridophytes are classified into four classes: Psilopsida (*Psilotum*), Lycopsida (*Selaginella, Lycopodium*), Sphenopsida (*Equisetum*) and Pteropsida (*Dryopteris, Pteris, Adiantum*).

39. **(d)** Mosses and ferns belong to bryophtes and pteridophytes respectively. In bryophytes, the dominant phase in the life cycle is the gametophytic plant body. However, in pteridophytes, the main plant body is a sporophyte, which is differentiated into true root, stem and leaves. These organs possess well – differentiated vascular tissues.

40. **(d)** Pteridophytes are the vascular plants (those having xylem and phloem tissues) that reproduce by releasing spores rather than seeds, and they include the highly diverse true ferns and other graceful, primarily forest-dwelling plants. The spreading of living pteridophytes is limited and is restricted to narrow geographical region because its gametophytes require cool, damp, shady places to grow and also it requires water for fertilization.

41. **(b)** *Cycas* (a gymnosperm) and *Adiantum* (known as Maiden hair fern, a pteridophyte) resemble each other in having motile sperms. Seeds, cambium are common in gymnosperms but absent in pteridophytes. True vessels are absent in both pteridophytes and gymnosperms.

42. **(d)** The ovules are not enclosed inside the ovary. Instead they are borne naked on the leafy sporophylls, and hence the name gymnosperms (gymnos- naked sperma- seed) is given Double fertilization is absent in gymnosperms.

43. **(d)** In gymnosperms, the reproductive structures are mostly in the form of compact cones except female organs of *Cycas*. There are two types of sporophylls, usually segregated to form distinct cones or strobili (male and female cones).

44. **(d)** **45.** **(a)**

EXERCISE - 2

NCERT Exemplar Questions

1. **(c)** Lower group of plants like algae exhibit great variation in mode of sexual and asexual reproduction. Some algae produce gametes which are not similar in shape, size and structure. Their fusion is called anisogamy. e.g., *Chlamydomonas*. Isogamy is the fusion of similar gametes, zoogamy is sexual reproduction of animals.

2. **(c)** **Phaeophyceae :** In the members of the class-Phaeophyceae, the plant body is usually attached to the substratum by means of a holdfast and has a stalk called stipe and a leaf like photosynthetic organ called frond.

3. **(d)** **Bryophyta** is a group of plants which have gametophytic haploid thalloid body. The motile male gametes are produced in special male reproductive structures called antheridia.
These gametes need thin film of water to swim and reach the female reproductive organ called archegonia. Pteridophytes, gymnosperm and monocots show higher level of organisation.

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

5. **(d)** **Gymnosperms** include medium sized or tall trees and shrubs. Their plants are well adapted to withstand extremes of temperature, humidity and wind. Reproductive organs are usually in the form of cones or strobili.
The male cones are made up of microsporophyll and female cones are made up of megasporophyll. The presence of sporophyll (micro and megasporophyll) shows the development of seed habit but seeds develop from naked ovule and are not covered.

6. **(a)** The germination of **haploid** spores of mosses produced by sporophyte after reductional division form the protonema. This structure later develops into an independent gametophytic plant.

7. **(d)** *Sequoia sempervirens* is a gymnosperm. It has thick, woody and branched stems. The plant also shows some xeric adaptations which helps it to survive in adverse climatic conditions.

Past Years NEET

8. **(d)** Bryophytes neither have pollen nor flowers and rely on water to carry the male gametes (sperm) to the female gametes (eggs). The antherozoids (male gametes of pteridophytes) are armed with hair-like or whip-like cilia or flagellae and are able to swim through water; they do not travel great distances and are only released when free water is available.

9. **(c)** *Sequoia semepervirans* is one of the tallest trees.

10. **(a)** *Volvox* is motile colonial fresh water green alga. It forms spherical colonies.
11. **(c)** *Chlamydomonas* has haplontic life cycle hence, shows zygotic meiosis.
12. **(d)** *Pinus* is a monoecious plant comprising of both male and female cones on same plant.
13. **(c)** Winged pollen grains are present in *Pinus*. Each pollen grain has two wing-like structures which enables it to float in air, as an adaptation for dispersal by the wind.
14. **(a)** The gymnosperms are a group of seed-producing plants. The name is based on the unenclosed condition of their seeds (called ovules in their unfertilized state).
15. **(b)** Fungus associated with roots of *Pinus* increases minerals & water absorption for the plant by increasing surface area and in turn fungus gets food from plant. Therefore, mycorrhizal association is obligatory for *Pinus* seed germination.
16. **(c)** In Pteridophyte, megaspore is retained for some time in female gametophyte, however the permanent retention is required for seed formation in Gymnosperms. That's why Pteridophytes exhibit precursor to seed habit only.
17. **(c)** *Chlorella* and *Spirulina* are unicellular algae. *Gelidium*, *Gracilaria*, *Laminaria* and *Sargassum* are multicellular. Volvox is colonial.
18. **(c)** Strobili or cones are found in *Equisetum*. Strobili or **cones** are the dense and compact structure **present** on non flowering plants. They contain sporangia and perform function of protecting spores from wild animals and harsh conditions of environment.
19. **(d)** Floridean starch is stored food material in red algae. Its structure is similar to Amylopectin and Glycogen.
20. **(b)** Phycoerythrin is the major pigment in red algae or rhodophytes. The photosynthetic pigments in red algae include chlorophyll-a, carotenoids and phycobilins. Phycoerythrin belongs to the phycobilins. These pigments are soluble in water.
Phycoerythrin (PE) is a red protein pigment complex produced by the light-harvesting phycobiliprotein family. It is present in red algae and cryptophytes as an accessory to the main chlorophyll pigments responsible for photosynthesis.
21. **(d)** Male and female gametophyte do not have an independent free-living existence in gmnosperms and angiosperms. In them they remains within the sporangia retained on the sporophytes. The pollen grain is released from the microsporangium and are carried in air currents and come in contact with the opening of the ovules borne on megasporophylls. The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.
22. **(d)** Algae are eukaryotic organisms with different chemical components in their cell wall.
Algae cell wall is composed of agar, carrageen and funori along with cellulose.
Cell wall of brown algae contains algin while in green alage it is composed of cellulose and pectin.
In blue green algae cell wall is composed of mucopeptides.
23. **(b)** *Ectocarpus* belongs to class-Phaeophyceae, in which reserve food is found in form of laminarin, mannitol and oil.
Ulothrix and *Volvox* belong to chlorophyceae (green algae). Members of this class have starch as reserve food material. Gracilaria is a member of red alage (Rhodophyceace). This class is characterised by having Floridean starch as stored food material.
24. **(a)** The gemmae are green, small discs of haploid tissue, and they directly give rise to new gametophytes. They are produced by some liverworts like marchantia.
Mosses reproduce vegatatively by fragmentation and budding of protonema.
Pteridophytes and Gymnosperms **normally do not reproduce asexually**.
25. **(a)** Genera like Selaginella and Salvinia which produce two kinds of spores i.e. macro (large) and micro (small) spores, are known as **heterosporous**.
Most of the pteridophytes produce single type of spores and are called **homosporus**.
Sorus are brownish or yellowish cluster of spores producing structures located on the lower surface of fern leaves.
26. **(b)** Hydrocolloid carrageen is obtained from red algae (rhodophyceae).
27. **(a)** Ulothrix belong to Chlorophyceae (green algae). Members of this class have starch as reserve food material.
28. **(a)** Spirogyra is a green algae which have dominant haploid –free living gametophyte. Fern is a pteridophyte having dominant sporophyte alternating with reduced gametophyte.
29. **(c)**
30. **(a)** Both the assertion and reason is correct and reason is the correct explanation of assertion. The predominant stage of life cycle of moss is gametophyte which consist of 2 stages. The first stage is protonema that directly develops from spore.
31. **(b)** Pteridophytes that produce two types of spores are known as heterosporous. *Selaginella* and *Salvinia* are heterosporous pteridophytes.
32. **(c)** Assertion is correct but reason is false as in gymnosperms the pollen grains are released from the microsporangium and they are carried in air currents. They come in contact with the opening of the ovules borne on megasporophylls. The pollen tube carrying the male gametes grows towards archegonia in the ovules and discharge their contents near the mouth of the archegonia.
33. **(c)** In Phaeophyceae sexual reproduction can occur by oogamy, isogamy or anisogamy .
Hence correct statements are A, C, D and E.

EXERCISE - 3

1. **(b)** A – I, B – III, C – II, D – IV
2. **(c)** A – V, B – I, C – II, D – IV
3. **(a)** A – V, B – III, C – II, D – I
4. **(a)** A – III, B – IV, C – I, D – II
5. **(b)** A – IV, B – V, C – I, D – II
6. **(b)** A – III, B – IV, C – II, D – I
7. **(d)** A – V, B – IV, C – III, D – I
8. **(d)** **9.** **(d)**
10. **(a)** In numerical taxonomy numbers and codes are assigned to each observable characteristics and the data is then processed. In this way each character is given equal importance and at the same time hundreds of characters can be considersed.
11. **(d)** Bryophytes are known as 'amphibians of plant kingdom'. In their vegetative structure, bryophytes have become adapted to land but they depend on water for sexual reproduction because the swimming habit is retained by their sperms.

12. **(a)** Main plant body is gametophytic in bryophytes and sporophytic in pteridophytes.

13. **(c)** Algae are chlorophyll bearing simple, thalloid, autotrophic and largely aquatic organisms. They reproduce by vegetative, asexual and sexual methods. Fusion of two gametes dissimilar in size is termed as anisogamous.

14. **(d)** Gemmae are a means of asexual reproduction found in many bryophytes (e.g, liverworts). They are 1 to many celled, specially produced clonal plant fragments. They are green, multicellular, asexual buds which develop in small receptacles (called gemma cups) located on the thalli. Gemmae become detached from the parent body and germinate to form new individuals.

15. **(c)** Bryophytes are small, non-vascular plants, such as mosses, liverworts and hornworts. Bryophytes do not have seeds or flowers. Instead they reproduce via spores.

16. **(c)** Gymnosperms are seed-bearing vascular plants, such as cycads, ginkgo, yews and conifers, in which the ovules or seeds are not enclosed in an ovary. Gymnosperm seeds develop either on the surface of scale or leaf-like appendages of cones or at the end of short stalk. The largest group of living gymnosperms are the conifers (pines, cypresses and relatives) and the smallest is ginkgo, a single living plant species found in China.

17. **(b)** Double fertilization is a characteristic of angiosperms not gymnosperms. But in both of these two groups, gametophytic phase is highly reduced and is retained inside sporophytic structures. Sequoia is the tallest gymnosperm not angiosperm. Tallest angiosperm belong to the genus *Eucalyptus*.

18. **(d)** Sexual reproduction occurs by the formation of sex organs born on special branches. The male antheridia are produced on antheridiophore and the female reproductive organs are 'archegonia'. They are borne on special stalked structures called archegoniophore. Both male and female sex organs may be present on same thalli or different thalli. After fertilisation, the egg becomes zygote, which grows to form sporophyte. It is differentiated into foot, seta and capsule. Inside the capsule, the diploid spore mother cells divide by meiosis and produce haploid spores. These spores germinate to form free-living gametophytes.

19. **(b)** Minute, slender, spirally curved body furnished with two long, terminal whiplash type flagella is usually seen in bryophyte sperms. The sperms once liberated from antheridia, in the presence of water swim and are attracted towards the archegonium. They enter and fertilise the egg in the archegonia and form a zygote. The zygote does not undergo immediate reduction division. A multicellular body called a sporophyte is produced.

20. **(d)** All the statements are correct. In mosses, vegetative reproduction occurs through fragmentation or through bud in secondary protonema.

21. **(a)** Statement (i) and (ii) are correct.
Riccia is liverwort in which simplest sporophyte consists of capsule only while *Polytrichum* is moss in which sporophyte consists of foot, seta & capsule. *Volvox* is a fresh water green colonial alga. Reproduction is both sexual and asexual in *Volvox*. Sexual reproduction is of oogamous type.

22. **(a)** Chlorella could be utilised to keep the air in space vehicles pure and supply food in space stations and prolonged space flight trips. The space travellers could feed on Chlorella soup. It is nourishing but not appetizing food.

23. **(d)** Brown algae show a range of colour from olive green to various shades of brown depending upon the amount of fucoxanthin, xanthophyll pigment, present in them.

24. **(b)** Archegonium is the female sex organ of the bryophytes. It appears for the first time in the liverworts and mosses and continues in the pteridophytes. Archegonium is absent in thallophytes (algae and fungi).

25. **(a)** Fragmentation leads to an increase in the number of plants in a locality but it does not permit the spread of the plant to an entirely new locality. Gemmae are easily carried as they are small and sufficiently buoyant. They spread by water and wind currents to new habitats when detached, and each grows into a new individual immediately.

26. **(c)** All the spores are of similar kinds in majority of the pteridophytes; such plants are called homosporous. Genera like Selaginella and Salvinia produce two kinds of spores i.e. macro (large) spores and micro (small) spores, hence, are known as heterosporous.

EXERCISE - 4

1. **(c)** No known seed plant has flagellated sperms.

2. **(b)** A – Archegonia, B – Gemma cup, C – Gametophyte, D – *sphagnum*

3. **(c)** Cryptogams are the plants without seeds. In the given flow chart 'P' represent algae in which sex organ are usually unicellular and non-jacketed. 'Q' represent pteridophytes, in which both sporophytic and gametophytic generation are independent. In pteridophytes, the main plant body is sporophyte which is differentiated into tree root, stem and leaves. 'R' represent bryophytes in which diploid sporophytic lives as a parasite on an independent haploid gametophyte. All known members of bryophytes have been found to be homosporus. 'S' and 'T' respectively represent angiosperm and gymnosperm which are included under phanerogams. Gymnosperms evolved earlier and thus are more ancient than angiosperms. Gymnosperms formed dominant flora on earth about 200 million years ago in the Mesozoic era.

4. **(a)** According to the given Venn diagram, P could be an alga or a bryophyte and Q could be a pteridophyte. Algae are aquatic and bryophytes are amphibious. Pteridophytes also inhabit moist and shady places butsome are xerophytic also.

5. **(c)** In the given table, W is an angiosperm, X could be an alga or bryophyte, Y is a pteridophyte and Z is a gymnosperm. In gymnosperms, endosperm is haploid pre-fertilisation structure.

6. **(b)** The correct name of the plants A, B, C and D are respectively *Selaginella*, *Equisetum*, *Salvinia* and *Ginkgo*. The first three plants belong to pteridophytes and the fourth one belongs to gymnosperms.

7. **(b)** The red algae usually reproduce vegetatively by fragmentation, asexually by non-motile spores and sexually by non-motile gametes. Red algae is the common name of Rhodophyta. They are called red algae because of the presence of red pigment, r-phycoerythrin.