HINTS & SOLUTIONS

EXERCISE - 1

NEET LEVEL

1. **(C)** Kelps and diatoms are the algae groups which have similarity in pigment composition.

2. **(C)** Autotrophic thallophytes are called as Algae.

3. **(C)** Parasitic algae involved Cephaleuros Virescens and Harveyella. Cephaleuros is an algal parasite on tea plants. Haveyella is a parastic form of red algae.

4. **(B)** Red algae are red because of the presence of pigment phycoerythrin. This pigment reflect red light and absorbs blue light.

5. **(D)** Ulva is a small genus of marine and brackish water (most salinity then fresh water) Green algae. It is edible and is often called 'sea lettuce.

6. **(A)** In algae, asexual reproductive structures called as sprongia are either unicellular or multicellular. During an asexual reproduction, later on all cells are fertile which are not enclosed with strelie cell or strelie jacket layer to around them. Algae are belongs to group of holophyta beacuse algae are not differetiation into root stem and leaves.

7. **(A)** The red rust of tea is the disease caused by algae known as Cephaleuros verescens. Cephaleuros is an algal parasite on tea plants.

8. **(D)** The most premitive group of algae is Cyanophyceae or Myxophyceae. In this group no zoospore formation, no flagellate bodies and no sexual reproduction have been seen. Cell of Cyanophyceae show prokaryotic organization. Plants are generally in fresh water and few forms marine.

9. **(A)** Phaeothyceae also known as brown algae. Brown algae contain chlorophyll A and C and a pigment called fucoxanthin, which give its colour.

10. **(A)** Food reserve in rodophyta, (Red algae) are stored outside of the chloroplast as floridean starch which are stored in the cytosol. Floridean starch is a unique molecule that resemble the amyloprotein portion of starch, is actually more like glycogen then starch

11. **(B)** In thallophyta, zygote shows meiosis as zygotic meiosis. Zygotic meiosis life cycle appears in all fungi and some algae. A zygotic meiosis is meiosis of a diploid zygote immediately after karyogamy, the fusion of two cell nuclie. Zygotic meiosis is also known as haplontic life cycle.

12. **(C)** Chlorophyll a and carotene are photosynthetic pigments common to all algae.

13. **(A)** The green algae Acetabularia is the largest unicellular plant having a 10 cm length. The green algae Acetabularia belongs to the family polyphysaceae and class is chlorophyta Acetabularia looks like umberrla shape.

14. **(A)** Red algae are seen in deepest water. They have red pigment known as Phycoerythrin can absorbs blue-green wavelength of visible spectrum of the light that can reach the maximum depth of water. They can live in deeper depth that any other algae.

15. **(D)** Phycobilins are water soulble pigments found in the stroma of chloroplats organelles that are present only in cyanobacteria and rhodophyta. The two classes of phycobilins includes phycocyanin and phycoerythrin. Phycocynin is a bluish pigment found in primaly found in cyanobacteria (blue-green algae) to aid in absorption light in photosynthesis, while phycoerythrin is a pigment found in rhodophyta (red algae) that is responsible for its characteristic red colour.

16. **(C)** Rhodophyta and cyanophyta have similar pigment, chlorophyll a is same in both group and B-carotene and phycobiliprotein are common accessory pigments. in both, cyanophyta and rhodophyta, the phycobilins pigment, phycocyanin and phycoerythrin are also shows similar. In phaeophyta and chlorophyta phycobilins pigment is absent and chlorophyll a is similar in all algal groups.

17. **(B)** The cell wall is complicated like blue-green algae. There cell wall has many different types of substance such as xylan, galactose, polyuronic acid, polysulphate esters.

18. **(A)** Stonewort as commonly known as Chara. It is also called as musk grass. Chara belongs to family Characeae, division Charophyta a group of green algae.

19. **(C)** Chondrus crispus is the scientific name of Irish moss. It is also commonly known as Carrageen or carrageen moss and jelly moss. Irish moss is a common red macro alga or sea weed that grows in the cool waters so it found on both side of atlantic ocean.

20. **(D)** In rhodophyta (red algae) and cyanophyceae (blue-green algae), motile flagelated cells are absent and it is the characterstic of these two class. Flagelated cells like structures are absent in higher fungi like basidiomycetes and mushrooms and also absent higher sea plants. In higher sea plants, (Gymnosperms) male gamete is non-flagellated.

21. **(B)** Cephaleuros is the alga which is recognized by plants pathogen and cause a disease known as red rust on tea. Polysiphonia fastigiata is a parastic red algae species on Ascophyllum nodusum. Laminaria is the brown algae in which thallus consists parenchymatous structure. Harveyella is the parastic red algae and it shows colourless, lack photosynthetic pigment and live as parasite in other or grows heteropically on other photosynthetic red algae.

22. **(D)** Green algae belongs to the chlorophyta. The scientific name of these algae contains the green pigment chlorophyll. Thus chlorophyta are consider to the ancestors of the higher land plants based on three points of evidence.

First : Green algae have chlorophyll a and b in the same amount as cells in higher plants

Second : Green algae can store food in the same form as do the higher plants.

Third : Green algae in higher plants both have well defined cell walls made up of cellulose.

23. **(B)** Pyrenoids are the spherical protein structure found within chloroplast of some algae. Pyrenoids contain protein beside starch and each pyrenoid has a central protein known as pyrenocrystal and a surrounding starch sheath.

24. **(D)** Chlorophyta is reproducing by both sexually and asexually. In sexual reproduction can be isogamy, anisogamy and oogamy. In oogamy type of reproduction, produces sperm and immotile eggs and it is different in size and motility. Primitive organism sometime exhibit isogamy means equally sized gametes , so cannot find male and female gametes due to same size transition from isogamy to anisogamy, because in aniogamy small and large motile gametes formed so clearly shown male and female gametes.

25. **(A)** Stephan Endlicher published his genera plantrum secundum oridinis disposita. In that he divided plant kingdom into Thallophyta and Cormophyta. The Thallophyta included plants with simple structure without stem, roots, vessels and clearly defined sex organs.

26. **(C)** The unique character of thallophyta is sexual reproduction. They reproduce sexually by fertilization and meiosis. Meiosis is sporic, gametic or zygotic. Vascular system or tissue is absent and plants body is like thallus, but they are general characters.

27. **(A)** In thallophyta, the main plant body is gametophyta.

28. **(D)** The plant body of thallophyta is not differentiated into roots, stem and leaves. So plant body is called thallus it is known as thallophyta. They do not possess vascular tissues. The thallus consists of single cell to well developed uniseriate or branched filaments. Sex organs are unicellular, and when multicellular every cell forms a gametes. There is no jackets of sterile cells.

29. **(D)** The thallophyta reproduced sexually when gametes fused to form a zygote. There are three types of sexual reproduction on the morphological and physiological behaviour gametes

Isogamous : Both gamtes are morphological and physiological similar and their fusion is called isogamets.

Anisogamous : The microgamets is smaller and more active, while the female gametes is larger and sluggish and their fusion is called as anisogamy.

Oogamous : Female gamete is large and non-motile and male gamete is small and motile their fusion is called oogamy.

30. **(B)** Chlorophyta is also known as green algae is called as most advanced algae because chlorophyta have chlorophyll a and b and store starch as a reserved food material inside their plastids. Also it is a diverse group of algae and most of them are fresh water forms. Plant body is motile and unicellular.

31. **(C)** In certain bryophytes especially in species of Antheceros, the cell possess chloroplast and pyrenoids which is an algal characters. The sperms are motile, which indicates the algal ancesory of the bryophytes.

32. **(C)** Moss gametophytes are either erect or extensively branched prostate plants that consists of an axis bearing spirally arranged leaf like. In suitable conditions moss spore will germinate and give rise to a microscopic chlorophyll branched filament from which eventually, the leafy gametophytes will arise.

33. **(C)** The sporophytes of moss is small an absent of leaf or roots. It consists of a foot that absorbs water and nutrients from the gametophyte, seta and capsule.

34. **(B)** Sporophyte with indefinite growth occurs in hornworts.

35. **(A)** Sphagnum can be used as substitue of absorbent cotton.

36. **(A)** Stems and leaves of bryophytes are analogous to stem and leaves of higher plants.

37. **(B)** The aquatic ancestory of bryophytes is most clearly demonstrate by the use of flagellated motile sperms. Flagellated motile sperm is related with flagellated male gametes or called as antherozoids. The flagellted male gametes of bryophytes in which their aquatic ancestors, presence of water to help them to move towards female gametes.

38. **(B)** Embryophyta is a major group of plants, sometimes known as land plants, that includes both the non-vascular bryophyta and the vascular land plants.

39. **(A)** Bryophyta known as non-vascular tissue. They do not have or contain xylem and phloem. They contain water conduction cells known as hydroids. Surrounding hyroids, the food conductivity tissue present known as leptom and food conductivity cells known as leptoids. Parenchymaous is present outer side of leptoids and hydroids are present inside of leptoids.

40. **(B)** Elaters are an elastic filament serving to disperse spores. It is a specially thickened filament, occuring in liverwort capsules and helps to disperse spores. so elaters are found in bryophyta, division liverwort . Mosses have lack elaters and some elaters are present in some hornwort species.

41. **(B)** Bryophytes are non-vascular plants, meaning they do not have xylem or phloem. These groups of plants requires external water, usually in the form of dew or rain. some bryophyta grow exclusively in dark , damp enviornments in order to produce moisture. Water is essential for bryophyte reproductive activities. Most mosses have water-conducting cells called hydroids in the centers of thier stems, and some even have food conductivity cells of a leptoids.

42. **(B)** In pteridophyte, deduction division occurs when spores are formed.

43. **(A)** The main plant body of pteridophyte is sporophyte.

44. **(A)** Cryptogamic plants are seedless.

45. **(D)** In pteridophyta, division Lycopsida, a club moss is spore bearing, cone like structure (strobilus) as its stip. Division Sphenopsida, horse tails is known as Equistum hyemale possess a terminal spore cone (strobilus).

46. **(B)** Adantium is commonly known as ' walking fern' beacuse its leaf tip when comes in contact with soil, develops adventitious roots, forms new leaves and develops into a new plants. So by vegetative reproduction its leaf tip adantium is called walking fern.

47. **(B)** Bryophyta known as taxonomic group of plants which have no seed or seed less and non-vascular tissue. Pteridophyta are spore producing and having vascular tissue but absence of seeds. It is also known as seedless vascular plants. Gymnosperms are naked seeded vascular tissue plants.

48. **(A)** Selaginella possess ligulate type of leaves and having two types of spore called microspores and megaspores so it is heterospory. In pteridium spores are either homospory or heterospory. Funaria and Riccia are belongs to bryophyta. There are absence of true leaves.

49. **(A)** In Lycopodium the antherozoids are by biflagellated. It is also seen in selaginella. Multiflagellate antherozoids are seen in equisetum and ferns.

50. **(B)** Azolla pinnata is an aquatic fern which contains a nitrogen fixing cyanobacteria known as Anabaena azollae, in its leaf cavities. It is an execllent biofertilizer for the rice crop.

51. **(A)** Azolla is known as aquatic ferns. Azolla shows heterosporous and spores in heterosporous ferns are formed in special structure called scorocarp.

52. **(D)** The antherozoids or sperm of fern are spirally coiled or twisted multiflagellate.

53. **(A)** In angiosperms and gymnosperm, both have ovules. In angiosperm ovules develop into fruits while in gymnosperm pollen grains fall and germinate directly on the ovules. Endosperms are present in both groups but in angiosperms it is triploid and gymnosperm it is haploid. Vessels are present in angiosperms but absent in gymnosperms.

54. **(B)** The megasporopylls or carpels are not differentiated into stigma, style and ovary. Ovules are exposed on the carples, true carples are absent and so seeds are naked.

55. **(C)** In angiosperms there is fruit as well as seed formation and seeds are always enclosed in a fruit.

In gymnosperm there is only seed formation but no fruit formation gymnosperm have no flowers or fruits, and have unenclosed or naked seeds on the surface of scales or leaves or called cones and this is the most important and major difference between them.

In gymnosperms true vessels present but in gymnosperms it is absent.
In gymnosperm endosperm is haploid, while in angiosperms endosperm is triploid.

56. **(D)** Gametophyte embedded in sporophyte in Spermatophyta.

57. **(C)** Eggs do not occur in archegonia in angiosperms.

58. **(D)** Antheridia and archegonia are absent in Angiosperms. In angiosperms, stamens and carpels are the male and female reproductive structures. In pteridophytes, antheridia and archegonia are the male and female sex organs.

59. **(A)** Pteridophyta is seedless vascular plants. They do not possess ovules and are homosporous. Megasporangium protected integument structure is absent in pteridophytes. Gymnosperms shows ovules which is not covered by ovary and angiosperms shoes ovules which covered by ovary.

60. **(A)** Ephedrine is obtained from the plant genus Ephedra sinica is a species of ephedra (ma huang) contains ephedrine and pseudoephedrine.

61. **(A)** In Gymnosperms, the pollination is exclusively by Anemophilous-micropylar. Anemophily is the pollination by wind.

62. **(A)** Resin turpentine is obtained from Pinus. Turpentine deprived of oil by distillation and the remains is called colophony. White turpentine is obtained from sapwood of Pinus palustris. European turpentine is obtained from Pinus sylvestris.

63. **(C)** The largest groups of living gymnosperms are the conifers included pines, cypresses and relatives and the smallest is ginkgo. Conifers are the largest group of gymnosperms which produce cones the sexual parts of the plant.

64. **(D)** Spore bearing tracheophyte are pteridophytea, gymnosperms and angiosperms.

65. **(C)** Gymnosperm gnetales orders comprise the closest living relatives of flowering plants angiosperms beacuse of a number of features apparently shared by both groups the presence of vessels (water conducting cells with holes all the way through the cell wall).

66. **(D)** Living fossil is all including Cycas, Gingko, Psilotum, Etc.

67. **(B)** Like all seed plants, Gymnosperms are heterosporous.

68. **(A)** During flowering plant reproduction, two structures are formed, a zygote and the endosperm. A zygote will grow and develop into an embryo. The endosperm is the plant embryo's food source. This process of forming a zygote and endosperm is called double fertilization.

69. **(C)** Sequoia belongs to genus conifers and in the order Coniferales. Sequoia sempervirens is world's tallest trees. It is also known as redwood tree.

70. **(D)** The gymnosperm is a perennial evergreen woody plant. Most of the gymnosperms are trees and some are shrubss. A few gymnosperms included may be lianas or climbers. There are no herbs gymnosperms.

71. **(C)** **Olericulture** is the science of vegetable growing, dealing with the culture of non-woody (herbaceous) plants for food. **Olericulture** is the production of plants for use of the edible parts.

72. **(A)** Pomology (from Greek pomum (fruit) + -logy) is a branch of botany that studies and cultivates fruit.

73. **(C)** **PALYNOLOGY**: The branch of science **concerned** with the study of pollen, spores.

74. **(A)** The study of living organisms for human welfare is called Applied Biology.

75. **(D)** **Exobiology** is considered to have a narrow scope limited to search of life external to Earth.

76. **(D)** Silviculture is the branch of science that deals with the development and utilization of forest. It is the cultivation of trees or the establishment or growth composition, health and quality of forests to meet diverse needs and values based on the knowledge of silvics. Silvics is the study of the life history and general characteristics of forest trees with respect to local environmental factor. Apiculture is the management and study of honeybees.
Horticulture is the branch of agriculture that deals with the art, science technology and business of plant cultivation e.g., fruits, vegetables, nuts seeds, herbs ornamental trees etc.

77. **(D)** The branch of biology that deals with bacteria, virus and fungi is called as Microbiology.

78. **(C)** pollination, embryo development and microsporogenesis are studied under plant embryology.

79. **(C)** **Alpha taxonomy or classical taxonomy:** It is based on external morphology, origin and evolution of plants.

80. **(C)**

EXERCISE - 2

AIIMS LEVEL

1. **(C)** Blue-green algae and red algae have similar pigment, chlorophyll 'a'. In same in both groups and B-carotene and phycobiliprotein are common accessory pigments. In both, blue-green algae and red algae, the phycobilins pigment, phycocyanin and phycoerythrin are also shows similar. In Rhodophyta (red algae) and Cyanophyceae (blue-green algae), motile flagellated cells are absent. The cell walls of blue-green algae are same like those of bacteria; they also usually seem to contain Muramic acid. All blue-green algae process photosynthetic pigments located in lamellar structures that appear to be flattened vesicles. These structures are similar to the Reproduction in blue-green algae is by cellular fission as in bacteria.

2. **(D)** Algae can be refferred to as plant-like organisms that are usually photosynthetic and aquatic, but do not have roots, stems, lleaves vascular tissue and have simple reproductive structures.
Algae do not have roots but attach to the substrate by rhizoids and rhizomes. Algae are classified as a primitive subkingdom of the plant kingdom the thallophytes. Thallus is a plant body of algae, formerly assigned to the group Thallophyta.

3. **(B)** Bryophytes and algae are both autotrophic, plant body is thallus-like and devoid of vascular tissues. Insteat of roots. rhizoids are present for attachment and absorption purpose. Both algae and bryophytes have motile sperms and need water for fertilization. But bryophytes can be separated from algae (Thallophyta) beacuse archegonium originated for the first time in bryophytes in the plant kingdom. It is a flask-shaped structure with swollen base called venter and upper elongated neck. The venter contains a venter contains a venter canal cell and an egg cell. It is surrounded by one-celled thick sterile jacket layer. In algae, sex organs are non-jackets and unicellular.

4. **(C)** Classification of algae is mainly based upon the nature of pigments. Other criteria are the nature of food reserved, nature of flagella and cell wall composition. Based on the pigment colour, nature of stored food material and cell organization, algae are divided into three main classes, red or Rhodophyceae algae, brown or Phaeophyceae algae and green or chlorophyceae.

5. **(A)** The original Carrangeenan was Chondrus Crispus, red seaweed found in the north Atlantic. Chondrus crispus is a mixture of kappa and lambda. Carrageenan extract is mucilage extracted from Chondrus crispus (Irish Moss) Seaweed. It is dried and powdered.

6. **(B)** The female sex organ of algae is called oogonium. They are usually unicellular, and contain one or more egg cells. If the female macrogamete remains stationary. It is called and egg cell or oosphere. In bryophyta, the female sex organ is called archegonium. Carpel is the female reproductive organ of flowering plants, composed of ovule, style and stigma.

7. **(B)** Gaudikov's effect has been seen in some species of algae. In Gaudikov's effect red algae are look like blue on sea surface but actually it is not a blue algae it is red algae in bottom or depth is sea.

8. **(C)** In some algae two entire individual fuse with each other. Such a type of sexual reproduction is called Hologamy.

9. **(C)** Some bule green algae (BGA) have empty looking thick walled structures in their trichrome, known as heterocysts and under aerobic conditions only the heterocysts blue green algae can fix nitrogen.
Vegetative reproduction occurs by fission or fragmentation or by the formation of Hormogonia in Cyanobacteria . Cyanobacteria formerly called blue-green algae are relatively simple, primitive life forms closely related to bacteria.
Food storage as cyanophycean starch occurs in Blue green algae.
Floridean starch is found in the Rhodophyta, red algae and brown algae (Phaeophyta) have laminarin or mannitol as the food storage.

10. **(D)** Cilia and flagella are the most ancient organelles for the providing motiliy. Red algae and Blue green algae have non-motile cells. In the cells of blue-green algae, cilia and flagella are absent but they have capacity of movement by gliding and rotatory motions. Cilia and flagella like structures are absent in red algae (higher algae).

11. **(A)** Green algae.

12. **(A)** Speramatangium in red algae, a male gametangium that is typically a colourless, each produces a single male gamete called Spermatia, which is released to fertilization the female gametangium called Sapogaonium.

13. **(A)** Certain cells in every filament possess one or more ring-like marking of hemicellulose, called as

apical caps and at their distal ends, such cells are called cap cells. The division in Oedoganium is uniqueq resulting in the formation of distinctive apical caps at the distal end of certain cells.

14. **(B)** In some large brown algae, certain cells are modified into long filaments called trumpet hyphae. These act as food-conducting tubes, like phloem in vascular plants carrying food from laminar to the holdfast.

15. **(B)** Chlorophyll c is found in brown algae, and dinoflagellates. Chlorophyll D is a minor pigment found in some red algae, while the rare chlorophyll E has been found in yellow-green algae.

16. **(D)** In some species of algae, like genus Vaucheria has asexual reproduction takes place by syn zoospores, which are interpreted as representing a number of zoospores that remain united in a single, composite structure. The syn zoospore bears many pairs of slightly unequal flagella.

17. **(C)** The reserve food is starch in algae and the reserve food is glycogen in fungi.

18. **(B)**

19. **(B)** Blue green algae are helpful in nitrogen economy of Indian agriculture. Nitrogen economy of rice soils in relation to nitrogen fixation by blue green algae. The role of blue green algae in nitrogen economy of rice fields is well documented and nitrogen fixed by these organisms may become available to rice plants only after their release into the surrounding either as extracellular products.

20. **(B)** Seaweeds belongs to Brown algae. The Phaeophyceaeor **brownalgae** (singular: **alga**), are a large group ofmostly **marine** multicellular **algae**, including many **seaweeds** located in colder Northern Hemisphere waters. They play an important role in **marine** environments, both as food and as habitats.

21. **(A)** Thallophyta is a primary division of the plant kingdom. The phylum consists of very diverse habit and structure including algae fungi and lichens. The simple forms are unicellular and reproduce vegetatively or by means of asexual spores. In higher forms the plant body is a thallus which is not differetiated into root stem and leaves. The thallophyte exist almost exclusively as gametophyte. They develop from haploid spores. Spores develop into a protonema which grows into a moss plant.

22. **(C)**

23. **(D)** In all bryophytes, the sporophyte is without differentiation into stem and leaves. It is rootless and consists of a foot, a seta and a capsule in Riccia, the foot and the seta are absent. The sporophytes of bryophytes are dependent upon gametophytes for their food and nutrient, same as in Riccia sporophyte is dependent upon gametophyte because Riccia sporophyte consists of a spherical spore capsule that develops within the thallose gametophyte.

24. **(D)**

25. **(A)** In Bryophyta, organs are referred to as 'Leaf like' and 'Stem like' and not the true leaf and stem have the complex tissues which perform the water and food conduction. Bryophytes being the lower plants plants do not have true leaf, stem and roots. They do not have vascular tissue system.

26. **(D)** In bryophytes, many liverwort species, within the spore capsules there are elaters as well as spores. Elaters are tubular cells with spiral thickening and often help spore release or dispersal. Pseudo elater is a single-celled structure that aids in spore dispersal in hornwort bryophytes. In mosses, most species have specialized hygroscopic structures known as Peristome teeth, around the mouth of capsule to aid in spore dispersal.

27. **(C)** In Mosses or Musci or bryophyta, rhizoids are presents. Rhizoids are branched, multicellular, arise from base of aixs, each with oblique septa. The septa between the cells are oblique and occur at long intervals.

28. **(D)** In Funaria, each spore on germination givees rise to the gametophyte that arises indirectely as a lateral bud from the protonema.

29. **(C)** In bryophytes, sporophyte is short-lived and attached to the dominant gametophyte. The gametiohyte is free-living and the male gametes or called antherozoids are biflagellate typically require a continuous water to reach the archegonia. The biflagellate antherozoids are produced inside containers called antheridia, from which they are released when ripe, and they use their two flagella to swim toward the archegonium.

30. **(D)** Bryophytes are the cryptogamae, which do not bear flowers and seeds. They are non-vascular land plants of moist habitat, in which diploid sporophyte lives as a parasite on independent haploid gametophyte. Pteridophytes are vascular cryptogams due to the presence of vascular tissues in the plant body. Gymnosperm and Angiosperms are Phanerogams, which possess flowers and seeds.

31. **(B)** Rhizoids of hepaticopsida and anthocerotopsida are unicellular and unbranched.

In anthocerotopsida scales are absent but in hepaticopsida scales are present. Bryopsida ehizoids are multicellular.

32. **(B)** In bryophyta sex an organ is covered by a sterile jackets cell while in algae and fungi which is belongs thallophyta have not sterile jacket which covered sex organ.

33. **(B)** Vascular tissues like xylem and pholem are found in the higher plants. These vascular tissues helps in the conduction of food and water through the complex plant body of higher plants. Roots are seen in higher plants, but they are absent in both thallophytes and bryophytes. Since, thallophytes and bryophytes dont have true leaves, stem and roots they have vascular tissues.

34. **(D)** The life cycle of bryophytes shows two phases : a haploid gametophytic phase and a diploid sporophytic phase. The main plant body bryophyta is gametophyte and the sporophyte or its basal part called foot, remains embedded in archegonium, so it always remains attached to the gametophyte.

35. **(A)** Non-vascular land plants are small simple plants without a vascular system. They do not have a phloem or xylem. Bryophytes are known as embryophytes. Embryophytes are also known as land plants. In bryophytes, vascular tissue is absent. Algae are considered as non vascular plants not non vascular land plants.

36. **(B)** Sanjeevani is commonly known as Selaginella bryopteris. While some references in scientific literature list Selaginella bryopteris as the Sanjeevani menthioned in Hindu mythology.

37. **(D)** Azolla is an aquatic floting fern, found in temperate climate suitable for paddy cultivation. The blue green algae cyanobacteria (Anabaena azollae) present as a symbiont with Azolla in the lower cavities actually fixes atmospheric nitrogen.

38. **(B)** **39.** **(D)**

40. **(A)** Evolution of seed habit first started in Selaginella like ancestral pteridophytes.

41. **(B)** Younger fern parts of stem, young leaves, rhizomes, petiole and rachis of mature leaves posses hair or scales called Ramenta. Ramenta protect them from mechanical injury and desiccation.

42. **(B)** In ferns, the permanent roots are adventitious roots.

43. **(A)** Pteridophytes have different from moss and seed plants in the sporophyte and gametophyte generations are independent and also free living.

44. **(A)** The gametophyte generation, in pteridophytes are nearly always short lived. The pteridophyta life cycle is characterized by having two separate free-living plants, gametophytes and sporophytes, interconnected by stages of the sexual process. The gametophytes of pteridophytes are bear male and female sex organ called antheridia (male) and archegonia (female).

45. **(C)** Stem: The main stem is underground, creeping and perennial rhizome. It often lies more than a meter below the surface of the soil. It is differentiated into nodes and internodes.

46. **(C)** The sporangia are the bodies in which the spores are produced is a part of pteridophytes. Sori sporangia, spores and sporangia, spores and sporocarp are the sporophyte fertility of pteridophytes. The mature fern plant is the sporophytes that produces spores which are released from sporangia. Sporangium (Clustered in sori) is the structure which produces spores.

47. **(B)** In pteridphytes, the sporophyte plant develops sporangia within which are diploid cells called spore mother cells or sporocytes. Each spore mother cell or sporocytes divides by meiotic or reduction division. Reduction divisions of spore mother cells are haploid, within their respective sporangia.

48. **(A)** Secondary growth takes plan by the activity of the cambium. Cambium is present in gymnosperm and dicot angiosperms. Secondary growth occurs in gymnosperms and angiosperms. But it is present in pteridophytes due to absence of cambium.

49. **(C)** Gymnosperms having similar structure and growth like to similar trees and having branches so it's known as Arborescent.

50. **(A)** Seeds of gymnosperms having two sporophytic and one gametophytic generation. The seed coat and megasporangium develop from tissues of the diploid sporophyte. The megasporangium is the haploid female gametophytic tissue of the next generation. The center of the seed contains the third generation, in the form of the embryo of the new diploid sporophyte.

51. **(C)** Fossils of williamsonia were first discovered by Birbal sahni, who extensive palaeobotanical worked in Inida. He found one hundered million years old fossil forest is in Rajmahal Hills, Bihar.

52. **(A)** The gymnosperms are more ancient than the angiosperms in evolutionary terms. Gymnosperms have formed two hundred million years ago and dominant vegetation in earth. Gymnosperms have been replaced by Angiosperms with changing time andclimatic conditions. Gymnosperms maintain their dominance over angiosperms only in the colder regions of the world where snow is the source of water rather rain.

53. **(C)** The extinct plant williansonia sewardiana which in forest Rajmahal hill, Bihar about 100 million years ago. This model is based on the reconstruction envisaged by Prof. Birbal Sahni.

54. **(D)** Cycas and ferns both possess circinate ptyxis and ramenta. The leaves are pinnately compound

and like the fern-leaves possess circinate ptyxis.

55. **(C)** The phenomenon of the development of more than one embryo in one ovule, seed or fertilized ovum is called polyembryony. It occurs in both animals as well as plants. In majority of the gymnosperms showing polyembryony, usually two or more archegonia develop in a female gametophyte. And as each archegonium contains an egg, two or more eggs may be fertilized and thus two or more potential embryos may be created. Only one embryo, however, survives usually, and all the others perish during the course of the development.

56. **(D)** Maize, Mint or known as Mentha and Peepal or known as Ficus religiosa are belongs to plant kingdom angiosperms, which known as flowering plants and as well as as produced seeds.

57. **(A)** A drug called "taxol" is obtained from Taxus tree is effective against Parkinson's disease.

58. **(D)** The reasons for success and dominance are as follows:

(1) Presence of deep, penetrating and wide-spreading roots which not only anchor the plants but also absorb water and mineral salts from deeper layers of the soil.

(2) Covering of aerial parts with water proof material like cutin in living tissue and suberin in dead corky bark.

(3) Mechanical tissues present to allow them to rise to great heights.

(4) Presence of long distance transport system in the form of vascular tissues.

(5) Modification of structure and physiology has occurred to suit various habitats— desert, rocky terrains, moist areas, acid neutral and alkaline soils, warm or cold areas, etc.

59. **(B)**

60. **(C)** Most specialised sporophylls found in angiosperms. In angiosperms flowers is a specialized shoot that have four types of modified leaves known as sporophylls called floral organs are present, they are sepals petals stamens and carpels.

61. **(B)** The most reduced gametophytic stage is present in Angiosperms.

62. **(D)**

63. **(D)** Archegoniate plants menas a plants group that produced archegonia. Archegonium is a female reproductive organ, which is present in fern (pteridophytes), mosses (bryophyta), liverworts and most gymnosperms. In angiosperms archegonia are absent, instead of archegonium they have carpels for the reproduction.

64. **(B)** In gymnosperm the endosperms a nutritive tissue is haploid and is formed before fertilization. In angiosperms the endosperms is triploid and is formed after fertilization.

65. **(B)** **Speleology** or spelaeology (also spelled spelæology) is the scientific **study** of**caves** and other karst features, their make-up, structure, physical properties, history,**life** forms, and the processes by which they form (speleogenesis) and change over time (speleomorphology).

66. **(D)** Carolus Linnaeus, also called Carl Linnaeus, Swedish **Carl von Linné** (born May 23, 1707, Råshult, Småland, Sweden—died January 10, 1778, Uppsala), Swedish naturalist.

67. **(B)** Norman Ernest Borlaug

Norman Borlaug. **Norman Ernest Borlaug** (March 25, 1914 – September 12, 2009) was an American agronomist, humanitarian, and Nobel laureate who has been called "the father of the Green Revolution."

68. **(A)** **Pedology** is the **study**of soils in their natural environment. It is one of two main branches of soil science, the other being edaphology.

69. **(B)** Euthenics is the improvement of human race by improving the environmental conditions i.e., by subjecting them to better nutrition , better unpolluted ecological conditions.better education and sufficient amount of medical facilities.

70. **(C)**

71. **(B)** Agrostology, sometimes graminology, is the scientific **study** of the **grasses** (the family Poaceae, or Gramineae).

72. **(B)** **Gerontology** is the **study** of aging and older adults.

73. **(D)** Soil

74. **(C)** **75.** **(A)** **76.** **(B)**

77. **(C)** **78.** **(C)** Floriculture. **79.** **(A)**

80. **(B)** Contributions of Dr. MS Swaminathan are as follows :

(i) Introduction of short high yielding varities of wheat in india.

(ii) Development of short duration, high yielding varities of rice.

EXERCISE - 3

P-1 (Matrix Match)

1. (E) **2.** (D) **3.** (D)
4. (C) **5.** (C) **6.** (C)
7. (C) **8.** (D) **9.** (C)

10. **(A)** : Artificial system of classification, put forward by Linnaeus uses one or two morphological characters for grouping of organisms.
Natural system of classification takes into consideration comparable study of characteres so as to bring out natural similarities and dissimilarities and hence natural relationships among the organisms. A natural system for classification of speed plants was proposed by Bentham and Hooker (1862 -1883) in their three-volume treatise 'Genera Plantarum'.
Classification based on evolutionary relationships of organisms is called phylogenetic system of classification. First phylogenetic system was proposed by Engler and Prantl (1887 - 99). In their treatise ' Die Naturlichen Pflanzen Familien' Engler and Prantl arranged flowering plants according to increasing complexity of their floral morphology.

11. **(C)** : Chemotaxonomy is based upon the characteristics of various chemical constituents of organisms. Chemical constituents of plants species have been found to be unvarying and do not change easily. Chemical characters have also helped in establishing relationships and statistical evaluation of taxonomic information.

12. **(A)** : Cryptogamae refers to plants without seeds and Phanerogamae refers to plants with seeds. Algae and bryophytes are non-vascular cryptogams. Pteridophytes are vascular cryptogams. Gymnosperms and angiosperms are phanerogams.

13. (A) **14.** (D) **15.** (D)

16. **(A)** : Spirogyra is an unbranched, mucilage covered green filamentous alga that forms free floating masses over the surface of water ponds.
Chlamydomonas is a microscopic eukaryotic, unicellular, pyriform, biflagellated gree alga.
Volvox is a fresh water green hollow ball like colonial alga of 0.5 - 2 mm diameter.
The giant brown algae are called kelps. The largest kelps are Macrocystis (40 - 100 m) and Nereocystis (20 - 30 m).

17. **(A)** : Funaria exhibits gametophytic (n) as well as sporophytic (2n) generation in its life cycle. The gametophytic generation is represented by a short lived protonema which produces spermatozoids in antheridium of male shoot and egg in archegonium of female shoot. Sporophyte of Funaria has embedded foot, an elongated curved seta and a terminal pyriform capsule. Sporophyte is nutritionally dependent on gametophyte.

18. **(C)** : Sexually, Marchantia is dioecious with sex organs borne on stalked upright receptacles or gametophores. Gametophore of male thallus is called antheridiophore having a stalk and a lobed male receptacle. Gametophore of female thallus is called archegoniphore. Its receptacle has nine cylindrical processes or rays.

19. **(B)** : Plant shown in the figure is Sphagnum. It is a bryophyte, commonly called as peat moss. it often growns in acidic marches. It is hygroscopic and possesses a remarkable water holding capacity. Hence, it is used as a packing material in transportation of flowers. It is also used in seedbeds and in moss sticks.

20. **(B)** : Plants given in the figure are A - Selaginella and B-Ginkgo respectively. Selaginella is a trailing, hanging or erect evergreen lycopod (Pteridophyte). Ginko biloba (a Gymnosperm) has not changed for the last several millions of years since its appearance in triassic period. It is also called living fossil. The plant has survived due to interest shown by horticulturists. It has natural immunity to several plant diseases.

21. **(A)**

22. **(A)** : In Equisetum, plant body is differentiated into stem, leaves and root. Adventitious roots develop in whorls over the nodes of rhizome. Aerial branches develop terminal strobili. In E. arvense, there are two types of aerial branches, green sterile and brown fertile. Terminal strobili occu only on fertile branches.

23. **(C)**

24. **(B)** : Stem portion of Cycas revoluta andC. circinalis is a good source of Sago - a kind of starch used in making bread by poor people. Seeds of Pinus gerardiana (Chilgoza) are edible. Oil obtained from Juniperus species is medicinally important. An important alkaloid ephedrine is ontained from Ephedra (a gymnosperm) and is used in treatment of cough, cold and other respiratory disorders.

25. **(B)** : Thuja plicata possesses the wood which is known for possessing certain antibiotics. It is resistant to weathers and is widely used for commercial purposes. It also provides an essential oil which is used in perfumery. Agar is obtained from cell wall of Gelidium and Gracilaria.

26. **(A)** : Gymnosperms shown in the figures are A - Cycas and B - Cedrus respectively. Cycas belongs to the group cycads and Cedrus belongss to conifers. Cycas is also called living fossil because it possesses a number of characters of extinct pteridosperms and cycads.

27. **(A)**

28. **(B)** : Pteridophytes are vascular cryptogams. They are the first vascular land plants.

29. **(A)**

30. **(A)** : Smallest angiosperm is Wolffia microscopici, while Rafflesia arnoldii is the parasitic plant with world's largest flower.

31 **(B)** : Zoomed in portions of leaves show paralled venation in plant A, a characteristic of monocotyledonae except for a few and reticulate venation in plant B, a characteristic of dicotyledonae.

EXERCISE - 3

P-2 (Assertion & Reason)

1. **(B)** : Biennial plants live for two favourable seasons. During the first season, the plants grow in size and store food. In the second season, they bear flowers that form fruits.

2. **(B)** : Bryophytes and tracheophytes possess an embryo stage. They are collectively called embryophyta. Bryophytes and tracheophytes are terrestrial plants. Bryophytes are nonvascular while tracheophytes possess vascular tissue.

3. **(B)** : Stamens are specialized microsporophylls. Each stamen has a narrow stalk or filament and a knob-like broader tip called nather. Anther develops four microspporangia or pollen grains. Carpels are specialized megasporophylls. Each carpel has a swollen base named ovary. The interior of ovary contains one or more placentae for bearing ovules.

4. **(A)** : On the basis of
(i) Thallus like non - vascular body.
(ii) Simple, unicellular non - jacketed sex organs and
(iii) No embryo development after gametic union, the algae and fungi have long been grouped together in thallophyta. The algae and fungi are the result of parallel development and do not indicate any phylogenetic relationship.

5. **(A)** : The colour of the algal thallus which varies in different classes of algae is due to the presence of definite chemical compounds in their cells. These are called the pigments. Each pigment has its own characteristic colour. The particular colour that an alga has is due to the predominance of one pigment in a combination of several others. Each group of algae has its own particular combination ofpigments and a characteristic colour which is not found in other algal groups.

6. The red algae flourish and occur in abundance at great depth of sea where other plants do not occur in abundance. The sunlight as it penetrates water, portions of spectrum such as red, orange, yellow and green light rays which are of short wavelengths are filtered out. Only the blue and violet rays of great wavelength remain and penetrate to great depths. The green pigment chlorophyll cannot trap these light rays of great wavelength and the green plants are thus unable to carry on photosynthesis at these depth. On the other hand the red pigment r-phycoerythrin and a blue pigment g-phycocyanin which are characteristic pigments of all the red algae, can utilize wavelengths of light (blue and violet rays) not absorbed by chlorophyll.

7. **(E)** : The carpogonium (female sex organ) in Nemalion, one of the simplest red alga, consist of a swollen basal part containing the female nucleus and an elongated terminal hair-like structure called the trichogyne. During fertilization the spermatium (male gamete) discharges its contents into the lateer. The spermatium nucleus migrates downwards to fuse with egg nucleus in the basal swollen part of the carpogonium. Soon after fertilization the trichogye shrivels.

8. **(A)** : In Spirogyra, the outermost portion of pectose changes into pectin. The latter dissolves in water to form the so called gelatinous sheath which is slimy. It envelopes the entire filaments. This makes filament slippery in touch.

9. **(C)** : The fusing gametes in the lower forms of algae are alike in size, structure and behaviour. They are indistinguishable as to sex. Such gametes are called the isogametes. Sexual reproduction which involves the fusion of isogametes is termed isogamous. It is a primitive type of sexual reproduction.

10. **(A)** : Angiosperms is the highly evolved group of plant kingdom. It is adapted for terrestrial habitats. Swimming habit of sperms is completely lacking in angiosperm. The pollen grains reached to the stigma by an external agency and delivered the male nucleus in the ovule through pollen tube.

11. **(B)** : Fertilized ovules ripen into seeds. The seeds are covered by fruits. A fruit is technically a ripened ovary. Gymnosperms contain ovules but they lack ovary, therefore, seeds are formed but fruits are not formed. Angiosperms contain both ovule and ovary and therefore, are seed bearing fruit forming plants.

12. **(B)** : The chloroplast of green algae contain one or more distinct, rounded, proteinaceous bodies called the pyrenoids. Pyrenoids diminish in size and ultimately disappear if the plant is under conditions of starvation. They reappear when the conditions become favourable.

13. **(C)** In green algae the eye spot is usually associated with the chloroplast. Eye-spot is considered as a photoreceptive organ.

14. **(B)** : Chlorella could be utilised to keep the air in space vehicles pure and supply food in space stations and feed on Chlorella soup. It is nourishing but not appetizing food.

15. **(B)** : In angiosperm, sporophylls are organised into flowers. Both microsporophylls and megasporophylls are specialised. A microsporophyll or stamen consists of a filament and an anther. A megasporophyll or carpel is rolled and partly sterilised to produce a stigma, style and ovary containing ovules.

16. **(C)** : Many believed that Chlorella could serve as a potential source of food and energy because its photosynthetic efficieny can theoritically reach 8 % comparable with other highly efficient crops nutrients. When dried, it has about 45 % protein, 20 % fat, 20 % carbohydrates, 5 % fibre and 10 % minerals and vitamins.

17. **(A)** : A life cycle characterised by a haploid thallus, and zygotic meiosis is called haplontic life cycle, It is also called as haplobiontic because only a single type of free living individual is involved in the life cycle. Spirogyra shows haplontic life cycle and therefore, it also shown zygotic nucleus.

18. **(A)** : In some species of red algae called coralline algae, the cell walls become hardened with calcium carbonate. These algae hence important for the formation of coral reefs. Coral reefs are formed through the accumulation of calcareous exoskeletons of coral animals, calcareous red algae and molluscs. They form the foundation of reefs by secreting a calcium carbonate skeleton and provides protection for the coral polyps. Calcium carbonate is secreted continously by the coral colony.

19. **(A)** : Bryophytes are a group of non-vascular land plants. The sex organs in the bryophytes are multicellular and jacketed. The kacket of sterile cells around the sperms and eggs in an adaptation to a life on land. It protects the sex cells against the drying effects of air.

20. **(E)** : Most of the bryophytes are land dwellers which inhabit damp, shaded and humid localities. A few of them live in or float on water. The bryophytes cannot carry on their reproductive activites without sufficient moisture. Presence of water is necessary.

21. **(C)** The bryophytes have evolved a life which comprises two phases-gametophyte and sporophytes. The gametophyte (haploid) is concerned with sexual reproduction and constitutes the most conspicuous, nutritionally independent phase in the life cycle. The sporophyte is dependent partly or wholly on the gametophyte for nutritional purpose.

22. **(C)** : Thallophytes, i.e., algae and fungi completely lack the formation of embryo. In vryophytes, the zygote, on germination, does not produce the gametophyte plant. It undergoes segmentation to form an embryo. The embryo (diploid) by further segmentation and differentiation gives rise to sporophytes. The sporophy;; obtains its nourishment directly from the parent gametophyte to which it is organically attached.

23. **(C)** : The female sex organ of the bryophytes is a remarkable structure. It appears for the first time in the liverworts and mosses and continues in the pteridophytes. Archegonium is absent in thallophytes (algae and fungi). Sex organs in them are male gametes and female gametes.

24. **(D)** : In bryophytes, the zygote, on germination, does not produce the gametophyte plant. It undergoes segmenttation to form an embryo. But the embryo formation and its developement to sporogonium and sporophyte are dependent on gametophyte plant as the sporophyte is dependent on the gametophyte for nutrition. They remain attached organically to the gametophytic plant. In algae, the zygote is independent and it does not form the sprophyte.

25. **(B)** : Fragmentation leads to increase in the number of plants in a locality but it does not permit spread of the plant to an entierly new locality. Being small and sufficiently buoyant, gemmae are easily carried. When detached, they spread by water and wind currents to new habitats, where each grows into a new individual immediately.

26. **(B)** : Pinus show alternation of generations. The sporophyte phase is of long duration and is represented by the huge pine tree, which bears the staminate and ovulate cones. Since meiotic division occur at the same time of the differentiation of the pollen grains and megaspores.

27. **(E)** : In Pinus, the embryo is straight and sonsists of a short axis bearing a ring of about ten slender, yellow cotyledons at the end, away from the micropylar end. In Pinus, more than one embryo come from a single egg by the splitting of the product of a single fertilization, termed as cleavage polyembrony.

28. **(B)** : The ovulate or female cone take three years to mature. The mature cones are hard woody and very large in size. Many important changes take place in the female cone during the intercal of about thirteen moths between pollination and the actual act of fertilization.

29. **(D)** : Female cones or ovulate cones are fewer in number and arise single or in a small cluster or two to four, each as a bud in the axial of a scale leaf towards the end of the new shoots of unlimited growth (long shoots) which do not bear the male cones.

30. **(A)** : Each sperm of Riccia is a minute, slender curved structure. It is furnished with a pair of whiplash flagella antheridium until enough moisture is present to permit them to swim about. Several of the sperms may swim downward in the liquid in the neck.

31. **(A)** : The sporogonium (capsule) of Riccia is the simplest among the liverworts. It lacks both the foot and the seta. There are no elater. Unlike other liverworts the embryo, sporogonium and spore mother cells in Riccia develop no chloroplasts. Thus no photosynthesis occurs there. The sporophyte remains totaly dependent upon the gametophytic thallus.

32. **(B)** : In young stems of Funaria, the cortical cells contain chloroplasts, hence, they are photosynthetic. The central cylinder forms the core of the stem. It consists of vertically elongated, thin-walled, narrow, compactly arranged cells without protoplasm. These thin walled, elongate, dead cells with nonlignified walls are commonly called the hydroids.

33. **(C)** : Pinus is monoecious as it bears both types ofcones on the same tree on separate branches. The male cone consists of a number of small spirally arranged microsporophylls. Each microsporophyll bears two microsporangia or pollen sacs as swelling on the lower surface of its horizontal position.

34. **(C)** : The formation of small, underground resting, budlike structures called the tubers has also been reported in some mosses. Formerly these underground bud-like structures were called the bulbils. The tubers develop singly on stem, leaves and rhizoids as small,spherical storage organs containing starch. These serve as means of perennation and enable the plant to tide over periods unfavourable for vegetative growth.

35. **(E)** : In Funaria, the gemmae develop on the stem and leaves of the gametophore at the onset of condition unfavourable of growth or during injury. These detached gemmae under conditions favourable for vegetative growth directly develop into new leafy gametophores.

36. **(B)** : Morphologically Funaria looks dioecious, but it is monoecious.
The antheridia (male sex organ) are formed at the summit of a relatively small, main leafy shoot which develops first. It is in fact the parent plant.
The female branch arises later as a lateral outgrowth from the base of the parent male shoot. When the two kinds of the sex organs are borne in separate clusters on two distinct branches of the same plant the arrangement is called monoecious. Funaria is protandrous (male mature first). This ensures cross fertilization.

37. **(E)** : In Funaria, the antheridia are not sunk in pits, but project from the surface of the receptacle and are aggregated to form a cluster. The leaves surrounding the antheridial cluster are known as the perigonial leaves. The antheridial cluster with the surrounding perigonial leaves is called the perigonium.

38. **(B)** : The peristome teeth are present at the mouth of capsule. The teeth may be solid cellular tissue or composed only of the thickened portions of the cell walls of adjacent cells.
When the teeth of peristome are solid structures composed of bundles of dead cells, it is termed nematodontous peristome are solid structures composed of bundles of dead cells, it is termed nematodontous peristome. It is found in polytrichum, Pogonatum and Tetraphis. If peristome composed of thin, membranous, transversely barred teeth, each tooth is made up of the thickened portions of the cell walls of adjacent cells. Such a peristome is called orthodontous.

39. **(B)** : Within the hypodermis of Pinus leaf is the parenchymatous mesophyll. It is compart and shows no differentiation into palisade and spongy tissues. It consists of thin walled cells which contain numerous chloroplasts and abundant starch. The mesophyll thus functions as the chlorophyll bearing tissue which manufactures food for plants.

40. **(A)** : Secondary growth takes place in the manner similar to dicotyledonous stem. The secondary word shows well marked growth tings which are formed annually due to environmental fluctuations. Each annual ring possesses a zone of spring and an autumn wood. Spring wood is formed during season under availability of enough water and minerals. It possess large polygonal, thin walled and wide tracheids with large bordered pits. Autumn wood is formed during Autumn season. It possesses smaller, squrish, thick walled and narrow tracheids with small bordered pits. It is evident that the size oftracheids shows a marked variation with regard to amount of nature availabe in the respective season.

41. **(A)** : Rubling and Tyler (1979) showed that air dried mosses can absorb metals. The accumulation of heavy metal cations in mosses enables them to be used as pollution indicators.

42. **(A)** : According to some Botanists, Mosses originated from algae. Protonema of mosses is similar to certain algae.

43. **(C)** : In the sproangia of Pteridium are not grouped together in small separate sori, but the sorus is continuous along the under margin of the pinnules, often for considerable distances. This type of sorus is known as continuous linear sours (coenosorus).

44. **(B)** : Indusium is an epidermal membranous outgrowth covering the sori in some fern. The coenosorus is surrounded by two well formed indusial lips, between which lies the receptacle. The outer indusial lip is well-developed and is formed by the reflexed margin of the pinnule, which overlaps the coenosorus and its sporangia. This is commonly called the false indusim.

45. **(B)** : In Dryopteris, young rhizome and leaves are covered with dry, brown chaffy scales known as rementa. In Pteridium, the rhizome and the leaves especially while young, are covered by a felt of simple hairs, and the scales are comspicuously absent.

46. **(D)** : The scale leaves are present both on the long and dwarf branches. They fall off as the branches mature, The scale leaves on the dwarf shoots are called the cataphylls and possess a distinct midrib.

47. **(D)** : In bryophytes, antheridia are well developed and often possess a stalk. In pteridophytes, antheridia are less developed and generally devoid of a stalk whereas pteridophytes has multiflagellate sperm formed from androcyte cell of antheridium. Bryphytes has biflagellate sperm.

48. **(E)** : In fern, fetilization usually takes place if the prothalli are watered from above as they would be by rain in the ordinary course of nature. They possess flagella for swimming movement towards archegonia through water.
The discharged matter at the mouth of the opened archegonial neck probably contains some chemical substance, e.g., malic acid, which by positive chemotaxis attracts the free swimming antherozoids, which penetrate the neck and reach the deeply seated ovum.

49. **(C)** : In the pteridophytes, the sporophytes gains physiological independence and develops into the dominant, typically photosynthetic phase of the life cycle. It is organized into stem, leaves and roots. For the first time in the sporophyte of the pteridophytes true roots develops. Psilophyta (a pteridophyte division) lack true roots.

50. **(E)** : In gymnosperms, xylem lacks true vessels and wood fibres. It consists oftracheids that are arranged in uniform radial rows and xylemparenchyma only. The phloem contains sieve tubes and parenchyma only. The phloem contains sieve tubes and parenchyma cells. There are no companion cells.

51. **(D)** : In eusporangiate type of development, large sporangia develop from a group of intials. In leptosporangiate type of development, small sporangiadevelop from a single initial, the former builds the entire sporangium, its contents and stalk and the latter takes no part in the process.

52. **(A)** : Leaf tips of Adiantum caudatum, develop adventitious buds for vegetative propagation. When leaf tip reaches the ground, it develops into new plant, therefore, it appears that the plant is walking.

53. **(A)** : The gymnosperms have their ovules freely exposed before and after fertilization. They are not enclosed by any ovary wall. The seeds formed by them lack seed coat. Hence due to absence of every wall and seed coat their seeds are nacked.

54. **(B)** : Long branches of Pinus become gradually shorter towards the apex. Hence the pine tree has a conical or pyramidal appearance. Long branches show the scars of fallen short branches.

55. **(C)** : InCycas there is no true and compact or property organised female cone. Megasporophylls are loosely arranged and thus form a loose female strobilus. The growing point of the stem is unaffected by thier development and continues its growth through the loose strobilus.

56. **(C)** : All living species of Cycas are dioecious as the male and female structures occurs on separate plants. The microsporophylls are aggregated into large compact male strobili orcones. The megasporophylls are loosely arranged. They do not form a true cone.

57. **(B)** : When the microspores reach maturity, the male cone elongates considerably and rapidly. The scales spearate from one another so that sporangia are exposed. The sporangia lose water and with the loss of water from its cells the exothecium shrinks. The sporangia thus open by a slit on its outer face. The spores fall out. The liberated spores are dispersed by wind.

58. **(A)** : The red colour of red algae (Rhodophyta) is due to abundant formation of r-phycoerythrin. Phycoerythrin absorb blue green wavelengths of light and reflect red light and thus imparts red colour to algae.

59. **(B)** : Brown algae vary incolour from olive green to various shades of brown depending upon the amount of the xanthophyll pigment, fucoxanthin present in them.

60. **(B)** : In pteridophytes, gametophytes bear male and female sex organs called antheridia and archegonia, respectivley. 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 results in the formation of zygote. Zygote thereafter produces a multicellular well-differentiated sporophyte which is the dominant phase of the pteridophytes.

61. **(A)**

62. **(A)** : In angiosperms, pistil consists of an ovary enclosing one to many ovules. Within ovules are present highly reduced female gametophytes termed embryo sacs. The embryo-sac formation is preceded by meiosis. Hence, each of the cells of an embryo-sac is haploid.

63. **(C)** : Members of Chlorophyceae are commonly called green algae. The plants body may be unicellular, colonial or filamentous. They are usually grass green due to the dominance of pigments, chlorophyll a and b.

64. **(B)** : 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.

65. **(D)** : 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 i.e, macro (large) and micro (small) spores, are known as heterosporous.

66. **(C)** : 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 fertilization. The seeds that develop post-fertilization, are not covered, i.e., are naked . After fertilization, zygote develops into an embryo and ovules into naked seeds.

67. **(D)** : In diplontic lifecycle, the diploid sporophyte is the dominant, photosynthetic and independent phase of the plant gametophyte is highly reduced and is retained within sporangia.

68. **(B)** : Unicellular algae Chlorella and Spirullina are rich in proteins and hence used as food supplement by space travellers.

69. **(C)** : Vegetative reproduction is mosses is by fragmentation and budding in the secondary protonema. After fertilisation, the zygote fevelops 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 and develop into new gametophyte.

70. **(A)** : Bryphytes are called terrestrial amphibians as they require an external layer of water on the soil surface for their existence. The external water is required for
(A) dehiscence of antheridia and archegonia
(B) swimming of male gametes to archegonia
(C) Protection from transpiration and hence desiccation as the plant body is not covered by cuticle
(D) Supply to water to all plants through capillarity in the absence of vascular tissues.

71. **(D)** : The leaves in gymnosperms are well-adapted to withstand extreme temperature, humidity and wind. In conifers, the needle-like leaves reduce the surface area. Their thick cuticle ans sunken stomata help to reduce water loss.

72. **(D)** : Sexual reproduction in algae takes place through fusion of two gametes. These gametes can be flagellated and similar in size (as in Chlamydomonas) 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 some species of Chlamydomonas is termed as anisogamous. Fusion between one large, non-motile (static) female gamete and a smaller, motile male gamete is termed oogamous.

EXERCISE - 4

P-1 (NEET/AIPMT)

1. **(A)** In *Spirogyra*, the sexual reproduction involves the fusion of two morphologically identical isogametes and physiologically dissimilar anisogametes. This is a case of primitive anisogamy. Inthis the active gamete is known as the male and the passive as the female

2. **(B)** *Ginkgo* is a gymnospermic plant so it comes before angiospermic plant *Pisum* (pea.) *Rhizopus* is a fungus and *Triticum* (wheat) is an angiospermic plant.

Option **(C)** has both angiospermic plants and option **(D)** has both gymnospermic plants.

3. **(C)** Fern is a pteridophyte and funaria is a bryophyte, both these produce spores but not seeds. Phanerogams is a proup of plants which produce seeds and flowers. It includes gymnospermic and angiospermic plants. While cryptogams is another group of plants which do not produce seeds and flowers, e.g. algae, fungi, bryophytes and pteridophytes.

4. **(A)** A ngiosperms are well adapted to terrestrial life and occur in diverese habitats like cold trundra to hot tropical and even desert areas. They also thrive well in aquatic habitat. Hence, they being the most successful, to have dominated the land flora.

5. **(D)** *anabaena* is a free living nitrogen fixing cyanobacterium which can form symbiotic association with water fern *Azolla*.

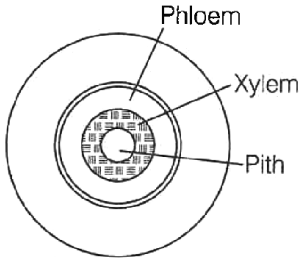
6. **(A)** The Cycadales is an ancient order of gymnosperms exhibiting several primitive features now having only a few liiving representative of once a large group of plants that glorified during the Mesozoic era. Therefore, *Cycas* is called as living fossil.

7. **(A)** *Adiantum* is also called walking fern. In *Adiantum* the tips of the leaves, on coming in contact with the soil, give out adventitious roots which ,in turn, produce new leaves and develop into new plants.

8. **(A)**

Column-I	Column - II
A. Peritrichous flagella (flagella all over the body)	Escherichia coli (a bacterium)
B. Living fossil	Ginkgo biloba (maiden hair tree)
C. Rhizophore (a form of aerial adventitious roots)	Selaginella (a pteridophyte)
D. Smallest flowering plant	Wolffia
E. Largest perennial algae	Macrocystis

9. **(B)** In the ectophloic siphonostele, the xylem surrounds pith and this xylem is surrounded by phloem, pericycle and endodermis respectively. e.g. *Osmunda* and *Equisetum*.



Ectophloic siphonostele

10. **(C)** The conifers (gymnosperm) differ from the grasses (angiosperm) in the formation of endosperm before fertilisation. Infact, in gymnosperms, the endosperm is a haploid tissue as it formed before fertilisation, while in angiosperms, endosperms, endosperm is formed after fertilisation as a result of triple fusion or double fertilisation, thus, it is triploid tissue. In both conifers and grasses seeds are produced from ovules. Xylem tracheids are present in both conifers and grasses.

Pollen tubes are also formed in both conifers and grasses.

11. **(A)** *Sphagnum* is a bryophyte, commonly called as bog moss or peat moss. It is hygroscopic and possesses a remarkable water bolding capacity. hence, it is used as a packing material in the transportation of flowers, live plants , tubers bulbs, seedlings, etc. It is also used in seed - beds and in moss-sticks.

12. **(B)** In gymnosperms, the pollen chamber is a cavity in the ovule in which pollen grains are stored after pollination.

13. **(D)** Flagellate male gametes are present in *Riccia,*

Dyropteris and *Cycas* .

14. **(A)** Types of pigments present in the cell of algae is the most important character for classification.

15. **(D)** Elaters are hygroscopic in nature and help in dispersal of spores.

16. **(D)** In the prothallus of a vascular cryptogam, the antherozoids and eggs mature at different times. As a result self fertilisation is prevented.

17. **(B)** The presence of vessels in the xylem is an angiospermic character found in *Gnetum* which distinguish it from *Cycas* and *Pinus*.

Gnetum resembles angiosperms in many other aspects also like.

(i) The leaves in *Gnetum* have reticulate venation that is an angiospermic character.

(ii) In *Gnetum* female gametophyte is only partly cellular befor fertilisation and beccomes completely cellular only after fertilisation. Some of the free nuclei act as eggs as there are no. archegonia.

The short apices in *Gnetum* and angiosperms show a distinct tunica and corpus configuration.

Thecortex of stem of *Pinus* is traverse by large resin ducts or canals. Each duct or canal is lined by a layer of thin walled parenchymatous glandular secretory cells constitiuting epithelium. The epithelial cells secrete resin into canal. Resin is the chief source of terpentine.

18. **(B)** The gynoecium in family - Cruciferae (Brassicaceae) is bicarpellary, syncarpous, ovary superior, unilocular with parietal placentation. At maturity ovary becomes bilocular deu to the formation of false septum (replum) e.g. mustard. In family- Asteraceae (Compositae) the gynoecium is bicarpellary syncarpous, ovary inferior, unilocular, one ovule in each locule basal placentation and stigma branched, e.g. sunflower.

In family N-Fabaceae (Leguninosae) the gynoecium is monocarpellary, unilocular with superiour ovary and marginal placentation, eg. pea.

19. **(B)** Form the following *Salvinia* is is heterosporous.

Heterospory is the production of spores of two different sizes and two different developmental patterns. Small spores are called microspores and larger as megaspore.

Microspores germinate to produec the male gametophyte or microgametophyte that bear male sex organs while, megaspore germinates to form female gametophyte or megagametophyte that bears archegonia or female sex organs. It is most important evolutionary development in the vascular plants because it has ultimately lead to seed development, e.g. *Selaginella, Marselia, Salvinia, Azolla, isoetes*.

Dryopteis is homosporous and 32-64 haploid spores are produced in each sporangium.

Adiantum is also homosporous. The spores are the pioneer structures of the gametophytic generation.

20. **(A)** In *Pteris* (also *Dryopteris*) the spore germinates to produce the prothallus. The prothallus is a small, green flat, surface loving, thallus-like object. It is monoecious and bears sex organs on the ventral side. The antheridia (male sex organs) arisee among the rhizoids towards the posterior side of the prothallus and are emergent. The archegonia develop in central cushion behind the emergent. The archegonia. In these plants male and female, gametophytes do have free living independent existence.

All species of *Polytrichum* are dioecious. The antheridia and archegonia are bome on different gametophore. The plant body is an erect leafy shoot but is not the entire gametophyte. The leafy shoot arise from protonema (the juvenile stage).

The leafy gametophore of *Funaria* reproduces sexually by formation of antheridia and archegonia. The antheridia are formed at the summit of a relatively small, thin, leafy shoot, which develops first. The female branch arises later as a lateral out growth from the base of parent male shoot.

Cedrus is a gymnosperm in which main plant body is a sporophyte on which reduced type of gametophytes are formed.

21. **(B)** *Pinus* is monoecious as it bear male cone as well as female cone on same tree, (but on separate branches.)

Marchantia, *Cycas* and papaya are dioecious plants

22. **(B)** Heterospory is the production of spores of two different sizes and of two different developmental patterns. It is the most important evolutionary development in the vascular plants because it has ultimately lead to seed development, which is seen in *Selaginella, Salvinia, Azolla,* etc.

23. **(A)** Pteridophytes are also called vascular crytopgams as these have a well developed vascular system but are non flowering plants. e.g. *Equisetum*.

24. **(C)** *Fucus* belongs to class Phaeophyceae, in which reserve food is found in form of laminarin, mannitol oil.

Chara belongs to class-Chlorophyceae, in which reserve food is found in form of starch and oil.

Porphyra and *Gracillaria* belongs to class - Rhodophyceae, in which reserve food is found in form of floridean starch and Galactan SO_4 polymers.

25. **(D)** In *Sphagnum*, male and female gametophytes are independent and free living. In bryophytes, the most conspicuous phase in life cycle is the gametophyte. It is independent and concerned with reproduction.

26. **(A)** Algae have cell wall made up of cellulose, galactans and mannans. Like plants, algae have cell walls containing either polysaccharides such as cellulose (glucan) or a variety of glycoproteins or both

The inclusion of additional polysaccharide in algal cell walls is used as a feature for algal taxonomy. Mananas form microfibrils in the cell walls of a number of marine green algae including those from the genera *Codium, Acetabularia* as well as in the walls of some red algae like *Porhyra.*

27. **(A)** The coralloid root of *Cycas* is symbiotically associated with nitrogen fixing blue green algae, Anabaeana cycadae and *Nostoc punctiforme*. These blue green algae (cyanobacteria) are prokaryotic, photosynthetic and autotrophic.

28. **(D)** *In marchantia*, a bryophyte, the archegonia (female sex organs) are borne on special branches called archegoniophore or female receptacles. Each archegoniophore has rows of archegonia protected by involucre or perichaetium.

29. **(C)** In gymnosperms, (e.g. *Pinus, Cycas*, etc.) the male and female gametophytes do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes.

30. **(C)** As we proceed from thallophyta to angiosperms, there is gradual reduction in gametophyte with reduced size of sex organs. From thallophyta to angiosperms, there is progressive elaboration of sporophytes.

Phase T	**hallophyta**	**Bryophyta**
pteriophyta	**Gymnosperms**	**Angiosperms**
Gametophyt(%)	90	75
50	25	10
sporop hyte (%)	10	25
50	75	90

31. **(D)** Gymnosperms lack xylem fibres. large amount of parenchymatous cells are present with secondary xylem tracheids. So, these are also known as softwood spermatophytes.

32. **(D)** Multicellular fungi, filamentous algae and protonema of mosses all show multiplication by fragmentation.

33. **(D)** origin of seed habitate can be traced in pteridophytes. SOme pteridophytes like Selaginella and salvinia are heterosporous as they produce two linds of spores micro (small) spores and macro (large) spores, which germinate and give rise to male and female gametophyte respectively.

The female gametophyte in these plese plants are retained on the parent sporophytes for variable periods. The developement of the zygote into young embryos takes place within the female gametophyte, This event is the precursor to the seed habit and considered to an important step in evolution.

34. **(B)** Multiciliated motile sperms are found in both Cycas (ygmnosperm) and *Adiantum* or walking fern (pteridophyte).

Seeds and cambium are present in *Cycas* (quite common in gymnosperms) but absent in pteridophytes. Vessels are absent in both.

35. **(C)** Statement I, and III are correct. Statement IV is incorrect and can be corrected as the sporophyte in mosses is more elaborate than in liverworts.

36. **(C)** Statement **(C)** is wrong as oomycetes include water moulds, white rusts and downy mildews. In these, female gamete is large and non-motile, whereas, male gamete is small and non-motile. Isogametes are found in algae like *Ulothrix, Chlamydomonas, Spirogyra*, etc,. which are similar in structure, function and behaviour. Anisogametes are found in *Chlamydomonas* in which one gamete is larger and non-motile and the other one is motile and smaller.

Oogamy is the fusion of non-motile egg with motile sperm. The gametes, differ both morphologically as well as physiologically . It occurs in *Chlamydomonas, Fucus, Chara, Volvox*, etc.

37. **(B)** Cyanobacteria within the coralloid roots of Cycas are chemoheterotrophic and specifically adapted to life in symbiosis. Only a few species of cyanobacteria form associations with *Cycas*. *Pinus* is is a *gymnosperm*. *Equisetum* belongs to vascular plants and to horse tail family. *Psilotum* belongs to division- Pteridophyta and is a fern-like plant.

38. **(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*

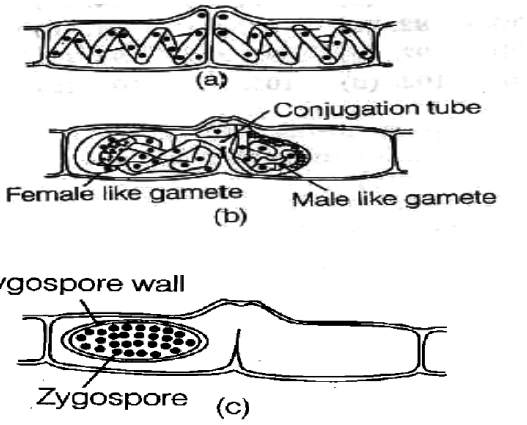
39. **(B)** *Chlorella* is a potential food source because it is high in protein and other essential nutrients when dried, it contains about 45% protein, 20% fat, 20% carbohydrate, 5% fibre and 10 % minerals and vitamins.

40. **(D)** Peat is mainly an accumulation of partially decayed vegetation or organic matter and *Sphagnum* accumulations can store ater, since both living and dead plants can hold large quantities of water and living matter (like meat) for long distance transport inside their cells hence, it is responsible for peat formation.

41. **(C)** Both antheridium and oogonium are the male and the female reproductive structures respectively. They have sterile jackets on their surface. In *Chara* globule (oogonium) is present on upper side of sterile vegetative (leaf like) structure.

42. **(D)** isogamy with non-flagellated gametes is seen in *Spirogyra*. It can reproduce both by sexual and asexual (vegetative) means.

They reproduce sexually by conjugation in which two non flagellated morphologically similar but physiologically different gemetes (isogamous) fuse togther. One filament acts as male gamete and passes through the conjugation tube of another filament which acts as female gamete.



43. **(C)** All the statements are correct except the statement **(B)**. *Mucor* (fungus) belongs to the class-Zygomycetes. The members of zygomycetes bear non-motile non-flagellated gametes.

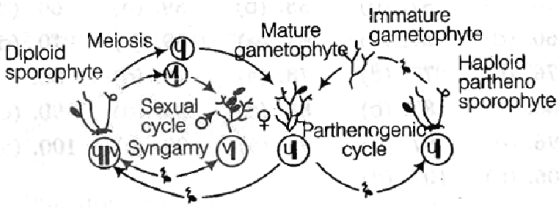
44. **(B)** Algin extracted from brown algae, e.g. *Laminaria*, atc. is a hydrocolloid used in shaving creams, jellies, flameproof plastic, etc. Carrageenan is extracted from red algae like *Chondrus* and used as emulsifier and clearing agent. Thus, only option **(B)** is incorrect and all other options are correct.

45. **(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.

46. **(B)** *Sequoia* is one of the tallest tree species, known as red wood tree. It is a gymnospermic plant. *Salvinia* is an angiosperm, but *Ginkgo* and *Pinus* are gymnosperms. Gymnosperms are well adapted to extremes of climate and are heterosporous.

47. **(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.

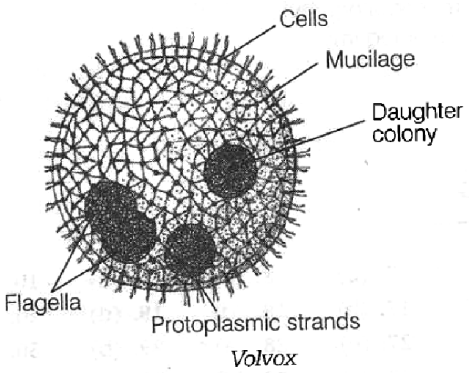
48. **(C)** *Ectocarpus* and *Fucus* respectively show haplodiplontic and diplontic life cycle.



Haplodiplontic life cycle of ***Ectocarpus***

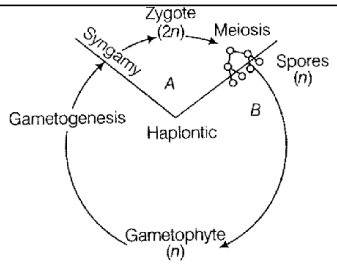
Concept Enhancer In *Ectocarpus* sporic meiosis occurs and haploid biflagellate meiozoospores are formed. They germinate to produce gametophytic thalli. The gametophytes liberate gametes, which fuse to form diploid zygote, which gives rise to a diploid plant

49. **(B)** *Volvox* is a fresh water green hollow ball - like colonial alga. Its colony has a fixed number of cells (500-60000). It is called coenobium.



Volvox

50. **(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 hapolid plants.



Life cycle pattern : Haplontic

51. **(C)**

Due to this gymnosperms means naked sperms.

[Gymnos = naked]

[sperma = seeds]

52. **(A)** Exogenous sexual spores are Basidispores, which are produced in Basidiomycetes fungi like *Agaricus*.

EXERCISE - 4

P-2 (AIIMS)

1. **(C) :** Maximum solar energy is trapped by algae and hence they evolve madimum amount of oxygen by the process of photosynthesis. Therefore, algae are useful because they purify the atmosphere by releasing oxygen.

2. **(C) :** Ulothrix has isogamous type os sexual reproduction where two isogametes of + and – strain come together and fuse and as a result a quadriflagellate zygospore is formed. with the return of favourable conditions, the diploid nucleus of zygospore divides meiotically and generally produces four motile or non-motile spores.

3. **(A) :** bryophytes are also known as 'amphibians of plant kingdom'. In them fertillisation takes place in presence of water. The spermatozoid swims to the neck of archegonium. It passes through the canal formed by the disintegration of neck canal cells and ventral canal cell and fuses with the egg.

4. **(D) :** Unlike Cycas and Pinus, Gnetum shows the occurrence of vessel elements and the absence of archegonia. Archegonia are altogether absent in the female gametophyte and vessels occur in the xylem along with the tracheids in the secondary wood. thus Gnetum shows affinities with angiosperms. Besides it resembles angiosperms in several other aspects like presence of tetrasporic embryo sac, free nuclear divisions in the embryo sac, two cotyledonous embryo etc.

5. **(A) :** Stele is a column containing vascular tissue which is surrounded by pericycle and separated from ground tissue by endodermis.
Siphonostele is medullated protostele or protostele with a central non-vascular pith. Leaf gaps are absent, siphonostele is of two types : In Ectophloic siphonostele, central pith is surrounded successively by xylem, phloem, pericycle and endodermis. In amphiphloic siphonostele there is a central pith and xylem is surrounded on either side by phloem, pericycle and endodermis. It is found in Osmunda and Equisetum.

6. **(A) :** Sexual reproduction in Spirogyra takes place by the process of conjugation. In Spirogyra, the process of conjugation may be of two types – scalariform conjugation and lateral conjugation. Scalariform conjugation occurs in heterothallic species. Lateral conjugation occurs between the adjacent cells of the same filament of homothallic species of Spirogyra. Lateral conjugation are of two types. They are indirect lateral conjugation (chain type) and direct lateral conjugation.

7. **(A) :** Bryophytes are nonvasclar terrestrial plants of moist habitats in which a multicellular diploid sporophyte lives as a parasite on an independent multicellular haploid gametophyte that develops multicellular jacketed sex organs. Whereas, in pteridophytes, the main plant body is a sporophyte which is differentiated into true root, stem and leaves and gametophyte is small or conspicuous, it is usually independent.

8. **(B) :** In mosses the sporophytes (i.e., the diploid body) are short-lived and dependent on the gametophyte. In the presence of water, sperms from the antheridia swim to the archegonia and fertilisation occurs, leading to the production of a diploid sporophyte. the sperm of mosses is biflagellate, i.e., they have two flagella that aid in propulsion. Since the sperms must swim to the archegonium, fertilisation cannot occur without water.

9. **(C) :** Endosperm is the food laden tissue which is meant for nourishing the embryo in seed plants. In gymnosperms, it represents the female gametophyte and thus is haploid(n). In angiosperms, the endosperms is a specia tissue which is formed as a result of fusion of a male gamete with diploid secondary nucleus of the central cell (vegetative fertilisation or triple fusion). The fusion product is primary endosperm cell having a triploid (3n) endosperm nucleus.

10. **(A)**

11. **(D) :** In pteridophytes, majority of plants are homosporous (producing similar king of spores) e.g., Lycopodium. However, plants of genera like Selaginella and Salvinia are heterosporous (producing macro and micro spores). Pinus and Cycas, which are gymnosperms, anr also heterosporous.

12. **(A) :** Roots in Cycas are of two types - normal and coralloid roots. Coralloid roots are irregular, negatively geotropic, dichotomously branched coral loke roots which do not posses root hair and root caps. Coralloid roots have a symbiotic association with blue-green algae like Nostoc and Anabaena species.

13. **(D) :** Alginic acid (or algin or alginate) in an anionic polysaccharide distributed widely in the cell walls of many brown algae (Phaeophyceae). It is a phycocolloid which is obtained commercially from Laminaria, Macrocystis, Nereocystis, Fucus, Sargassum etc.

14. **(B)**

15. **(C) :** Genera like Selaginella and Salvinia which produce two kinds of spores, macro (large) and micro (small) spores, are known as heterosporous pteridophytes Lycopodium and Equisetum are homosporous pteridophytes i.e., they produce only one type of spores.

16. **(B)** eA - V; B - IV; C - II; D - I; E - III

17. **(D)** In chlorophyceae, the stored food material is starch and the major pigments are chlorophyll- a and b. In phaeophyceae, laminarian is the stored food and major pigments are chlorophyll a, c and fucoxanthin.

18. **(A) :** Coral reefs are formed through the accumulation of calcareous exoskeletons of coral animals, calcareous red algae and molluscs. They from the foundation of reefs by secreting a calcium carbonate skeleton that provides protection for the coral polyps.

19. **(A) :** Pinus (a conifer) is a heterosporous plant producing mega and microspores inside megasporangium and microsporangium respectively. Each microsporangium is a small, sessile and elongated sac like structure having two layered wall. Inside the all lie tapetum which is a nourishing layer. Inside the cavity are large number of dusty and two winged microspores present. On maturity the microsporangium wall bursts from the upper side forming a longitudinal slit. A large number of yellow pollen grains are liberated which are carried by wind due to the presence of wings.

20. **(B) :** The haploid spores on germination gives rise to alga-like filamentous branched portion called primary protonema. This protonema develops buds, from which leafy gametophyte arises. Sometimes this primary protonema breaks up into small fragments accidentally and these fragments give rise to leafy gametophores.

21. **(A) :** Vessels are much elongated tubes which are closed at either end and are formed by the union of several short, wide and thickened cells called vessel elements. the end walls of vessel elements are transverse or oblique. they are often completely dissolved. The condition is called simple perforation plate. In a few cases the end walls remain intact and possess several pores in reticulate, scalariform or forminate forms. Such an end wall is called multiple perforation plate. Sieve tubes are elongated tubular conducting channels of phloem formed of several cells called sieve tube elements or members or sieve tube cells. sieve tube members are placed end to end. The end walls are generally bulged out. The end walls are generally bulged out. They may be transverse or oblique. They have many small pores or sieve pits. Due to the presence of sieve pits the end walls are commonly called sieve plates. In some cases the end walls of sieve elements possess more than one porous area. Such an end wall is called compound sieve plate.

Gymnosperms and pteridophytes lack these two vascular structures i.e., vessels and sieve elements. In angiosperms presence of vessels and sieve elements in addition to all other vascular tissues make their food and water transport more efficient.

22. **(B) :** 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. Unlike bryophytes and pteridophytes, in gymnosperms the male and the female gametophytes do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes.

23. **(B)**

24. **(C)**

MOCK TEST

1. **(B)** : Alginic acid is obtained from brown algae whereas carrageenan is obtained from red algae.

2. **(B)** : Porphyra and laminaria are both marine algae. In Rhodophyta (red algae) reserve food is floridean starch.

3. **(D)** : Alginic acid (or algin or alginate) is an anionic polysaccharide distributed widely in the cell walls of many brown algae (Phaeophyceae). It is a phycocolloid which is obtained commercially from Laminaria, Macrocystis, Nereocystis, Fucus, Sargassum, etc.

4. **(B)** : Reserve food of Chlorophyceae (Green algae) is starch. Laminarin and mannitol are the reserve food materials of Phaeophyceae (Brown- algae).

5. **(D)** : Sexual reproduction in algae takes place through fusion of two gametes . .In Spirogyra, the gametes are similar in size (isogamy) and non-flagellated (non-motile).

6. **(C)** : Red algae are eukaryotic autotrophs with chi-a and d, phycobilins as pigments, floridean strach as food reserve and abundant phycocolloids (like agar, carrageenin, funori) but they lack flagellate cells. They are mostly marine. Common red algae are Gracilaria, Gelidium, Porphyra, Polysiphonia, Batrachospermum, Chondrus, etc.

7. **(B)** 8. **(A)**

9. **(A)** : In oomycetes, like other oogamous organisms female gamete is large and non- motile, while male gamete is small and motile.

10. **(D)** : Isogamous fertilisation is the fusion of two similar gametes while anisogamous fertilisation is fusion of two morphologically dissimilar motile gametes. In rhodophyceae, the major pigments are chlorophyll 'a' and 'd' but the stored food is floridean starch:

11. **(A)** : Chlorophyll is a class of pigments found in all photosynthetic organisms. The most important members are chlorophyll a and chlorophyll b which occur in all land plants are responsible for their green colour. Phycoerythrin is an accessory photosynthetic .pigment occurring mainly in the red 'algae and cyanobacteria. It is a phycobiliprotein, in which the pigmented prosthetic group is phycoerythrobilin, which gives phycoerythrin its red colour. Fueoxanthin is the major carotenoid brown pigment present along with chlorophyll, in the brown algae.

12. **(C)** : Iodine is found in Laminaria, member of phaeophyceae or brown algae.

13. **(A)** : Majority of algae (eukaryotes) possess a definite cell wall containing cellulose and other carbohydrates. In algal cell wall, different chemical components are present which vary widely among different groups (e.g., xylan, mannan, galactan, alginic acid, silica, agar, pectin, carrageenin, etc.). Cell wall of blue-green algae is made up of micro-peptides (proteins). This micro-peptide is not found in eukaryotic algae.

14. **(C)**

15. **(A)** : In Spiragyra, lateral conjugation takes place in between the two adjacent cells of the same filament, of which upper cell functions as male gametangium and the lower cell as female gametangium. The lower cell increases in size but upper cell remains smaller. The content of male cell passes into the female one and as a result zygospore is formed .

16. **(D)** : Algae are a group of chlorophyllous, nonvascular plants with thallose plant body. Different algae show different pigments present in the cell like chlorophylls a, b, xanthophylls, carotenes etc. These pigments provide the base for classification of various groups of algae into different classes. Chlorophyceae possess chlorophyll a, b . pigments, phaeophyceae has fucoxanthin, rhodophyceae has r-phycocyanin and r-phycoerythrin.

17. **(E)**

18. **(A)** : Bryophytes include mosses and liverworts. Fems and horsetails are pteridophytes. The plant body is thallus like and lacks true roots, stem or leaves. It produces gametesÂ·, hence is called a gametophyte. In mosses, after fertilisation, the zygote develops-into- a sporoplfyfe, consisting of foot, seta and capsule. Asexual reproduction in liverworts takes place by gemmae. Bryophytes are called amphibians of plant kingdom because the plants can live in soi_! but are dependent on water for sexual reproduction.

19. **(A)**

20. **(D)** : Algae and mosses are included in plant kingdom while fungi constitute a separate kingdom. Type of life cycles are different in different cases: Algae and mosses are autotrophic while fungi are heterotrophs. But they all show multiplication by fragmentation.

21. **(E)**

22. **(A)** : Sequoia sempervirens is the tallest gymnosperm. The leaves of gymnosperms are well adapted to extremes : elimate. This is the reason for gymnosperm to flourish in cold areas where instead of rain, snow is the source of water. Gymnosperms are heterosporous i.e., produce two different kind of spores-microspores and megaspores. Salvinia is an aquatic pteridophyte.

23. **(C)**

24. **(D)** : The angiosperms are flowering plants. The male sex organ in a flower is stamen, it consists of narrow stalk called filament and knob-like broader tip called anther. Each anther consists of 4 pollen sacs or microsporangia. Sporogenous tissue fills the whole interior of a microsporangium. The sporogenous cells may directly function as PMCs (pollen mother cells). Each PMC by meiotic division gives rise to a group-of four haploid microspores or pollen grains. Angiosperms show double fertilisation. Out of the two male gametes released into embryo sac, one male gamete fuses with egg cell to form zygote (2n) and other male gamete fuses with diploid secondary nucleus to form the triploid primary endosperm nucleus (PEN). After fertilisation ovules develop into seeds and ovary into fruit.

25. **(E)** : In diplontic life- cycle there is a somatic phase or vegetative indi:vidual.

26. **(A)** The red colour of red algae (Rhodophyta) is due to abundant formation of r-phycoerythrin. Phycoerythrin absorb blue green wavelengths of light and reflect red light and thus imparts red colur to algae

27. **(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.

28. **(B)** In pteridophytes, 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 archeonium results in the formation of zygote. Zygote thereafter produces a multicellular well differentiated sporophyte which is the dominant phase of the pteriodphytes

29. **(A)**

30. **(A)** In angiosperms, pistil consists of an ovary enclosing one to many ovules. Within ovules are present highly reduced female gametophytes termed embryo sacs. The embryo sac formation is preceded by meiosis. hence, each of the cells of an embryo sac is haploid.