CHAPTER

3 Plant Kingdom

3.1. Algae

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

In the members of Phaeophyceae,

(I) Asexual reproduction occurs usually by biflagellate zoospores.

(II) Sexual reproduction is by oogamous method only.

(III) Stored food is in the form of carbohydrates which is either mannitol or laminarin.

(IV) The major pigments found are chlorophyll a, c, and carotenoids and xanthophyll.

(V) Vegetative cells have a cellulosic wall usually covered on the outside by gelatinous coating of algin.

Choose the correct answer from the options given below:

(A) (II), (III), (IV) and (V) only

(B) (I), (III), (IV) and (V) only

(C) (I), (II), (III) and (V) only

(D) (I), (II), (III) and (IV) only **[NEET 2024]**

2. Which of the following is incorrectly matched?

(A) *Ulothrix* — Mannitol

(B) *Porphyra* — Floridean starch

(C) *Volvox* — Starch

(D) *Ectocarpus* — fucoxanthin **[NEET 2022]**

3. Which of the following algae contain mannitol as reserve food material?

(A) *Ectocarpus* (B) *Gracilaria*

(C) *Volvox* (D) *Ulothrix* **[NEET 2021]**

4. Which of the following algae produce Carrageen?

(A) Green algae (B) Brown algae

(C) Red algae (D) Blue-green algae

[NEET 2021]

5. Phycoerythrin is the major pigment in:

(A) red algae (B) blue-green algae

(C) green algae (D) brown algae.

[NEET Oct. 2020]

6. Which of the following pairs is of unicellular algae?

(A) *Gelidium* and *Gracilaria*

(B) *Anabaena* and *Volvox*

(C) *Chlorella* and *Spirulina*

(D) *Laminaria* and *Sargassum* **[NEET Sept. 2020]**

7. Which one of the following statements is wrong?

(A) Algae increase the level of dissolved oxygen in the immediate environment.

(B) Algin is obtained from red algae and carrageenan from brown algae.

(C) Agar-agar is obtained from *Gelidium* and *Gracilaria.*

(D) *Laminaria* and *Sargassum* are used as food.

[NEET Phase-II 2016]

8. Which one of the following statements is wrong?

(A) Algin and carrageenan are products of algae.

(B) Agar-agar is obtained from *Gelidium* and *Gracilaria.*

(C) *Chlorella* and *Spirulina* are used as space food.

(D) Mannitol is stored food in Rhodophyceae.

[AIPMT Cancelled 2015]

9. Male gametes are flagellated in:

(A) *Polysiphonia* (B) *Anabaena*

(C) *Ectocarpus* (D) *Spirogyra*

[AIPMT Cancelled 2015]

10. Which one of the following shows isogamy with non-flagellated gametes?

(A) *Sargassum* (B) *Ectocarpus*

(C) *Ulothrix* (D) *Spirogyra* **[AIPMT 2014]**

11. Which one of the following is wrong about *Chara*?

(A) Upper oogonium and lower round antheridium

(B) Globule and nucule present on the same plant

(C) Upper antheridium and lower oogonium

(D) Globule is male reproductive structure

[AIPMT 2014]

12. Select the wrong statement.

(A) Isogametes are similar in structure, function and behaviour.

(B) Anisogametes differ either in structure, function and behaviour.

(C) In oomycetes female gamete is smaller and motile, while male gamete is larger and non-motile.

(D) *Chlamydomonas* exhibits both isogamy and anisogamy and *Fucus* shows oogamy. **[NEET 2013]**

13. Isogamous condition with non-flagellated gametes is found in:

(A) *Chlamydomonas* (B) *Spirogyra*

(C) *Volvox* (D) *Fucus*. **[NEET 2013]**

14. Monoecious plant of *Chara* shows occurrence of:

(A) antheridiophore and archegoniophore on the same plant

(B) stamen and carpel on the same plant

(C) upper antheridium and lower oogonium on the same plant

(D) upper oogonium and lower antheridium on the same plant. **[NEET 2013]**

15. Which one of the following is wrongly matched?

(A) *Spirogyra* - Motile gametes

(B) *Sargassum* - Chlorophyll

(C) Basidiomycetes - Puffballs

(D) *Nostoc* - Water blooms **[NEET Karnataka 2013]**

16. Algae have cell wall made up of:

(A) cellulose, galactans and mannans

(B) hemicellulose, pectins and proteins

(C) pectins, cellulose and proteins

(D) cellulose, hemicellulose and pectins.

[AIPMT Screening 2010]

17. Mannitol is the stored food in:

(A) *Chara* (B) *Porphyra*

(C) *Fucus* (D) *Gracilaria*.

[AIPMT Screening 2009]

18. Phylogenetic system of classification is based on:

(A) morphological features

(B) chemical constituents

(C) floral characters

(D) evolutionary relationships. **[AIPMT 2009]**

19. If you are asked to classify the various algae into distinct groups, which of the following characters you should choose?

(A) Nature of stored food materials in the cell

(B) Structural organization of thallus

(C) Chemical composition of the cell wall

(D) Types of pigments present in the cell

[AIPMT 2007]

20. Phenetic classification of organisms is based on:

(A) observable characteristics of existing organisms

(B) the ancestral lineage of existing organisms

(C) dendrogram based on DNA characteristics

(D) sexual characteristics. **[AIPMT 2004]**

21. Diversification in plant life appeared:

(A) due to long periods of evolutionary changes

(B) due to abrupt mutations

(C) suddenly on earth

(D) by seed dispersal. **[AIPMT 2004]**

22. Sexual reproduction in *Spirogyra* is an advanced feature because it shows:

(A) different sizes of motile sex organs

(B) same size of motile sex organs

(C) morphologically different sex organs

(D) physiologically differentiated sex organs.

[AIPMT 2003]

23. A research student collected certain alga and found that its cells contained both chlorophyll-a, b, c and chlorophyll-d as well as phycoerthrin. The alga belongs to:

(A) Rhodophyceae (B) Bacillariophyceae

(C) Chlorophyceae (D) Phaeophyceae

[AIPMT 2000]

24. Sexual reproduction involving fusion of two cells in *Chlamydomonas* is:

(A) isogamy (B) homogamy

(C) somatogamy (D) hologamy. **[AIPMT 1998]**

25. Chloroplast of *Chlamydomonas* is:

(A) stellate (B) cup-shaped

(C) collar-shaped (D) spiral. **[AIPMT 1993]**

26. The common mode of sexual reproduction in *Chlamydomonas* is:

(A) isogamous (B) anisogamous

(C) oogamous (D) hologamous.

[AIPMT 1991]

27. The product of conjugation in *Spirogyra* or fertilization of *Chlamydomonas* is:

(A) zygospore (B) zoospore

(C) oospore (D) carpospore **[AIPMT 1991]**

3.2. Bryophytes

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

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

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

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

(A) A is correct but R is not correct.

(B) A is not correct but R is correct.

(C) Both A and R are correct and R is the correct explanation of A.

(D) Both A and R are correct but R is NOT the correct explanation of A. **[NEET 2023]**

29. Gemmae are present in:

(A) mosses (B) pteridophytes

(C) some gymnosperms (D) some liverworts.

[NEET 2021]

30. Which one is wrongly matched?

(A) Gemma cups – *Marchantia*

(B) Biflagellate zoospores – Brown algae

(C) Uniflagellate gametes – *Polysiphonia*

(D) Unicellular organism – *Chlorella* **[NEET 2018]**

31. Which of the following is responsible for peat formation?

(A) *Marchantia* (B) *Funaria*

(C) *Riccia* (D) *Sphagnum* **[AIPMT 2014]**

32. Which one of the following is common to multicellular fungi, filamentous algae and protonema of mosses?

(A) Diplontic life cycle

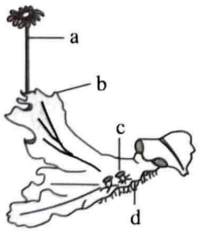
(B) Members of kingdom-Plantae

(C) Mode of nutrition

(D) Multiplication by fragmentation

[AIPMT Screening 2012]

33. Examine the figure below and select the right option giving all the four parts (a, b, c and d) correctly identified.



	a	b	c	d
(A)	Archegoni-ophore	Female thallus	Gemma cup	Rhizoids
(B)	Archegoni-ophore	Female thallus	Bud	Foot
(C)	Seta	Sporophyte	Protonema	Rhizoids
(D)	Antheridni-ophore	Male thallus	Globule	Roots

[AIPMT Mains 2011]

34. Spore dissemination in some liverworts is aided by:

(A) indusium (B) calyptra

(C) peristome teeth (D) elaters. **[AIPMT 2007]**

35. In a moss the sporophyte:

(A) manufactures food for itself, as well as for the gametophyte

(B) is partially parasitic on the gametophyte

(C) produces gametes that give rise to the gametophyte

(D) arises from a spore produced from the gametophyte.

[AIPMT 2006]

36. Moss peat is used as a packing material for sending flowers and live plants to distant places because:

(A) it serves as a disinfectant

(B) it is easily available

(C) it is hygroscopic

(D) it reduces transpiration. **[AIPMT 2006]**

37. The antherozoids of *Funaria* are:

(A) multiciliated (B) monociliated

(C) aciliated (D) biflagellate

[AIPMT 1999]

38. Bryophytes comprise:

(A) dominant phase of gametophyte which produces spores

(B) small sporophyte phase and generally parasitic on gametophyte

(C) sporophyte is of longer duration

(D) dominant phase of sporophyte which is parasitic.

[AIPMT 1999]

39. Which of the following is true about bryophytes?

(A) They are thalloid.

(B) They posses archegonia.

(C) They contain chloroplast.

(D) All of these **[AIPMT 1999]**

40. Bryophytes are dependent on water, because:

(A) water is essential for their vegetative propagation

(B) sperms can easily reach upto egg in the archegonium

(C) archegonium has to remain filled with water for fertilization

(D) water is essential for fertilization for their homosporous nature. **[AIPMT 1998, 91]**

41. Bryophytes can be separated from algae, because they:

(A) possess archegonia

(B) contain chloroplast

(C) are thalloid forms

(D) have no conducting tissue. **[AIPMT 1997]**

42. Elater mechanism for spore dispersal is exhibited by:

(A) liverworts (B) *Marchantia*

(C) *Riccia* (D) *Funaria*. **[AIPMT 1996]**

43. The plant body of moss (*Funaria*) is:

(A) completely sporophyte

(B) predominantly gametophyte with sporophyte

(C) completely gametophyte
(D) predominantly sporophyte with gametophyte.
[AIPMT 1995]

44. In bryophytes:
(A) both generation are independent
(B) gametophyte are dependent upon sporophytes
(C) sporophytes complete their life cycle
(D) sporophytes are dependent upon gametophytes.
[AIPMT 1994]

45. Protonema occurs in the life cycle of:
(A) *Riccia* (B) *Funaria*
(C) *Anthoceros* (D) *Spirogya.*
[AIPMT 1993, 90]

46. Moss peristome takes part in:
(A) spore dispersal (B) photosynthesis
(C) protection (D) absorption.
[AIPMT 1990]

47. Apophysis in the capsule of *Funaria* is:
(A) lower part (B) upper part
(C) middle part (D) fertile part.
[AIPMT 1990]

3.3. Pteridophytes

48. Identify the incorrect pair:
(A) Sphenopsida — *Adiantum*
(B) Pteropsida — *Dryopteris*
(C) Psilopsida — *Psilotum*
(D) Lycopsida — *Selaginella*
[Re-NEET 2024]

49. Identify the pair of heterosporous pteridophytes among the following:
(A) *Psilotum* and *Salvinia*
(B) *Equisetum* and *Salvinia*
(C) *Lycopodium* and *Selaginella*
(D) *Selaginella* and *Salvinia* **[NEET 2024]**

50. Genera like *Selaginella* and *Salvinia* produce two kinds of spores. Such plants are known as:
(A) Homosorus (B) Heterosorus
(C) Homosporous (D) Heterosporous.
[NEET 2021]

51. Strobili or cones are found in:
(A) *Pteris* (B) *Marchantia*
(C) *Equisetum* (D) *Salvinia.*
[NEET Sept. 2020]

52. In bryophytes and pteridophytes, transport of male gametes requires:
(A) insects (B) birds
(C) water (D) wind.
[NEET Phase-I 2016]

53. The plant body is thalloid in:
(A) *Sphagnum* (B) *Salvinia*
(C) *Marchantia* (D) *Funaria.*
[NEET Karnataka 2013]

54. Archegoniophore is present in:
(A) *Chara* (B) *Adiantum*
(C) *Funaria* (D) *Marchantiá.*
[AIPMT Screening 2011]

55. *Selaginella* and *Salvinia* are considered to represent a significant step towards evolution of seed habit because:
(A) female gametophyte is free and gets dispersed like seeds
(B) female gametophyte lacks archegonia
(C) megaspores possess endosperm and embryo surrounded by seed coat
(D) embryo develops in female gametophyte which is retained on parent sporophyte.
[AIPMT Mains 2011]

56. Which one of the following is considered important in the development of seed habit?
(A) Dependent sporophyte
(B) Heterospory
(C) Haplontic life cycle
(D) Free-living gametophyte **[AIPMT Screening 2009]**

57. Which one of the following is heterosporous?
(A) *Dryopteris* (B) *Salvinia*
(C) *Adiantum* (D) *Equisetum*
[AIPMT Screening 2008]

58. Pteridophytes differ from bryophytes and thallophytes in having:
(A) vascular tissues
(B) motile antherozoids
(C) archegonia
(D) alternation of generations. **[AIPMT 1993]**

59. The plant group that produces spores and embryo but lacks vascular tissues and seeds is:
(A) Pteridophyta (B) Rhodophyta
(C) Byrophyta (D) Phaeophyta.
[AIPMT 1992]

60. Sperms of both *Funaria* and *Pteris* were released together near the archegonia of *Pteris*. Only its sperm enters the archegonia as:

(A) *Pteris* archegonia repel *Funaria* sperms

(B) *Funaria* sperms get killed by *Pteris* sperms

(C) *Funaria* sperms are less mobile

(D) *Pteris* archegonia release chemical to attract its sperms. **[AIPMT 1989]**

3.4. Gymnosperms

61. Which of the following is the correct match?

(A) Gymnosperms : *Cedrus, Pinus, Sequoia*

(B) Angiosperms : *Wolffia, Eucalyptus, Sequoia*

(C) Bryophytes : *Polytrichum, Polysiphonia, Sphagnum*

(D) Pteridophytes : *Equisetum, Ginkgo, Adiantum*

[Re-NEET 2024]

62. Which of the following statement is incorrect about gymnosperms?

(A) They are heterosporous.

(B) Male and female gametophytes are free-living.

(C) Most of them have narrow leaves with thick cuticle.

(D) Their seeds are not covered. **[NEET Oct. 2020]**

63. Which one of the following statements is correct?

(A) Horsetails are gymnosperms.

(B) *Selaginella* is heterosporous, while *Salvinia* is homosporous.

(C) Ovules are not enclosed by ovary wall in gymnosperms.

(D) Stems are usually unbranched in both *Cycas* and *Cedrus*. **[NEET 2018]**

64. Select the mismatch.

(A) *Pinus*	Dioecious
(B) *Cycas*	Dioecious
(C) *Salvinia*	Heterosporous
(D) *Equisetum*	Homosporous

[NEET 2017]

65. Conifers are adapted to tolerate extreme environmental conditions because of:

(A) broad hardy leaves

(B) superficial stomata

(C) thick cuticle

(D) the presence of vessels. **[NEET Phase-II 2016]**

66. Select the correct statement.

(A) *Salvinia*, *Ginkgo* and *Pinus* all are gymnosperms.

(B) *Sequoia* is one of the tallest trees.

(C) The leaves of gymnosperms are not well adapted to extremes of climate.

(D) Gymnosperms are both homosporous and heterosporous. **[NEET Phase-I 2016]**

67. Which one is a wrong statement?

(A) Archegonia are found in Bryophyta, Pteridophyte and Gymnosperms.

(B) *Mucor* has biflagellate zoospores.

(C) Haploid endosperm is typical feature of gymnosperms.

(D) Brown algae have chlorophyll-a and c, and fucoxanthin. **[AIPMT Latest July 2015]**

68. What is common in all the three, *Funaria*, *Dryopteris* and *Ginkgo*?

(A) Presence of archegonia

(B) Well-developed vascular tissues

(C) Independent gametophyte

(D) Independent sporophyte **[NEET Karnataka 2013]**

69. *Cycas* and *Adiantum* resemble each other in having:

(A) seeds (B) motile sperms

(C) cambium (D) vessels.

[AIPMT Screening 2012]

70. Which one of the following is a correct statement?

(A) Pteridophyte gametophyte has a protonemal and leafy stage.

(B) In gymnosperms female gametophyte is free-living.

(C) Antheridiophores and archegoniophores are present in pteridophytes.

(D) Origin of seed habit can be traced in pteridophytes. **[AIPMT Screening 2012]**

71. Read the following five statements and answer as asked next to them.

(I) In *Equisetum* the female gametophyte is retained on the parent sporophyte.

(II) In *Ginkgo* male gametophyte is not independent.

(III) The sporophyte in *Riccia* is more developed than that in *Polytrichum*.

(IV) Sexual reproduction in *Volvox* is isogamous.

(V) The spores of slime moulds lack cell walls.

How many of the above statements are correct?

(A) Two (B) Three

(C) Four (D) One

[AIPMT Mains 2012]

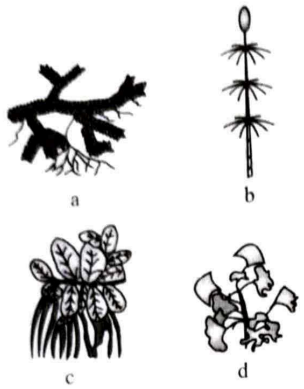
72. The gametophyte is not an independent, free living generation in:

(A) *Adiantum* (B) *Marchantia*

(C) *Pinus* (D) *Polytrichum*.

[AIPMT Screening 2011]

73. Examine the figures a, b, c and d. In which one of the four options, all the items a, b, c and d are correct?



a b c d

	a	b	c	d
(A)	*Chara*	*Marchantia*	*Fucus*	*Pinus*
(B)	*Equisetum*	*Ginkgo*	*Selaginella*	*Lycopodium*
(C)	*Selaginella*	*Equisetum*	*Salvinia*	*Ginkgo*
(D)	*Funaria*	*Adiantum*	*Salvinia*	*Riccia*

[AIPMT Mains 2010]

74. Which one of the following is a vascular cryptogamae?

(A) *Equisetum* (B) *Ginkgo*

(C) *Marchantia* (D) *Cedrus*

[AIPMT Screening 2009]

75. In which one of the following, the male and female gametophytes do not have free-living independent existence?

(A) *Pteris* (B) *Funaria*

(C) *Polytrichum* (D) *Cedrus*

[AIPMT Screening 2008]

76. Select one of the following pairs of important features distinguishing *Gnetum* from *Cycas* and *Pinus* and showing affinities with angiosperms:

(A) Absence of resin duct and leaf venation

(B) Presence of vessel elements and absence of archegonia

(C) Perianth and two integuments

(D) Embryo development and apical meristem.

[AIPMT Screening 2008]

77. Flagellated male gametes are present in all the three of which one of the following sets?

(A) *Zygnema*, *Saprolegnia* and *Hydrilla*

(B) *Fucus*, *Marsilea* and *Calotropis*

(C) *Riccia*, *Dryopteris* and *Cycas*

(D) *Anthoceros*, *Funaria* and *Spirogyra*. **[AIPMT 2007]**

78. In gymnosperms, the pollen chamber represents:

(A) a cavity in the ovule in which pollen grains are stored after pollination

(B) an opening in the megagametophyte through which the pollen tube approaches the egg

(C) the microsporangium in which pollen grains develop

(D) a cell in the pollen grain in which the sperms are formed. **[AIPMT 2007]**

79. Which of the following propagates through leaf-tip?

(A) Walking fern (B) Sprout-leaf plant

(C) *Marchantia* (D) Moss. **[AIPMT 2004]**

80. Which one of the following is a living fossil?

(A) *Cycas* (B) Moss

(C) *Saccharomyces* (D) *Spirogyra* **[AIPMT 2004]**

81. Which one of the following is categorised under living fossils?

(A) *Pinus* (B) *Cycas*

(C) *Selaginella* (D) *Metasequoia*

[AIPMT 2003]

82. Transfusion tissue is present in the leaves of:

(A) *Pinus* (B) *Dryopteris*

(C) *Cycas* (D) Both (A) and (C).

[AIPMT 1998]

83. In *Pinus*, the pollen grain has 6 chromosomes then its endosperm will have:

(A) 12 (B) 18

(C) 6 (D) 24 **[AIPMT 1992]**

84. In *Pinus*/gymnosperms, the haploid structure are:

(A) megaspore, endosperm and embryo

(B) megaspore, pollen grain and endosperm

(C) megaspore, integument and root

(D) pollen grain, leaf and root. **[AIPMT 1989]**

85. In *Pinus*/*Cycas*/gymnosperms, the endosperm is:

(A) triploid (B) haploid

(C) diploid (D) tetraploid. **[AIPMT 1988]**

3.5. Angiosperms

86. Male gametophyte with least number of cells is present in:

(A) *Pteris* (B) *Funaria*

(C) *Lilium* (D) *Pinus*. **[AIPMT 2014]**

87. Conifers differ from grasses in the:

(A) formation of endosperm before fertilization

(B) production of seeds from ovules

(C) lack of xylem tracheids

(D) absence of pollen tubes. **[AIPMT 2006]**

88. Match items in Column I with those in Column II.

	Column I		Column II
(a)	Peritrichous flagellation	(i)	*Ginkgo*
(b)	Living fossil	(ii)	*Macrocystis*
(c)	Rhizophore	(iii)	*Escherichia coli*
(d)	Smallest flowering plant	(iv)	*Selaginella*
(e)	Largest perennial alga	(v)	*Wolffia*

Select the correct answer from the following.

	(a)	(b)	(c)	(d)	(e)
(A)	(i)	(ii)	(iv)	(v)	(iii)
(B)	(iii)	(ii)	(i)	(iv)	(v)
(C)	(iii)	(i)	(iv)	(v)	(ii)
(D)	(ii)	(iii)	(v)	(i)	(iv)

[AIPMT 2005]

89. Which one of the following pairs of plants are not seed producers?

(A) Fern and *Funaria*

(B) *Funaria* and *Ficus*

(C) *Ficus* and *Chlamydomonas*

(D) *Punica* and *Pinus* **[AIPMT 2003]**

90. Which of the following plants produce seeds but not flowers?

(A) Maize (B) Mint

(C) Peepal (D) *Pinus* **[AIPMT 2002]**

91. Plant group with largest ovule, largest tree and largest gametes is:

(A) gymnosperm (B) angiosperm

(C) bryophyta (D) pteridophyta

[AIPMT 2000]

92. *Pinus* differs from mango in having:

(A) tree habit

(B) green leaves

(C) ovules not enclosed in ovary

(D) wood **[AIPMT 1993]**

93. Turpentine is got from:

(A) angiospermous wood

(B) bryophytes

(C) gymnospermous wood

(D) ferns **[AIPMT 1992]**

*3.6. Plant Life Cycles and Alternation of Generation

94. Which one of the following has haplontic life cycle?

(A) *Funaria* (B) *Polytrichum*

(C) *Ustilago* (D) Wheat

[AIPMT Screening 2009]

SOLUTIONS

1. (B) In the members of Phaeophyceae, sexual reproduction may be isogamous, anisogamous or oogamous.

Related Theory

- *Asexual reproduction in most brown algae is by biflagellate zoospores that are pear-shaped and have two unequal laterally attached flagella.*
- *Food is stored as complex carbohydrates, which may be in the form of laminarin or mannitol.*
- *Brown algae possess chlorophyll a, c, carotenoids and xanthophylls.*
- *The vegetative cells of brown algae have a cellulosic wall usually covered on the outside by a gelatinous coating of algin.*

2. (A) *Ulothrix* is a member of chlorophyceae (green algae), with starch as the reserve food material. Mannitol is the stored food material of brown algae (phaeophyceae).

Related Theory

- *The fungi constitute a unique kingdom of heterotrophic organisms. They show a great diversity in morphology and habitat.*

3. (A) Mannitol is a form of complex carbohydrates stored as food in some definite algae. The members of phaeophyceae, also known as brown algae, store food as mannitol. *Ectocarpus* is a brown algae, *Gracilaria* is red algae, and *Volvox*, and *Ulothrix* are green algae.

Related Theory

- *The reserve food of brown algae is laminarin. Red algae stores it as floridean starch. Green algae have starch as the reserve food.*

4. (C) Carrageenan is a sulfated galactan that is mostly extracted from red algae.

Related Theory

- *Carrageens are used as gelling, thickening, and stabilising agents, especially in food products and sauces.*

5. (A) Phycoerythrin (PE), a red protein-pigment complex is present in red algae and cryptophytes, along with phycocyanin. Blue-green algae (cyanobacteria) contain chl-a, along with yellowish carotenoids, the blue pigment phycocyanin, and, in some species,

*** Topics/Qs are in NEET latest syllabus but has been removed from NCERT.**

the red pigment phycoerythrin. Green algae consist of chl-a, chl-b, β-carotene, and xanthophylls. Brown algae contains chlorophyll $c_1 + c_2$ and fucoxanthin.

6. (C) *Chlorella* and *Spirulina* are unicellular green algae. They are rich in proteins and hence, used as food supplements by space travellers. *Gelidium* (red algae), *Gracilaria* (red algae), *Laminaria* (brown algae) and *Sargassum* (brown algae) are multicellular brown algae. *Volvox* (green algae) is colonial and *Anabaena* is filamentous cyanobacteria.

Related Theory

Single-cell protein (SCP) refers to protein derived from cells of microorganisms such as yeast, fungi, algae, and bacteria, which are grown on various carbon sources for synthesis. SCP is a protein source for human food supplements and animal feeds. SCP production may have potential for feeding the ever-increasing world population. Massive quantities of SCP can be produced in a single day. As a source of protein it is very promising with potential to satisfy the world shortage of food, while population increases. There are several carbon sources that are used as energy sources for microorganisms for growing and producing SCP.

7. (B) Algin is obtained from brown algae like *Laminaria*. It is used in jelly, shaving cream, flameproof plastic, *etc.* Carrageenan is obtained from red algae and is used as an emulsifier and clearing agent. Algae are photosynthetic organisms. In the presence of sunlight, they produce oxygen through photosynthesis and release this oxygen into the water. Agar-agar is obtained from red algae like *Gelidium* and *Gracilaria*. *Laminaria* and *Sargassum* are algae, which are used as food.

Related Theory

Algae is promising towards the production of biodiesel. Their carbohydrate content is used to yield bioethanol and biobutanol. The energy density of biobutanol is similar to gasoline, and it can be used in a gasoline engine without any modification. Its energy density is greater than both ethanol and methanol. Biodiesel can serve as a cheaper source of renewable energy. Moreover, it is environmental-friendly, and it can help reduce global warming and climate change by controlling the level of pollution.

8. (D) Laminarin is the stored food in phaeophyceae (brown algae), which transport it throughout their bodies in the form of mannitol. In rhodophyceae, floridean starch is stored as food. In green algae, food is stored as amylose and amylopectin. Algin is found in the cell walls of brown algae, while carrageenan is found in red algae. Agar-agar is obtained from red algae (*Gracilaria, Ahnfeltia, Gelidium,* and *Pterocladiella*). *Chlorella* and *Spirulina* are single-celled proteins or SCP, and are used by the space astronauts as a source of food in the form of capsules.

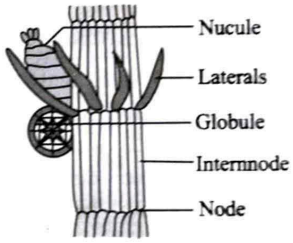
9. (C) *Ectocarpus* is a brown algae, in which male and female gametes are flagellated. In *Polysiphonia*, gametes are not flagellated or non-motile, while in *Anabaena*, sexual reproduction is absent. In *Spirogyra*, sexual reproduction takes place by conjugation and gametes are non-motile.

Related Theory

In phaeophyceae, sexual reproduction can be isogamous, anisogamous or oogamous, by the formation of zoospore. Male gametes are flagellated and flagella is heterokont. Life cycle is haplontic or diplontic with alternation of generations.

10. (D) *Spirogyra*, a green alga shows isogamy with non-flagellated gametes, while in *Ulothrix* also a green alga, gametes are flagellated and isogamous. *Ectocarpus* and *Sargassum* belong to brown algae and the gametes are anisogamous.

11. (C) Both antheridium and oogonium are the male and female reproductive structures, respectively. They have sterile jackets on their surface. The male sex structure antheridium is present on the lower side, while female sex organ oogonium is present on the upper side of sterile vegetative leaf like structure. The figure is givens as:



Chara Sex Organs

12. (C) In oomycetes, female gamete is larger and non-motile, while male gamete is smaller and motile. It is found in white rust, downy mildews, *etc.* Isogametes are found in *Ulothrix, Chlamydomonas, Spirogyra, etc.* Anisogametes are found in *Chlamydomonas*. Oogamy is the fusion of non-motile egg with motile sperm and occurs in *Chlamydomonas, Fucus, Chara, Volvox, etc.*

13. (B) Isogamy is found in *Spirogyra*, where both gametes are non-motile. In *Chlamydomonas*, isogamy, anisogamy and oogamy are found, with both motile and non-motile gametes. In *Volvox* and *Fucus*, oogamy is found with non-motile egg and motile sperm.

14. (D) *Chara* is a green algae. The sexual reproduction in *Chara* is of highly advanced oogamous type. The male sex organ is called antheridium or globule and the female sex organ is called oogonium or nucule. The sex organs arise on the branches of limited growth or primary laterals, the nucule above the globule. The development of globule and nucule takes place simultaneously, but species globule matures before nucule.

Related Theory

The plant body of Chara is haploid. The vegetative reproduction takes place by the formation of amylum stars, bulbils and secondary protonema. Asexual reproduction is absent. The sexual reproduction is of advanced oogamous type. The male and female sex organs are globule and nucule respectively. After fertilisation a diploid spore is formed. At the time of germination diploid oospore nucleus divides to make haploid nuclei and haploid Chara plant. Thus, the life cycle of Chara is predominantly of haploid type.

15. (A) In *Spirogyra*, gametes are non-motile and sexual reproduction takes place by conjugation. *Sargassum* belongs to phaeophyceae, which contains chlorophyll a and chlorophyll c. Basidiomycetes includes puffballs, mushrooms, *etc*. *Nostoc* is a colonial cyanobacteria, which causes algal bloom.

Related Theory

Since blue-green algae are prokaryotes, they are not currently included under algae (because all algae are classified as eukaryotic organisms). These organisms live in moist or aquatic environments just like other algae. They obtain energy through the process of photosynthesis. Ecologically, some species of blue-green algae are significant to the environment as it fixes the nitrogen in the soil. Hence, these are also called nitrogen-fixing bacteria. E.g., Nostoc, Anabaena, etc.

16. (A) Algae have a cell wall that consists of cellulose, galactans and mannans. Algae, including plants, contain cell walls that comprise either polysaccharides like cellulose or a range of glycoproteins or both. In bacteria, the cell wall is composed of peptidoglycan.

Related Theory

The presence of additional polysaccharides in algal cell walls is often used as a tool for algal taxonomy. Mannans-type microfibrils are found in the cell walls of a variety of marine green algae, such as those in the genera Codium, and Acetabularia and in the walls of certain red algae, such as Porphyra.

17. (C) *Fucus* is an example of brown algae and food is stored in it as complex carbohydrates in the form of mannitol.

18. (D) Phylogenetic classification is based on evolutionary sequence as well as the genetic relationship among the living organisms.

19. (D) Algae are a group of chlorophyllous, non-vascular plants with thallus plant body. Different algae show different pigments present in the cell like chlorophyll - a, b, xanthophylls, carotenes, *etc*. These pigments provide the basis for classification of various groups of algae into different classes. Chlorophyceae possess chlorophyll - a, b pigments, phaeophyceae has chlorophyll - a, c, fucoxanthin, and rhodophyceae has chlorophyll - a, d and r-phycoerythrin.

20. (A) Phenetics is a form of numerical systematics in which organisms are grouped based upon the total or relative number of shared characteristics (based on observable similarities and differences between taxa), while phylogenetics is the systematic study of relationship between organisms based on evolutionary similarities and differences.

Caution

Cladistics considers both phenetics and phylogenetics. The accuracy of cladistics is greater than the accuracy of phenetics in classifying organisms.

21. (A) Diversification in plant life appeared due to long periods of evolutionary changes. Earlier, the plants were thalloid and there were no differentiation among root, stem and leaves. Vascular tissues were absent as in algae and bryophytes. In pteridophytes, seed habit was observed for the first time. Gymnosperms consist of vascular tissues and naked seed habitats. Angiosperms showed secondary growth, along with fruit formation.

Mnemonics

Plant kingdom includes: Algae, Bryophyta, Pteridophyta, Gymnosperms, and Angiosperms.
It can be memorised as:
Anil Bola, Papa Ghar Aagye
Anil – ***Algae***
Bola – ***Bryophytes***
Papa – ***Pteridophytes***
Ghar – ***Gymnosperms***
Aagye – ***Angiosperms.***

22. (D) In *Spirogyra*, the sexual reproduction involves the fusion of two morphologically identical isogametes and physiologically dissimilar anisogametes. This is a case of primitive anisogamy.

23. (A) Algae are classified on the basis of pigments they have. In rhodophyceae (red algae) the pigments are chlorophyll-a, d, r-phycoerythrin, r-phycocyanin, α and β-carotene. Abundant phycoerythrin provides red colour to alga.

Related Theory

Among the other options:
- *Members of chlorophyceae (green algae) contain chloropyll-a, b, and β-carotene, α-carotene pigments.*
- *Members of bacillariophyceae contain chlorophyll-a,c, α and β-carotene pigments.*
- *In phaeophyceae, the pigments are chlorophyll-a, chlorophyll-c and carotenes and xanthophylls.*

24. (D) In *Chlamydomonas*, two vegetative cells may fuse to form a zygospore and the phenomenon is called as hologamy.

25. (B) In *Chlamydomonas*, the chloroplast is cup-shaped. The chloroplast occupies the major portion of cell and is thick at the base, while its sides are relatively thin and projected upwards.

Related Theory

Chlamydomonas is an alga, which is mostly used as a model for research purposes in cell biology and molecular biology for fundamental studies of flagellar motility, chloroplast dynamics, genetics, and biogenesis.

26. (A) In isogamy both the gametes that are produced are similar in shape, size and structure. These are morphologically similar but physiologically different. Isogamy is most common in sexually reproducing *Chlamydomonas*.

27. (A) Zygospore is produced by the conjugation in *Spirogyra* or fertilisation of *Chlamydomonas*.

28. (C) The gametophyte generation in mosses begins with the germination of a haploid spore, which gives rise to a filamentous structure called a protonema. The protonema stage is characterized by the development of a moss with branching, green, one-cell-thick filaments, which can grow and spread across the soil or substrate.

The sporophyte generation in mosses produces capsules that contain spores. When the spores are released, they germinate to form protonema, which then gives rise to the gametophyte generation.

29. (D) In liverworts, such as *Marchantia*, the flattened plant body or thallus is a haploid gametophyte with gemma cups scattered around its upper surface. The gemma cups are cup-like structures containing gemmae.

30. (C) *Polysiphonia* is a red algae, in which reproduction is of oogamous type. The male sex organ produce non-flagellate male gametes. In brown algae, sexual reproduction can be in the form of isogamy or anisogamy or oogamy. In isogamy and anisogamy, both gametes are motile and possess two unequal laterally attached flagella. *Chlorella* is a unicellular green algae. In *Marchantia*, gemma cups are found on dorsal surface, which contain gemmae, helping in vegetative propagation.

31. (D) *Sphagnum* is called peat moss because it grows in acidic marshes and helps in peat formation. Peat forms when plant material does not fully decay in acidic and anaerobic conditions. It is composed mainly of wetland vegetation: principally bog plants including mosses, sedges and shrubs.

Related Theory

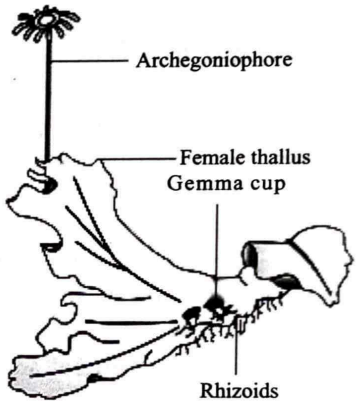
Peat is the surface organic layer of a soil that consists of partially decomposed organic matter, derived mostly from plant material, which has accumulated under conditions of waterlogging, oxygen deficiency, high acidity and nutrient deficiency. Peat is used for domestic heating purposes as an alternative to firewood and forms a fuel suitable for boiler firing in either briquetted or pulverized form.

32. (D) Multicellular fungi, filamentous algae and protonema of mosses show multiplication by fragmentation. Fungi is a separate phylum, while algae and mosses belong to Kingdom Plantae. Fungi shows saprophytic heterotrophic nutrition and mosses and algae are autotrophic. Protonema of mosses shows haploid phase, while filamentous algae and multicellular fungi show haplo-diplontic life cycle.

Related Theory

Protonema is a branched filamentous structure seen in bryophytes. They are formed by spore-germination. In mosses, the stage leads to hormone accumulation leading to the growth of newly formed cells.

33. (A) The given diagram represents a bryophyte- liverwort, *Marchantia*.



An archegoniophore is a female gametangiophore that rises from the thallus and has a stalk, an archegonial head, and dangling lobes or figures.

The body of a gametophyte plant, known as a thallus, is devoid of xylem and phloem and hence, lacks a genuine stem, true leaf, and true root.

Gemma cups are cup-shaped structures that include structures of the gemmae type. Small haploid tissue discs called gemmae immediately produce new gametophytes. Rainfall disperse the gemma cups.

Simple rhizoid protuberances that resemble hairs protrude from the bottom epidermal cells. Rhizoids absorb water through capillary action, whereby water rises between rhizoid threads.

Caution

Archegoniophore (female reproductive structure) is a flasked shaped structure, whereas antheridiophore (male reproductive structure) is an oval shaped structure.

34. (D) Elater is an elongated, spirally thickened, water-attracting cell in the capsule of a liverwort, derived from sporogenous tissue and assisting in spore dispersal. Within the spore capsules of many liverwort species there are elaters as well as spores. Elaters do not work in the same way in all species and there are some species where elaters play little or no role in spore release.

35. (B) In mosses, the sporophyte developing from the embryo partially depends on the gametophyte. It contains chlorophyll and hence, is capable of

making its own food. Sporophyte is attached to the photosynthetic gametophyte so that it can get nourishment from the gametophyte. Hence, it is partially parasitic on the gametophyte. Some cells of the sporophyte undergo meiosis to produce haploid spores. The spores germinate to produce gametophyte.

36. (C) *Sphagnum* is a bryophyte, commonly called bog moss or peat moss. It is hygroscopic and possesses remarkable water-holding capacity. Hence, it is used as a packaging material in the transport of flowers, live plants, tubers, bulbs and seedlings. It is also used in seedbeds and in moss sticks.

37. (D) The antherozoids of *Funaria* are spirally coiled and bear two equal flagella (biflagellate) at anterior end.

38. (A) Bryophytes are non-vascular plants that include mosses, liverworts, and hornworts. They are known for their dominant gametophyte phase, the visible leafy part of bryophytes is haploid gametophyte.

39. (D) Bryophytes are characterised by the presence green photosynthetic (chlorophyll containing) and thalloid structures. They also possess archegonia, which are female sex organs.

40. (B) Bryophytes live in soil but are dependent on water for sexual reproduction. Water helps in the transfer of sperms to the archegonium (female sex organs) that makes water essential for completion of life cycle of bryophytes.

41. (A) Bryophytes can be separated from algae because archegonium originated for the first time in bryophytes in plant kingdom. Archegonium is a flask-shaped structure with a swollen venter and long neck. This is absent in algae.

42. (B) *Marchantia* possesses elaters, which show twisting movements due to spiral bands of thickenings and this leads to liberation and dispersal of spores.

43. (B) *Funaria* is known as common moss or green moss. The plant body of *Funaria* is predominantly gametophyte, which reproduces by producing gametes and form zygote on fusing. Zygote develops into sporophyte.

44. (D) In bryophytes sporophytes are dependent upon gametophytes. The multicellular diploid sporophyte lives as a parasite on an independent multicellular haploid gametophyte that develops multicellular jacketed sex organs.

45. (B) Protonema occurs in life cycle of *Funaria*. A protonema is a thread-like chain of cells, which develops into a leafy gametophyte.

46. (A) Moss peristome present in capsule takes part in dispersal of spores.

47. (A) Apophysis is the lower portion of capsule in continuation with seta.

48. (A) *Adiantum* belongs to the class Pteropsida.

49. (D) Heterospory refers to the production of two types of spores, microspores, and megaspores, by different structures within the same plant. The microspores develop into male gametophytes, while the megaspores develop into female gametophytes. *E.g.*, *Selaginella, Salvinia* and *Azolla*.

50. (D) Genera like *Selaginella* and *Salvinia,* which produce two kinds of spores, *i.e.,* macro (large) and micro (small) spores, are known as heterosporous.

51. (C) Strobili or cones are found in some pteridophytes. *Equisetum* is a pteridophyte of class Sphenopsida. *Pteris* and *Salvinia* are pteridophytes. *Marchantia* is a bryophyte.

Related Theory

Living gymnosperms are a diverse group of plants, most of which bear their sporangia in large, prominent strobili or cones. These strobili are similar to those of lycopsids and horsetails. Strobili consist of a shortened stem with several modified leaves (sporophylls) that bear sporangia. Like all seed plants, gymnosperms are heterosporous. The sporangia that generate the male microspores and female megaspores are usually borne on separate cones. Male cones (staminate cones) are typically much smaller than female cones (ovulate cones). Sporophylls that bear microsporangia are called microsporophylls. Sporophylls that bear macrosporangia are called macrosporophylls.

52. (C) In primitive plants, such as bryophytes and pteridophytes, male gametes reach female reproductive organs with the help of water currents, for fertilisation.

Related Theory

Bryophytes and pteridophytes do not produce pollen grains or flowers. Pollination is a process of transfer of pollen to the female reproductive organs of a plant. Both gymnosperms and angiosperms undergo pollination but pteridophytes and bryophytes does not show pollination.

Caution

Students should remember that pollination is a characterstic feature of gymnosperms and angiosperms only.

53. (C) *Marchantia* is a bryophyte, also called liverworts, having a dorso-ventrally flattened thallus body. *Sphagnum* and *Funaria* are mosses (bryophytes), where plant body is leafy. *Salvinia* is a pteridophyte. It has a sporophyte plant body with true leaves, stem and root.

Related Theory

Bryophytes are non-vascular plants including mosses, liverworts, and hornworts. They are characterised by the absence of true roots, stems and leaves and rhizoids perform the function of roots, essentially anchoring the plants into the surface.

54. (D) Antheridiophore and archegoniophore are the structures found in dioecious bryophytes (*e.g.*, *Marchantia*). Antheridiophore is the stalk-like

structure (gametophore) that bears antheridia, *i.e.*, male sex organs. Archegoniophore is a stalk-like structure on which archegonium, *i.e.* female sex organs are borne. *Funaria* is also a bryophyte but is monoecious. *Chara* is an alga, while *Adiantum* is a pteridophyte.

Related Theory

- *Marchantia is dioecious, having separate male and female plants. It is highly advanced oogamous type and sexual reproduction takes place by male and female reproductive organs called Antheridium and archegonium.*

55. (D) In *Selaginella* and *Salvinia*, embryo develops in female gametophyte, which is retained on parent sporophyte, both are heterosporous in nature, *i.e.*, the female gametophyte remains on the parent sporophytes for variable periods. The development of the zygotes into young embryos takes place within the female gametophytes. This event is a precursor to the seed habit considered an important step in evolution. Hence, heterospory leads to seed habits in plants.

Related Theory

- *In pteridophyte, megaspore is retained for a significant amount of time within female gametophyte on the parent sporophyte. However, the permanent retention of seed is seen in gymnosperms. Thus, pteridophytes exhibit precursor to seed habit.*

56. (B) Development of heterospory or formation of two types of spores is important for the development of seed habit. Heterospory is an expression of sex determination of spores of the plant, which ultimately leads to seed development, *e.g.*, *Selaginella, Salvinia, Azolla, etc.*

Related Theory

- *Seed is the final product of sexual reproduction. It has a hard and durable seed coat that helps them to remain in a dormant stage for a long time. Seed habit is seen in plants from pteridophytes. It is not seen in other lower plants.*

57. (B) *Selaginella* and *Salvinia* are heterosporous pteridophytes. *Dryopteris*, *Equisetum* and *Adiantum* are homosporous.

58. (A) Pteridophytes have well developed vascular tissue sytem whereas, these are absent in bryophytes and thallophytes.

59. (C) Bryophytes lack vascular tissue system but they produce spores and embryos.

Caution

- *Rhodophytes and phaeophytes are algae and they produce spores but do not form embryo.*
- *Pteridophytes have a well developed vascular tissue system and they produce spores and embryo.*

60. (D) Only the sperms of *Pteris* enter the archegonia, as archegonia of *Pteris* releases a chemical malic acid to attract its sperms for fertilisation.

61. (A) All the given examples in option (A) belongs to gymnosperms.

62. (B) Gymnosperms are heterosporous, *i.e.*, they produce both male and female cones, each making the gametes needed for fertilisation. Megaspores made in cones develop into the female gametophytes inside the ovules of gymnosperms, while pollen grains develop from cones that produce microspores. Thus, male and female gametophytes are not free-living. Conifers evolved to have needles that retain more water and seeds that could hang out until there was enough moisture to take root. Their seeds are not enclosed inside fruit, but are instead exposed or on the scales of cones.

Related Theory

- *Gymnosperms (Gk: gymnos- naked, sperma- seed) are the seed-producing plants, but unlike angiosperms, they produce seeds without fruits. These plants develop on the surface of scales or leaves, or at the end of stalks forming a cone-like structure. These plants have vascular tissues, which help in the transportation of nutrients and water. Xylem does not have vessels and the phloem has no companion cells and sieve tubes.*

63. (C) In gymnosperms, seed are naked, and hence, they do not occur inside the fruit. Horsetail (*Equisetum*) is a pteridophyte. *Selaginella* and *Salvinia* are heterosporous pteridophytes. *Cycas* has an unbranched columnar stem, while *Cedrus* possess branched stem.

64. (A) *Pinus* is a monoecious plant as it bears male and female cones on the same plant.

Related Theory

- *The male pollens of cone occurs in clusters sub terminally on lower branches. The female cones develops in groups of 2-6 on upper long branches of the tree. Their position on the tree helps prevent self-fertilisation.*

65. (C) Conifers are the gymnosperms, which are capable to withstand the extreme environmental conditions due to their leave, which are needle-like and, covered with thick cuticle.

Related Theory

- *Gymnosperms are sporophytes. The sporangia are present on sporophylls, which together make up cones. The female gametophyte develops from the haploid spores within the sporangia. All gymnosperms are heterosporous. One type of cone is the small pollen cone, which produces microspores that subsequently develop into pollen grains. The other type of cones, the larger cones, make megaspores that develop into female gametophytes called ovules. The complete sexual process can take three years. After this process is completed, the individual sporophylls separate and float in the wind to a habitable place.*

Caution

Most gymnosperms lack xylem vessel, while all angiosperms have vessels.

66. (B) *Sequoia* (giant redwood) is one of the tallest trees, with an average height of 115 m. *Ginkgo, Sequoia* and *Pinus* are gymnosperms, while *Salvinia* is a hydrophytic pteridophyte. Gymnosperms have needle-like leaves, which help in preventing the loss of moisture and help them to survive in dry and cold conditions. They also have naked seeds, which allow them to reproduce better. Gymnosperms are heterosporous that produce two different kinds of spores-microspores and megasopres.

67. (B) *Mucor* belongs to zygomycetes, which produce non-motile, non-flagellated gametes.

Related Theory

Zygomycetes are fungi belonging to the Eumycota, the true fungi that form extended mycelia and diverse asexual and sexual spore structures. As the hyphae have no cross walls between the cells, they are said to be coenocytic. Sexual reproduction in these organisms occurs when sexually opposite hyphae fuse and form spores called zygospores. The largest order of Zygomycetes is Mucorales. Fungi in this order are known as pin moulds, which create black bread mould.

68. (A) In *Funaria* (bryophyte), *Dryopteris* (pteridophyte) and *Ginkgo* (gymnosperm), female sex organ archegonium is formed. *Funaria* and *Dryopteris* lacks vascular bundle and have independent sporophyte, while *Ginkgo* have an independent gametophyte.

69. (B) Multiciliated motile male gametes are found *in Cycas* (gymnosperm) and *Adiantum* or walking fern (pteridophyte). Seeds and cambium are absent in pteridophytes, but present in *Cycas*. Vessels are absent in both.

70. (D) The seed habit is the process of adoption of heterospory and the retention and germination of a single megaspore within megasporangium to form a female gametophyte, and it is traced in pteridophytes. In gymnosperms, female gametophyte is free-living. Antheridiophores and archegoniophores are present in pteridophytes. The gametophyte of pteridophytes has a protonema and gametophytic leafy stage.

71. (D) The spores of *Equisetum* germinate shortly after shedding and give rise to form prothallus. *Equisetum* belongs to pteridophytes where female gametophyte has independent existence and does not retain on parent sporophyte. In *Gingko* (gymnosperm), male and female gametophyte do not have independent existence. The simplest known sporophyte among bryophytes is that of *Riccia*, while highest evolved known is found in Bryopsida (*Polytrichum, Pogonatum*). Sexual reproduction in *Volvox* is of oogamous type. The spores in slime moulds are haploid, unicellular, usually globose with smooth, spiny or reticulately thickened cell walls. Hence the only correct statement is "In *Ginkgo* male gametophyte is not independent".

Related Theory

In Equisetum, spores are formed on strobili or cones, special spore-bearing structures. These cones project individually at the apex of fertile shoots. The primitive kind of cone is a sub-sessile and is apiculate, whereas the advanced form of it is stalked with a rounded apex.

72. (C) In gymnosperms (*e.g., Pinus, Cycas*), the male and female gametophytes do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes. Bryophytes (*Polytrichum* and *Marchantia*) and pteridophytes (*Adiantum*) have independent and free-living gametophyte.

73. (C) *Selaginella* and *Salvinia*, are heterosporous pteridophytes, which produce micro and macrospores. *Ginkgo biloba* is a living fossil because its ancestors are unchanged for the last many hundred years, while its relatives disappeared. Leaves of *Equisetum* (a fern) are found in a whorl-like appearance with them growing from the same point surrounding the stem. Leaves sprout from nodes, while the base of leaves is united surrounding the stem creating a collar.

74. (A) Vascular cryptogams refers to seedless vascular plants, which includes pteridophytes *e.g., Equisetum. Marchantia* is a bryophyte. *Cedrus* and *Ginkgo* are gymnosperms.

75. (D) In *Cedrus* (gymnosperm), the male and female gametophyte do not have an independent free-living existence. They remain within the sporangia retained on the sporophytes within microsporangium. In *Polytrichum* and *Funaria* (bryophytes), the main plant body is a gametophyte, which is independent and the sporophyte is partially or fully dependent on gametophytic generation. In *Pteris* (pteridophyte) gametophyte is usually independent and sporophyte is the dominant phase in the life cycle.

76. (B) Members of order Gnetales possess vessels and show absence of archegonia, which resemble the characteristics of angiosperms. Such characteristics distinguish it from other gymnosperms, like *Cycas* and *Pinus*.

Related Theory

Gnetum resembles angiosperms in many aspects-

(1) The leaves have reticulated - venation that is an angiospermic character.

(2) The presence of vessels in the xylem is also an angiospermic character

(3) The female gametophyte is only partly cellular before fertilisation and becomes completely cellular only after fertilisation. Some of the free nuclei act as eggs as there is no archegonium.

77. (C) The male gametes of bryophytes are biflagellate, and those of pteridophytes are multiflagellate, except *Selaginella* having biflagellate gametes. The male gametes of gymnosperms are non-motile except those of *Cycas* having multiciliate gametes.

Zygnema, Spirogyra, Saprolegnia – Green algae

Hydrilla, Calotropis – Angiosperm

Fucus – Brown algae

Marsilea, Dryopteris, Anthoceros – Pteridophyte

Riccia, Funaria – Bryophyta

Cycas – Gymnosperm

78. (A) The space in the ovule where pollen grains are placed after pollination is called as the pollen chamber in gymnosperms.

79. (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.

80. (A) *Cycas* is called a living fossil because cycads are one of the oldest forms of plant life. They were here long, long before dinosaurs stomped the Earth and have remained basically unaffected.

81. (B) Cycadales is an ancient order of gymnosperms exhibiting several primitive features. Therefore, *Cycas* is a living fossil.

82. (D) Transfusion tissues are found around the vascular bundles in the leaflets of the gymnosperms, such as *Pinus* and *Cycas*. These tissues supply water and minerals to mesophyll tissue up to margins so that the mesophyll cells can carry out photosynthesis.

83. (C) If the pollen grain of *Pinus* has 6 chromosomes then in its endosperm will also have 6 chromosomes, as endosperm and pollen grains are both haploid structures.

Caution

➥ *Pinus is a gymnosperm. Endosperm is haploid in gymnosperms whereas tripoid in angiosperms.*

84. (B) Endosperm is haploid (n) and formed before fertilisation. Megaspore mother cell undergoes reduction division to form a linear tetrad of haploid megaspores. Microspore (pollen grain) is the first stage of gametophyte (n).

85. (B) Gymnosperms such as *Pinus* and *Cycas*, have haploid (n) endosperm that develops prior to fertilisation. Endosperm in angiosperms is triploid ($3n$) and develops following double fertilisation.

86. (C) In angiosperms (*Lilium*), the gametophyte is short lived and usually consists of 2-3 cells, as in pollen grains. While in bryophytes (*Funaria*), gametophyte is free-living, independent phase of plant, bearing sporophyte. *Pteris* has a multicellular gametophytic prothallus, which has both antheridia and archegonia.

The number of cells in male gametophytes in different plant occurs as:

Funaria (bryophyte) > *Pteris* (pteridophyte) > *Pinus* (gymnosperm) > *Lilium* (angiosperm)

Caution

➥ *During the course of evolution in plants, the size of gametophytes have reduced significantly. The male and female gametes became dependent on sporophyte and were only formed during sexual reproduction. Hence, each plant groups succeeding bryophytes, the gametophyte becomes less and less prominent.*

87. (A) In gymnosperms, the endosperm is formed, before fertilisation. In both conifers and grasses seeds are produced from ovules. Xylem tracheid and pollen tubes are present in both conifers and grasses.

88. (C) Flagellation is the arrangement of flagella over the body surface of a bacterial cell. Peritrichous bacteria has flagella all over the surface of cell, *e.g., E. coli.*

Ginkgo biloba is called living fossil because it is the single living genus in a big fossilised order Ginkgoales.

Rhizophore is a leafless, colourless, positively geotropic elongated structure that grows down from the point of bifurcation of stem. It occurs in *Selaginella.*

Wolffia is a hydrophyte and the smallest angiosperm.

Macrocystis belongs to class Phaeophyceae. It is the largest perennial alga, about 40-60 m in size.

89. (A) Fern and *Funaria* belong to pteridophytes and bryophytes, respectively, so they do not reproduce by producing seeds. They reproduce by spore formation.

90. (D) *Pinus* is a gymnospermic plant, *i.e.*, it produce naked seeds and do not have flowers. Maize, Mint and Peepal are angiosperms (flower bearing plants).

91. (A) Gymnosperms are the group of plants with largest ovule, largest tree and largest gametes, *e.g., Sequoia, Cycas.*

92. (C) *Pinus* is a gymnospermic plant, whereas mango is an angiospermic plant. Seeds are naked in *Pinus*, whereas seeds are enclosed in the ovary in mango.

93. (C) Turpentine is extracted form *Pinus*, which is a gymnospermic plant.

94. (C) *Ustilago* has haplontic life cycle. In their sexual phase, only zygospore is diploid structure. All others have diplontic life cycle.

Related Theory

➥ *Haplontic life cycle – E.g., Green algae (Volvox, Spirogyra, Chlamydomonas, etc.)*

➥ *Diplontic life cycle – E.g., Gymnosperms, Angiosperms, Fucus, etc.*

➥ *Haplo-diplontic life cycle – E.g., Bryophytes, some algae such as Ulva, Polysiphonia, Ectocarpus, Kelps, etc.*