CHAPTER 3

Plant Kingdom

3.0 Introduction

1. Phylogenetic system of classification is based on
(a) morphological features
(b) chemical constituents
(c) floral characters
(d) evolutionary relationships. *(2009)*

2. 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. *(2004,2003)*

3. A system of classification, in which a large number of traits are considered, is
(a) natural system (b) phylogenetic system
(c) artificial system (d) synthetic system. *(1999)*

4. Phylogenetic classification is one which is based on
(a) overall similarities (b) utilitarian system
(c) habits of plants
(d) common evolutionary descent. *(1994)*

5. System of classification used by Linnaeus was
(a) natural system (b) artificial system
(c) phylogenetic system (d) asexual system. *(1989)*

6. Artificial system of classification was first used by
(a) Linnaeus (b) De Candolle
(c) Pliny the Edler (d) Bentham and Hooker. *(1989)*

7. Classification given by Bentham and Hooker is
(a) artificial (b) natural
(c) phylogenetic (d) numerical. *(1988)*

3.1 Algae

8. Floridean starch has structure similar to
(a) starch and cellulose
(b) amylopectin and glycogen
(c) mannitol and algin
(d) laminarin and cellulose. *(NEET 2020)*

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

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

11. 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-II 2016)*

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

13. Male gametes are flagellated in
(a) *Ectocarpus* (b) *Spirogyra*
(c) *Polysiphonia* (d) *Anabaena*. *(2015 Cancelled)*

14. 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 *(2014)*

15. Which one of the following shows isogamy with non-flagellated gametes?
(a) *Sargassum* (b) *Ectocarpus*
(c) *Ulothrix* (d) *Spirogyra* *(2014)*

16. Select the wrong statement.
(a) In oomycetes, female gamete is smaller and motile, while male gamete is larger and non-motile.
(b) *Chlamydomonas* exhibits both isogamy and anisogamy and *Fucus* shows oogamy.
(c) Isogametes are similar in structure, function and behaviour.
(d) Anisogametes differ either in structure, function or behaviour. *(NEET 2013)*

17. Isogamous condition with non-flagellated gametes is found in
(a) *Volvox* (b) *Fucus*
(c) *Chlamydomonas* (d) *Spirogyra.*
(NEET 2013)

18. Monoecious plant of *Chara* shows occurrence of
(a) upper antheridium and lower oogonium on the same plant
(b) upper oogonium and lower antheridium on the same plant
(c) antheridiophore and archegoniophore on the same plant
(d) stamen and carpel on the same plant.
(NEET 2013)

19. Which one of the following is wrongly matched?
(a) *Spirogyra* - Motile gametes
(b) *Sargassum* - Chlorophyll
(c) Basidiomycetes - Puffballs
(d) *Nostoc* - Water blooms
(Karnataka NEET 2013)

20. Algae have cells made up of
(a) cellulose, galactans and mannans
(b) hemicellulose, pectins and proteins
(c) pectins, cellulose and proteins
(d) cellulose, hemicellulose and pectins. *(2010)*

21. Mannitol is the stored food in
(a) *Porphyra* (b) *Fucus*
(c) *Gracillaria* (d) *Chara.* *(2009)*

22. 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 *(2007)*

23. 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. *(2003)*

24. A student observed an algae with chlorophyll *a*, *b* and phycoerythrin, it should belong to
(a) Phaeophyta (b) Rhodophyta
(c) Chlorophyta (d) Bacillariophyta. *(2000)*

25. *Ulothrix* can be described as a
(a) filamentous alga lacking flagellated reproductive stages
(b) membranous alga producing zoospores
(c) filamentous alga with flagellated reproductive stages
(d) non-motile colonial alga lacking zoospores.
(1998)

26. An alga, very rich in protein, is
(a) *Chlorella* (b) *Nostoc*
(c) *Spirogyra* (d) *Ulothrix.* *(1997)*

27. *Ulothrix* filaments produce
(a) heterogametes (b) basidiospores
(c) isogametes (d) anisogametes. *(1997)*

28. Brown algae is characterised by the presence of
(a) fucoxanthin (b) haematochrome
(c) phycocyanin (d) phycoerythrin. *(1997)*

29. The pyrenoids are made up of
(a) proteinaceous centre and starchy sheath
(b) core of nucleic acid surrounded by protein sheath
(c) core of protein surrounded by fatty sheath
(d) core of starch surrounded by sheath of protein.
(1995)

30. In Chlorophyceae, the mode of sexual reproduction is
(a) isogamy (b) anisogamy
(c) oogamy (d) all of these. *(1994)*

31. Pyrenoids are the centres for formation of
(a) *Porphyra* (b) enzymes
(c) fat (d) starch. *(1993)*

32. Chloroplast of *Chlamydomonas* is
(a) stellate (b) cup-shaped
(c) collar-shaped (d) spiral. *(1993)*

33. In *Ulothrix*/*Spirogyra*, reduction division (meiosis) occurs at the time of
(a) gamete formation (b) zoospore formation
(c) zygospore germination
(d) vegetative reproduction. *(1993)*

34. The common mode of sexual reproduction in *Chlamydomonas* is
(a) isogamous (b) anisogamous
(c) oogamous (d) hologamous. *(1991)*

35. The product of conjugation in *Spirogyra* or fertilization of *Chlamydomonas* is
(a) zygospore (b) zoospore
(c) oospore (d) carpospore. *(1991)*

36. Sexual reproduction involving fusion of two cells in *Chlamydomonas* is
(a) isogamy (b) homogamy
(c) somatogamy (d) hologamy. *(1988)*

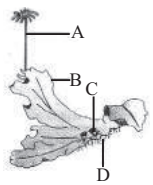
3.2 Bryophytes

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

38. Which of the following is responsible for peat formation?
(a) *Marchantia* (b) *Riccia*
(c) *Funaria* (d) *Sphagnum* *(2014)*

39. 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 *(2012)*

40. Examine the given figure and select the correct option giving all the four parts (A, B, C and D) rightly identified.



	A	B	C	D
(a)	Archego-niophore	Female thallus	Gemma cup	Rhizoids
(b)	Archego-niophore	Female thallus	Bud	Foot
(c)	Seta	Sporo-phyte	Proto-nema	Rhizoids
(d)	Antherid-iophore	Male-thallus	Globule	Roots

(Mains 2011)

41. Spore dissemination in some liverworts is aided by
(a) indusium (b) calyptra
(c) peristome teeth (d) elaters. *(2007)*

42. Peat moss 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. *(2006)*

43. 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. *(2006)*

44. The antherozoids of *Funaria* are
(a) multiciliated (b) monociliated
(c) aciliated (d) biciliated. *(1999)*

45. 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. *(1999)*

46. Which of the following is true about bryophytes?
(a) They are thalloid.
(b) They posses archegonia.
(c) They contain chloroplast.
(d) All of these *(1999)*

47. Bryophytes are dependent on water, because
(a) water is essential for their vegetative propagation
(b) the 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. *(1998)*

48. Bryophytes can be separated from algae, because they
(a) possess archegonia
(b) contain chloroplast
(c) are thalloid forms
(d) have no conducting tissue. *(1997)*

49. Elater mechanism for spore dispersal is exhibited by
(a) liverworts (b) *Marchantia*
(c) *Riccia* (d) *Funaria*. *(1996)*

50. The plant body of moss (*Funaria*) is
(a) completely sporophyte
(b) predominantly gametophyte with sporophyte
(c) completely gametophyte
(d) predominantly sporophyte with gametophyte. *(1995)*

51. In bryophytes
(a) both generations are independent
(b) gametophytes are dependent upon sporophytes
(c) sporophytes complete their life cycle
(d) sporophytes are dependent upon gameto-phytes. *(1994)*

52. Protonema occurs in the life cycle of
(a) *Riccia* (b) *Funaria*
(c) *Anthoceros* (d) *Spirogya*. *(1993, 1990)*

53. Bryophytes are amphibians because
(a) they require a layer of water for carrying out sexual reproduction
(b) they occur in damp places
(c) they are mostly aquatic
(d) all the above. *(1991)*

54. Moss peristome takes part in
(a) spore dispersal (b) photosynthesis
(c) protection (d) absorption. *(1990)*

55. Apophysis in the capsule of *Funaria* is
(a) lower part (b) upper part
(c) middle part (d) fertile part. *(1990)*

3.3 Pteridophytes

56. Strobili cones are found in
(a) *Salvinia* (b) *Pteris*
(c) *Marchantia* (d) *Equisetum.*
(NEET 2020)

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

58. Syngamy can occur outside the body of the organism in
(a) mosses (b) algae
(c) ferns (d) fungi.
(Karnataka NEET 2013)

59. The plant body is thalloid in
(a) *Sphagnum* (b) *Salvinia*
(c) *Marchantia* (d) *Funaria.*
(Karnataka NEET 2013)

60. Compared with the gametophytes of the bryophytes, the gametophytes of vascular plants tend to be
(a) smaller but to have larger sex organs
(b) larger but to have smaller sex organs
(c) larger and to have larger sex organs
(d) smaller and to have smaller sex organs. *(2011)*

61. Archegoniophore is present in
(a) *Marchantia* (b) *Chara*
(c) *Adiantum* (d) *Funaria.* *(2011)*

62. *Selaginella* and *Salvinia* are considered to represent a significant step toward 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. *(Mains 2011)*

63. Which one of the following is considered important in the development of seed habit?
(a) Heterospory
(b) Haplontic life cycle
(c) Free-living gametophyte
(d) Dependent sporophyte *(2009)*

64. Which one of the following is heterosporous?
(a) *Adiantum* (b) *Equisetum*
(c) *Dryopteris* (d) *Salvinia* *(2008)*

65. In the prothallus of a vascular cryptogam, the antherozoids and eggs mature at different times. As a result
(a) there is high degree of sterility
(b) one can conclude that the plant is apomictic
(c) self fertilization is prevented
(d) there is no change in success rate of fertilization.
(2007)

66. Plants reproducing by spores such as mosses and ferns are grouped under the general term
(a) cryptogams (b) bryophytes
(c) sporophytes (d) thallophytes. *(2003)*

67. In ferns, meiosis takes place at the time of
(a) spore formation (b) spore germination
(c) gamete formation
(d) antheridia and archegonia formation. *(2000)*

68. Dichotomous branching is found in
(a) liverworts (b) pteridophytes
(c) fern (d) *Funaria.* *(1999)*

69. The walking fern is so named because
(a) it propagates vegetatively by its leaf tips
(b) it knows how to walk by itself
(c) its spores are able to walk
(d) it is dispersed through the agency of walking animals. *(1998)*

70. Heterospory and seed habit are often exhibited by a plant possessing
(a) petiole (b) ligule
(c) bract (d) spathe. *(1997)*

71. Which of the following plant kingdom is called 'amphibians'?
(a) Pteridophyta (b) Thallophyta
(c) Tracheophyta (d) Bryophyta *(1996)*

72. Pteridophytes differ from bryophytes and thallophytes in having
(a) vascular tissues
(b) motile antherozoids
(c) archegonia
(d) alternation of generations. *(1993)*

73. Pteridophytes differ from mosses/bryophytes in possessing
(a) independent gametophyte
(b) well developed vascular system
(c) archegonia
(d) flagellate spermatozoids. *(1993)*

74. Which one of the following is not common between *Funaria* and *Selaginella*?
(a) Archegonium (b) Embryo
(c) Flagellate sperms (d) Roots *(1992)*

75. The plant group that produces spores and embryo but lacks vascular tissues and seeds is
(a) Pteridophyta (b) Rhodophyta
(c) Bryophyta (d) Phaeophyta. *(1992)*

76. Sperms of both *Funaria* and *Pteris* were released together near the archegonia of *Pteris*. Only its sperms enter 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. *(1989)*

77. Evolutionary important character of *Selaginella* is
(a) heterosporous nature
(b) rhizophore
(c) strobili
(d) ligule. *(1989)*

3.4 Gymnosperms

78. Which of the following statements is correct?
(a) Ovules are not enclosed by ovary wall in gymnosperms.
(b) *Selaginella* is heterosporous, while *Salvinia* is homosporous.
(c) Horsetails are gymnosperms.
(d) Stems are usually unbranched in both *Cycas* and *Cedrus*. *(NEET 2018)*

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

80. Conifers are adapted to tolerate extreme environmental conditions because of
(a) broad hardy leaves (b) superficial stomata
(c) thick cuticle (d) presence of vessels.
(NEET-II 2016)

81. Select the correct statement.
(a) *Sequoia* is one of the tallest trees.
(b) The leaves of gymnosperms are not well adapted to extremes of climate.
(c) Gymnosperms are both homosporous and heterosporous.
(d) *Salvinia*, *Ginkgo* and *Pinus* all are gymnosperms.
(NEET-I 2016)

82. In which of the following, gametophyte is not independent free living?
(a) *Pteris* (b) *Pinus*
(c) *Funaria* (d) *Marchantia*
(2015 Cancelled)

83. Read the following five statements (A to E) and select the option with all correct statements.
A. Mosses and lichens are the first organisms to colonise a bare rock.
B. *Selaginella* is a homosporous pteridophyte.
C. Coralloid roots in *Cycas* have VAM.
D. Main plant body in bryophytes is gametophytic, whereas in pteridophytes it is sporophytic.
E. In gymnosperms, male and female gametophytes are present within sporangia located on sporophyte.
(a) A, D and E (b) B, C and E
(c) A, C and D (d) B, C and D
(2015 Cancelled)

84. Which one is a wrong statement?
(a) Haploid endosperm is typical feature of Gymnosperms.
(b) Brown algae have chlorophyll *a* and *c* and fucoxanthin.
(c) Archegonia are found in Bryophyta, Pteridophyta and Gymnosperms.
(d) *Mucor* has biflagellate zoospores. *(2015)*

85. Read the following statements (A – E) and answer the question which follows them.
(A) In liverworts, mosses and ferns gametophytes are free-living.
(B) Gymnosperms and some ferns are heterosporous.
(C) Sexual reproduction in *Fucus*, *Volvox* and *Albugo* is oogamous.
(D) The sporophyte in liverworts is more elaborate than that in mosses.
(E) Both, *Pinus* and *Marchantia* are dioecious.
How many of the above statements are correct?
(a) Three (b) Four
(c) One (d) Two *(NEET 2013)*

86. 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
(Karnataka NEET 2013)

87. 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. *(2012)*

88. *Cycas* and *Adiantum* resemble each other in having
(a) seeds (b) motile sperms
(c) cambium (d) vessels. *(2012)*

89. Read the following five statements (A – E) and answer as asked next to them.
(A) In *Equisetum*, the female gametophyte is retained on the parent sporophyte.
(B) In *Ginkgo*, male gametophyte is not independent.
(C) The sporophyte in *Riccia* is more developed than that in *Polytrichum*.
(D) Sexual reproduction in *Volvox* is isogamous.
(E) The spores of slime moulds lack cell walls.
How many of the above statements are correct?
(a) Two (b) Three
(c) Four (d) One *(Mains 2012)*

90. 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)	*Chara*	*Marchantia*	*Fucus*	*Pinus*
(b)	*Equisetum*	*Ginkgo*	*Selaginella*	*Lycopodium*
(c)	*Selaginella*	*Equisetum*	*Salvinia*	*Ginkgo*
(d)	*Funaria*	*Adiantum*	*Salvinia*	*Riccia*

(Mains 2010)

91. Which one of the following is a vascular cryptogam?
(a) *Ginkgo* (b) *Marchantia*
(c) *Cedrus* (d) *Equisetum* *(2009)*

92. In which one of the following male and female gametophytes do not have free living independent existence?
(a) *Polytrichum* (b) *Cedrus*
(c) *Pteris* (d) *Funaria* *(2008)*

93. 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. *(2007)*

94. 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* *(2007)*

95. 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) *Funaria* and *Pinus* *(2003)*

96. Which one of the following is a living fossil?
(a) *Cycas* (b) Moss
(c) *Saccharomyces* (d) *Spirogyra* *(2004)*

97. Which one of the following is categorised under living fossils?
(a) *Pinus* (b) *Cycas*
(c) *Selaginella* (d) *Metasequoia* *(2003)*

98. *Cycas* has two cotyledons but not included in angiosperms because of
(a) naked ovules (b) seems like monocot
(c) circinate ptyxis (d) compound leaves.
(2001)

99. In which of the following would you place the plants having vascular tissue lacking seeds?
(a) Pteridophytes (b) Gymnosperms
(c) Algae (d) Bryophytes *(1999)*

100. The endosperm of gymnosperm is
(a) diploid (b) polyploid
(c) triploid (d) haploid. *(1999)*

101. Which one of the following statements about *Cycas* is incorrect?
(a) It has circinate vernation.
(b) Its xylem is mainly composed of xylem vessel.
(c) Its roots contain some blue-green algae.
(d) It does not have a well organized female flower.
(1998)

102. Transfusion tissue is present in the leaves of
(a) *Pinus* (b) *Dryopteris*
(c) *Cycas* (d) both (a) and (c).
(1998)

103. Multicellular branched rhizoids and leafy gametophytes are the characteristics of
(a) some bryophytes (b) pteridophytes
(c) all bryophytes (d) gymnosperms. *(1997)*

104. The smallest plant family 'Gymnosperm' has how many species?
(a) 640 (b) 300
(c) 1000 (d) 900 *(1996)*

105. A gymnospermic leaf carries 16 chromosomes. The number of chromosomes in its endosperm will be
(a) 12 (b) 8
(c) 16 (d) 24. *(1996)*

106. In *Pinus*, the wings of the seed develops from
(a) ovuliferous scale (b) integument
(c) nucellus (d) bract. *(1994)*

107. Which one is the most advanced from evolutionary view point?
(a) *Selaginella* (b) *Funaria*
(c) *Chlamydomonas* (d) *Pinus* *(1993)*

108. Resin and turpentine are obtained from
(a) *Cycas* (b) *Pinus*
(c) *Cedrus* (d) *Abies*. *(1992)*

109. In *Pinus*, the pollen grain has 6 chromosomes then in its endosperm will have
(a) 12 (b) 18
(c) 6 (d) 24. *(1992)*

110. A plant having seeds but lacking flowers and fruits belongs to
(a) pteridophytes (b) mosses
(c) ferns (d) gymnosperms. *(1992)*

111. A plant in which sporophytic generation is represented by zygote is
(a) *Pinus* (b) *Selaginella*
(c) *Chlamydomonas* (d) *Dryopteris*. *(1992)*

112. 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. *(1989)*

113. In *Pinus*/*Cycas*/gymnosperms, the endosperm is
(a) triploid (b) haploid
(c) diploid (d) tetraploid. *(1988)*

3.5 Angiosperms

114. Which one of the following pairs is wrongly matched?
(a) *Ginkgo* – Archegonia
(b) *Salvinia* – Prothallus
(c) Viroids – RNA
(d) Mustard – Synergids *(Mains 2012)*

115. How many organisms in the list given below are autotrophs?
Lactobacillus, *Nostoc*, *Chara*, *Nitrosomonas*, *Nitrobacter*, *Streptomyces*, *Saccharomyces*, *Trypanosoma*, *Porphyra*, *Wolffia*
(a) Four (b) Five
(c) Six (d) Three *(Mains 2012)*

116. Male and female gametophytes are independent and free-living in
(a) mustard (b) castor
(c) *Pinus* (d) *Sphagnum*. *(2010)*

117. Select one of the following pairs of important features distinguishing *Gnetum* from *Cycas* and *Pinus* and showing affinities with angiosperms.
(a) Perianth and two integuments
(b) Embryo development and apical meristem
(c) Absence of resin duct and leaf venation
(d) Presence of vessel elements and absence of archegonia *(2008)*

118. 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. *(2006)*

119. Ectophloic siphonostele is found in
(a) *Osmunda* and *Equisetum*
(b) *Marsilea* and *Botrychium*
(c) *Adiantum* and *Cucurbitaceae*
(d) *Dicksonia* and Maiden hair fern. *(2005)*

120. Match items in column I with those in column II.

Column I	**Column II**
(A) Peritrichous flagellation	(J) *Ginkgo*
(B) Living fossil	(K) *Macrocystis*
(C) Rhizophore	(L) *Escherichia coli*
(D) Smallest flowering plant	(M) *Selaginella*
(E) Largest perennial alga	(N) *Wolffia*

Select the correct answer from the following.
(a) A - L; B - J; C - M; D - N; E - K
(b) A - K; B - J; C - L; D - M; E - N
(c) A - N; B - L; C - K; D - M; E - J
(d) A - J; B - K; C - N; D - L; E - M *(2005)*

121. Top-shaped multiciliate male gametes and the mature seed which bears only one embryo with two cotyledons, are characterised features of
(a) cycads
(b) conifers
(c) polypetalous angiosperms
(d) gamopetalous angiosperms. *(2005)*

122. Angiosperms have dominated the land flora primarily because of their
(a) power of adaptability in diverse habitat
(b) property of producing large number of seeds
(c) nature of self pollination
(d) domestication by man. *(2004)*

123. Which one pair of examples will correctly represent the grouping spermatophyta according to one of the schemes of classifying plants?
(a) *Acacia*, sugarcane (b) *Pinus*, *Cycas*
(c) *Rhizopus*, *Triticum* (d) *Ginkgo*, *Pisum* *(2003)*

124. Which of the following is without exception in angiosperms?
(a) Presence of vessels (b) Double fertilisation
(c) Secondary growth (d) Autotrophic nutrition *(2002)*

125. Which of the following plants produces seeds but not flowers?
(a) Maize (b) Mint
(c) Peepal (d) *Pinus* *(2002)*

126. Plant group with largest ovule, largest tree and largest gametes is
(a) gymnosperm (b) angiosperm
(c) bryophyta (d) pteridophyta. *(2000)*

127. Largest sperms in the plants world are found in
(a) Banyan (b) *Cycas*
(c) *Thuja* (d) *Pinus.* *(1998)*

128. A well developed archegonium with neck consisting of 4-6 rows and neck canal cells, characterises
(a) gymnosperms and flowering plants
(b) pteridophytes and gymnosperms
(c) gymnosperms only
(d) bryophytes and pteridophytes. *(1995)*

129. *Pinus* differs from mango in having
(a) tree habit (b) green leaves
(c) ovules not enclosed in ovary
(d) wood. *(1993)*

130. Turpentine is got from
(a) angiospermous wood
(b) bryophytes
(c) gymnospermous wood
(d) ferns. *(1992)*

131. Which one has the largest gametophyte?
(a) *Cycas* (b) Angiosperm
(c) *Selaginella* (d) Moss *(1991)*

3.6 Plant Life Cycles and Alternation of Generations

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

133. Life cycles of *Ectocarpus* and *Fucus* respectively are
(a) diplontic, haplodiplontic
(b) haplodiplontic, diplontic
(c) haplodiplontic, haplontic
(d) haplontic, diplontic. *(NEET 2017)*

134. Consider the following four statements whether they are correct or wrong.
A. The sporophyte in liverworts is more elaborate than that in mosses.
B. *Salvinia* is heterosporous.
C. The life-cycle in all seed-bearing plants is diplontic.
D. In *Pinus*, male and female cones are borne on different trees.
The two wrong statements together are
(a) A and C (b) A and D
(c) B and C (d) A and B. *(Mains 2011)*

135. Which one of the following has haplontic life cycle?
(a) *Polytrichum* (b) *Ustilago*
(c) Wheat (d) *Funaria* *(2009)*

ANSWER KEY

1.	(d)	**2.**	(a)	**3.**	(a)	**4.**	(d)	**5.**	(b)	**6.**	(a)	**7.**	(b)	**8.**	(b)	**9.**	(d)	**10.**	(a)
11.	(b)	**12.**	(b)	**13.**	(a)	**14.**	(c)	**15.**	(d)	**16.**	(a)	**17.**	(d)	**18.**	(b)	**19.**	(a)	**20.**	(a)
21.	(b)	**22.**	(d)	**23.**	(d)	**24.**	(b)	**25.**	(c)	**26.**	(a)	**27.**	(c)	**28.**	(a)	**29.**	(a)	**30.**	(d)
31.	(d)	**32.**	(b)	**33.**	(c)	**34.**	(a)	**35.**	(a)	**36.**	(d)	**37.**	(a)	**38.**	(d)	**39.**	(d)	**40.**	(a)
41.	(d)	**42.**	(c)	**43.**	(b)	**44.**	(d)	**45.**	(b)	**46.**	(d)	**47.**	(b)	**48.**	(a)	**49.**	(b)	**50.**	(b)
51.	(d)	**52.**	(b)	**53.**	(a)	**54.**	(a)	**55.**	(a)	**56.**	(d)	**57.**	(b)	**58.**	(b)	**59.**	(c)	**60.**	(d)
61.	(a)	**62.**	(d)	**63.**	(a)	**64.**	(d)	**65.**	(c)	**66.**	(a)	**67.**	(a)	**68.**	(a)	**69.**	(a)	**70.**	(b)
71.	(d)	**72.**	(a)	**73.**	(b)	**74.**	(d)	**75.**	(c)	**76.**	(d)	**77.**	(a)	**78.**	(a)	**79.**	(d)	**80.**	(c)
81.	(a)	**82.**	(b)	**83.**	(a)	**84.**	(d)	**85.**	(a)	**86.**	(a)	**87.**	(d)	**88.**	(b)	**89.**	(d)	**90.**	(c)
91.	(d)	**92.**	(b)	**93.**	(c)	**94.**	(c)	**95.**	(a)	**96.**	(a)	**97.**	(b)	**98.**	(a)	**99.**	(a)	**100.**	(d)
101.	(b)	**102.**	(d)	**103.**	(a)	**104.**	(d)	**105.**	(b)	**106.**	(a)	**107.**	(d)	**108.**	(b)	**109.**	(c)	**110.**	(d)
111.	(c)	**112.**	(b)	**113.**	(b)	**114.**	(b)	**115.**	(c)	**116.**	(d)	**117.**	(d)	**118.**	(a)	**119.**	(a)	**120.**	(a)
121.	(a)	**122.**	(a)	**123.**	(d)	**124.**	(b)	**125.**	(d)	**126.**	(a)	**127.**	(b)	**128.**	(d)	**129.**	(c)	**130.**	(c)
131.	(d)	**132.**	(c)	**133.**	(b)	**134.**	(b)	**135.**	(d)										

Hints & Explanations

1. (d) : Phylogenetic system or classification is based on evolutionary sequence as well as the genetic relationship among the living beings. Engler and Prantl's System of Classification was jointly proposed in *Die Naturlichen Pflanzenfamilien* in 1892. It is the first phylogenetic system of classification which includes all the plants from algae to angiosperms arranged in an evolutionary sequence from simplicity to complexity.

2. (a) : Phenetic classification is a type of numerical taxonomy. In this type of classification the organisms are arranged according to overall similarity of existing organisms based on available characters. It is also called Adansonian taxonomy because the same was first attempted by Adanson (1763), of course on the basis of external traits only. Numerical taxonomy evolved around 1950. It has received impetus with the availability of calculating machines and computers. In numerical taxonomy as many characters as possible are employed for evaluating degree of similarity and difference. All characteristics used in analysis are given equal weightage and importance. A proper selection of characters, their organisation and analysis in the light of current knowledge is key to success of this method. A lot of subjectivity can creep in depending upon the judgement of the biosystematist. No weightage is given to the quantity of the character present.

3. (a) : There are three systems of classification - artificial, natural and phylogenetic. In the natural system of classification the organisms are arranged on the basis of all known taxonomic characters instead of one or first few. These include morphological, anatomical, cytological, physiological and biochemical characters of the organisms. The artificial system is based on one or a few characters that are easily observable. The phylogenetic system tries to organize organisms on the basis of their genetic and phylogenetic relationships besides taxonomic characters.

4. (d) : Phylogenetic systems of classification bring out evolutionary relationships of organisms. Phylogenetic systems of classification came into existence after acceptance of doctrine of evolution and natural selection propounded by Charles Darwin in his book "On the origin of Species" by means of Natural Selection. Darwin had put forward the view that the present day plants/ animals originated from some ancestral ones after undergoing some periodical changes. So the phylogenetic classification is based on the evolutionary descent of a group of organisms and the relationships are depicted through a phylogram and a cladogram.

5. (b) : Linnaeus put forward an "Artificial system" of plant classification which was based on sexual characters like cryptogamia, monoecia, monandria, diandria, polyandria, etc. It is commonly also called as sexual system of plant classification.

6. (a) : Artificial system of classification was first used by Linnaeus.

7. (b) : Classification given by Bentham and Hooker is Natural System. Monocots were placed after dicots; closely related families were separated; gymnosperms were placed between dicots and monocots.

8. (b) : In Rhodophyceae, food is stored as floridean starch which is very similar to amylopectin and glycogen in structure.

9. (d) : *Gelidium*, *Gracilaria, Laminaria* and *Sargassum* are multicellular. *Anabaena* is filamentous blue green algae. *Volvox* is colonial.

10. (a)

11. (b) : Alginic acid is obtained from brown algae whereas carrageenan is obtained from red algae.

12. (b) : Laminarin and mannitol are food reserves of brown algae or Phaeophyceae. Rhodophycean algae store food in the form of floridean starch.

13. (a) : *Ectocarpus* produces biflagellate gametes. *Anabaena* is a cyanobacteria and does not reproduce sexually. *Spirogyra* produces non-flagellated male gamete during conjugation, where entire cell content functions as gamete. *Polysiphonia* also produces non-flagellated spermatia.

14. (c) : All species of *Chara* reproduce sexually and show highly advanced oogamy. The sex organs are the most distinctive features of the Order Charales and are the most complicated among the thallophytes. Male and female gametangia are called antheridia and oogonia respectively. Male fructification (cluster of antheridia) is called globule and the female is nucule. They are borne at the nodes of short branches, globule towards lower side and nucule (female structure) towards upper side.

15. (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).

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

17. (d) : *Chlamydomonas* has flagellated gametes which are similar or dissimilar in size. In *Volvox* and *Fucus*,

non-motile female gametes and motile male gametes are produced (oogamy). *Spirogyra* has gametes that are similar in size (isogamous) and are non-flagellated.

18. (b) : *Refer to answer 14.*

19. (a) : In *Spirogyra*, gametes are non-motile and sexual reproduction takes place by conjugation. *Sargassum* belongs to Phaeophyceae group of algae. They are commonly called as 'brown algae' and contain photosynthetic pigments chlorophyll *a* and *c*. Puffballs are Basidomycetes with a stalked rounded structure that sends out puffs of spores, *e.g.*, *Lycoperdon oblongisporum*. *Nostoc* is a colonial cyanobacterium. It enriches its habitat with nitrogen by fixing atmospheric nitrogen and also causes water bloom.

20. (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.

21. (b) : *Fucus* is a brown algae, that belongs to Class Phaeophyta. In this alga the accumulation product of photosynthesis is D-mannitol (a sugar alcohol) and the reserve food material is laminarin.

22. (d) : Algae are a group of chlorophyllous, non-vascular plants with thallose plant body. Different algae show different pigments present in the cell like chlorophyll - *a, b,* xanthophylls, carotenes, etc. These pigments provide the base for classification of various groups of algae into different classes. Members of Chlorophyceae possess chlorophyll - *a, b* pigments, Bacillariophyceae contains diatomin pigment whereas that of Phaeophyceae has fucoxanthin, Rhodophyceae has *r*-phycocyanin and *r*-phycoerythrin and cyanophyceae has phycobilin pigment.

23. (d) : *Spirogyra* is a freshwater green alga which belongs to Class Chlorophyceae. The sexual reproduction in *Spirogyra* is called conjugation. It involves the fusion of two morphologically identical but physiologically dissimilar non-ciliated gametes.

For development of gametes, some of the cells start to act like male and female gametangia in which the cell contents become separated from the cell wall, shrink and ultimately forms gametes. The fusion of these gametes takes place by scalariform conjugation or lateral conjugation.

24. (b) : The algal Class Rhodophyceae contains a red pigment (*r*-phycoerythrin) and a blue pigment (*r*-phycocyanin) in the chromatophores.

These pigments can utilize those wavelengths of light (blue-green region of spectrum, *i.e.*, 480-520 nm) that are not absorbed by chlorophyll. This enables red algae to grow at greater depths than other plants (upto 300 ft. below water). In addition to these, chl. *a*, chl. *d*, carotenes and xanthophylls are present.

In phaeophyceae chromatophores are yellowish brown in colour possessing xanthophylls in abundance.

Bacillariophyceae are called 'diatoms' due to presence of an accessory brown pigment called 'diatomin', other pigments are chl. *a*, chl. *c* (but not chl. *b*), carotenes and xanthophylls.

In chlorophyceae colouring pigments are just like higher plants, *i.e.*, chl. *a*, chl. *b*, xanthophylls and carotenes.

25. (c) : *Ulothrix* is a green filamentous alga, belonging to Class Chlorophyceae. The plant body is an unbranched filament consisting of numerous cylindrical cells joined end to end. Under favourable conditions, each cell produces zoospores except holdfast. These zoospores are of two types – macrozoospores and microzoospores. The macrozoospores are larger in size and are quadriflagellate and the microzoospores are smaller zoospores which may be biflagellate or quadrifagelleate. Under unfavourable conditions, nonmotile mitospores called aplanospores are produced. Sexual reproduction in *Ulothrix* is of isogamous type. The isogametes fuse to form a quadriflagellate zygospore which after meiosis forms 16 aplanospores or zoospores.

26. (a) : *Chlorella* is a unicellular green alga that contains high percentage of proteins, lipids and most of the known vitamins (carotene, riboflavin, vitamin B_{12}, choline, etc.) and grows more quickly than *Porphyra*, so scientists are doing research to obtain food from it. The nutritional value is comparable to the mixture of soybeans and spinach.

27. (c) : *Ulothrix* belongs to Class Chlorophyceae of Division Thallophyta. The plant body consists of an unbranched filament, consisting of numerous cylindrical cells joined end to end. It is heterothallic and sexual reproduction is of isogamous type. Except holdfast each cell of the filament can give rise to 64 to 128 gametes. The gametes are similar in size, shape and other features. So these gametes are called isogametes. When two gametes of (+) and (–) strain come together they fuse and a quadriflagellate zygospore is formed.

28. (a) : Brown algae are the members of the Class Phaeophyceae. Their chromatopores are ellipsoidal or discoid. They contain chlorophyll *a*, chl *c*, β- and *c*-carotenes and xanthophyll pigments (*e.g.*, lutein, flavoxanthin, violaxanthin). They also contain large amount of a brown pigment – fucoxanthin which masks the green colour of chlorophyll pigment. This gives characteristic brown colour to these plants, hence the name brown algae.

29. (a) : Pyrenoids are found in many bryophytes and algae. They are small, spherical bodies found in the cytoplasm of a plant cell. They are rich in proteins and are surrounded by a starch sheath.

30. (d)

31. (d) : Pyrenoids are the centres for formation of starch. There are present in chloroplast and are proteinaceous in nature covered by starch plate. They synthesize and store starch in them.

32. (b) : Chloroplast in *Chlamydomonas* is cup-shaped. It is one celled structure whereas stellate, spiral and collar shaped chloroplasts are present in *Zygnema*, *Spirogyra* and *Ulothrix* respectively.

33. (c) : In *Ulothrix*/*Spirogyra* reduction division (meiosis) occurs at the time of zygospore formation. Plant body of *Ulothrix* and *Spirogyra*, is gametophytic (haploid), they produce zoogametes (n) which fuses to form zygosporic ($2n$) diploid, which is a resting spore. Onset of favourable condition zygospore undergoes reductional division, or meiosis to produce zoo-meiospores.

34. (a) : In *Chlamydomonas* sexual reproduction takes place through isogamy, anisogamy, and oogamy. Isogamy *i.e.,* the fusion of similar gametes is the common mode of sexual reproduction in it. Anisogamy is fusion of morphologically similar but physiologically different cells. Oogamy is fusion of different gametes.

35. (a) : The product of conjugation in *Spirogyra* or fertilization of *Chlamydomonas* is zygospore. Both are the members of green algae where gametes are fused to form zygote which develops into a thick walled zygospore.

36. (d) : Isogamy involves the fusion of gametes which are morphologically and physiologically similar. They are called isogametes. In *Chlamydomonas*, two vegetative cells may fuse to form a zygospore and the phenomenon is called as hologamy. As a result of fusion of two gametes, zygospore is formed.

37. (a) : A non-motile male gamete or spermatium is the characteristic feature of *Polysiphonia*.

38. (d) : Among the bryophytes *Sphagnum* accounts by far the most important place economically. It is popularly called bog moss or peat moss. It is perennial and its growth continues year after year. Older portions undergo death but do not decompose due to secretion of acid that accounts for the antibacterial and antifungal actions. The increasing mass of dead remains accumulate year after year and form a compact dark coloured mass rich in carbon which is called peat. Peat is used as fuels. Paraffin, acetic acid, peat tar and ammonia are formed as by-products of peat obtained for industrial uses.

39. (d) : Algae and moss are included in plant kingdom while fungi constitute a separate kingdom. Among them, mosses invariably show diplontic life cycle while others may or may not. Algae and moss are autotrophic while fungi are heterotrophs. But they all show multiplication by fragmentation.

40. (a) : The given figure is of female thallus of *Marchantia* (bryophyte) in which A, B, C and D are archegoniophore, female thallus, gemma cup and rhizoids respectively.

41. (d) : An elater is a cell (or structure attached to a cell) that is hygroscopic and therefore will change shape in response to changes in moisture in the environment. Elaters come in a variety of forms, but are always associated with plant spores. In plants that do not have seeds, they function in dispersing the spores to a new location. In the liverworts, elaters are cells that develop in the sporophyte alongside the spores. They are complete cells, usually with helcial thickenings at maturity that respond to moisture content. In most liverworts, the elaters are unattached, but in some leafy species (such as *Frullania*) a few elaters will remain attached to the inside of the sporangium (spore capsule). The elaters by hygroscopic movement help in spore dispersal.

42. (c) : The partially decomposed *Sphagnum* mass accumulates to form compressed mass called peat, which after drying is used as coal. So it is also called peat moss. *Sphagnum* has the capacity to retain water for long periods and thus it is used to cover plant roots during transportation.

43. (b)

44. (d) : Androcytes or antherozoid mother cell of *Funaria* metamorphoses into a single biflagellate spermatozoid (antherozoids). It is a spirally coiled biflagellate (biciliated) structure.

45. (b) : In bryophytes the main plant body is gametophytic which is independent and may be thallose (no differentiation in root, stem and leaves) *e.g.*, *Riccia*, *Marchantia*, *Anthoceros,* etc. or foliose (having leafy axis) *e.g.*, *Sphagnum*, *Funaria,* etc. The gametophyte bears the sex organs antheridium and archegonium. Sexual reproduction is of oogamous type. It forms zygote that gives rise to the sporophytic phase. It is differentiated into foot, seta and capsule. The capsule produces spores after meiosis that again gives rise to gametophytic phase. The sporophyte is partially or fully dependent upon the gametophyte and is of shorter duration.

46. (d) : Bryophytes are green photosynthetic and thalloid structures where the plant body lacks true root, stem and leaves. Instead of roots, rhizoids are present for attachment and absorption purpose. They have motile sperms and so they need water for fertilization. Archegonia evolved 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 canal cell and an egg cell. It is surrounded by one celled thick sterile jacket layer.

47. (b) : Bryophytes are called amphibians of plant kingdom because they complete their vegetative phase on land but water is necessary for their reproductive phase. Water helps in maturation and dehiscence of sex organs in bryophytes. It also helps in the transfer of sperms to the archegonium that make water essential for completion of life cycle of bryophytes.

48. (a) : Bryophytes and algae are both autotrophic, plant body thallus like and devoid of vascular tissues. Instead 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 because archegonium originated for the first time in bryophytes in plant kingdom. It is a flask shaped structure with swollen base called venter and upper elongated neck. The 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-jacketed and unicellular.

49. (b) : *Marchantia* is a liverwort in which the sex organs are borne on disc shaped 8-lobed receptacles borne at the tip of vertical gametophores. Sperms are attracted to opened archegonia by proteins and K^+ salts. Fertilization produces a parasitic sporophyte made of foot, seta and capsule. The capsule encloses sporocytes and elaters. These elaters show twisting movements due to spiral bands of thickenings and this leads to liberation and dispersal of spores. In *Riccia* elaters are absent and in *Funaria* peristome teeth help in spore dispersal.

50. (b) : *Funaria* is known as common moss or green moss. The plant body is foliose that consists of stem axis which bears many leaves and instead of roots, rhizoids are present. It is gametophytic (n) and independent. It bears antheridia and archegonia on the same plant but on different branches.

After fertilization the zygote ($2n$) divides to form the sporophyte which consists of foot, seta and capsule. The basal foot is embedded in the apex of female branch. It absorbs nutrients and provides support for the sporophyte. Inside the capsule haploid spores are produced as a result of meiosis. Thus again the gametophytic phase starts. So the gametophytic phase is the dominant phase of the life cycle of *Funaria*.

51. (d)

52. (b) : Protonema occurs in the life cycle of *Funaria*. The spore is the first cell of gametophytic generation and it germinates to form a filamentous branched alga like structure called protonema. If gives rise to new plant.

53. (a) : *Refer to answer 47.*

54. (a) : Moss peristome is present in capsule and takes part in spore dispersal. The hygroscopic action of peristomial teeth help in the removal of operculum. The lengthening and shortening of peristomial teeth help in the dispersal of spores. The inner peristome acts as a sieve allowing only a few spores to escape at a time.

55. (a) : Apophysis is basal portion of capsule in continuation with seta. The outer layer of apophysis is epidermis which has stomata for gaseous exchange. In capsule of *Funaria* stomata are present only in apophysis.

56. (d) : The sporophytes of pteridophytes bear sporangia that are subtended by leaf-like appendages called sporophylls. In some cases sporophylls may form distinct compact structures called strobili or cones, *e.g.*, *Selaginella*, *Equisetum*.

57. (b) : The sperms of bryophytes and pteridophytes are flagellated and hence require an external supply of water to reach archaegonia.

58. (b) : Syngamy is the complete and permanent fusion of male and female gametes to form the zygote. When fertilization occurs outside the body of the organism, this type of gametic fusion is called external fertilization or external syngamy. In majority of algae, external fertilization occurs.

59. (c) : *Sphagnum* and *Funaria* belong to Class Bryopsida of Division Bryophyta. They are typically mosses. The plant body has radial symmetry and is essentially leafy.

Salvinia belongs to Division Pteridophyta. It has a sporophyte plant body with true leaves, stem and roots. *Marchantia* belongs to Class Hepaticopsida of Division Bryophyta. They are also called liverworts. The plant body is a dorsoventrally flattened thallus.

60. (d) : In bryophytes, the dominant phase of life cycle is gametophytic plant body. In contrast, vascular plants have sporophytic plant body in most of their life cycle and reduced, smaller gametophyte which have smaller sex organs.

61. (a) : *Marchantia* is a dioecious plant. Male plants bear antheridiophores and female plants bear archegoniophores. Antheridiophores consists of a stalk and a disc like portion called receptacle. Archegoniophore is composed of a stalk and disc like receptacle at its distal end.

62. (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, macro (large) and micro (small) spores, are known as heterosporous. The megaspores and microspores germinate and give rise to female and male gametophytes, respectively. The female gametophytes

in these plants are retained on the parent sporophytes for variable periods. The development of the zygotes into young embryos take place within the female gametophytes. This event is a precursor to the seed habit considered an important step in evolution.

63. (a) : The differentiation of spores into microspores and megaspores and their dependence on the parent sporophyte for the nutrition, are certain features in the life cycle of *Selaginella*, which have been considered as the essential pre-requisties for the formation of seeds, characteristic of spermatophytes. It is generally agreed, that the seed plants arose from the heterosporous vascular plants that instead of discharging the megaspore acquired the habit of retaining it within the megasporangium.

64. (d) : The sporophyte of pteridophyte produces meiospores inside sporangia, which may be homosporous (*e.g.*, *Equisetum*, *Adiantum*, *Dryopteris,* etc.) or heterosporous (*e.g., Salvinia, Selaginella* etc.).

65. (c) : In prothallus of vascular cryptogams the antherozoids and eggs mature at different times. The spores on germination gives rise to prothallus. The antherozoids are biflagellated or multiflagellated. The egg is produced inside the venter, water is essential for fertilization and it is always cross-fertilization. Self fertilization is prevented.

66. (a) : Eichler divided Plant Kingdom into two sub-kingdoms - Cryptogamae and Phanerogamae. All plants without flowers and seeds are included in the Sub-kingdom Cryptogamae whereas Phanerogamae includes plants which bear flowers and seeds.
Cryptogams are further classified into three divisions: Thallophyta, Bryophyta and Pteridophyta.
Spore bearing plants such as mosses and ferns belong to cryptogams because instead of reproducing by flowers and seeds they reproduce by means of spores.

67. (a) : A fern plant body is sporophytic (2n) and is differentiated into roots, stems and leaves. On the ventral surface of leaves sporangia are borne in a group called sori. Inside the sporangium are present the spores which are formed by reduction division. Thus the spores produced are haploid in nature and germinate to produce a prothallus that represents the gametophytic generation. Antheridium and archegonium are borne on this prothallus. Thus meiosis takes place at the stage of spore formation.

68. (a) : Dichotomous branching is characteristic feature of liverworts, *e.g.*, *Riccia, Marchantia, Pellia,* etc. It is a primitive form of branching. It is also called forked branching. In liverworts the thallus is flat and dorsiventral and dichotomously branched. The thallus has a notch at the anterior end. At the base of the notch, there is a growing point consisting of a single apical cell. It divides repeatedly to form two branches of the same size.

69. (a) : Walking fern is named so because when its leaf tips come in contact with soil, form new plants as adventitious buds develop at leaf tips. This helps in the spread of fern over a large soil surface and thus the name 'walking fern'.

70. (b)

71. (d) : Bryophytes are called amphibians of plant kingdom because they complete their vegetative phase on land but water is necessary for their reproductive phase. Water helps in maturation and dehiscence of sex organs in bryophytes. It also helps in the transfer of sperms to the archegonium that make water essential for completion of life cycle of bryophytes.

72. (a) : Pteridophytes differs from bryophytes and thallophytes in having well developed vascular tissue system. Vascular tissues plays an important role in conducting water and food materials to the plants. Whereas these are absent in bryophytes and thallophytes.

73. (b) : *Refer to answer 72.*

74. (d) : Root is not common between *Funaria* and *Selaginella*. *Funaria* is a bryophyte and have archegonium, embryo, flagellated sperms which are also present in *Selaginella*. *Selaginella* is a pteridophyte and it has root which is absent in *Funaria*.

75. (c) : Bryophytes are the plants which produces spores and embryos but they do not has vascular tissue system. While rhodophytes and phaeophytes are algae and produces spores (no embryos) only and pteridophytes produces spores, embryo and well developed vascular tissue system.

76. (d) : Sperms of both *Funaria* and *Pteris* were released together near the archegonia. But only the sperms of *Pteris* enter the archegonia, as *Pteris* archegonia releases a chemical malic acid to attract its sperms for fertilization.

77. (a) : Evolutionary important character of *Selaginella* is heterosporous nature. *Selaginella* produces two types of spores microspores and megaspores. Heterospory in the life cycle of *Selaginella* leads to the formation of seed habit.

78. (a) : Gymnosperms have naked ovule. *Selaginella* and *Salvinia* both produce two kinds of spores, macro (large) and micro (small) hence, called heterosporous. *Equisetum* (horse tail, scouring rush) is a pteridophyte. Stems are branched in *Cedrus* but unbranched in *Cycas*.

79. (d) : *Pinus* is a monoecious plant, *i.e.*, in *Pinus* the male and female cones or strobili are borne on the same plant.

80. (c) : Needle like leaves with thick cuticle and sunken stomata are xerophytic adaptations of conifers for tolerating extreme environmental conditions.

81. (a) : *Sequoia sempervirens* is the tallest gymnosperm. The leaves of gymnosperms are well adapted to extremes of climate. 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 kinds of spores-microspores and megaspores. *Salvinia* is an aquatic pteridophyte.

82. (b) : In gymnosperms (like *Pinus*), the male and female gametophyte do not have an independent free living existence. They remain within the sporangia retained on the sporophytes, *i.e.*, female gametophyte (within megasporangium) and male gametophyte (within microsporangium).

83. (a) : *Selaginella* is a heterosporous pteridophyte. Coralloid roots of *Cycas* harbour blue green algae like *Nostoc, Anabaena* and are not a type of VAM (vesicular arbuscular mycorrhiza) which is a symbiotic association with fungus.

84. (d) : *Mucor* is a member of Zygomycetes (the conjugation fungi) in which motile cells, *e.g.,* zoospores, planogametes, etc., are absent. Asexual reproduction takes place by the formation of non-motile mitospores called sporangiospores. Sexual reproduction takes place by the formation of non-motile zygospores.

85. (a)

86. (a) : In *Funaria* (Bryophyta), *Dryopteris* (Pteridophyta) and *Ginkgo* (Gymnosperm) female sex organ archaegonium is formed. *Funaria* lacks independent sporophyte and vascular tissues while independent gametophyte is absent in *Ginkgo*.

87. (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, macro (large) and micro (small) spores, are known as heterosporous. The megaspores and microspores germinate and give rise to female and male gametophytes, respectively. The female gametophytes in these plants are retained on the parent sporophytes for variable periods. The development of the zygotes into young embryos take place within the female gametophytes. This event is a precursor to the seed habit considered an important step in evolution.

88. (b) : *Cycas* is a gymnosperm and *Adiantum* is a pteridophyte. Cambium and seeds are absent in pteridophytes, while vessels are absent in both of these two groups. Both *Cycas* and *Adiantum* resemble each other in having multi-ciliated sperms.

89. (d) : *Equisetum* is a pteridophyte and in pteridophytes, the main plant body is a sporophyte which is differentiated into true root, stem and leaves. Gametophytes are small or inconspicuous and free living, mostly photosynthetic thalloid called prothallus.

Riccia is a liverwort and *Polytrichum* is a moss. The sporophyte in mosses is more elaborate than that in liverworts.

Volvox shows oogamous type of sexual reproduction, *i.e.*, fusion between one large, non motile (static) female gamete and a smaller, motile male gamete.

During unfavourable conditions, the slime mould differentiates and forms fruiting bodies bearing spores at their tips. The spores possess true walls. They are extremely resistant and survive for many years, even under adverse conditions.

90. (c) : A – *Selaginella*
B – *Equisetum*
C – *Salvinia*
D – *Ginkgo*

91. (d) : Pteridophytes are known as vascular cryptogams (Gk *kryptos* = hidden + *gamos*= wedded). They reproduce by spores rather than seeds. They are the first vascular land plant. The pteridophyte *Equisetum* belongs to the Class Sphenophyta. All vegetative parts of it possess vascular tissues (*i.e.*, hadrome equivalent to xylem and leptome equivalent to phloem) organised in definite groups of steles.

92. (b) : In gymnosperm (like *Cedrus*) the male and female gametophyte do not have an independent free living existence. They remain within the sporangia retained on the sporophytes *i.e.*, female gametophyte with megasporangium and male gametophyte within microsporangium.

93. (c) : In gymnosperms, pollen chamber represents the microsporangium in which pollen grains develop. The microspore is generally a globular sac like structure having large number of microspores. The microspores are also termed as pollen grains.

94. (c) : Flagellated male gametes are mostly seen in lower groups of plants like algae, bryophytes, pteridophytes. It is also seen in certain gymnosperms like *Cycas*. The bryophytes like *Riccia* have the male gametes which are biflagellate.

95. (a) : Seed producing plants belong to Spermatophyta. It includes gymnosperms and angiosperms. Seed habit or seed formation originated in gymnosperms. It requires the retention of megasporangium or the only on the parent plant and non-shedding of megaspore, development of integument and in site formation of female gametophyte. All these

features developed in gymnosperms and angiosperms. Thallophytes, bryophytes and pteridophytes lack these features and thus do not reproduce by producing seeds.

Fern and *Funaria* belong to pteridophytes and bryophytes respectively so they do not reproduce by producing seeds.

96. (a) : *Cycas* and *Ginkgo* are often considered as the living fossil because they are one of the few representative of once a large group of plants (which was once a well flourished group) and possess traits of extinct pteridosperms and other gymnosperms.

97. (b)

98. (a) : *Cycas* belongs to Order Cycadales of gymnosperms because it has naked seed. It is not enclosed inside a fruit. It does not have double fertilization and so the endosperm formed is haploid in nature and not triploid. So it is not included in angiosperms as they have ovules (or seeds) produced inside fruit. This is the main difference between gymnosperms and angiosperms.

99. (a) : Algae, bryophyte and pteridophyte are cryptogams, but out of them algae and bryophytes are lower cryptogams and do not possess vascular tissue (xylem and phloem), whereas in pteridophytes, vascular tissue system is well developed and so these are higher cryptogams or vascular cryptogams. The term cryptogams means that these plants reproduce by means of spores and do not produce seeds.

The vascular tissue of pteridophytes is well developed. They contain both xylem and phloem. In xylem, vessels are absent and in phloem companion cells are absent.

So pteridophytes or vascular cryptogams are a group of seedless vascular plants, that have successfully invaded the land and reproduce by means of spores. Gymnosperms are naked seed bearing plants called phanerogams.

100. (d) : The endosperm of gymnosperms is haploid. It is a pre-fertilisation tissue and is equivalent to female gametophyte, hence it is haploid in nature but in angiosperms, it is post-fertilization tissue and is generally triploid in nature.

101. (b) : *Cycas* belongs to Order Cycadales of gymnosperms. Its leaves show circinate vernation, *i.e.*, the leaves are coiled in young stage. The coralloid roots in *Cycas* arise from the lateral branches of the normal roots and contain blue-green algae like *Nostoc* and *Anabaena*. A well developed flower like that of angiosperms is absent in *Cycas*. It has compact cones containing microsporophylls and megasporophylls. The megaspores are loosely arranged on the megasporophyll. The male cone is a compact structure. Vessels in xylem are absent and it contains only tracheids for conduction of water.

102. (d) : Transfusion tissue is a specialized tissue present on either side of midrib in between the palisade and spongy tissues of the leaf of *Cycas* and also in *Pinus* leaf at the sides of the sclerenchymatous region. It is made of horizontally arranged tracheids. These supply water and minerals to mesophyll tissue upto margins so that the mesophyll cells can carry out photosynthesis. It is of two types primary transfusion tissue present next to the midrib bundle and secondary transfusion tissue that runs upto margins of the leaf. In *Pinus* it consists of tracheids and albuminous cells.

103. (a) : The Division Bryophyta includes three Classes Hepaticopsida, Anthocerotopsida and Bryopsida. The members of Hepaticopsida and Anthocerotopsida have a thallose plant body which is dorsiventrally differentiated and dichotomously branched. On the ventral surface unicellular or multicellular rhizoids are present. The member of Bryopsida have a main plant body that has a leafy gametophore made up of an axis having spirally arranged leaves. The rhizoids are multicellular and branched, *e.g.*, *Sphagnum*, *Funaria, Riccia*, *Anthoceros*. So only few member of bryophytes have leafy gametophytes.

104. (d) : Gymnosperms originated about 200 million years ago and were dominant species at that time. However most of the members have become extinct now and only few living forms are known today. There are around 900 living species of this group.

105. (b) : Gymnosperms show distinct alternation of generations. The sporophytic phase is dominant. The sporphyte is differentiated into root, stem and leaves. So the number of chromosomes in a leaf cell is diploid ($2n$), ($2n = 16$). Double fertilization is absent in gymnosperms. The endosperm develops before fertilization directly from the megaspore. So the number of chromosomes in endosperm will be $8(n = 8)$.

106. (a) : Mature ovule with embryo constitutes seed. The seed is covered with hard seed coat. The outer layer of the seed coat is testa (from middle stony layer). Testa encloses a brown, thin membranous tegmen (from inner fleshy layer). The tegmen surrounds fleshy endosperm.

The embryo is present inside the endosperm. At maturity of seed, a thin layer of ovuliferous scale fuses with testa to form a wing (*i.e.*, seeds are winged) which helps in the dispersal of seed in conifers (*Pinus*).

107. (d) : *Pinus* is more advanced from the evolutionary point of view. It is a gymnosperm (Phanerogams) having well developed vascular conducting system and bears seeds. While others *Selaginella*, *Funaria* and *Chlamydomonas* do not bear seeds.

108. (b) : Resins and turpentine are obtained from *Pinus* which is gymnospermic plant. *Cycas* is an ornamental

plant. Paper and Canada balsam are obtained from *Abies* and timber is obtained from *Cedrus deodara*.

109. (c) : In *Pinus*, if the pollen grain has 6 chromosomes then in its endosperm will also have 6 chromosomes as endosperm and pollen grains are both haploid structures.

110. (d) : A plant having seed but lacking flowers and fruit belongs to gymnosperms. Gymnosperms are vascular land plants and bears seeds which are naked *i.e.*, ovules not enclosed in the ovary. Hence, flowers are absent.

111. (c) : A plant in which sporophytic generation is represented by zygote is *Chlamydomonas*. It is a type of algae that has gametophytic plant body (haploid). It reproduce sexually by gametes which are isogametes that fuses to produce diploid zygote which is the only sporophytic generation.

112. (b) : In *Pinus*/gymnosperms, endosperm is produced before fertilization and hence it is haploid. Megaspore and pollen grains are structures of male gametophytes and it is also haploid.

113. (b) : *Refer to answer 112.*

114. (b)

115. (c) : Autotrophic nutrition involves manufacture of organic materials from inorganic raw materials with the help of energy obtained from outside sources. It is of two types – chemosynthesis and photosynthesis. The organisms which are able to manufacture their organic food from inorganic raw materials with the help of energy derived from exergonic chemical reactions are called chemoautotrophs. *Nitrosomonas* and *Nitrobacter* are chemoautotrophic nitrifying bacteria.

Those organisms who can manufacture organic compounds from inorganic raw materials with the help of solar energy in the presence of photosynthetic pigments are called photoautotrophs. *E.g.*, *Nostoc*, *Chara*, *Porphyra* and *Wolffia*.

116. (d) : *Sphagnum* is a bryophyte in which dominant phase or plant body is independent and free living gametophyte. The sporophyte is parasitic over gametophyte. In *Pinus* (a gymnosperm), mustard and castor (angiosperms), the main plant body is sporophytic. Gametophyte is highly reduced and is completely dependent on sporophyte.

117. (d) : In gymnosperm except Order Gnetales (*Gnetum*) xylem consist of xylem parenchyma and tracheids with bordered pits but lacks vessels. So, Gnetales are the most advanced among gymnosperms. They lack archegonia in female gametophyte thus showing similarity with angiosperm and act as connecting link between the two.

118. (a) : Conifers belong to gymnosperms. They are seed bearing plants in which the sporophylls are aggregated to form cones and the seeds develop in exposed state over the surface of megasporophylls. Vascular strand consists of tracheids and sieve cells. Female gametophyte forms archegonia, provides nourishment to developing embryo and later gets transformed into food-laden tissue or endosperm inside the seed. This endosperm is formed before fertilization so it is haploid in nature. It provides nourishment for growth of seedlings at the time of seed germination. Grass is an angiospermic plant and endosperm is produced after fertilization.

119. (a) : Stele is a column containing vascular tissues 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*.

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

Ginkgo belongs to Order Ginkgoales of gymnosperms. It is called living fossil because it is the single living genus in a big fossilized order. *Macrocystis* belongs to Class Phaeophyceae. It is the largest perennial alga, about 40-60 m in size. *Wolffia* is the smallest flowering plant. Rhizophore is a leafless, colourless, positively geotropic elongated structure that grows down from the point of bifurcation of stem. It occurs in *Selaginella*.

121. (a) : *Cycas* is an evergreen palm like plant. The plant body is sporophytic differentiated into root, stem and leaves, sexual reproduction is of oogamous type takes place by the fusion of distinct male and female gametes. The male and female gametes are formed by the germination of microspores and megaspores which are borne on microsporophylls and megasporophylls. These microspores germinate to form male gametophyte that produces male gametes. The male gametes of *Cycas* are largest (300 μ) in nature, visible to naked eye, oval in form and top shaped. It is spirally coiled in the anterior half with thousands of small cilia. After fertilization the ovule is connected into a seed. In the endosperm of seed lies a well developed embryo having two cotyledons, a plumule and a radicle.

122. (a) : Angiosperms are highly evolved and well adapted land plants. They have both vessels and

tracheids in xylem for better conduction of water. Roots are modified into taproots, adventitious roots, pneumatophores, etc., to suit the desired climate.

Sex organs are highly developed, sporophylls are organized into flowers and the flowers are highly coloured or modified to attract pollinators at different times and places. Insect pollination is more prevalent because it is more efficient and leads to less wastage of pollen grains as compared to wind pollination. So the flowers are made attractive to attract a variety of insects. Seed are more protected as they are enclosed inside a fruit.

All these adaptations have made angiosperms more adaptive in diverse habitats.

123. (d) : Spermatophyta includes seed bearing plants and this includes gymnosperms and angiosperms. *Acacia* and sugarcane both are angiosperms. *Pinus* and *Cycas* both are gymnosperms. *Rhizopus* belongs to Kingdom Fungi and *Tritcum* is an angiosperm. *Ginkgo* is gymnosperm and *Pisum* is an angiosperm. So *Ginkgo* and *Pisum* correctly represent the grouping spermatophyta.

124. (b) : In angiosperms presence of vessels is not universal feature as there are certain angiosperms where vessels are absent, *e.g.*, *Wintera*, *Trochodendron,* etc.

Secondary growth is increase in the girth or diameter of axis (root and stem) of the plant by formation of secondary tissue by the activity of lateral meristem. It occurs in dicotyledons of angiosperms and gymnosperms. But in monocotyledons of angiosperms the primary plant body is complete in itself and doesn't produce any secondary tissue.

Autotrophic plants are those which synthesise their organic food themselves by the process of photosynthesis. But certain angiospermic plants have heterotrophic mode of nutrition. *E.g.*, *Rafflesia*, *Orobanche*, *Striga* are root parasites.

But double fertilization is universal in all angiosperms. It involves fusion of one male gamete with the egg cell and another male gamete with the diploid secondary nuclei.

125. (d)

126. (a) : Gymnosperms are the most primitive seed plants. The plants are generally perennial, woody trees or shrubs. In general, tallest trees in gymnosperms, *e.g.*, *Sequoia sempervirens* is 366 ft. in height. The male gametes of *Cycas* are largest (300 μ) in size, they are visible to naked eye and are oval in form and top-shaped. The ovule of *Cycas* is also largest in the plant kingdom.

127. (b)

128. (d) : Bryophytes and pteridophytes both have alternation of generation. The gametophytic phase is dominant in bryophytes whereas in pteridophytes it is short lived. Sex organs are embedded in some members of bryophytes and pteridophytes. Sperms are flagellate and so water is required for fertilization. Sterile jacket is present around the sex organs for protection. Archegonium appeared for the first time in bryophytes in plant kingdom. It is a flask shaped structure. It has swollen basal portion called venter and upper elongated neck. The venter has egg cell and venter canal cell. There are 4-6 vertical rows of neck cells enclosing neck canal cells in bryophytes.

The archegonia have short neck made of four rows of vertically elongated cells that encloses four neck canal cells in pteridophytes.

129. (c) : *Pinus* is a gymnospermic plant which has a well developed conducting tissue system but seeds are naked. Whereas mango is an angiospermic plant in which seed are enclosed in the ovary and fruit is present.

130. (c) : Resins and turpentine are obtained from *Pinus* which is gymnospermic plant.

131. (d) : Moss has the largest gametophyte. Mosses are small, soft plants that are typically 1-10 cm tall, some species are much larger. They commonly grow close together in clumps or mats in damp or shady locations. They do not have flowers or seeds and their simple leaves cover the thin wiry stem.

132. (c) : In *Chlamydomonas*, zygote divides by meiosis. It exhibits haplontic type of life cycle.

133. (b) : *Ectocarpus* possesses haplodiplontic whereas *Fucus* possesses diplontic life cycle.

134. (b) : The sporophyte in mosses is more elaborate than that in liverworts. The male and female cones or strobili is borne on same tree in (*Pinus*).

135. (d) : *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. Egg and spermatozoids are fused to form zygote. From zygote diploid sporophyte is produced. The capsule of sporophyte produces haploid spores. Then the haploid gametophyte is produced from the haploid spores. So, the zygote is the only diploid stage in the life cycle. Hence, the life cycle is haplontic life cycle.

❖❖❖