Solution

PLANT KINGDOM WS 1

Class 11 - Biology

Section A

1. **(a)** Phaeophyceae
   Explanation: The plant body of Phaeophyceae is attached to root-like holdfast, the stalk which is similar to stipe and frond which is similar to leaves.
2. **(a)** Holdfast
   Explanation: Angiosperms plants have roots to hold the soil and remain erect. Similarly, Rhodophytes have holdfast by which they remain attached with substratum to absorb water and minerals.
3. **(c)** Algae
   Explanation: Algae are chlorophyll-bearing, simple, thalloid, autotrophic plants with the simplest body organization. Their body is thallus like without true root, stem, and leaf differentiation.
4. **(d)** Oogamous
   Explanation: Oogamy is a form of anisogamy (heterogamy) in which the female gamete (e.g. egg cell) is significantly larger than the male gamete and is non-motile.
5. **(a)** Algae
   Explanation: Spirulina is a blue-green alga and It is one of the most potent nutrient sources of vitamins B-1(thiamine), B-2 (riboflavin), B-3(nicotinamide), B-6 (pyridoxine), B-9 (folic acid, vitamin C, vitamin D, vitamin A, and vitamin E. It is also a source of potassium, calcium, chromium, copper, iron, magnesium, manganese, phosphorus, selenium, sodium and zinc.
6. **(a)** Water
   Explanation: Most of the algae are aquatic, can be freshwater algae - Chlorophyceae or marine algae - Phaeophyceae and Rhodophyceae.
7. **(d)** Monera
   Explanation: Cyanobacteria are classified under the kingdom Monera because they are unicellular with prokaryotic cells.
8. **(d)** Haploid
   Explanation: A dominant, independent, photosynthetic, thalloid, or erect phase of Bryophytes and pteridophytes is represented by a haploid gametophyte.
9. **(a)** Independent and dominant sporophyte
   Explanation: In bryophytes, the dominant phase in the life cycle is the gametophytic plant body. However, in pteridophytes, the main plant body is a sporophyte which is differentiated into true root, stem and leaves.
10. **(d)** Mosses
    Explanation: The bryophytes are divided into liverworts and mosses so they are closely related to each other.
11. **(c)** Bryophytes
    Explanation: Bryophytes are also called amphibians of the plant kingdom because these plants can live in soil but are dependent on water for sexual reproduction.
12. **(b)** Leaf apex
    Explanation: In sexual reproduction, the sex organs antheridia and archegonia are produced at the apex of the leafy shoots.
13. **(b)** Sphagnum
    Explanation: Sphagnum is also known as peat moss as it provides peat that has long been used as fuel.

14.

(c) Gametophyte and Capsule

Explanation: Gametophytes and capsule are diploid structure and alternate with a haploid structure called spores by reduction division.

15. **(a)** Haploid

Explanation: The main plant body of the bryophyte is haploid. It produces gametes, hence is called a gametophyte.

16.

(c) Bryophytes

Explanation: Bryophytes are called amphibians of the plant kingdom as they can grow in both land and water. Water is essential for the completion of the life cycle as they release antherozoids into the water where they come in contact with archegonium to produce a zygote.

17.

(b) Epiphytes

Explanation: Epiphytes are dependent on other large plants for space or physical support. It remains to attach with other plants but does not obtain food or another nutrient from it so they are not parasitic on the supporting plants.

18. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: The hypnospores of Chlamydomonas are red due to the presence of a red pigment called haematochrome. The red hypnospores of quite a number of species of Chlamydomonas (C. nivalis) are responsible for the phenomenon of “red snow”.

19.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: The Phaeophyta are an assemblage of most highly evolved types of algae. In them, the vegetative organisation of the thallus surpasses that of any of the algae so far considered. Postelsia palmaeformis, a native of the Pacific shores of North America, resembles in appearance the palm trees. It is commonly known as the sea palm.

20.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: With respect to their nutrition the algae are autotrophic. All most of the cells of the thallus normally contain chlorophyll. The green cells can manufacture their own carbohydrate food from CO_2 and water through the agency of sunlight.

Since the early steps in photosynthesis in all the algal groups are practically the same, the food materials which accumulate as food reserves is in the form of polysaccharides, however, vary from group to group and thus provide useful data for preliminary classification of algae.

21.

(d) A is false but R is true.

Explanation: Sexual reproduction in algae varies from isogamy, anisogamy to oogamy. In isogamy and anisogamy both the gametes are motile with heterokont flagellation. In oogamy, only the male gametes are motile or flagellate. The female gametes are nonmotile. Oogamy is the general rule in most phaeophytes.

22. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: In some species of Anthoceros there are stoma-like pores or slits on the ventral surface of the thallus. These are called the slime pores. Hormogones of Nostoc gain entry into the mucilage cavities through the slime pores. The cavities containing Nostoc colonies are visible to the naked eye as small, deep blue-green rounded spots. The association of Nostoc benefits Anthoceros especially when the thallus inhabiting species of Nostoc is capable of nitrogen fixation. The algal partner receives all the organic carbon it needed mainly from its host, Anthoceros.

23. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: The plant body of bryophytes is more differentiated than that of algae. It is thallus-like and prostrate or erect and attached to the substratum by unicellular or multicellular rhizoids. They lack true roots, stems, or leaves. They may possess root-like, leaf-like, or stem-like structures.

24. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Anthoceros sporophyte has a well developed typically ventilated photosynthetic tissue. For water and minerals in solution, it depends on the parent gametophyte to which it is attached by its massive foot. The sporophyte of Anthoceros is thus semi-independent. They are long lived. For example Anthoceros fusiform is had grown for nine months and were on the brink of achieving independence from the ageing gametophytes.

25.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Nepenthes khasiana is a green plant, but shows heterotrophic nature for nitrogen supply, therefore, is called as carnivorous plants. Their leaves are modified with a foliaceous leaf base, tendrillar petiole, lamina modified into pitcher and leaf apex forming its lid. Insects are attracted by the grey colour of lid and pitcher as well as the nectar available on the rim and neck of pitcher. An insect which enters the pitcher in search of nectar, slips downwardly into the digestive fluid. The breakdown products of insects are absorbed by the glandular surface of the pitcher.

Fig. *Nepenthes khasiana*

26. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation: Bryophytes are a group of non-vascular land plants. The sex organs in the bryophytes are multicellular and jacketed. The jacket of sterile cells around the sperms and eggs is an adaptation to a land habitat. It protects the sex cells against the drying effects of air.

27.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation: Sporogonium of Riccia completely lacks chloroplasts. Therefore, it is dependent upon the gametophyte for food, water and minerals. However in Marchantia, with differentiation of the young sporophyte into foot, seta and capsule, the immature cells of the seta, capsule wall, elaters and even those of the foot develop chlorophyll. They are autotrophic to a considerable extent. It may be partly dependent upon the parent plant (gametophyte) for its food supply. For the supply of water and minerals in solutions it is entirely dependent upon the parent plant.

28.

(d) Chlamydomonas

Explanation: The algae present in the figure is Chlamydomonas which is a unicellular algae present in fresh water. Two flagella is attached to it that helps in the movement in water.

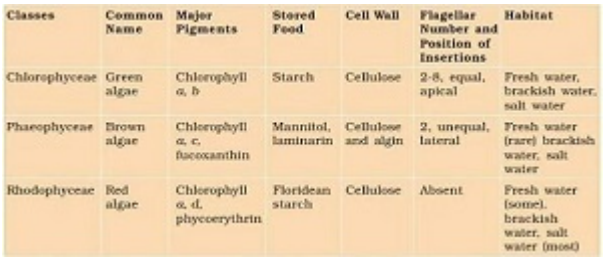
29.

(d) The algal component will survive while the fungal component will die.

Explanation: The algal component will survive while the fungal component will die. This symbiosis is more in the favour of fungal partner than the algal partner and is also termed as helotism, i.e., master and slave relationship where the fungus is the master and alga is a slave. When living together, both are benefitted from each other. The algal component does photosynthesis and provides food and fungal component anchors water which is an important raw material for photosynthesis.

30. Algae.
31. Chlorophyll a and b
32. Mannitol is the reserve food material in Phaeophyceae or Brown Algae.
33. Floridean starch
34. Mosses
35. Thalloid, Theydo not have stems or leaves; instead their main body is flat, like a green pancake.

Section B

36. **Habit and Habitat of Algae.** Algae are chlorophyll bearing, simple, thalloid, autotrophic and largely aquatic (both fresh water and marine) organisms. They occur in a variety of other habitats: moist stones, soils and wood. Some of them also occur in association with fungi (lichen) and animals (e.g. on sloth bear).
37. **Cytotaxonomy** is the branch of biology dealing with the relationships and classification of organisms using comparative studies of chromosomes.
38. Spirullina is made by algae and is used as a nutritional supplement.
    Many red algae such as Corallina are used in treating worm infections.
    Algae contains high amounts of simple and complex carbohydrates which provide the body with a source of additional fuel. In particular, the sulfated complex carbohydrates are thought to enhance the immune system's regulatory response
39. They perform half of the total carbon dioxide-fixation on earth by photosynthesis, acting as the primary producers in aquatic habitats.
40. 

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

41. The basic assumption behind phylogenetic classification (cladistics) is that members of a group share a common evolutionary history, and are thus more "closely related" to one another than they are to other groups of organisms. Related groups of organisms are recognized because they share a set of unique features (apomorphies) which were not present in distant ancestors, but which are shared by most or all of the organisms within the group. These shared derived characteristics are called synapomorphies.
42.

Green Algae	**Red Algae**
Chlorophyll- a, b, xanthophyll and carotene pigments are present.	r-phycoerythrin, chlorophyll-a and d are present.
Reserve food is in the form of pyrenoids and oil droplets.	Reserve food materials are in the form of floridean starch.
Phycocolloids are absent.	Phycocolloids are present.
They live in moderate depths.	They live in very deep water.

43. Because a bryophyte lives on land but needs water for reproduction. In other words it needs both land and water to survive.
44. **Three characteristics of Bryophyta:**
    i. They are small, erect plant growing in moist shady places.
    ii. They have no leaf-like, stem-like and root-like structures.
    iii. Most plants are **gametophytes.** They develop from haploid spores.
45. **Structure of Bryophytes.** It is thallus like and prostrate or erect, and attached to the substratum by unicellular or multicellular rhizoids. They lack true roots, stem or leaves. They may possess root like, leaf like or stem like structures.
46. Features of mosses
    i. Erect, radially symmetrical leafy body produced from the filamentous or thalloid juvenile stage is called protonema.
    ii. They bear multicellular branched rhizoids.
    iii. Sporophyte contains a large amount of green tissue and is partially dependent upon the gametophyte.
47. In liverworts, the plant body is thalloid, e.g., Marchantia. The thallus is dorsiventral and closely appressed to the substrate. In mosses, the predominant stage is the gametophyte. It has two phases
    i. **Protonema stage** which develops directly from a spore.
    ii. The **leafy stage** which develops from the secondary protonema as a leaf bud.
48. Mosses form dense mat over the surface of ground, thereby helping in preventing soil erosion.Peat moss is especially good at this because it has its own special way of absorbing water and preventing it from creating runoff which in its turn would eat away at the soil.

Section C

49.

Zygospore	**Zoospore**
Zygospore is thick-walled resting spore	Zoospore is naked spore produced within a sporangium.
Zygospore is the product of sexual reproduction by fusion of contents of two similar gametangia.	Zoospore is motile having one, two or more flagella.

It is found in a group of Phycomycetes, zygomycetes fungi and all orders of green algae.	It is found in some Phycomycetes fungi and green and brown algae.

50.

Algae	Bryophytes
Mostly aquatic.	Mostly terrestrial, found in damp, shady places.
Thallus single-celled to branched filaments.	Thallus made of parenchymatous cells.
No tissues differentiation.	Tissues differentiation well marked.
Stomata absent.	Stomata present.
Rhizoids absent.	Rhizoids present.
Asexual reproduction by aplanospores or zoospores.	Asexual reporduction is absent.
Sexual reproduction isogamous, anisogamous or oogamous.	Sexual reproduction is of oogamous type.
No embryo formed after fertilization. **Examples:** Ulothrix, Volvox, Codium, Ulva, Chladophora.	Embryo formed after fertilization. **Examples:** Riccia, Marchantia, Funaria, Porella.

51.

Green Algae	Brown Algae
It belongs to Chlorophyta.	It belongs to Phaeophyta.
Chlorophyll a + b present.	Chlorophyll a + c present.
Reserve food material is starch.	Reserve food material is Laminarian starch.
Unicellular to multicellular and may be motile or flagellated.	Filamentous and heterotrichous, multicellular forms.
β-carotene and carotenoids are other pigments present in algae e.g., Spirogyra, Chlamydomonas.	Fucoxanthin and special carotenoids are present in brown algae. e.g., Fucus and Sargassum.

52. **Industrial uses of algae:**
- Agar, a major medium for laboratory culture, is produced from algae.
- Sea weds are major source of fertilizers.
- Algae is used as bio-fuel
- Algae is used for sewage treatment.

53. **Red algae-** The photosynthetic pigments are located in the chromatophores are chlorophyll-a, d, and a, β-carotenes, xanthophyll, and bili proteins.
Green algae- Chromoplasts contain chlorophyll-a, b, carotene, and xanthophyll.
Brown algae- The chromatophores contain chlorophyll-a, c, and β, a-carotenes and xanthophyll.

54.
i. Protonemal cell of a Moss- It is haploid (N).
ii. Primary endosperm nucleus (PEN) in dicot- It is triploid (3N).
iii. Leaf cell of a Moss- It is haploid (N).
iv. Prothallus cell of a fern- It is haploid (N).
v. Gemma cell in Marchantia- It is haploid (N).
vi. Meristem cell of Monoco-. It is diploid (2N).
vii. Ovum of a Liverwort- It is haploid (N).
viii. Zygote of a Fern- It is diploid (2N).

55. The main basis of classification of algae is the presence or absence of pigments, which impart an algae its colour.
Chlorophyceae contains chlorophyll a and b, giving it the green colour and the name blue-green algae'.
Phaeophyceae contains chlorophyll a and c and fucoxanthin. The fucoxanthin gives it the brown colour and hence the name "brown algae'.
Rhodophyceae contains chlorophyll a and d and phycoerythrin. The phycoerythrin gives the distinct red colour and hence the name 'red algae'.

56. It is carried out by quantitative assessment of similarities and differences in order to make objective assessments. It is now easily carried out using computers based process on all observable characteristics. Number and codes are assigned to all the characters and the data are then processed. In this way, each character is given equal importance and at the same time, hundreds of characters can be considered.

57.

Bryophytes	Pteridophytes
The main plant body is gametophyte.	It is a sporophyte.
These are non-vascular plants.	These are vascular plants.
The sporophyte is parasitic over gametophyte.	The sporophyte is independent of the gametophyte.
Plant body can be thallus or foliose.	It is differentiated into stem, leaves, and roots.
True stems and leaves are not present.	It has true stems and leaves.
Roots are absent, rhizoids are present.	Roots are present.
Sex organs are stalked.	Sex organs are sessile.
The wall of the archegonial neck is 5-6 rowed.	The wall of the archegonial neck is 4-rowed.

58. Bryophytes commonly grow in moist, shaded areas in hills. These are also called **amphibians** of the plant kingdom because, these can live in soil, but are dependent on water for sexual reproduction.
Some bryophytes grow in diverse habitats, such as
   i. **Aquatic**, e.g. Riccia, Ricciocarpus, Riella
   ii. **Epiphyte**, e.g. Radula, Dendroceros
   iii. **Saprophyte**, e.g. Buxbaumia, Cryptothalius
   iv. **Dry habitats**, e.g. Polytrichum
   v. **Deserts**, e.g., Tortula desertorum
   vi. **Dry rocks**, e.g., Porella

59. i. **Red algae:** The pigment phycoerythrin in Rhodophyceae gives it the unique red colour and hence the name red algae.
Brown algae: The pigment fucoxanthin in phaeophyceae gives it the unique brown colour and hence the name brown algae.
   ii. In liverworts there is no protonema stage, while in moss the life cycle begins with the protonema stage.
   iii. Majority of pteridophytes are homosporous, while some of them are heterosporous. Selaginella and salvinia are heterosporous. Basically the presence of heterospory in certain pteridophytes is a precursor of seed habits of higher plants, like gymnosperms and angiosperms.

60.

Moss(Bryophyte)	Fern (pteridophyde)
Sex organs are borne on the gametophytic plant body.	Sex organs are borne on an inconspicuous gametophyte or prothallus which represents an alternate phase to the sporophytic plant body.
The antheridia are well developed and often possess a stalk.	The antheridia are less developed and mostly devoid of a stalk.
Antheridial jacket made up of several cells.	Antheridial jacket mostly made up of only 3-cells.
Sperms are biflagellate.	Muitiflagellate sperms.
Archegonia often have a stalk.	Archegonia do not have a stalk.

61.

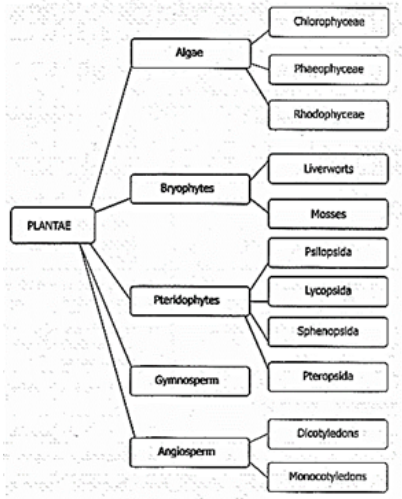
Sporophyte	Gametophyte
Diploid multicellular phase in the life cycle of an organism.	The gametophyte is a haploid multicellular phase in the life cycle of an organism.
Cells possess two genomes or double sets of chromosomes.	Cells have one genome or a single set of chromosomes.
Does not produce gametes.	Gametophyte directly produces gametes.
Sporophyte gives rise to meiospores by meiosis.	Gametophyte does not produce meiospores. Two gametes formed by its fuse during fertilization. The diploid cell grows to produce sporophyte.
The sporophyte is formed by the germination of the zygote.	The gametophyte is formed by germination of meiospore.

Section D

62. Bryophytes have root-like structures called rhizoids. Rhizoids absorb water and minerals and also help in fixation of thallus on the substratum.
63. The male sex organ is called antheridium. They produce biflagellate antherozoids. The female sex organ called archegonium is flask-shaped and produces a single egg.
64. Bryophytes are called as “amphibians of the plant kingdom” because they are terrestrial plants, but require water to complete their life cycle at the time of sexual reproduction.
65. Many algae such as Volvox, Spirogyra and some species of Chlamydomonas represent haplontic pattern of life cycle.
66. When sporophytic and gametophytic generations occur alternately in the life cycle of a plant. This phenomenon is called as alternation of generations.
67.
    - **Diplontic life cycle-** Here mitotic divisions occurs only in diploid cells. Gametes formed through meiosis are haploid in nature. The diploid zygote divide mitotically. In this process production of multicellular diploid organism or in the production of many diploid single cells takes place. E.g. Animals.
    - **Haplontic life cycle-** Here mitosis occurs in haploid cells. It results in the formation of single haploid cells or a multicellular haploid organism. These forms produce the gametes through mitosis. Zygote is formed after fertilization. This cell is the only diploid cell in the entire life cycle of the organism. Thus the same zygotic cell later undergoes meiosis. E.g. Some Algae and Fungi.

Section E

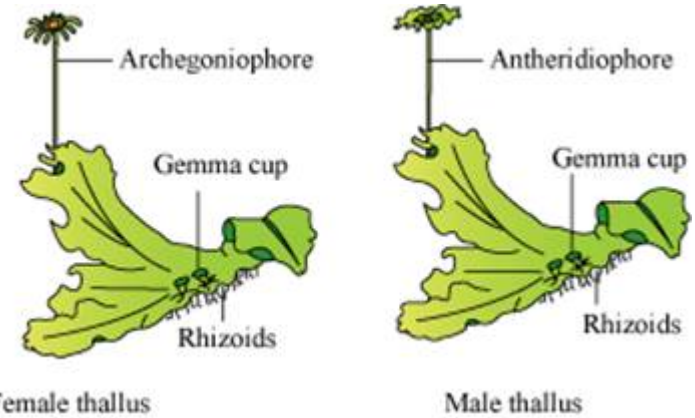
68. **(d)** Haploid and in mosses.
    Explanation: Protonema is a juvenile filamentous stage of moss gametophyte.
69. **(c)** Swimming of sperms to egg in archegonium.
    Explanation: Swimming of sperms to egg in archegonium Explanation: Bryophytes are amphibians of plant kingdom. They grow in soil but require water for sexual reproduction. Their sperms require water to swim into the egg.
70. **(c)** Is partially parasitic on gametophyte.
    Explanation: Moss sporophyte remain attached on gametophyte and absorb nutrient from it. It becomes green in some region and thus becomes photosynthetic and prepares it own food, thus it is partially parasitic on gametophytic.
71. **(a)** Bryophytes
    Explanation: Bryophytes are nonvascular embryophytes.
72. **(c)** A is true but R is false.
    Explanation: Moss protonema unlike green alga bears oblique septa and produces, not sex organs, but gametophores.
73. **Features of Plant Kingdom:**
    - Plants are autotrophic, except for some carnivorous plants. They trap photo energy from sunlight and convert it to chemical energy through photosynthesis. Because of these plants are the main channel for supplying energy in the food chain on earth.
    - Reproduction in plants can be by any of the following modes: Vegetative or Asexual, and Sexual Reproduction.
    - The plant cell is unique because of the presence of cell wall and large vacuoles. Green parts of plant contain chlorophyll, which helps them in trapping the photo energy.
    - Sizes of plants can vary from microscopic to a very large tree. Plants are mainly divided into Algae, Bryophytes, Pteridophytes, Gymnosperms and Angiosperms.



- Lower plants, like algae and bryophytes, have thalloid structure, while higher plants, like gymnosperms and angiosperms, have clearly defined roots and stems.
- In higher plants root gives a means to anchor in the soil and helps the plant in taking minerals and water from the soil. Green leaves on the stem help them in photosynthesis.
- Most of the plant grow as a result of photosynthesis. After photosynthesis, extra food is utilized to facilitate growth.
- Usually in higher plants growth is unlimited and some taller trees can live a life of more than 1000 years.
- Being the main carbon fixation agents, plants are very important for the whole ecology.
- The whole food basket for humans is being filled by the plant kingdom. Even animal products, like milk and poultry, are indirect results of plants carbon fixation.
- Plants supply raw materials for a majority of economic activities. Wood for furniture and building materials come from plants. The whole paper industry is dependent on plant kingdom. Think of a life if there was no paper and you may understand the larger impact on human civilization.
- Angiosperms have special organs, called flower, to bear sexual parts. Flowers are helpful tool in facilitating variations and further evolution of the plant kingdom.

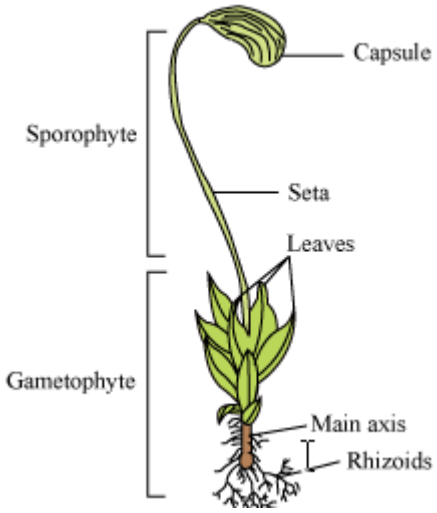
74. i. **Protonema.** A protonema is a thread like chain of cells that forms the earliest stage (the haploid phase) of a bryophyte life cycle. When a moss or liverwort first grows from the spore, it grows as a protonema which develops into a leafy gametophore. Example: Some mosses and all liverworts.
    ii. **Antheridium.** An antheridium is a haploid structure or organ producing and containing male gametes. It is present in the gametophyte phase of lower plants like mosses and ferns, and also in the primitive vascular psilotophytes. Many algae and some fungi, for example ascomycetes and water moulds, also have antheridia during their reproductive stages.
    iii. **Archegonium** . An archegonium is a multicellular structure or organ of the gametophyte phase of certain plants producing and containing the ovum or female gamete. The archegonium has a long neck and a swollen base. Archegonia are typically located on the surface of the plant thallus, although in the horned liverworts they are embedded.
    iv. **Diplontic** . The major part of the life cycle is composed of gametophytic stage and gametophytes produce haploid male and female gametes. This happens in all the higher plants and animals. This kind of life cycle is called diplontic life cycle.
    v. **Sporophylls.** Sporophyll is a leaf that bears sporangia. Both microphylls and megaphylls can be sporophylls. In heterosporous plants, sporophylls bear either megasporangia (megasporophylls), or microsporangia (microsporophylls).
    vi. **Isogamy.** Isogamy refers to a form of sexual reproduction involving gametes of similar morphology, differing only in allele expression in one or more mating, type regions. Since both gametes look alike, they cannot be classified as 'male' or "female". Instead organisms undergoing isogamy are said to have different mating types, most commonly noted as "+" and "-" strains. Fertilization occurs when "+" and "-" gametes fuse to form a zygote.

75. a. Female and male thallus of a liverwort:



Female thallus Male thallus

b. Gametophyte and sporophyte of Funaria:



c. Alternation of generation in Angiosperm