1. What are the advantages of classifying organisms?

Ans. There are a wide range of life forms (about 10–13 million species) around us. These life forms have existed and evolved on the Earth over millions of years ago. The huge range of these life forms makes it very difficult to study them one by one. Therefore, we look for similarities among them and classify them into different classes, so that we can study these different classes as a whole. This makes our study easier.

Therefore, classification serves the following advantages:

(i) It determines the methods of organising the diversity of life on Earth.

(ii) It helps in understanding millions of life forms in detail.

(iii) It also helps in predicting the line of evolution.

2. How would you choose between two characteristics to be used for developing a hierarchy in classification?

Ans. For developing a hierarchy of classification, we choose the fundamental characteristic among several other characteristics. For example, plants differ from animals in the absence of locomotion, chloroplasts, cell wall, etc. But, only locomotion is considered as the basic or fundamental feature that is used to distinguish between plants and animals. This is because the absence of locomotion in plants gave rise to many structural changes such as the presence of a cell wall for protection, and the presence of chloroplast for photosynthesis (as they cannot move around in search of food like animals). Thus, all these features are a result of locomotion. Therefore, locomotion is considered to be a fundamental characteristic. By choosing the basic or fundamental characteristic, we can make broad divisions in living organisms as the next level of characteristic is dependent on these. This goes on to form a hierarchy of characteristics.

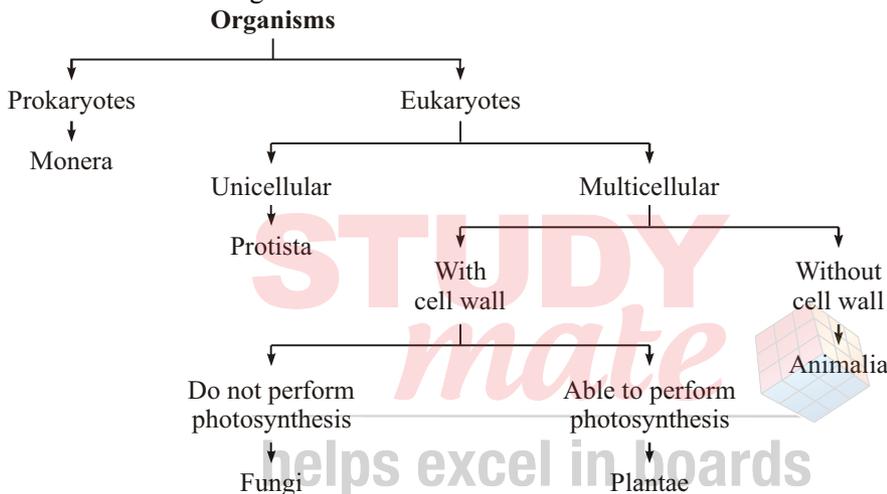3. Explain the basis for grouping organisms into five kingdoms.

Ans. R.H. Whittaker proposed a five-kingdom classification of living organisms on the basis of Linnaeus' system of classification. The five kingdoms proposed by Whittaker are Monera, Protista, Fungi, Plantae and Animalia.

The basis for grouping organisms into five kingdoms is as follows:

(i) On the basis of the presence or absence of membrane-bound organelles, all living organisms are divided into two broad categories of eukaryotes and prokaryotes. This division lead to the formation of kingdom Monera, which includes all prokaryotes.

(ii) Then, eukaryotes are divided as unicellular and multicellular on the basis of cellularity. Unicellular eukaryotes form kingdom Protista,

and multicellular eukaryotes form kingdom Fungi, Plantae and Animalia.

(iii) Animals are then separated on the basis of the absence of a cell wall.

(iv) Since fungi and plants both contain a cell wall, they are separated into different kingdoms on the basis of their modes of nutrition. Fungi have saprophytic mode of nutrition, whereas plants have autotrophic mode of nutrition. This results in the formation of the five kingdoms.

Organisms

Prokaryotes → Monera

Eukaryotes →

Unicellular → Protista

Multicellular →

With cell wall

Without cell wall → Animalia

Do not perform photosynthesis → Fungi

Able to perform photosynthesis → Plantae

4. What are the major divisions in the Plantae? What is the basis for these divisions?
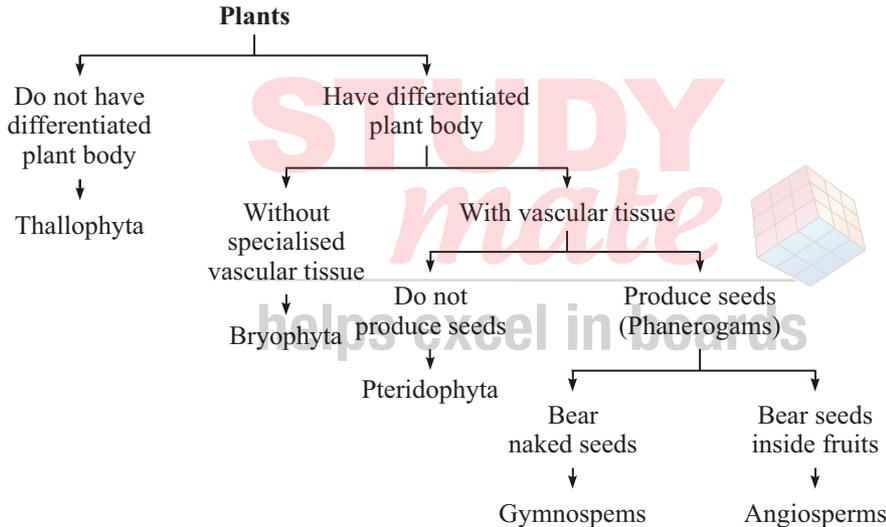
Ans. The kingdom Plantae is divided into five main divisions: thallophyta, bryophyta, pteridophyta, gymnosperms and angiosperms.

The classification depends on the following criteria:

❖ Differentiated/Undifferentiated plant body

❖ Presence/Absence of vascular tissues

❖ With/Without seeds

❖ Naked seeds/Seeds inside fruits

(i) The first level of classification depends on whether a plant body is well differentiated or not. A group of plants that do not have a well-differentiated plant body are known as thallophyta.

(ii) Plants that have well-differentiated body parts are further divided on the basis of the presence or absence of vascular tissues. Plants

without specialised vascular tissues are included in the division bryophyta, whereas plants with vascular tissues are known as tracheophyta.
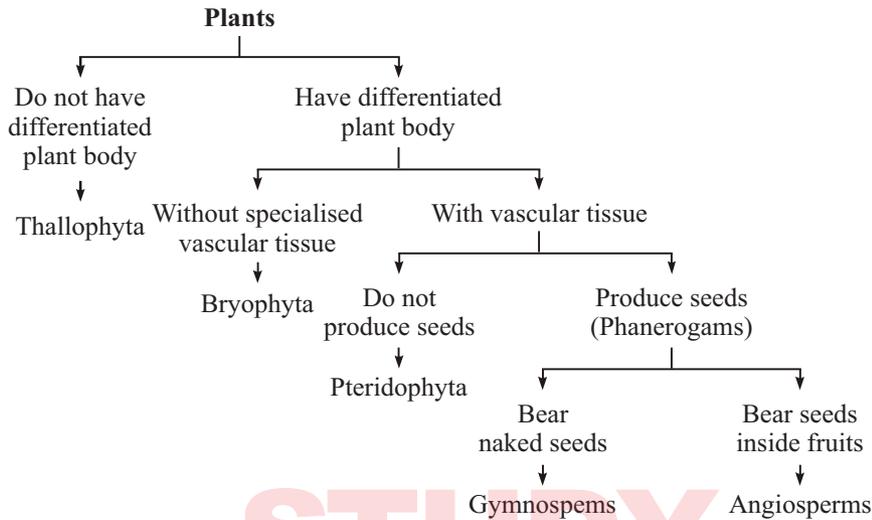
(iii) Tracheophyta is again sub divided into division pteridophyta, on the basis of the absence of seed formation.

(iv) The other group of plants having well-developed reproductive organs that finally develop seeds are called phanerogams. This group is further sub divided on the basis of whether the seeds are naked or enclosed in fruits. This classifies them into gymnosperms and angiosperms. Gymnosperms are seed-bearing, non-flowering plants, whereas angiosperms are flowering plants in which the seeds are enclosed inside the fruit.

Plants

- Do not have differentiated plant body → Thallophyta
- Have differentiated plant body
  - Without specialised vascular tissue → Bryophyta
  - With vascular tissue
    - Do not produce seeds → Pteridophyta
    - Produce seeds (Phanerogams)
      - Bear naked seeds → Gymnospems
      - Bear seeds inside fruits → Angiosperms

5. How are the criteria for deciding divisions in plants different from the criteria for deciding the subgroups among animals?

Ans. Criteria for deciding divisions in plants are as follows:

(i) Differentiated/Undifferentiated plant body

(ii) Presence/Absence of vascular tissues

(iii) With/Without seeds

(iv) Naked seeds/Seeds inside fruits

Plants

Do not have differentiated plant body → Thallophyta

Have differentiated plant body

Without specialised vascular tissue → Bryophyta

With vascular tissue

Do not produce seeds → Pteridophyta

Produce seeds (Phanerogams)

Bear naked seeds → Gymnospems

Bear seeds inside fruits → Angiosperms

Criteria for deciding subgroups among animals are as follows:

Kingdom Animalia is divided into two major groups on the basis of the presence or absence of a notochord.
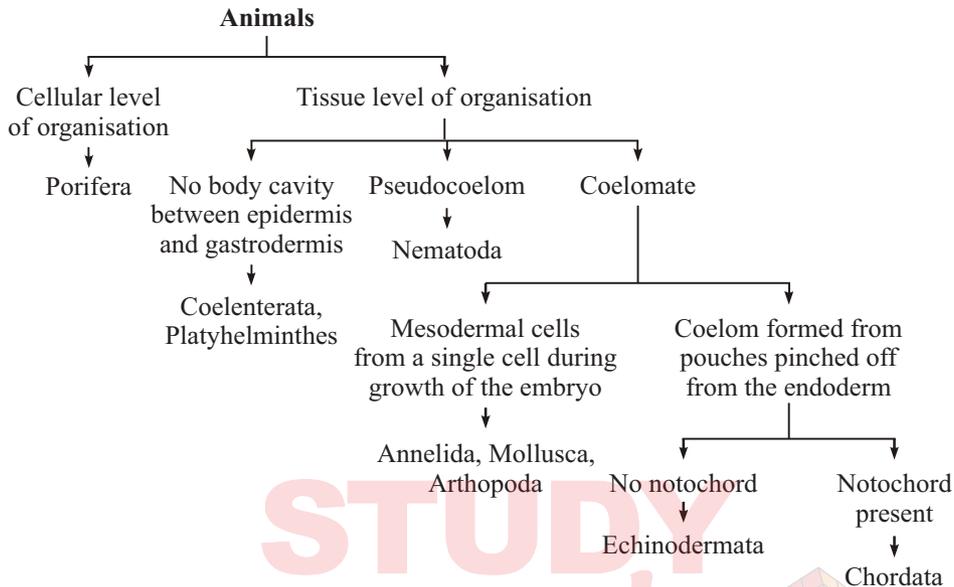
Animalia

Chordata   Non-chordata

Non-chordates do not possess a notochord, while all members of the phylum chordates possess a notochord.

Non-chordate is further divided into subgroups on the basis of the following features:
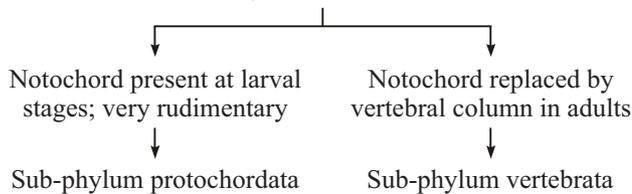
1. **True Tissue:** Absent, present
2. **Body cavity:** Absent, present
3. **Types of body symmetry:** Radial, bilateral
4. **Types of coelom development:** Acoelom, pseudocoelom and true coelom
5. **Types of true coelom:** Enterocoelom, schizocoelom

On the basis of the above features, non-chordates are divided into the following subgroups: porifera, coelenterate, platyhelminthes, nematodes, annelids, molluscs, arthropoda and echinodermata.

Animals

- Cellular level of organisation
  - Porifera
- Tissue level of organisation
  - No body cavity between epidermis and gastrodermis
    - Coelenterata, Platyhelminthes
  - Pseudocoelom
    - Nematoda
  - Coelomate
    - Mesodermal cells from a single cell during growth of the embryo
      - Annelida, Mollusca, Arthopoda
    - Coelom formed from pouches pinched off from the endoderm
      - No notochord
        - Echinodermata
      - Notochord present
        - Chordata

All members of the phylum chordate possess a notochord. However, some animals such as *Balanoglossus, Amphioxus, Herdmania* etc. have a notochord, which is either absent or does not run the entire length of the animal's body. Therefore, these animals are kept in a separate sub-phylum called protochordata, and the rest of the chordates are included in the sub-phylum vertebrata. The members of the sub-phylum vertebrata are advanced chordates. They are divided into five classes: pisces, amphibian, reptilia, aves and mammalia.

Phylum Chordata

- Notochord present at larval stages; very rudimentary
  - Sub-phylum protochordata
- Notochord replaced by vertebral column in adults
  - Sub-phylum vertebrata

6. Explain how animals in vertebrata are classified into further subgroups.

Ans. Animals in vertebrata are classified into five classes:

(i) **Class Pisces:** This class includes fish such as tuna, rohu, shark (Scoloidon) etc. These animals mostly live in water. Hence, they have special adaptive features such as a streamlined body, presence of a tail for movement, gills etc. to live in water.

(ii) **Class Amphibia:** It includes frogs, toads and salamanders. These animals have a dual mode of life. In the larval stage, the respiratory organs are gills, but in the adult stage, respiration occurs through the lungs or skin. They lay eggs in water.

(iii) **Class Reptilia:** It includes reptiles such as lizards, snakes, turtles etc. They usually creep or crawl on land. The body of a reptile is covered with dry and cornified skin to prevent water loss. They lay eggs on land.

(iv) **Class Aves:** It includes all birds such as sparrow, pigeon, crow, etc. Most of them have feathers. Their forelimbs are modified into wings for flight, while hind limbs are modified for walking and clasping. They lay eggs.

(v) **Class Mammalia:** It includes a variety of animals which have milk-producing glands to nourish their young ones. Some lay eggs and some give birth to young ones. Their skin has hair as well as sweat glands to regulate their body temperature.

Vertebrates

Pisces   Amphibia   Reptilia   Aves   Mammalia