Question 1:

Why do we classify organisms?

Solution 1:

There are a wide range of life forms (about 10 million −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 to study these different classes as a whole. Thus, classification makes our study easier.

Question 2:

Give three examples of the range of variations that you see in life-forms around you.

Solution 2:

Examples of range of variations observed in daily life are:

(i) Variety of living organisms in terms of size ranges from microscopic bacteria to tall trees of 100 metres.

(ii) The colour, shape, and size of snakes are completely different from those of lizards.

(iii) The life span of different organisms is also quite varied. For example, a crow lives for only 15 years, whereas a parrot lives for about 140 years.

Question 1:

Which do you think is a more basic characteristic for classifying organisms?

(a) The place where they live.

(b) The kind of cells they are made of. Why?

Solution 1:

The kind of cells that living organisms are made up of is a more basic characteristic for classifying organisms, than on the basis of their habitat. This is because on the basis of the kind of cells, we can classify all living organisms into eukaryotes and prokaryotes. On the other hand, a habitat or the place where an organism lives is a very broad characteristic to be used as the basis for classifying organisms. For example, animals that live on land include earthworms, mosquitoes, butterfly, rats, elephants, tigers, etc. These animals do not resemble each other except for the fact that they share a common habitat. Therefore, the nature or kind of a cell is considered to be a fundamental characteristic for the classification of living organisms.

Question 2:

What is the primary characteristic on which the first division of organisms is made?

Solution 2:

The primary characteristic on which the first division of organisms is made is the nature of the cell. It is considered to be the fundamental characteristic for classifying all living organisms. Nature of the cell includes the presence or absence of membrane-bound organelles. Therefore, on the basis of this fundamental characteristic, we can classify all living organisms into two broad categories of eukaryotes and prokaryotes. Then, further classification is made on the basis of cellularity or modes of nutrition.

Question 3:

On what basis are plants and animals put into different categories?

Solution 3:

Plants and animals differ in many features such as the absence of chloroplasts, presence of cell wall, etc. But, locomotion is considered as the characteristic feature that separates animals from plants. 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), the presence of chloroplasts (for photosynthesis) etc. Hence, locomotion is considered to be the basic characteristic as further differences arose because of this characteristic feature.

Question 1:

Which organisms are called primitive and how are they different from the so-called advanced organisms?

Solution 1:

A primitive organism or lower organism is the one which has a simple body structure and ancient body design or features that have not changed much over a period of time. An advanced organism or higher organism has a complex body structure and organization. For example, an Amoeba is more primitive as compared to a starfish. Amoeba has a simple body structure and primitive features as compared to a starfish. Hence, an Amoeba is considered more primitive than a starfish.

Question 2:

Will advanced organisms be the same as complex organisms? Why?

Solution 2:

It is not always true that an advanced organism will have a complex body structure. But, there is a possibility that over the evolutionary time, complexity in body design will increase. Therefore, at times, advanced organisms can be the same as complex organisms.

Question 1:

What is the criterion for classification of organisms as belonging to kingdom Monera or Protista?

Solution 1:

The criterion for the classification of organisms belonging to kingdom Monera or Protista is the presence or absence of a well-defined nucleus or membrane-bound organelles. Kingdom Monera includes organisms that do not have a well-defined nucleus or membrane-bound organelles and these are known as prokaryotes. Kingdom Protista, on the other hand, includes organisms with a well-defined nucleus and membrane-bound organelles and these organisms are called eukaryotes.

Question 2:

In which kingdom will you place an organism which is single-celled, eukaryotic and photosynthetic?

Solution 2:

Kingdom Protista includes single celled, eukaryotic, and photosynthetic organisms.

Question 3:

In the hierarchy of classification, which grouping will have the smallest number of organisms with a maximum of characteristics in common and which will have the largest number of organisms?

Solution 3:

In the hierarchy of classification, a species will have the smallest number of organisms with a maximum of characteristics in common, whereas the kingdom will have the largest number of organisms.

Question 1:

Which division among plants has the simplest organisms?

Solution 1:

Thallophyta is the division of plants that has the simplest organisms. This group includes plants, which do not contain a well differentiated plant body. Their body is not differentiated into roots, stems, and leaves. They are commonly known as algae.

Question 2:

How are pteridophytes different from the phanerogams?

Solution:

Pteridophyta	Phanerogams
They have inconspicuous or less differentiated reproductive organs.	They have well developed reproductive organs.
They produce naked embryos called spores.	They produce seeds.
Ferns, Marsilea, Equisetum, etc. are examples of pteridophyta.	*Pinus, Cycas*, fir, etc. are examples of phanerogams.

Question 3:

How do gymnosperms and angiosperms differ from each other?

Solution 3:

Gymnosperm	Angiosperm
They are non-flowering plants.	They are flowering plants.
Naked seeds not enclosed inside fruits are produced.	Seeds are enclosed inside fruits.
Pinus, Cedar, fir, *Cycas*, etc. are some examples of gymnosperms.	Coconut, palm, mango, etc. are some examples of angiosperms.

Question 1:

How do poriferan animals differ from coelenterate animals?

Solution 1:

Porifera	Coelenterate
They are mostly marine, nonmotile, and found attached to rocks.	They are exclusively marine animals that either live in colonies or have a solitary lifespan.
They show cellular level of organisation.	They show tissue level of organisation.
Spongilla, *Euplectella*, etc. are poriferans.	*Hydra*, sea anemone, corals, etc. are coelenterates.

Question 2:

How do annelid animals differ from arthropods?

Solution 2:

Annelids	Arthropods
The circulatory system of annelids is closed.	Arthropods have an open circulatory system.
The body is divided into several identical segments.	The body is divided into few specialized segments.

Question 3:

What are the differences between amphibians and reptiles?

Solution 3:

Amphibian	Reptiles
They have a dual mode of life.	They are completely terrestrial.
Scales are absent.	Skin is covered with scales.

They lay eggs in water.	They lay eggs on land.
It includes frogs, toads, and salamanders.	It includes lizards, snakes, turtles, chameleons, etc.

Question 4:

What are the differences between animals belonging to the Aves group and those in the mammalia group?

Solution 4:

Aves	Mammals
Most birds have feathers and they possess a beak.	They do not have feathers and the beak is also absent.
They lay eggs. Hence, they are oviparous.	Some of them lay eggs and some give birth to young ones. Hence, they are both oviparous and viviparous.

Question 1:

What are the advantages of classifying organisms?

Solution 1:

There are a wide range of life forms (about 10 million-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.

Question 2:

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

Solution 2:

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.

Question 3:

Explain the basis for grouping organisms into five kingdoms.

Solution 3:

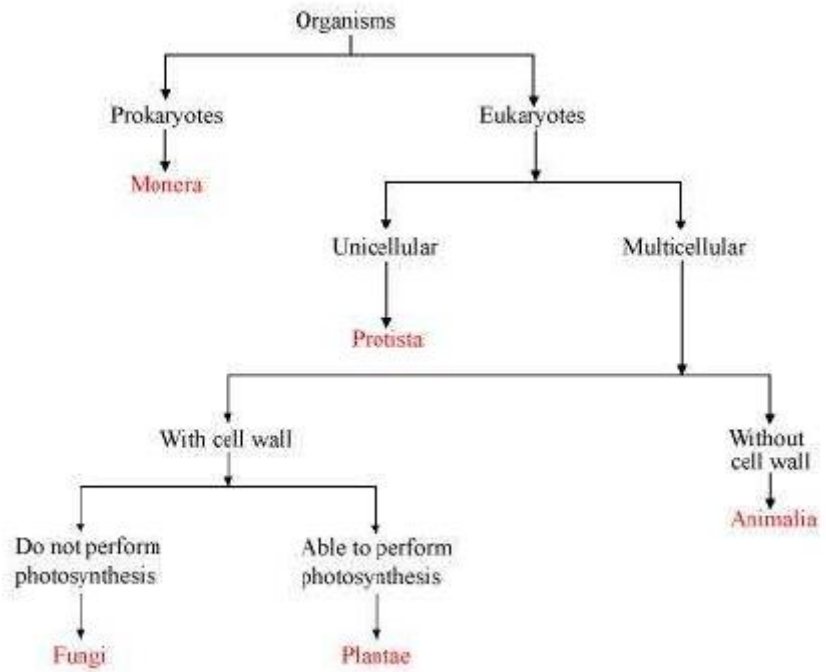
R.H. Whittaker proposed a five kingdom classification of living organisms on the basis of Linnaeus' system of classification. The five kingdoms proposed by Whittaker are Monera, Protista, Fungi, Plantae, and Animalia. The basis for grouping organisms into five kingdoms is as follows:

(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.



Question 4:

What are the major divisions in the Plantae? What is the basis for these divisions?

Solution 4:

The kingdom Plantae is divided into five main divisions: Thallophyta, Bryophyta, Pteridophyta, Gymnosperms, and Angiosperms.

The classification depends on the following criteria:

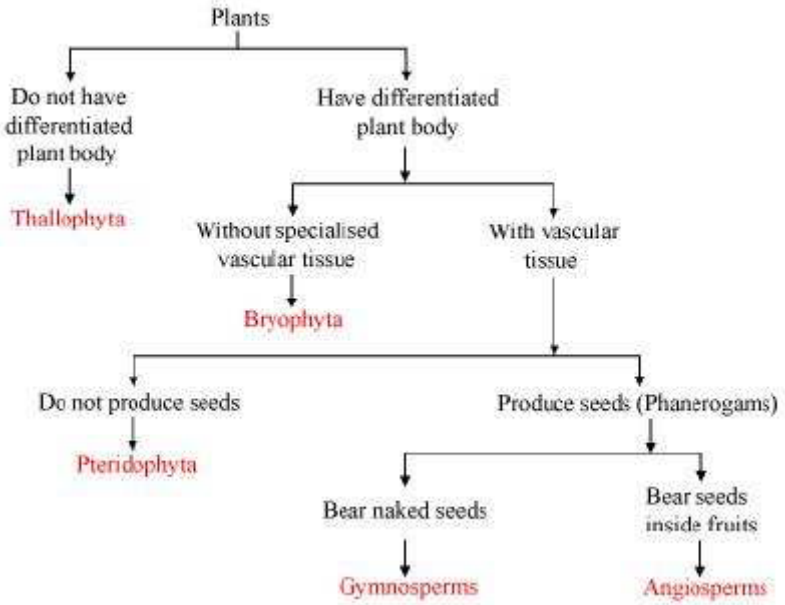
• Differentiated/ Undifferentiated plant body
• Presence /absence of vascular tissues
• With/without seeds
• Naked seeds/ seeds inside fruits

(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 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.



Question 5:

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

Solution 5:

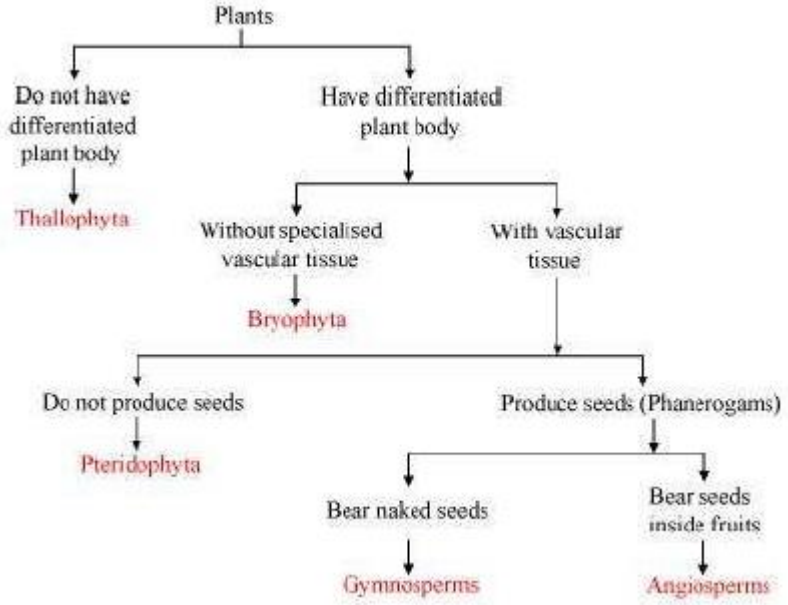
Criteria for deciding divisions in plants are:

(i) Differentiated/ Undifferentiated plant body

(ii) Presence/ absence of vascular tissues

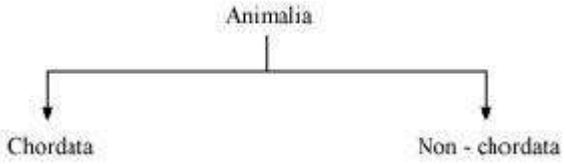
(iii) With/without seeds

(iv) Naked seeds/ seeds inside fruits



Criteria for deciding subgroups among animals are:

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

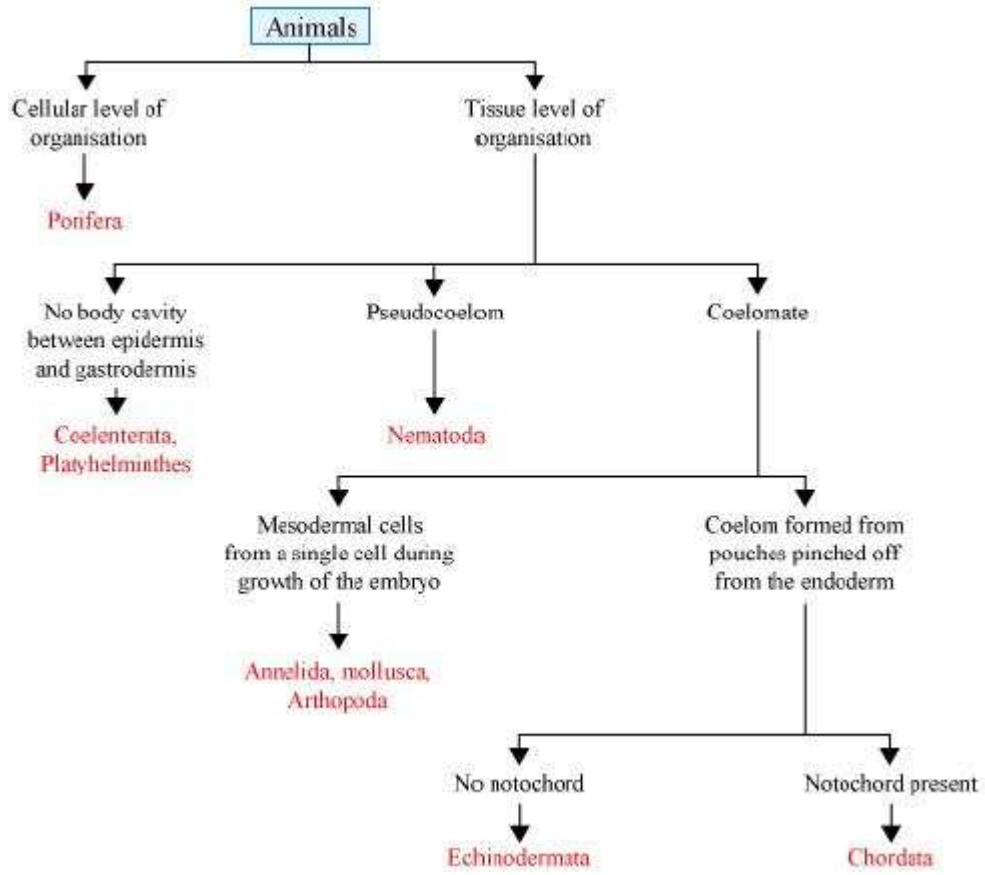


Non-chordates do not possess a notochord, while all members of the phylum chordates possess a notochord.

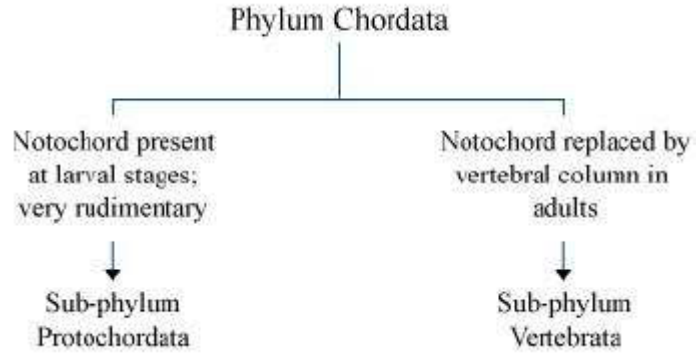
Non-chordate is further divided into subgroups on the basis of the following features:

1. True Tissue — Absent, Present
2. Body cavity — Absent, Present
3. Type of body symmetry — Radial, Bilateral
4. Type of coelom development — Acoelom, Pseudocoleom, True coleom
5. Types of true coelom — Enterocoleom, Schizocoleom

On the basis of the above features, non-chordates are divided into the following subgroups: Porifera, Coelenterate, Platyhelminthes, Nematodes, Annelids, Molluscs, Arthropoda, and Echinodermata.



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 subphylum vertebrata are advanced chordates. They are divided into five classes: Pisces, Amphibian, Reptilia, Aves, and Mammalia.

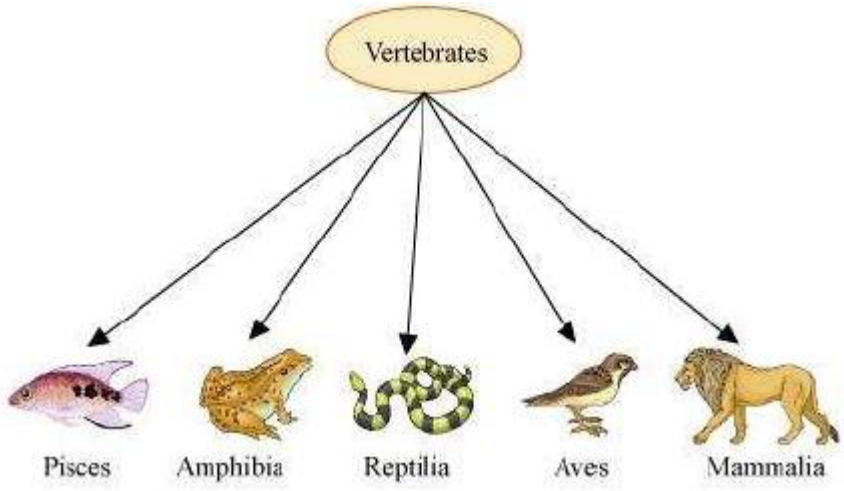


Question 6:

Explain how animals in Vertebrata are classified into further subgroups.

Solution 6:

Animals in Vertebrata are classified into five classes:



(i) **Class Pisces:** This class includes fish such as Scoliodon, tuna, rohu, shark, 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.