

BIOLOGY

Chapter 7: Diversity in Living Organisms



Diversity in Living Organisms

- The variety in living organisms existing on the Earth is called **biodiversity**.
- **Taxonomy** is a biological science which deals with the identification, nomenclature and classification of organisms.
- The system of sorting living organisms into various groups based on their characteristic similarities and differences is called **classification**.
- The principles of classification help us in tracing the evolutionary relationships of the species around us.
- Organisms with ancient body designs are referred to as **primitive** or lower organisms, while organisms which have acquired their body designs relatively recently are called **advanced** or higher organisms.
- A **species** is a group of organisms of a particular kind whose members can interbreed among themselves to produce fertile young ones.
- **Diversity** is the presence of different organisms in the same ecosystem or geographical location. Diversity gives a chance for a more balanced ecosystem.
- **Evolution** is the slow process by which the organisms change according to their needs to survive the environment around them. Evolution leads to the formation of new organisms and more diversity in the ecosystem.
- **Charles Darwin** was an English biologist and a naturalist. He travelled on HMS Beagle to Galapagos Island in South America. Using his observation, he proposed the theory of evolution in his book On the Origin of Species.

Nomenclature

Carolus Linnaeus

- Carolus Linnaeus is a Swedish botanist and physician who is also called ‘Father of taxonomy’.
- He introduced the Binomial nomenclature and laid the ground rules which paved way for modern taxonomy.

Binomial Nomenclature

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- The **binomial nomenclature** system was suggested by the Swedish botanist **Carolus Linnaeus**.
 - According to binomial nomenclature, every organism is given a scientific name for identity. The scientific name includes two terms. The **first term** is the name of the **genus**, and the **second term** is the name of the **species**.

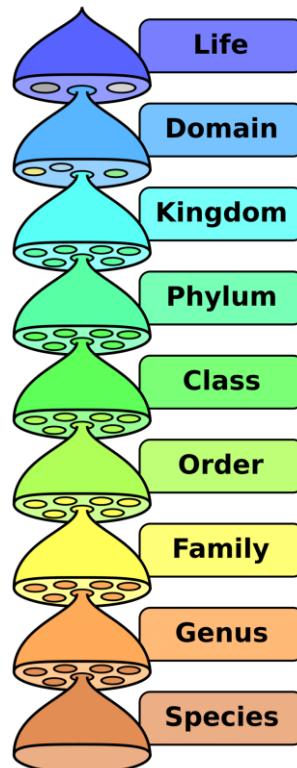
Taxonomy

Taxonomy is the branch of science that deals with the classification of organisms.

Hierarchy of Classification

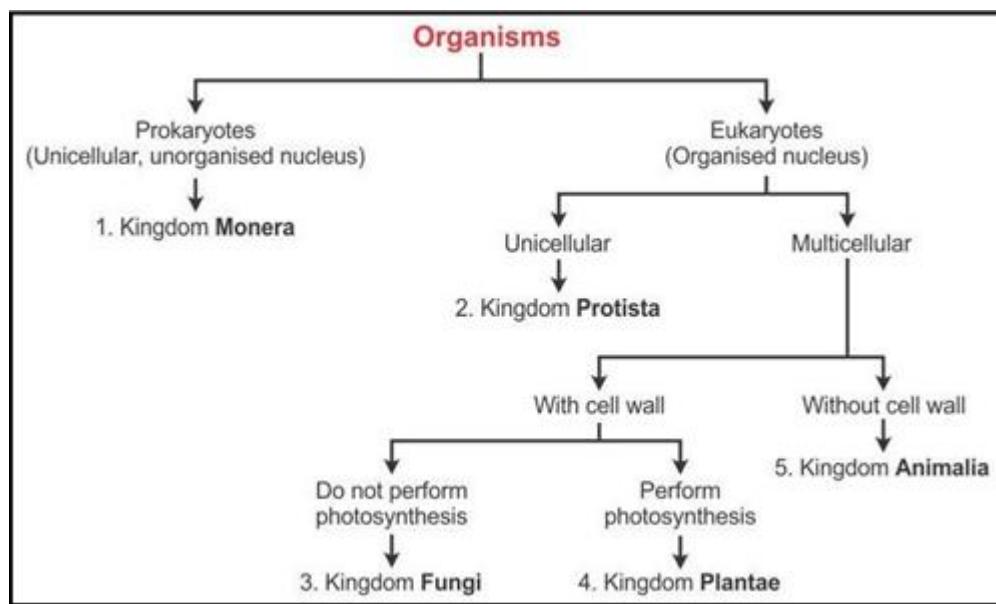
Kingdom → Phylum → Class → Order → Family → Genus → Species

- A **kingdom** is the highest level of classification which consists of a number of phyla or divisions (in case of plants) with similar characteristics.
- **Phylum/Division** is a level of classification which consists of a number of classes with similar characteristics.
- A **class** is the level of classification which consists of a number of orders with similar characteristics.
- An **order** is the level of classification which consists of a number of families with similar characteristics.
- A **family** is the level of classification which consists of a number of Genus with similar characteristics.
- **Genus** is the level of classification which consists of a number of species with similar characteristics.
- **Species** is the level of classification which consists of a number of organisms with similar characteristics and can interbreed to give rise to a fertile offspring.



Five Kingdom Classification

- 5 Kingdom classification is the most accepted system of classification given by R.H.Whittaker.
- This classification solved most of the issues in taxonomy related to the placement of bacteria and fungi.
- The 5 kingdoms are Monera, Protista, Fungi, Plantae and Animalia.



Kingdom Monera

- All the prokaryotic organisms are placed in this Kingdom.
- Bacteria and their ancient cousin, archaebacteria are the organisms that makeup Kingdom Monera.
- These are prokaryotic, unicellular, autotrophic/heterotrophic organisms.
- Bacteria have a cell wall made up of polysaccharides.

Archea

- The category in the kingdom Monera which consists of the organisms surviving in extremely hot conditions.
- They are considered to be the most ancient living organism present on the planet.

Eubacteria

- Eubacteria is phylum of Monera consists of all the bacteria that survive in a normal

environment.

- All the major helpful and pathogenic bacteria we know today fall under this category.

Gram +ve/-ve bacteria

- Some bacteria have a very thick cell wall which makes them take up Gram stain and appear violet.
- There are other bacteria which have a thin cell wall and on Gram staining appear pink.
- Usually, gram +ve bacteria are pathogenic in nature.

Kingdom Protista

- **Protista Kingdom** Protista is made up of all the eukaryotic unicellular organism except yeast.
- **Protozoans** are the unicellular eukaryotic organisms that come under the Kingdom Protista.
- Examples include paramecium, amoeba, Plasmodium, euglena, leishmania etc.
- **Fungi like Protists** This kingdom includes unicellular fungi like yeast and moulds.
- **Plant-like Protists** Kingdom Protista includes some unicellular algae which are photosynthetic.

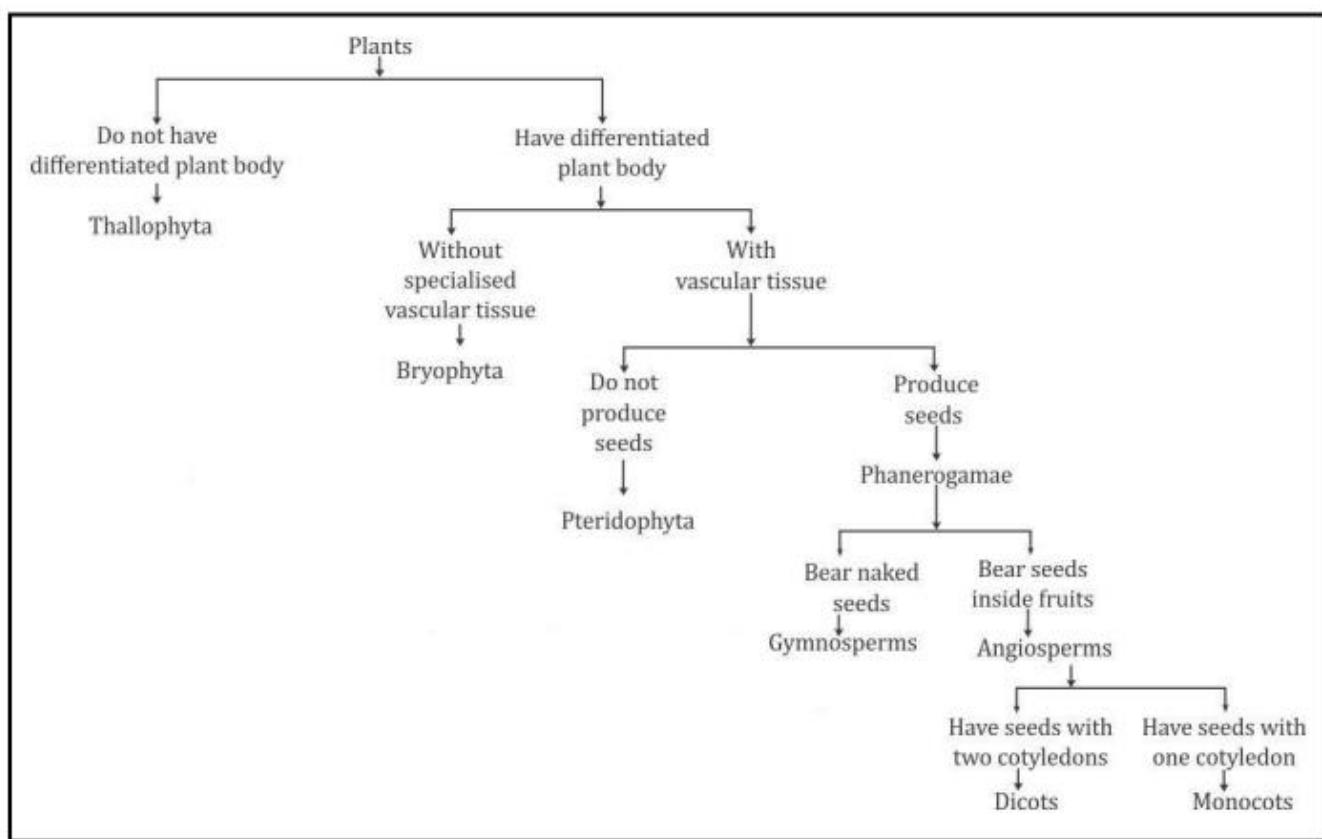
Kingdom Fungi

- The organisms of Kingdom Fungi are mostly saprophytic.
- It is the only Kingdom which has the multicellular and unicellular organisms.
- Majority of them have a cell wall made up of chitin.

KINGDOM	CHARACTERISTICS	EXAMPLES
Monera	<ul style="list-style-type: none"> Organisms have a prokaryotic cell structure. The cell lacks a distinct nucleus. 	Bacteria, Cyanobacteria, Mycoplasma
Protista	<ul style="list-style-type: none"> Contain a well-defined nucleus. Nuclear materials are organised in the form of a linear, double-stranded and helical DNA along with proteins. 	Chlamydomons Euglena, Amoeba
Fungi	<ul style="list-style-type: none"> Possess a true nucleus and a definite cell wall, which is composed of chitin. 	Mucor, Rhizopus, Puccinia

Plantae	<ul style="list-style-type: none"> Cell is bound by a cell wall, which is made of cellulose. Contains a true nucleus and membrane-bound cell organelles. 	Algae, mosses, ferns
Animalia	<ul style="list-style-type: none"> Lack cell wall and plastid. 	Earthworm, Sycon, beetle

Classification of Kingdom Plantae



Cryptogamae

- Cryptogams literally mean ‘plants with hidden reproductive parts’
- Cryptogams are plants that produce spores to reproduce instead of seeds. So these plants do not have flowers or fruits.
- Cryptogams are further classified as thallophytes, bryophytes and pteridophytes.

Phanerogamae

- Phanerogams are plants that produce seeds for reproduction.

- Some of them do not produce flowers, while the others produce flowers.
- Phanerogams are further classified as gymnosperms and angiosperms.

Thallophyta

- Thallophyta is the first division of plant kingdom.
- It consists of red, green and brown algae.
- They don't have a lot of differentiated structure.

Bryophyta

- Bryophyta is the 2nd division of plant kingdom.
- These are the first plants to have differentiated roots and shoots.

Pteridophyta

- Pteridophyta is the 3rd division of plant kingdom.
- These plants have proper differentiation of roots, stem and leaves.

Gymnosperms

- Gymnosperm stands for naked seed.
- They are the first phanerogams since they produce seeds, which is not enclosed in a fruit.

Angiosperms

- Angiosperm is the last division of plant kingdom and has what scientist assume, the most evolved organisms on the planet.
- They bear flowers and fruits, inside which the seeds are found.

Cotyledons

- Cotyledons are structures present in seeds for nutrition during germination when leaves are not yet developed.

- Angiosperms either have two cotyledons making them dicots or only one, making them monocot.

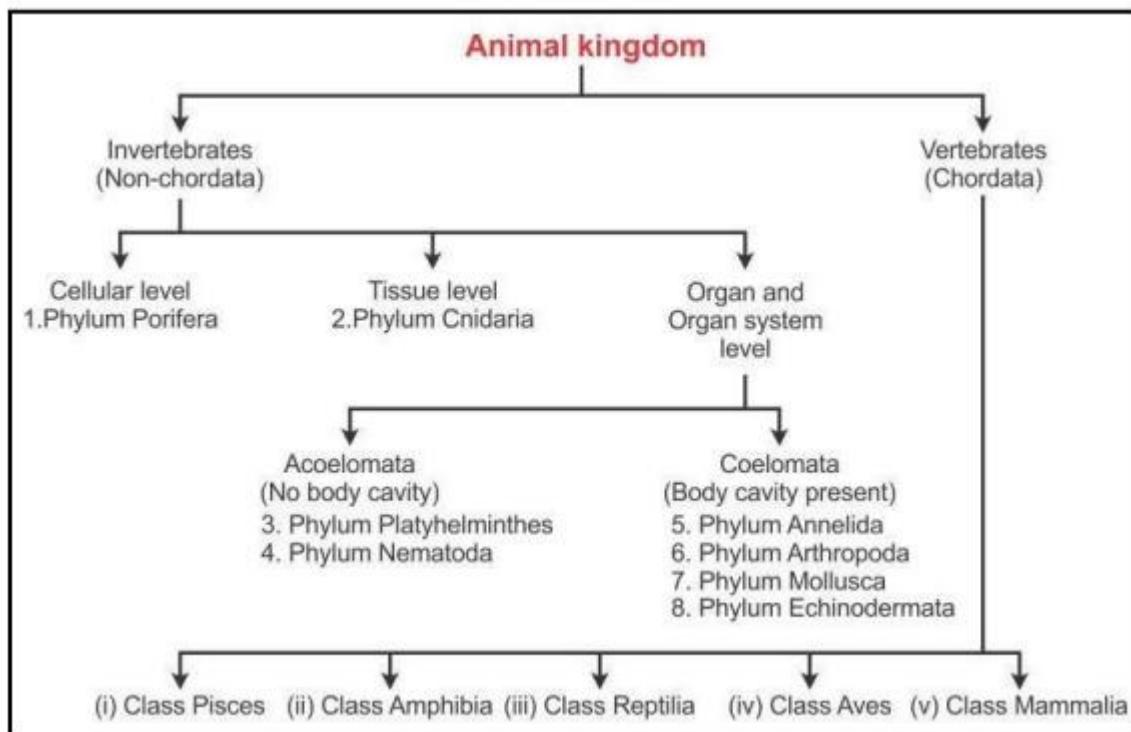
Dicots and Monocots

- Angiosperms, the highly evolved plants on the planet Earth, are further classified based on the number of cotyledons their seeds have.
- When seeds have two cotyledons, they are called dicots.
- Dicots have tap root system and reticulate venation. Examples: Mango, Pea, Beans, etc.
- If seeds have only one cotyledon, they become monocots.
- Monocots show fibrous root system and parallel venation.
- Examples: all grains like wheat, maize, rice etc.

SUBKINGDOM– DIVISION	CHARACTERISTICS	EXAMPLES
Subkingdom Cryptogamae Division Thallophyta/Algae	<ul style="list-style-type: none"> Plants have an irregularly shaped, undifferentiated body called thallus. Predominantly aquatic. 	<i>Nostoc,</i> <i>Oscillatoria,</i> <i>Chlamydomonas</i>
Subkingdom Cryptogamae Division Bryophyta	<ul style="list-style-type: none"> Plant body is either in the form of an undifferentiated thallus or in the form of leafy erect structures. No specialised tissue for the conduction of water and other substances from one part of the plant body to another. 	<i>Riccia, Funaria,</i> <i>Anthoceros</i>
Subkingdom Cryptogamae Division Pteridophyta	<ul style="list-style-type: none"> Plant body is differentiated into stem, leaves and roots. Have specialised tissue for the conduction of water and other 	<i>Psilotum,</i> <i>Nephrolepis,</i> <i>Equisetum</i>

	substances from one part of the plant body to another.	
Subkingdom Phanerogamae Division Gymnospermae	<ul style="list-style-type: none"> Bear naked seeds. Usually perennial, evergreen and woody. 	<i>Gingko, Pinus, Gnetum</i>
Subkingdom Phanerogamae Division Angiospermae	<ul style="list-style-type: none"> Plant body produces seeds which are enclosed within the fruits. Based on the number of cotyledons, angiosperms are divided into two classes—monocots and dicots. 	Maize, bean, wheat

Classification of Kingdom Animalia



Classification of Phylum Invertebrata

PHYLUM	CHARACTERISTICS	EXAMPLES
Porifera	<ul style="list-style-type: none"> Simplest multicellular animals with perforated bodies. 	Sycon, bath

	<ul style="list-style-type: none"> The body consists of a tube. 	
Coelenterata	<ul style="list-style-type: none"> Have a two-layered body wall, which encloses a single cavity in which digestion takes place. There are finger-like projections called tentacles present near the mouth for catching food. 	Hydra, jellyfish
Platyhelminthes	<ul style="list-style-type: none"> Small, soft, flattened and unsegmented worms. Do not have a body cavity or a coelom. 	Liver fluke, tapeworm
Annelida	<ul style="list-style-type: none"> The body is cylindrical and divided into ring-like segments. Have a true body cavity called coelom, present between the body wall and the digestive tube, which is filled with coelomic fluid. 	Earthworm, leech
Nemathelminthes	<ul style="list-style-type: none"> The body is long, cylindrical and unsegmented without a body cavity. The nervous system is well-developed and consists of simple nerves. 	Hookworm, Ascaris
Arthropoda	<ul style="list-style-type: none"> Have jointed limbs, one pair each on some or on all body segments. Have an exoskeleton made of chitin but lack cilia. 	Crayfish, crab
Mollusca	<ul style="list-style-type: none"> Have a soft, unsegmented body without appendages but with a hard and calcareous shell to protect the soft body. 	Snail, slug
Echinodermata	<ul style="list-style-type: none"> The body may be spherical, cylindrical or star-shaped, hard, unsegmented or non-metameric. Possess a spiny exoskeleton. 	Starfish, brittle star
Urochordata	<ul style="list-style-type: none"> Triploblastic animals with a coelom which show bilateral symmetry. The body has three distinct parts—proboscis, collar and trunk. 	Balanoglossus, Amphioxus

Classification of Phylum Vertebrata

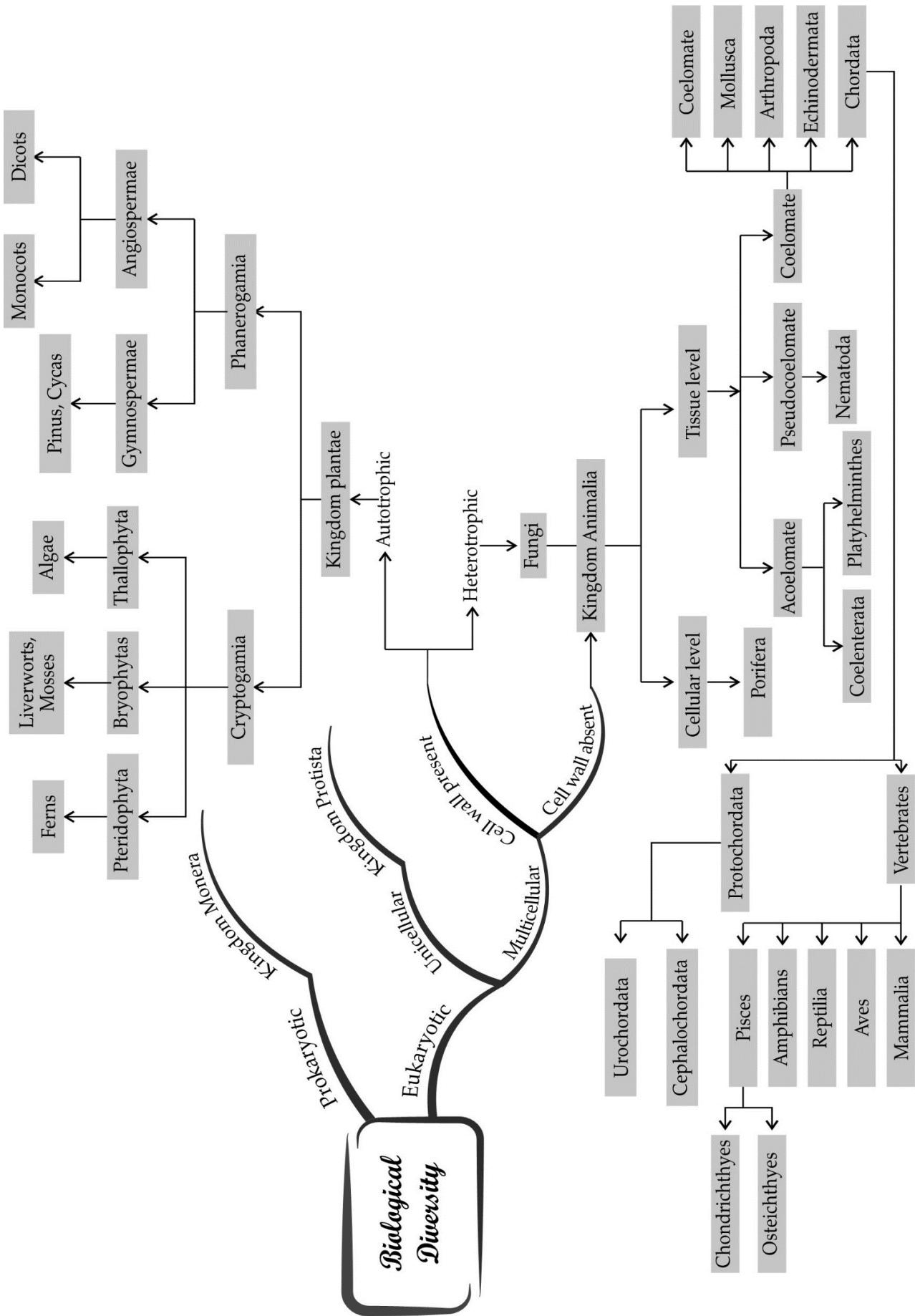
CLASS	CHARACTERISTICS	EXAMPLES
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Pisces	<ul style="list-style-type: none"> Organisms belonging to Class Pisces are fish. They are cold-blooded or poikilothermic animals. 	Shark, dogfish
Amphibia	<ul style="list-style-type: none"> The body is divisible into a head and trunk. Neck is absent. Have a three-chambered heart with two auricles and one ventricle. They are cold-blooded animals. 	Frog, toad
Reptilia	<ul style="list-style-type: none"> The body is divisible into head, neck, abdomen and tail. Most of them have a three-chambered heart. <p>Ventricle of the heart is partially divided.</p>	Lizard, snake
Aves	<ul style="list-style-type: none"> All birds belong to Class Aves. Warm-blooded or homeothermic animals. Heart is four-chambered. 	Pigeon, sparrow
Mammalia	<ul style="list-style-type: none"> Warm-blooded animals. Have a four-chambered heart with two auricles and two ventricles. 	Cat, dog

Differences between Vertebrates and Invertebrates

VERTEBRATES	INVERTEBRATES
1. Have an internal skeleton	1. No internal skeleton
2. Backbone present	2. Backbone absent
3. Tail usually present	3. Tail absent (anus at the tip of the back end of the body)
4. Heart on the ventral side of the body	4. Heart, when present, on the dorsal side of the body
5. Nerve (spinal) cord dorsal and	5. Nerve cord ventral and solid

hollow	
6. Have two pairs of limbs	6. Have three or more pairs of limbs if present
7. Haemoglobin in red blood cells	7. Haemoglobin, if present, dissolved
8. Examples: Fish, frog, lizard, bird	8. Examples: Leech, earthworm, Sycon



Important Questions

➤ Multiple Choice Questions:

1. Mammals are:

- (a) warm-blooded
- (b) cold-blooded
- (c) both
- (d) none of them

2. Reptiles are:

- (a) warm-blooded
- (b) cold-blooded
- (c) both
- (d) none of them

3. The book 'Systema Naturae' was written by:

- (a) Carolus Linnaeus
- (b) Whittaker
- (c) Haeckel
- (d) None of them

4. How many research papers of Carolus Linnaeus were published on classification?

- (a) 12
- (b) 13
- (c) 14
- (d) 16

5. Which among the following produce seeds?

- (a) Thallophyta
- (b) Bryophyta
- (c) Pteridophyta
- (d) Gymnosperms

6. Who proposed the nomenclature system of living organisms first of all?

- (a) Robert Hooke
- (b) Carolus Linnaeus
- (c) Leeuwenhoek

(d) Schleiden

7. Who is considered the father of taxonomy?

(a) Carolus Linnaeus

(b) Robert Hooke

(c) Leeuwenhoek

(d) Schleiden

8. Which one is a true fish?

(a) Jellyfish

(b) Starfish

(c) Dogfish

(d) Silverfish

9. Which among the following have an open circulatory system?

(i) Arthropoda

(ii) Mollusca

(iii) Annelida

(iv) Coelenterata

(a) (i) and (ii)

(b) (iii) and (iv)

(c) (i) and (iii)

(d) (ii) and (iv)

10. Gymnosperms are kept under:

(a) Algae

(b) Bryophyta

(c) Tracheophyta

(d) None of them

11. Which among the following have scales?

(i) Amphibians

(ii) Pisces

(iii) Reptiles

(iv) Mammals

(a) (i) and (iii)

(b) (iii) and (iv)

(c) (ii) and (iii)

(d) (i) and (ii)

12. The amphibian animal is:

(a) Fish

(b) Frog

(c) Lizard

(d) Bat

13. Identify a member of Porifera:

(a) Spongilla

(b) Euglena

(c) Penicillium

(d) Hydra

14. Two chambered heart occurs in:

(a) crocodiles

(b) fish

(c) aves

(d) amphibians

➤ Very Short Question:

1. Who wrote the book “The Origin of Species”?

2. Who proposed the classification of organisms into 5 kingdom?

3. Define species.

4. Give example of the organism belonging to Monera and Protista Kingdom.

5. Name the appendages used for movement by organism belonging to Protista kingdom.

6. What is lichen?

7. What is symbiotic relationship?

8. What is saprophytic nutrition?

9. Give simple classification of plant kingdom.

10. Name the plant amphibian.

➤ Short Questions:

1. Give the characteristics of Monera.

2. Give the characteristics of Protista.
3. Give the difference between thallophyte and bryophyte.
4. What are hermaphrodites? Give two examples.
5. Give the difference between monocots and dicots.
6. Give the difference between two types of symmetry that animals show.
7. Differentiate between vertebrates and invertebrates.
8. Name the phylum of the following animals:
(a) Tapeworm (b) Starfish
(c) Jellyfish (d) Octopus

➤ Long Questions:

1. Write a note on plant tissues.
2. Show the types of animal tissues using flow chart.
3. What is connective tissue? Explain its types.

➤ Assertion Reason Questions:

1. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
 - a. Both Assertion and Reason are correct, and reason is the correct explanation for assertion.
 - b. Both Assertion and Reason are correct, and Reason is not the correct explanation for Assertion.
 - c. Assertion is true but Reason is false.
 - d. Both Assertion and Reason are false.

Assertion: Nucleus can be A basic characteristic of animal classification.

Reason: Nucleated cells have capacity to participate making multicellular organism because they can take up specialised function.

2. For two statements are given- one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below:
 - a. Both Assertion and Reason are correct, and reason is the correct explanation for assertion.
 - b. Both Assertion and Reason are correct, and Reason is not the correct explanation for Assertion.

- c. Assertion is true but Reason is false.
- d. Both Assertion and Reason are false.

Assertion: Nucleus can be A basic characteristic of animal classification.

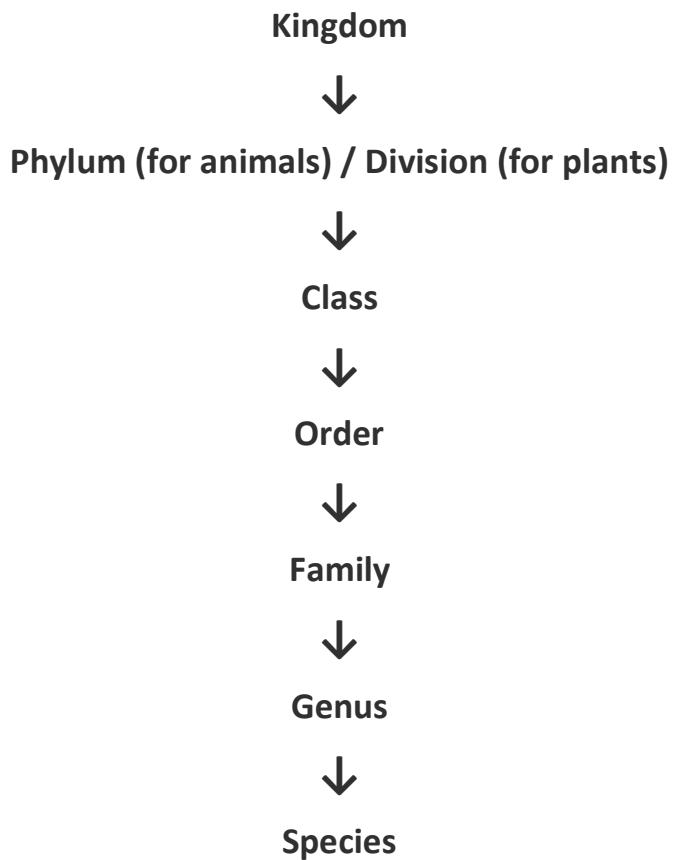
Reason: Nucleus is the only organelle present in the cell which shows animal characters.

➤ Case Study Questions:

1. Biologists, such as Ernst Haeckel (1894), Robert Whittaker (1969) and Carl Woese (1977) have tried to classify all living organisms into broad categories, called kingdoms.

The classification Whittaker proposed has five kingdoms: Monera, Protista, Fungi, Plantae and Animalia, and is widely used. These groups are formed on the basis of their cell structure, mode and source of nutrition and body organisation.

The modification Woese introduced by dividing the Monera into Archaebacteria (or Archaea) and Eubacteria (or Bacteria) is also in use. Further classification is done by naming the sub-groups at various levels as given in the following scheme:



Thus, by separating organisms on the basis of a hierarchy of characteristics into smaller and smaller groups, we arrive at the basic unit of classification, which is a 'species'. A species includes all organisms that are similar enough to breed and perpetuate.

(i) Who proposed Five Kingdoms?

- (a) Ernst Haeckel (1894)
- (b) Robert Whittaker (1969)

- (c) Carl Woese (1977)
- (d) None of above

(ii) Which of the following kingdom is a part of five kingdom system?

- (a) Monera
- (b) Protista
- (c) Animalia
- (d) All of the above

(iii) Kingdom Monera divided into

- (a) Archaebacteria
- (b) Eubacteria
- (c) Both a & b
- (d) None of above

(iv) A groups of five kingdom are formed on the basis of

- (a) Cell structure,
- (b) Mode and source of nutrition
- (c) Body organisation.
- (d) All of the above

(5) What is species?

2. The first level of classification among plants depends on whether the plant body has well differentiated, distinct parts. The next level of classification is based on whether the differentiated plant body has special tissues for the transport of water and other substances. Further classification looks at the ability to bear seeds and whether the seeds are enclosed within fruits.

THALLOPHYTA

Plants that do not have well-differentiated body design fall in this group. The plants in this group are commonly called algae. These plants are predominantly aquatic. Examples are Spirogyra, Ulothrix, Cladophora, Ulva and Chara.

BRYOPHYTA

These are called the amphibians of the plant kingdom. The plant body is commonly differentiated to form stem and leaf-like structures. There is no specialised tissue for the conduction of water and other substances from one part of the plant body to another. Examples are moss (Funaria) and Marchantia.

PTERIDOPHYTA

In this group, the plant body is differentiated into roots, stem and leaves and has specialised tissue for the conduction of water and other substances from one part of the plant body to another. Some examples are Marsilea, ferns. The reproductive organs of plants in all these three groups are very inconspicuous, and they are therefore called 'cryptogams', or 'those with hidden reproductive organs'. On the other hand, plants with well-differentiated reproductive parts that ultimately make seeds are called phanerogams. This group is further classified, based on whether the seeds are naked or enclosed in fruits, giving us two groups – gymnosperms and angiosperms.

Gymnosperms are the plants which bear naked seeds and are usually perennial, evergreen and woody. Examples are pines and deodar. Angiosperms are the plants which seeds are enclosed inside an ovary.

(i) Plants that do not have well-differentiated body is known as _____.

- (a) Bryophytes
- (b) Pteridophytes
- (c) Thallophytes
- (d) Angiosperms

(ii) The plants which bear naked seeds:

- (a) Angiosperms
- (b) Gymnosperms
- (c) Thallophytes
- (d) Pteridophytes

(iii) Phanerogams are further classified into:

- (a) Angiosperms
- (b) Gymnosperms
- (c) Thallophytes
- (d) Both a & b

(iv) Which of the following is the distinguishing feature of Bryophytes:

- (a) Plant body is differentiated to form stem and leaf-like structures
- (b) No specialised tissue for the conduction of water and food
- (c) Both a & b
- (d) None of above

(v) Explain the three important aspect on which classification of Plantae?

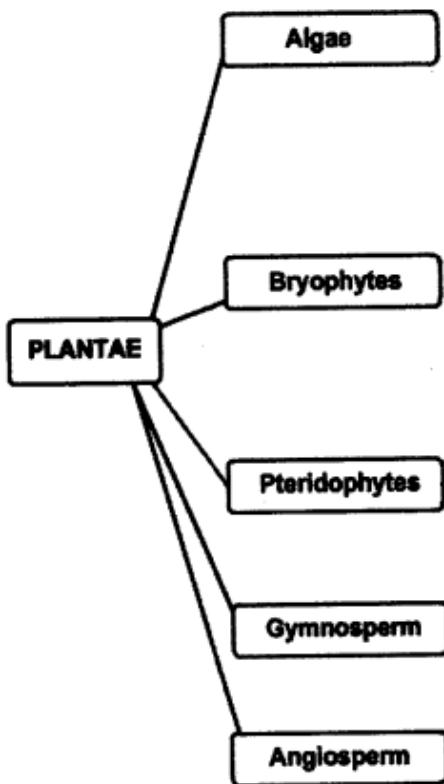
✓ **Answer Key-**

➤ Multiple Choice Answers:

1. (a) warm-blooded
2. (b) cold-blooded
3. (a) Carolus Linnaeus
4. (c) 14
5. (d) Gymnosperms
6. (b) Carolus Linnaeus
7. (a) Carolus Linnaeus
8. (c) Dogfish
9. (a) (i) and (ii)
10. (c) Tracheophyta
11. (c) (ii) and (iii)
12. (b) Frog
13. (a) Spongilla
14. (b) fish

➤ Very Short Answers:

1. Answer: Charles Darwin in 1859.
2. Answer: Robert Whittaker (1959).
3. Answer: All organisms that are similar to breed and perpetuate.
4. Answer: Monera, Anabaena, blue-green algae Protista—Eugleno, Paramecium, Amoeba
5. Answer:
 - Paramecium – Cilia
 - Euglena – Flagella
 - Amoeba – Pseudopodia
6. Answer: The symbiotic association of fungi and blue-green algae, is called lichen.
7. Answer: It is a relationship between two organisms in which both of them are benefitted, e.g., fungi gets food from blue-green algae and in return blue-green gets shelter [lichens].
8. Answer: The organisms using dead and decaying organic matter as food are said to show saprophytic nutrition.
9. Answer:



10. Answer: Bryophyta e.g., Funaria (Moss).

➤ Short Answer:

1. Answer:

- (a) Organisms are unicellular, do not have a defined nucleus.
- (b) Organisms may have cell wall or may not have cell wall.
- (c) Mode of nutrition is either autotrophic or heterotrophic.

2. Answer:

- (a) Organisms are unicellular and eukaryotic.
- (b) Use appendages for locomotion like cilia, flagella, etc.
- (c) Nutrition is either autotrophic or heterotrophic.
- (d) E.g., algae, protozoa.

3. Answer:

Thallophyte	Bryophyte
Body is thallus like not differentiated into -root, stem. Example: Spirogyra.	Plant Body is differentiated into stem and leaf like structures. Example: Moss.

4. Answer: When an organism has both the sexes, i.e., it can produce both sperms and eggs are called hermaphrodites. Example: Sponges, earthworms.

5. Answer:

Monocots	Dicots
1. Seeds with one cotyledon.	Seeds with two cotyledons.
2. Leaves have parallel venation.	Leaves have reticulate venation.
3. Root system—fibrous.	Root system—tap root.

6. Answer: Symmetry—Bilateral and Radial

Bilateral Symmetry	Radial Symmetry
Any organism that has same design on left and right halves of the body. Example: Earthworm, spider, cockroach.	Any organisms with a body design such that it can be divided into two equal halves from any radius. Example: Starfish sea urchin.

7. Answer:

Vertebrates	Invertebrates
1. Notochord is present.	Notochord is absent.
2. True internal skeleton present.	No true internal skeleton present.

8. Answer:

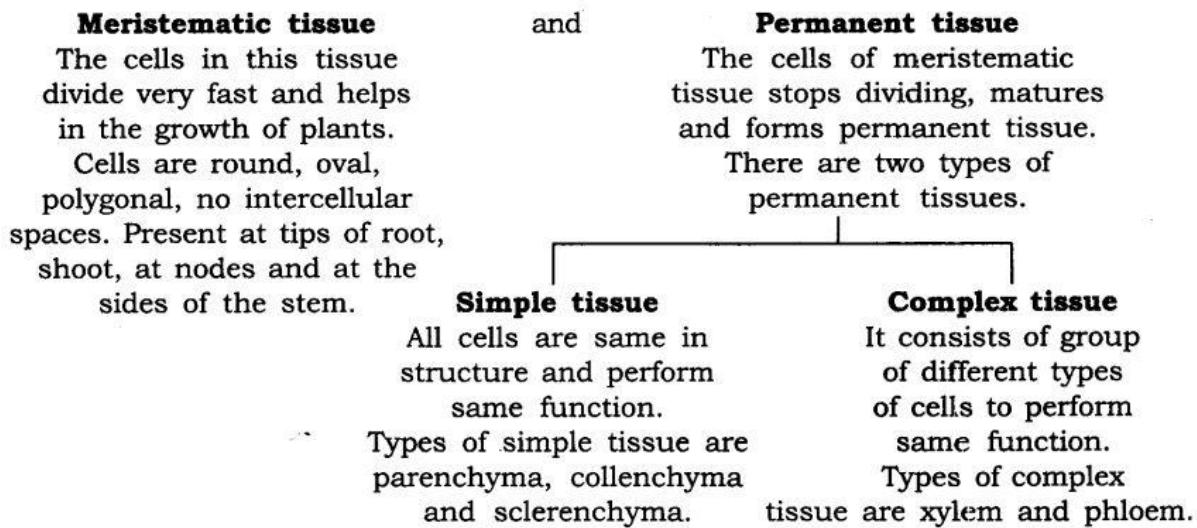
- (a) Tapeworm – Flatyhelminthes
- (b) Starfish – Echinodermatai

(c) Jellyfish – Coelenterata

(d) Octopus – Mollusca

➤ Long Answer:

1. Answer: Plant tissues consist of two main types of tissue.



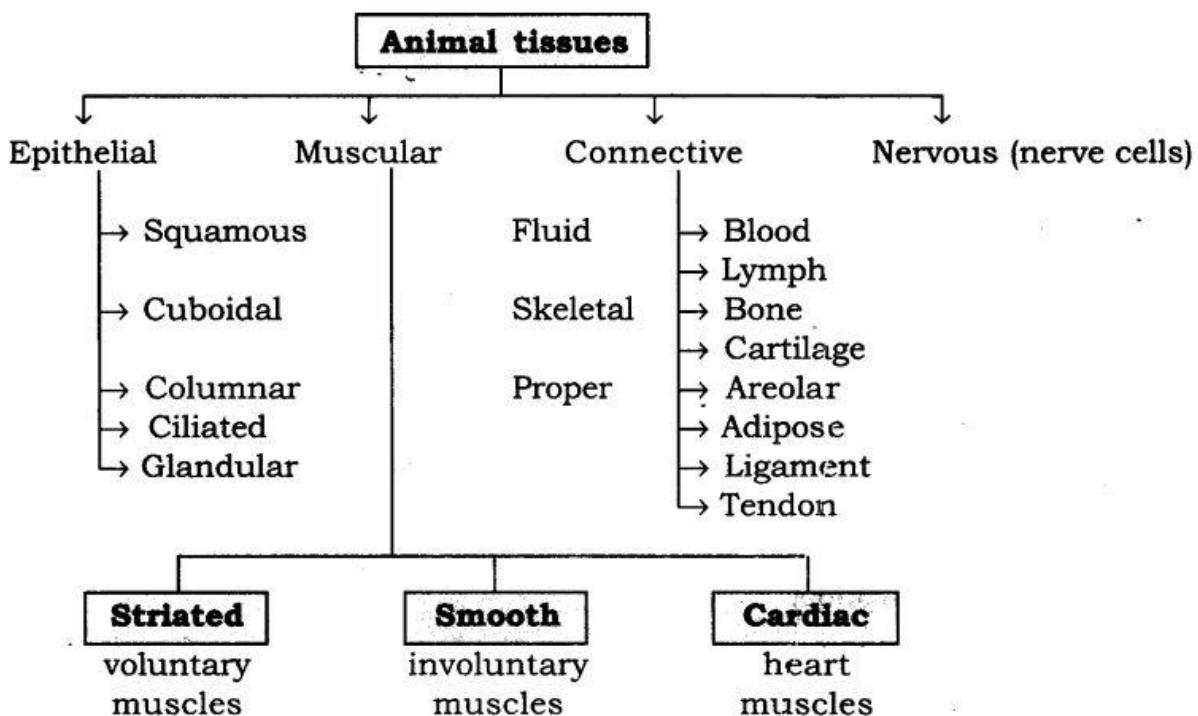
Parenchyma: Present in soft parts of the plant.

Collenchyma: Provides mechanical support to plant present in stalks. Sclerenchyma: They provide strength and flexibility to the plants.

Xylem: Conduct water in plants from root to shoot. Consists of tracheids, vessels, xylem parenchyma and xylem fibres.

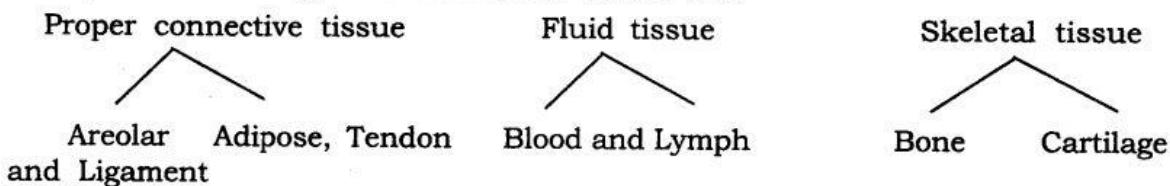
Phloem: Conduct food to all parts of plant. Consist of sieve tubes, companion cell, phloem parenchyma and phloem fibres.

2. Answer:



3. Answer: The connective tissue consists of different types of cells, all of them perform same function.

The different types of connective tissue are:



Areolar connective tissue: It is found between the skin and muscles, around blood vessels and nerves and in the bone marrow.

Areolar tissue fills the space inside the organs. It supports internal organs and helps in repair of tissues.

Adipose tissue: Adipose tissue stores fat, found below the skin and between internal organs. The cells of this tissue are filled with fat globules. It acts as insulator due to fat storage.

Blood: It has a fluid called plasma, in plasma are present red blood cells, white blood cells and platelets. Blood flows all over the body and helps in the transport of gases, digested food, hormones and waste material to different parts of the body.

Lymph: Lymph carries digested fat and lot of white blood cells in the plasma. **Bone:** It forms the framework that supports the body. It supports the different parts of our body. It is strong and non-flexible tissue.

Cartilage: It is present in nose, ear, trachea and larynx. It smoothenes bone surfaces at joints.

Tendon: It connects bone and muscles. These tissues are fibrous, flexible and with lot of strength.

Ligament: It connects bone to 'bone'. It is elastic, has lot of strength.

➤ Assertion Reason Answer:

1. (a) Both Assertion and Reason are correct, and reason is the correct explanation for assertion.
2. (c) Assertion is true but Reason is false.

➤ Case Study Answers:

1.

- (i) (b) Robert Whittaker (1969)
- (ii) (d) All of the above
- (iii) (c) Both a & b
- (iv) (d) All of the above

(v) By separating organisms on the basis of a hierarchy of characteristics into smaller and smaller groups, we arrive at the basic unit of classification, which is a 'species'. A species includes all organisms that are similar enough to breed and perpetuate.

2.

- (i) (c) Thallophytes
- (ii) (b) Gymnosperms
- (iii) (d) Both a & b
- (iv) (c) Both a & b

(v) The first level of classification among plants depends on

- Whether the plant body has well differentiated, distinct parts
 - Whether the differentiated plant body has special tissues for the transport of water
- The ability to bear seeds and whether the seeds are enclosed within fruits