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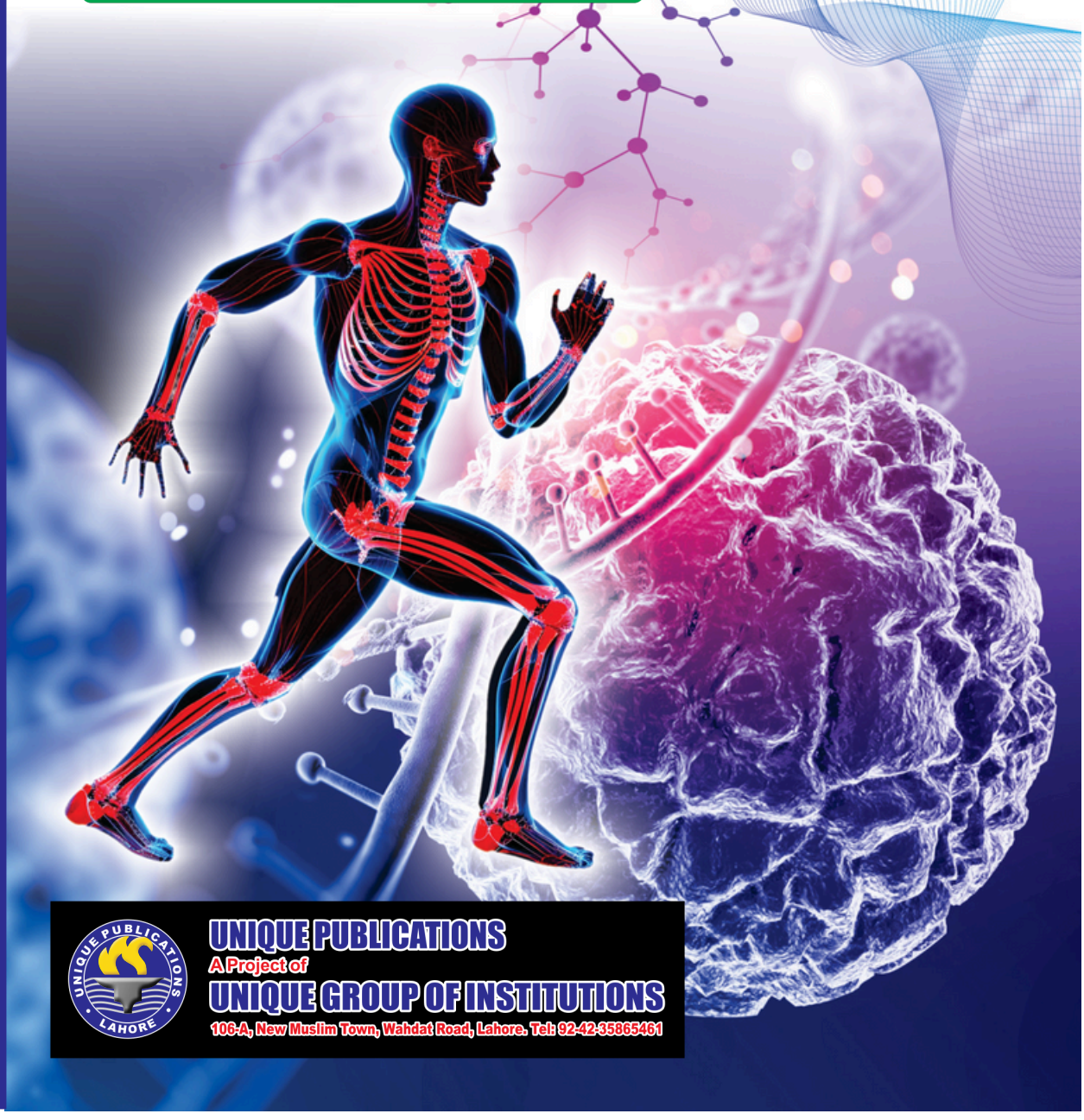

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Unit 01

BIODIVERSITY & CLASSIFICATION

- Three domain system of classification
- Taxonomic Hierarchy
- Salient features of kingdoms of domain eukarya
- Classification of kingdom Animalia
- Classification of viruses
- Biodiversity
- Species and speciation

DESCRIPTIVE QUESTIONS

THREE-DOMAIN SYSTEM OF CLASSIFICATION

Q1. Explain Three-Domain System of Classification. How is it different from the Five-Kingdom system? 11401001

Ans. Five-Kingdom Classification

- This system was proposed by **American ecologist Robert Whittaker** in **1969.**
- According to this system all living organisms were classified into **five** kingdoms.
- **Monera, Protista Fungi, Plantae** and **Animalia.**
- The kingdom **Monera** included all **prokaryotes** (organisms **without a nucleus**).
- The other four kingdoms included **eukaryotes** (organisms **with a nucleus**).

Three-Domain Classification

- An American microbiologist, **Carl Woese** in **1990** proposed the **three domain system** based on **molecular** and **genetic** studies. His three domain system provides a more **accurate** picture of **evolutionary relationships** of organisms.
- **Woese** discovered that prokaryotes are not all the same, they exist in **two** very different forms:

1. Bacteria
2. Archaea

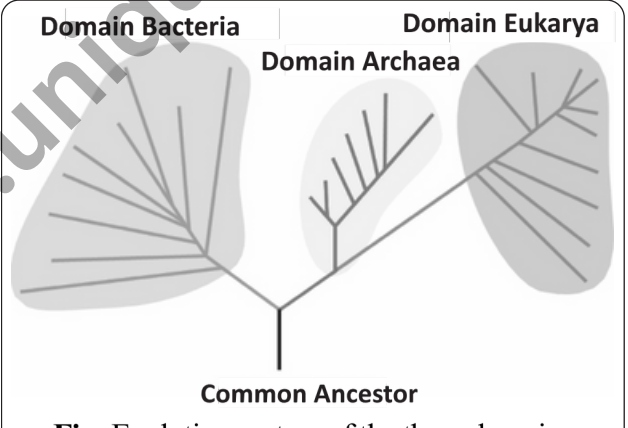


Fig: Evolutionary tree of the three domains

- He introduced three domains instead of kingdoms:

1. **Domain Bacteria** – True bacteria **(prokaryotes)**
2. **Domain Archaea** – Ancient bacteria-like organisms **(prokaryotes)**
3. **Domain Eukarya** – All **eukaryotes** (Protists, Fungi, Plants, Animals)

Key Differences

- The **five-kingdom system** grouped all prokaryotes into **one kingdom** (Monera).

★ **Note:** All questions and paragraphs marked with a star ★ are explanations of the Box Information provided in the textbook.

- The **three-domain system** separates **prokaryotes** into **two** distinct domains: Bacteria and Archaea.

Molecular evidences suggest Archaea are more closely related to eukaryotes than to bacteria. Which means Eukarya evolved from Archaea, after archaea split off from bacteria.

Q2. Describe distinguishing unique characteristics of Domain Archaea. Write their major groups. / Explain how archaea are unique from bacteria and eukarya? **11401002**

Ans. Characteristics of Domain Archaea

In the five-kingdom system, this domain was included in kingdom Monera. The name Archaea comes from the Greek archaios ("ancient"). They are prokaryotes which diverged from bacteria in very ancient times.

★**Archaebacteria:** Achaea were initially classified as a group of bacteria, and were called archaebacteria.

Size: Individual archaeans range from **0.1 µm to over 15 µm** in diameter, some form aggregates or filaments up to **200 µm in length.**

Morphology

They occur in various shapes, such as spherical, rod-shape, spiral, lobed, or rectangular.

Reproduction: Archaea reproduce asexually by **binary or multiple fission, fragmentation,** or **budding.** Mitosis and meiosis do not occur in archaea.

Archeans are unique because;

1. Cell Membrane

- Archaean's cell membrane contains lipids with **ether-linkage** between **glycerol** and **fatty acid chains.** The fatty acid chains are branched. That's why their cell membranes are more resistant to extreme conditions.
- **Bacteria and Eukarya** have membrane lipids with fatty acids attached to glycerol by **ester linkages.** The fatty acid chains are **unbranched.**

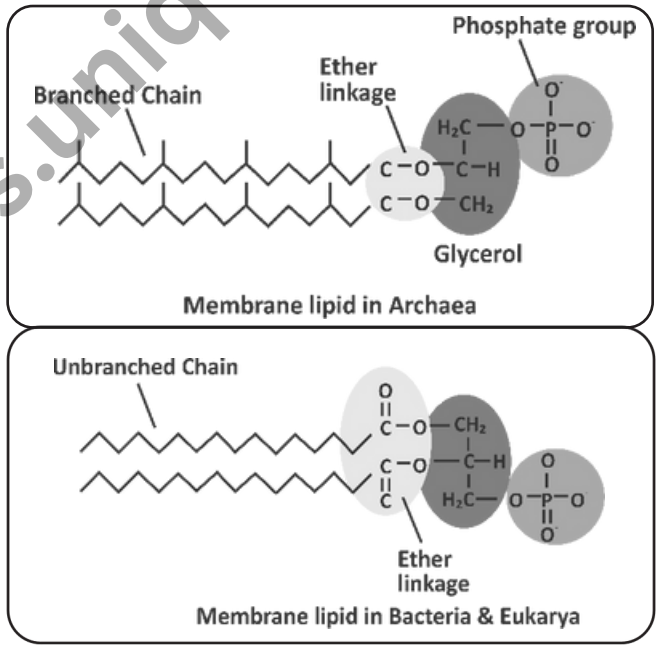


Fig: Difference in membrane lipids of Archaea and other organisms

2. Cell Wall Composition

- The cell walls of **archaea** lack cellulose and peptidoglycan. Instead, they contain distinct polysaccharides and proteins.
- Some archaea have pseudopeptidoglycan.
- On the other hand, **bacterial cell** walls contain peptidoglycan, a polymer consisting of sugars and amino acids that provides structural support.
- In **Eukarya,** the cell walls, if present, are composed of cellulose (in plants) or chitin (in fungi).

3. Genetic Differences

Archaea share several genetic sequences and regulatory features with eukaryotes, highlighting their closer evolutionary relationship.

4. Metabolism

- **Archaea** have unique metabolic processes like **methanogenesis** (production of methane), which is not found in bacteria or Eukarya.
- **Bacteria** exhibit metabolic pathways, including photosynthesis, nitrogen fixation and fermentation.
- In **Eukarya,** the metabolic processes are often more complex and include cellular respiration, photosynthesis (in plants and algae), and various forms of fermentation.

Major Groups of Archaea

The major groups of Archaea include;

- **Methanogens**-produce methane as a metabolic byproduct.
- **Halobacteria**-live in extremely saline environments.
- **Thermococci**-found in hot environments.
- **Thaumarchaeota** involved in nitrogen cycle.

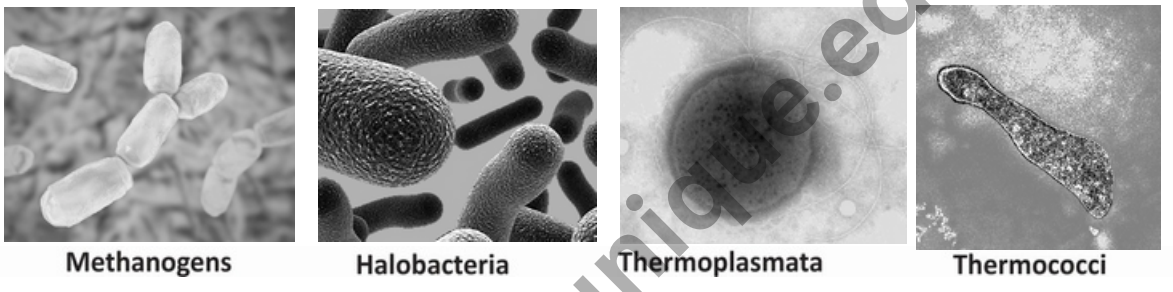


Fig: Major groups of Archaea

Q3. Describe the general characteristics of Domain Bacteria. / Describe the characteristics which distinguish bacteria from other domains. **11401003**

Ans. General characteristics of Domain Bacteria

In the five-kingdom system, this domain was included in kingdom Monera. They are the **true bacteria.** They possess several distinct characteristics that differentiate them from other domains i.e., Archaea and Eukarya.

General Characteristics

Here are the general characteristics of the domain Bacteria:

- **Cell Structure:** Like archaea, bacteria possess prokaryotic cell i.e., **lack a true nucleus** and membrane-bound organelles.
- **Cell Wall Composition:** Bacteria have a cell wall composed of **peptidoglycan (murein),** a unique polymer that provides structural support and shape.
- **Genetic Material:** Like Archaea, bacteria possess a **single, circular chromosome** composed of DNA, located in the nucleoid region.

- **Plasmids:** Most bacteria have **small, circular DNA** molecules that can be transferred between bacteria, aiding in genetic diversity and adaptation.
- **Reproduction:** Bacteria primarily reproduce asexually through binary fission, a process where a single cell divides into two identical daughter cells.
- **Nutritional Modes:** Include **autotrophs** (self-feeding, e.g., photosynthetic bacteria) and **heterotrophs** (feeding on organic matter, e.g., decomposers).
- **Morphology:** Bacteria exhibit a variety of shapes, such as cocci (spherical), bacilli (rod-shaped), spirilla (spiral-shaped), and vibrios (comma-shaped).
- **Arrangement:** Cells may be found singly, in pairs (diplococci), chains (streptococci), clusters (staphylococci), or other arrangements based on species-specific characteristics.
- **Flagella:** Many bacteria have one or more flagella, whip-like structures that enable movement.
- **Pili and Fimbriae:** These are hair-like structures in some bacteria. They help in attachment to surfaces and in exchange of genetic material with other bacteria.
- **Respiration:** Bacteria can be obligate aerobes, obligate anaerobes, facultative anaerobes, microaerophiles or aerotolerant anaerobes. Some bacteria perform **fermentation** to produce energy in the absence of oxygen.
- **Extremophiles:** Some bacteria thrive in extreme conditions, such as high temperatures **(thermophiles),** high salinity **(halophiles),** and low pH **(acidophiles).**
- **Pathogenicity:** Some bacteria cause diseases in humans, animals, and plants, producing toxins or other virulence factors.
- **Symbiosis:** Many bacteria live in symbiotic relationships with other organisms, including mutualism (both benefit) and commensalism (one benefits, the other is not harmed).

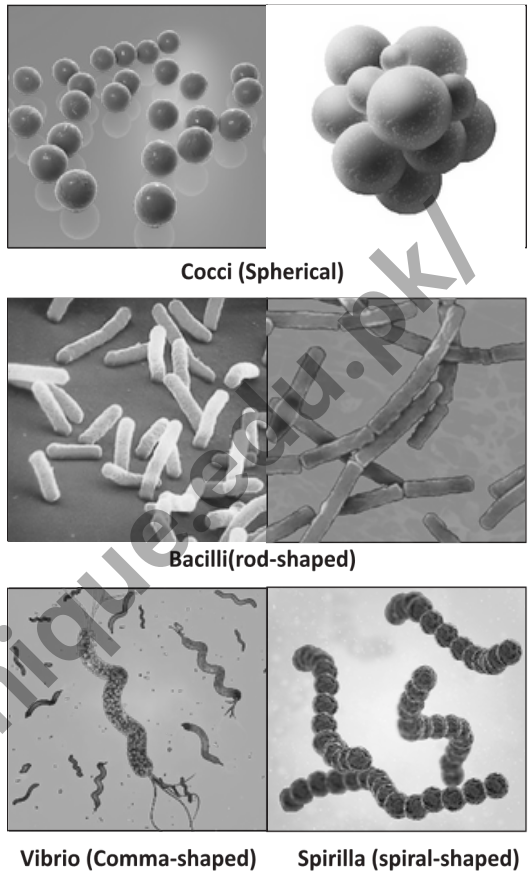


Fig: Different forms of Bacteria

Major Groups of Bacteria

- The domain Bacteria is divided into numerous groups. For example;
  Proteobacteria (Gram negative) e.g., ***Escherichia coli, Rhizobium***, ***Helicobacter pylori.***
- Firmicutes (Gram positive) e.g., ***Bacillus subtilis*****,** ***Lactobacillus*****,** ***Clostridium botulinum*****.**
- Actinobacteria e.g., ***Streptomyces*****,** ***Mycobacterium tuberculosis.***
- Cyanobacteria e.g., ***Anabaena, Spirulina***.
- Spirochaetes e.g., ***Treponema pallidum***.
- Acidobacteria e.g., ***Acidobacterium***.
- Aquificae e.g., ***Aquifex pyrophilus***.

Q4. Explain the general characteristics of Domain Eukarya. 11401004

Ans. General characteristics of Domain Eukarya

The domain Eukarya encompasses all organisms with eukaryotic cells, which are fundamentally different from the prokaryotic cells of Bacteria and Archaea.

General Characteristics

Here are the general characteristics of the domain Eukarya that justify its classification as a separate domain.

- **Cell Structure:** They possess eukaryotic cells - with true **nucleus** enclosed by a nuclear membrane. Cells have **membrane-bounded organelles** e.g., mitochondria, chloroplasts (in plants and algae), endoplasmic reticulum, Golgi apparatus, lysosomes and peroxisomes. Cells also have **cytoskeleton** i.e., a complex network of microtubules, microfilaments, and intermediate filaments that provides structural support, enables cell movement and facilitates intracellular transport.
- **Genetic Material:** Their DNA is organized into multiple **linear chromosomes** within the nucleus. DNA is associated with **histone proteins,** which help in the organization and regulation of genetic material.
- **Reproduction:** Most eukaryotes undergo sexual reproduction involving meiosis and fertilization, leading to genetic diversity. Some eukaryotes can also reproduce asexually through mitosis, producing genetically identical offspring.
- **Complex Cellular Organization:** In multicellular eukaryotes, cells differentiate into specialized types forming tissues and organs with **specific functions.**
- **Evolutionary Relationships:** Eukaryotes are believed to have originated through endosymbiosis, where certain prokaryotic cells such as aerobic bacteria (mitochondria) and cyanobacteria (chloroplasts) were engulfed by anaerobic prokaryotic amoeboid cell (a host cell), leading to a symbiotic relationship.

TAXONOMIC HIERARCHY

Q5. Elaborate the hierarchical system for the classification of living organisms. 11401005

Ans. The classification of living organisms is organized into a hierarchical system that allows scientists to categorize and understand the relationships between different forms of life. This system includes several levels, known as **taxa** (singular: **taxon**), each representing a rank in the biological classification system. The primary levels of this hierarchy are: kingdom, phylum, class, order, family, genus, and species. Below is a detailed description of each level.

1. Domain

It is the **highest level of classification.** Currently, there are three domains: Archaea, Bacteria and Eukarya.

2. Kingdom

The kingdom is one of the highest taxonomic ranks, just below domain. It groups together all forms of life that **share fundamental characteristics.**

- **Example:** In the domain Eukarya, there are several kingdoms, such as Animalia (animals), Plantae (plants), Fungi (fungi), and Protista (protists).

3. Phylum

Phylum is the next level of classification below kingdom. Organisms within a phylum **share a basic body plan** and significant structural features.

- **Example:** In the kingdom Animalia, the **phylum Chordata** includes all animals with a notochord, such as **mammals, birds, reptiles, amphibians,** and **fishes**.

4. Class

Class further divides organisms within a phylum **based on more specific common traits.**

- **Example:** Within the phylum Chordata, the class Mammalia includes all mammals, which are characterized by having hair and mammary glands.

5. Order

Order categorizes organisms within a class based on **additional shared characteristics and evolutionary history.**

- **Example:** Within the class Mammalia, the order Primates includes humans, monkeys, and apes, characterized by their **large brains** and **opposable thumbs.**

6. Family

Family groups organisms within an order that are even **more closely related, sharing more precise common attributes.**

- **Example:** Within the order Primates, the family Hominidae includes great apes and humans.

7. Genus

Genus is a **more specific** rank within a family, grouping species that are **very closely related** and often visually similar.

- **Example:** Within the family Hominidae, the genus Homo includes humans and closest extinct relatives.

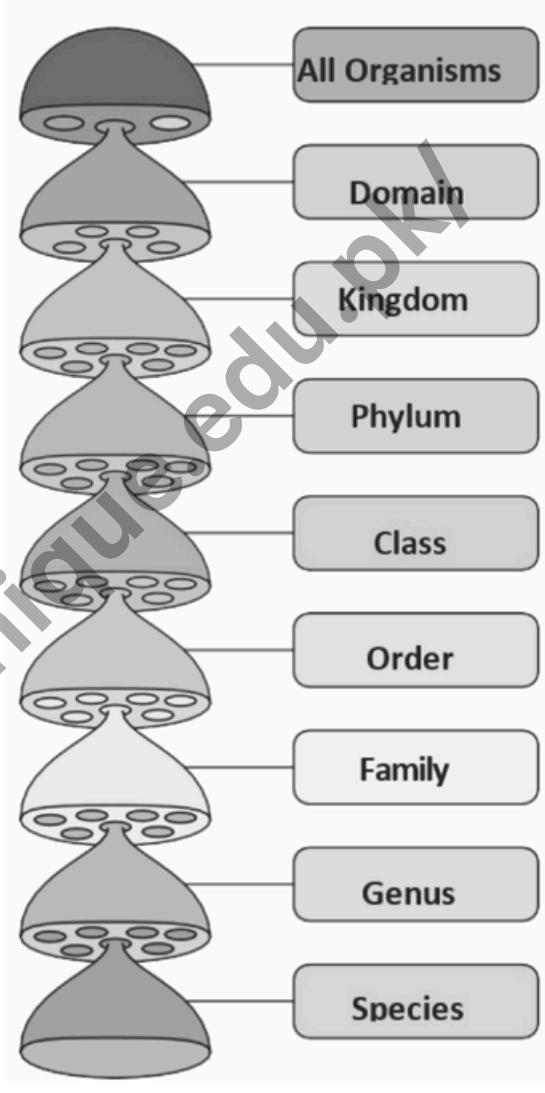


Fig: Taxonomic hierarchy

8. Species

Species is the **most specific level** of classification, representing a **single type of organism.** Members of a species can interbreed and produce fertile offspring.

- **Example:** Within the genus Homo, the species *Homo sapiens* refers to modern humans.

Taxonomic Rank	Human *(Homo sapiens)*	Sparrow *(Passer domesticus)*	Onion *(Allium cepa)*
Domain	Eukarya	Eukarya	Eukarya
Kingdom	Animalia	Animalia	Plantae
Phylum	Chordata	Chordata	Angiosperms
Class	Mammalia	Aves	Monocots
Order	Primates	Passeriformes	Asparagales
Family	Hominidae	Passeridae	Amaryllidaceae
Genus	Homo	Passer	Allium
Species	*Homo sapiens*	*Passer domesticus*	*Allium cepa*

SALIENT FEATURES OF KINGDOMS OF DOMAIN EUKARYA

Q6. What are the salient features of kingdoms of domain Eukarya? / Describe main characteristics of kingdom protoctista, fungi, plantae and animalia. Provide examples for each kingdom. **11401006**

Ans. Eukarya consists of kingdoms protista, fungi, plantae and animalia. It includes all eukaryotes which consist of complex, **eukaryotic cells,** containing **nucleus** and other **membrane-bound organelles.**

1. Kingdom Protista

Kingdom Protista includes eukaryote which are **unicellular or colonial or filamentous** or simple multicellular. Simple multicellular means that they do not have multicellular sex organs. There are three types of protists.

Major Groups or Protists

- **Protozoa:** The group Protozoa includes **animal-like protists.** They are unicellular and are heterotrophic. Examples are Paramecium, Amoeba, Plasmodium, and Trypanosoma.
- **Algae:** The group Algae includes plant-like protists. They have cell walls made of cellulose. They have chlorophyll and are autotrophs. Examples include Euglena, diatoms, dinoflagellates, red algae, green algae, brown algae.
- **Fungi-like protists:** The groups Myxomycota and Oomycota include Fungi-like protists. They have hyphae-like structure and are saprophytic e.g., slime molds and water molds.

★ **Parasitic protists:** Certain protists are parasitic and cause diseases like malaria *(Plasmodium),* amoebic dysentery *(Entamoeba histolytica),* and sleeping sickness *(Trypanosoma).*

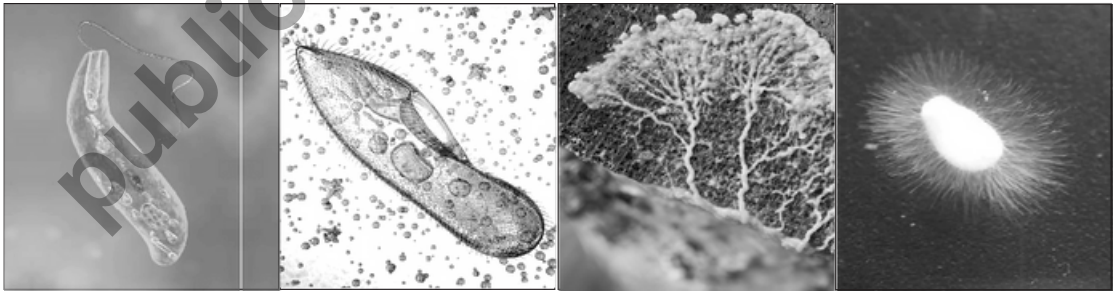


Fig: Common protists

2. Kingdom Fungi

Fungi are eukaryotic, heterotrophic organisms that are unicellular or multicellular. Their cells are covered by **cell wall made of chitin** (a polysaccharide). Fungi get nutrients in a unique way. They **do not ingest food** like animals and some protists. They **absorb food** from surroundings. Examples are **mushrooms, rusts, smuts** and **molds.**

★ **Uses:** Some fungi are used in the production of bread, cheese and beer. Others have medicinal properties, such as penicillin, an antibiotic derived from the fungus *Penicillium.*

Major Groups of Fungi

The following are the major groups of fungi:

- **Zygomycota** includes the fungi which **lack septa (aseptate)** in their hyphae. Examples are Rhizopus (bread molds), which grow on moist bread, fruits etc.
- **Ascomycota** includes the largest groups of fungi. They have septate hyphae. Examples include common molds, morels, truffles, cup fungi, neurospora and yeasts.

★ **Lichens and mycorrhizae:** There are about 100,000 known species of fungi. Most of the Ascomycetes are found in lichens and some are found in mycorrhizae.

- **Basidiomycota** includes the fungi with septate hyphae. Examples are mushrooms, toadstools, puffballs, jelly fungi and bracket/shelf fungi, rusts and smuts.

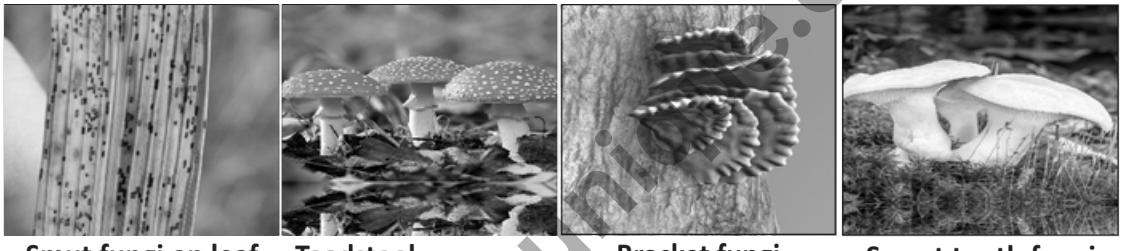


Fig: Common fungi

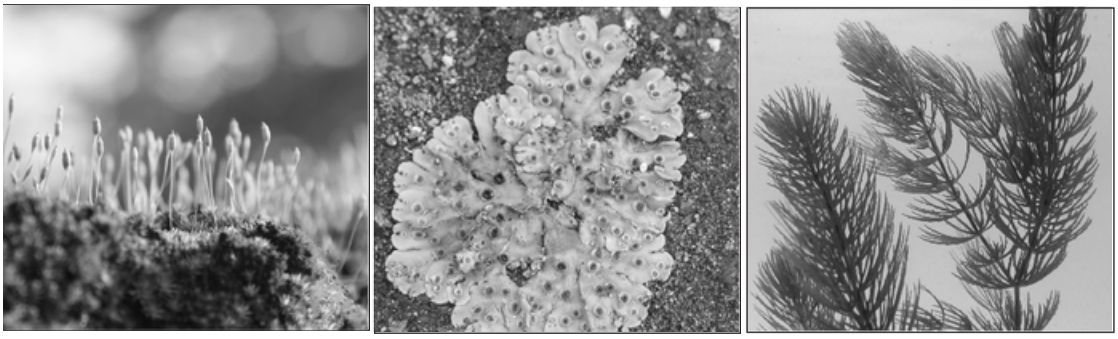
3. Kingdom Plantae

It includes plants which are **eukaryotic, multicellular** organisms with cell walls made of **cellulose.** They are autotrophic and prepare food through **photosynthesis.** All plants **develop** from **embryos.** Examples are mosses, ferns, conifers and flowering plants.

Major Groups of Plants

Plants are divided into two major groups:

- **Non-vascular plants** or **bryophytes** lack conducting tissues (xylem and phloem). Examples include liverworts, hornworts, and mosses.
- **Vascular plants** or **tracheophytes** have conducting tissues. Vascular plants are of two types i.e., seedless plants (e.g., ferns) and seed plants (e.g., conifers and flowering plants). Seed producing vascular plants are **Gymnosperms** (naked seeds) i.e., cone- bearing, **no flowers or fruits** (e.g., Pine and Spruce) whereas **Angiosperms** (flowering plants) are the most diverse plant group (235000 species) which produce seeds enclosed in fruits (**Monocots** e.g., grass, corn and Dicots e.g., rose and sunflower).



Moss Liverwort Hornwort

Non-Vascular (bryophytes)

Sago palm Pine Cedrus Ginkgo bilobai

Capsicum Mustard

Vascular plants

Fig: Major groups of Kingdom Plantae

4. Kingdom Animalia

This kingdom of **eukaryotes** includes animals which are eukaryotic, **multicellular** and **heterotrophic.** They develop from embryos. They **ingest** food and digest it within their bodies, e.g., mammals, birds, reptiles etc.

Q7. Draw a table showing distinguishing characteristics of kingdoms of Three domains. 11401007

Ans.

Table: Distinguishing Characteristics of the kingdoms of three domains

Domain	Bacteria	Archaea	Eukarya			
Kingdom	**Monera**		**Protista**	**Fungi**	**Plantae**	**Animalia**
Cell Type	Prokaryotic	Prokaryotic	Eukaryotic	Eukaryotic	Eukaryotic	Eukaryotic
Nuclear Envelope	Absent	Absent	Present	Present	Present	Present
Presence of Cell Wall	In all	In all	In some, Absent in animal like protists	In all	In all	Absent
Composition of cell wall	Peptidoglycan	Various Chemicals	Polysaccharides and proteins	Chitin	Cellulose and other polysaccharides	No Cell wall
Mode of Nutrition	Autotroph or heterotroph	Autotroph or heterotroph	Photosynthetic or heterotroph, or combination	Absorptive heterotroph	Photosynthetic autotrophs	Ingestive heterotrophs
Multi cellularity	Absent	Absent	Absent in most forms	Present in most forms	Present in all forms	Present in all forms

Basic terminologies related to kingdom animalia

The animals (multicellular = metazoa) are subclassified into:

i. **Parazoa** (phylum Porifera) these animals lack tissues organized into organs and have indeterminate shape, and are asymmetrical.

ii. **Eumetazoa** includes animals of other phyla, these animals have tissues organized into organs and organ systems. These include radially symmetrical animals (grade **Radiata**) and bilaterally symmetrical animals (grade **Bilateria**).

(a) **Grade Radiata** includes simplest of the Eumetazoa (phylum **Cnidaria**), they are much simpler in their organization.

(b) **Grade Bilateria** includes the animals where the right side is approximately the same as the left side and where there is a distinct anterior end is said to have bilateral symmetry. The animal can be divided into two equal parts by an imaginary line only in one plane.

Diploblastic animals

The body of these animals consists of two layers of cells, ectoderm and endoderm. Animals show lesser degree of specialization and do not form specialized organs. There is no special transport system. No central nervous system. Sac like digestive system is present.

Triploblastic animals

The body of these animals is made from three layers' ectoderm, mesoderm and endoderm. The cells of these animals show greater degree of specialization and have specialized organ

and organ system. Special transport systems i.e. blood vascular system is present. Central nervous system is present. Tube like digestive system is present.

The body of these animals is made of three layers' ectoderm mesoderm and endoderm. After embryonic development these layers in most triploblastic animals are not distinct as separate layers of cells, but are represented by the structures formed from them. The cells of these animals show greater degree of specialization. These have specialized organs and organs systems. Special transport systems i.e. blood vascular system is present in most of the cases.

Ectoderm: The germinal layer that develops into systems such as integumentary and nervous system.

Mesoderm: The germinal layer that develops into muscular, skeletal and reproductive systems.

Endoderm: The germinal layer that forms the lining of digestive tract and forms other glands of digestive system, such as liver.

Triploblastic animals may be acoelomate, pseudocoelomates or coelomate.

Acoelomates

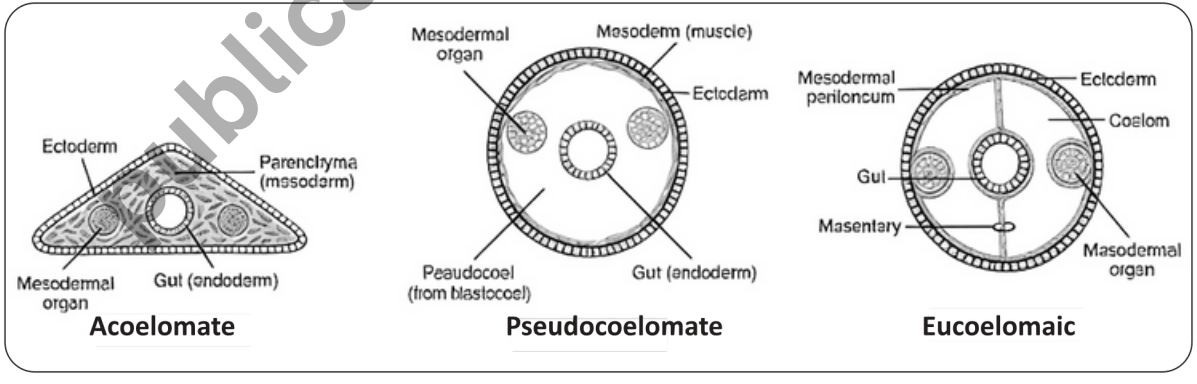
In phylum Platyhelminthes there is no body cavity or coelom, and the mesoderm forms a loose, cellular tissue called mesenchyma or parenchyma which fills the space between the ectoderm and endoderm. It forms a packing around the internal organs of the animals to support and protect them. Such animals are called acoelomates.

Pseudocoelomates

In Aschelminthes the space between the body wall and the digestive tube is called pseudocoelom (false body cavity). Pseudocoelom is not homologous to true coelom because: is not lined by coelomic epithelium. It has no relation with the reproductive and excretory organs. It develops from the blastocoel of the embryo and it is bounded externally by the muscles and internally by the cuticle of the intestine. The animals having pseudocoelom are called pseudocoelomates.

Coelomates

Coelom is cavity present between the body wall and the alimentary canal and is lined by mesoderm. The mesoderm splits into outer parietal layer which underlines the body wall and the visceral layer which covers the alimentary canal and the cavity between them is the true coelom. It is filled with fluid called coelomic fluid. The animals which possess coelom or true body cavity are called coelomates e.g., animals from annelids to chordates.



The coelomates are further divided into;

i. Proterostomes

In protostomes, the blastopore (the first opening in the developing embryo) becomes the mouth. Coelom or body cavity is formed due to splitting of mesoderm (schizocoelous). This series includes animals belonging to phyla Aschelminthes annelida, mollusca and arthropoda.

ii. Deuterostomes

The mouth is formed at some distance anterior to the blastopore and blastopore forms the anus. Coelom is developed as an outpouching of archenterons (enterocoelous). This series includes animals belonging to phyla Echinodermata, hemichordate and chordata.

CLASSIFICATION OF KINGDOM ANIMALIA

Q8. Discuss the general characteristics of Phylum Porifera. **11401008**

Ans. General characteristics of Phylum Porifera (literal meaning: pore bearing)

This phylum contains sponges.

1. Habitat: Most of them are marine while some live in freshwaters. *Leucosolenia* and *Euplectella* (Venus flower basket) are marine sponges. *Spongilla* is a common freshwater sponge.

2. Level of Organization: Sponges **do not have tissue level** organization. Most sponges are asymmetrical but some have radial symmetry.

3. Nervous System: They do not have nervous system.

4. Water Flow System: There are numerous pores in body wall called **ostia**. Through ostia, water enters the body. The larger pore through which water leaves the body is called **osculum**.

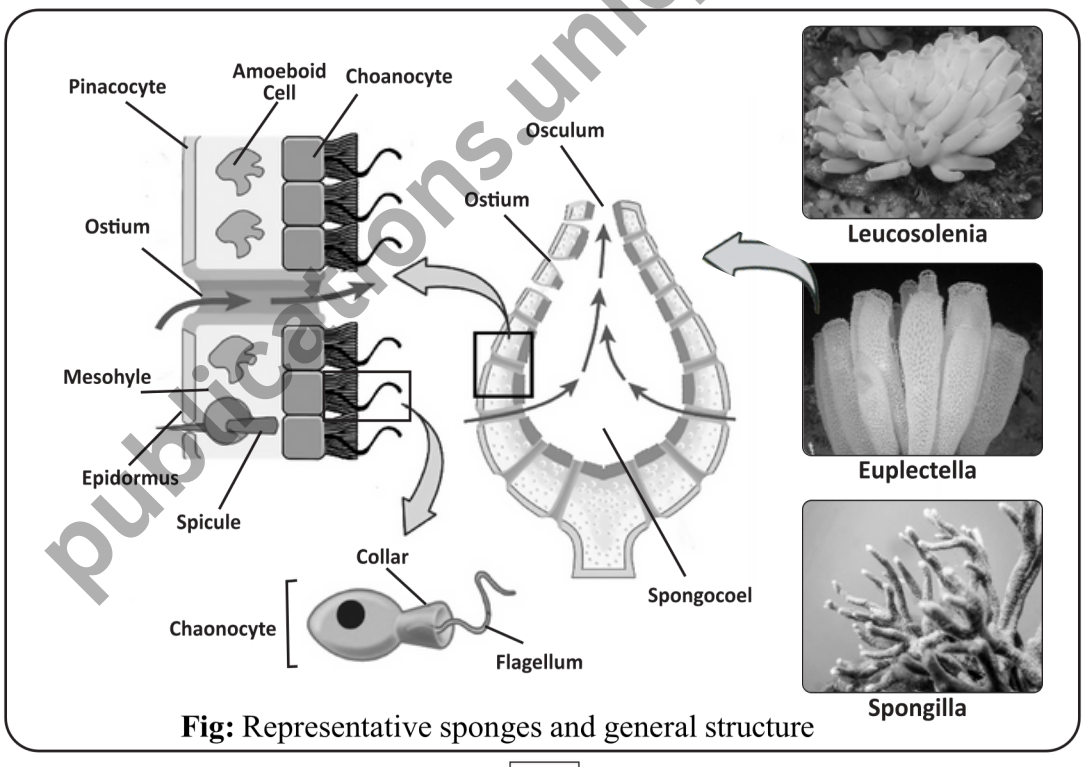


Fig: Representative sponges and general structure

5. Body Structure

- **The outer layer (pinacoderm)** of body is made of thin, flat cells called **pinacocytes.**
- **The middle layer** is jelly-like and is called **mesohyle.** It contains **amoeboid cells.**
- **The inner layer (choanoderm)**, which lines the spongocoel, is made of **choanocytes** or **collar cells.**
- They have **skeleton** in the form of minute needles of **calcium carbonate** or **silica.**

6. Reproduction

Most sponges reproduce asexually by budding or regeneration. Some sponges form resistant capsules, called **gemmules.** When parent sponge dies, it releases its gemmules. In favourable environment, amoeboid cells come out of the gemmules and form a new sponge.

Q9. Describe the general characteristics of Phylum Cnidaria. **11401009**

Ans. General characteristics of Phylum Cnidaria

1. Habitat

Almost all cnidarians are marine, although a few are found in freshwater e.g., hydra and jellyfish. Most cnidarians are colonial e.g., obelia, corals, sea fans etc. Most of them are sessile e.g., hydra, coral, obelia etc. Some cnidarians are motile e.g., jellyfish.

2. Symmetry

They are radially symmetrical animals and are diploblastic.

3. Body Structure

The adult body contains two tissue layers i.e., the **epidermis** and the gastrodermis, derived from ectoderm and endoderm respectively. Between the epidermis and gastrodermis, a jelly-like **mesoglea** is present. It contains amoeboid cells that have originated either from ectoderm or endoderm.

4. Defense System

They possess special cells, called cnidocytes. A cnidocyte contains a special organelle, called nematocyst. Nematocysts defend the body and captures prey.

5. Digestive System

Cnidarians have a blind-ending **cavity,** called **gastrovascular cavity** or enteron. It opens outside by a single opening, the mouth. **Mouth** also acts as anus for the removal of undigested material. Mouth is surrounded by a series of projections, called **tentacles.** This type of digestive system in which there is a single opening for the entry of food and removal of undigested matter, is called sac-like/sac-type digestive system.

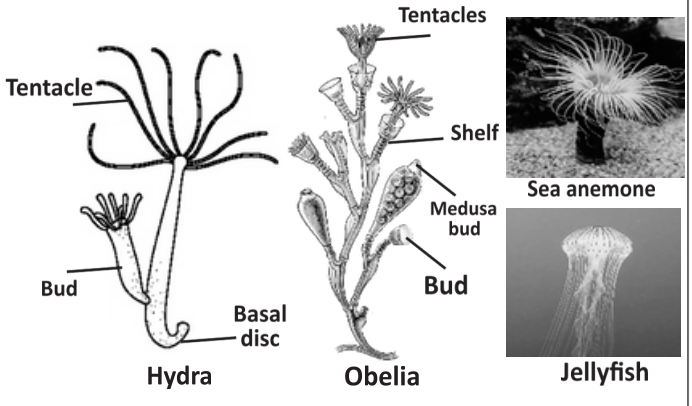


Fig: Representative cnidarians

6. Nervous System

The nervous system is in the form of a network of neurons in the body wall. There is **no central nervous system** (brain and spinal cord), respiratory, excretory and transport systems.

7. Body Forms

There are two body forms in cnidarians i.e., polyps and medusae.

- **Polyps** are cylindrical and are attached to a substrate at the **aboral end.** They reproduce asexually.
- **Medusae** are umbrella-like and are free-swimming. They reproduce sexually.

Q10. Describe the general characteristics of Phylum Platyhelminthes. 11401010

Ans. General characteristics of Phylum Platyhelminthes (literal meaning: flat worms)

They are called "flatworms". They are unsegmented and body is soft and dorsoventrally compressed.

1. Habitat: Most of them are free-living e.g., planaria. Some are endoparasites of humans and other animals e.g., liver fluke, tapeworm, and blood-fluke.

2. Body Organization

They are triploblastic i.e., the tissues of the body are derived from three embryonic layers i.e. **ectoderm, mesoderm** and **endoderm.**

★ **Segmented body:** Tape worm belonging to phylum Platyhelminthes are segmented.

3. Body Cavity

They are **acoelomates (no body cavity).** A loose connective tissue called **parenchyma** fills space between the body wall and body organs.

4. Bilateral Symmetry

They have bilateral symmetry with distinct **left and right** sides as well as **dorsal and ventral** sides.

5. Excretory System

They have a network of tubular **protonephridia.** These tubules have numerous branches. Each branch ends in a bulb-like cell called **flame cell.**

The cilia of flame cells beat to suck surrounding fluid into the tubules. The tubules filter the waste materials from fluid and release them out of body wall through a small opening called a **nephridiopore.**

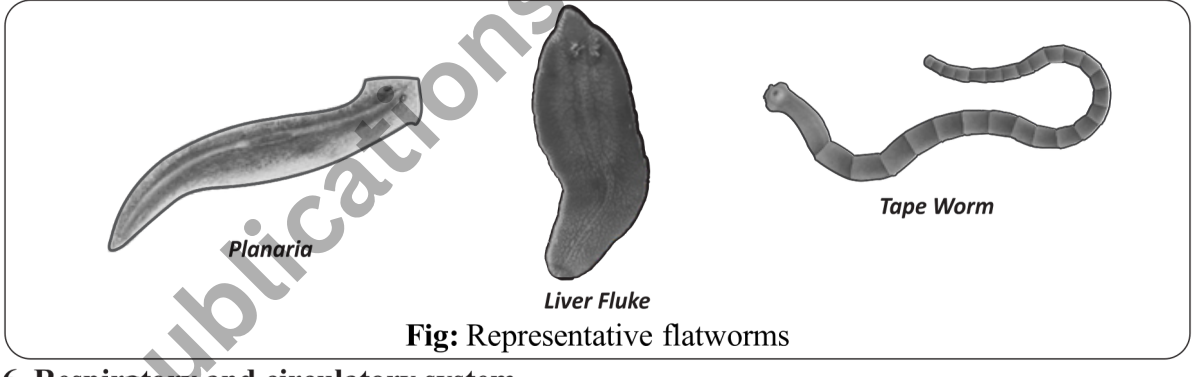


Fig: Representative flatworms

6. Respiratory and circulatory system

They do not have respiratory and circulatory (transport) systems.

7. Nervous System

They have a network of neurons. There are **cerebral ganglia** in the anterior end (head). These ganglia are attached to **longitudinal nerve cords** that are **interconnected across** the body by transverse branches.

8. Eyespots

Most free-living flatworms have two simple eyespots at their anterior end.

9. Reproduction

Flatworms reproduce asexually by "fission" in which the animal constricts in the middle and then divides into two pieces. Each piece then regenerates the missing part. The sexually-reproducing flatworms are hermaphrodites (bisexual).

Q11. Outline the general characteristics of Phylum Nematoda. 11401011

Ans. General characteristics of Phylum Nematoda (literal meaning: thread-like)

★**Aschelminths:** They are roundworms with elongated worm-like (round) body with pointed ends.

The pseudocoelomates are classified in **seven** phyla. These phyla are grouped as a unit called **Aschelminths.** Phylum Nematoda is the **representative phylum** of this group.

1. Habitat: Some roundworms are free-living (in water and soil) e.g., ***Caenorhabditis elegans.*** Many are parasites e.g., ***ascaris,*** **hookworm, pinworm,** and **whipworm.**

2. Body Organization

They are triploblastic, bilateral symmetrical, and possess unsegmented bodies.

Body Cavity: They are pseudocoelomates because they possess a false body cavity called pseudocoelom filled with fluid.

3. Digestive System

They possess tube-like digestive system. It consists of an alimentary canal with two openings; mouth at anterior end and anus at posterior end.

The parasitic roundworms have simplified digestive systems.

4. Excretory System

Their excretory system consists of **protonephridia** and two excretory canals, which unite at the anterior end to form a single canal. The single canal then opens outside through a **nephridiopore** on the ventral surface.

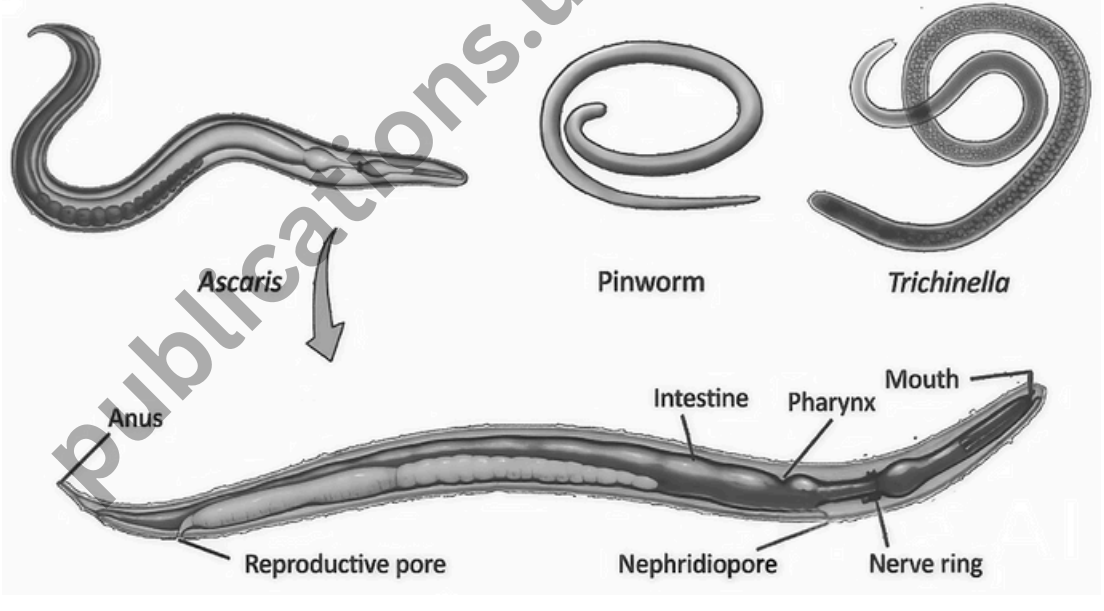


Fig: Representative roundworms and general structure

5. Nervous system
They possess a **network of neurons** in body. There is a nerve ring around the pharynx, which is attached to four longitudinal nerve cords.
6. Sense Organ
They have raised **hair-like sense organ** called **sensory papillae,** present on lips.
7. Respiratory and circulatory system
They do not have defined respiratory and **circulatory systems.**
8. Reproduction
They are **unisexual** i.e.; male nematodes have testes and female nematodes have ovaries.

Q12. Describe the general characteristics of Phylum Mollusca. **11401012**

Ans. General characteristics of Phylum Mollusca (literal meaning: soft bodied)
Molluscs have soft un-segmented bodies.
1. Habitat: They are widely distributed in natural habitats. Some of them are exclusively aquatic e.g., mussels, octopus and oyster. The others live in moist places e.g., land snail.
2. Body organization
Molluscs are triploblastic and have bilateral symmetry. They possess true coelom. Among **coelomates,** they are included in the group called **protostomes.**
3. Body Structure
Their body can be divided into **three parts** i.e., **head, visceral mass** (contains organs of digestion, excretion and reproduction), and **foot** (attached with visceral mass).
4. Mantle Cavity
They have an epithelial envelope around the visceral mass, called as **mantle.** The space between mantle and visceral mass is called as **mantle cavity.** In most molluscs, the outer surface of mantle secretes a calcareous shell.
5. Radula
All molluscs (except bivalvia) have is a rasping tongue-like organ, called **radula.**

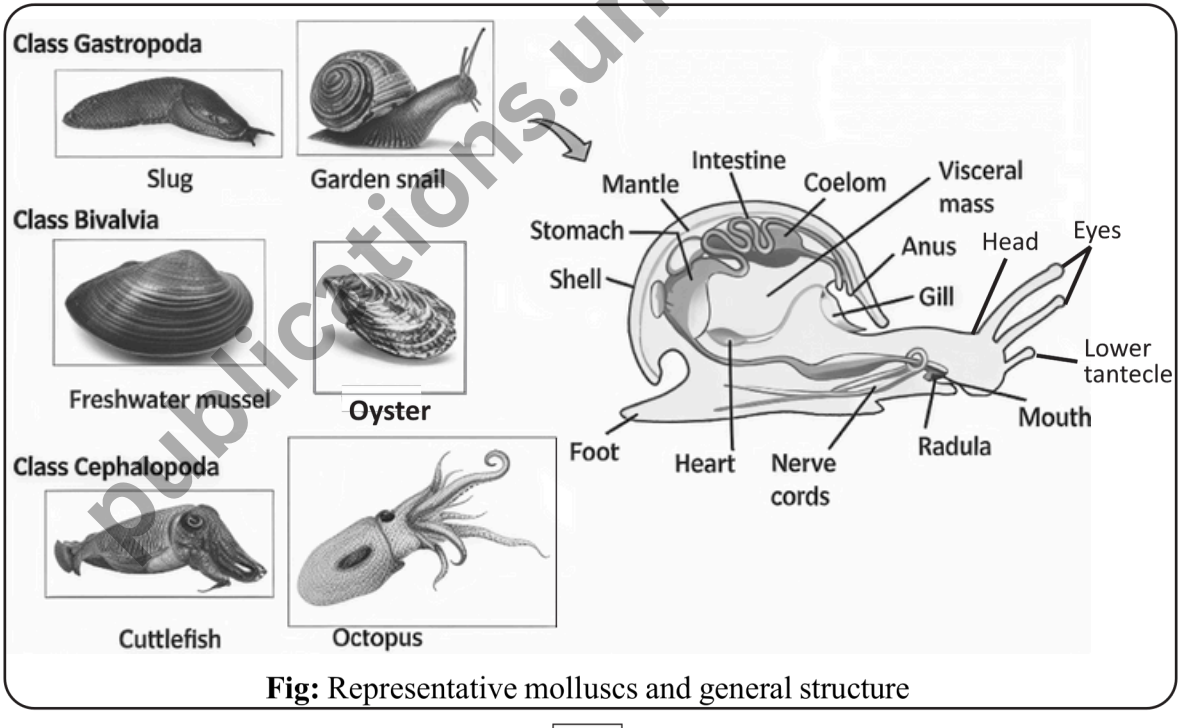


Fig: Representative molluscs and general structure

6. Circulatory System
All of them (except cephalopods) have open type blood circulatory system. Their heart consists of a **single ventricle** and **two auricles.**

7. Digestive System
They possess tube-like digestive system in which the gut has two openings, i.e., mouth and anus.

8. Excretory System
Their excretory system consists of paired tubular structures called **nephridia.** Wastes are gathered from sinuses and discharged into coelom around the heart. The nephridia open in this coelom. They have **tiny cilia** around their openings, which move the fluid from coelom into the nephridia. Nephridia discharge waste materials in mantle cavity, from where they are expelled out.

9. Respiratory System
In molluscs, gills work for the exchange of gases.

10. Nervous System
They have **three pairs of interconnected ganglia** present in the head, visceral mass and foot. The ganglia are interconnected by means of nerve cord.

11. Locomotion
They move with the help of **muscular foot.** Some molluscs are sessile. Most molluscs are unisexual.

12. Classes of molluscs
i. Class Gastropoda e.g., slug, garden snail.
ii. Class Bivalvia e.g., fresh water mussel, oyster.
iii. Class Cephalopoda e.g., octopus, cuttle fish.

Q13. Describe the general characteristics of Phylum Annelida. **11401013**

Ans. General characteristics of Phylum Annelida (literal meaning: little rings)
Annelids are commonly called segmented worms.

1. Habitat
They are found in marine water (e.g., nereis), freshwater (e.g., leech), and in damp soil (e.g., earthworm). Some annelids are ectoparasites e.g., leeches.

2. Body organization
Annelids are bilaterally symmetrical and triploblastic. They are **protostome coelomates.**

3. Metameric Segmentation
Their body is divided transversely into a number of similar parts called **segments.** Internally, the segments are separated from each other by cross walls called **septa.** Each segment is provided with its own **circulatory, excretory** and **neural elements**. This type of segmentation in body is called **metameric segmentation.**

4. Setae
Annelids have special parts called **setae.** Setae are chitinous bristles in the ventral wall of each segment. They are used for **anchoring** the worm during movement. Setae are absent in leeches. Their body wall is surrounded by a moist, acellular cuticle secreted by epidermis.

5. Digestive System
They possess **tube-like** digestive system. The digestive tube is divided into distinct parts, each performing a specific function. The parasitic annelids have simplified digestive system.

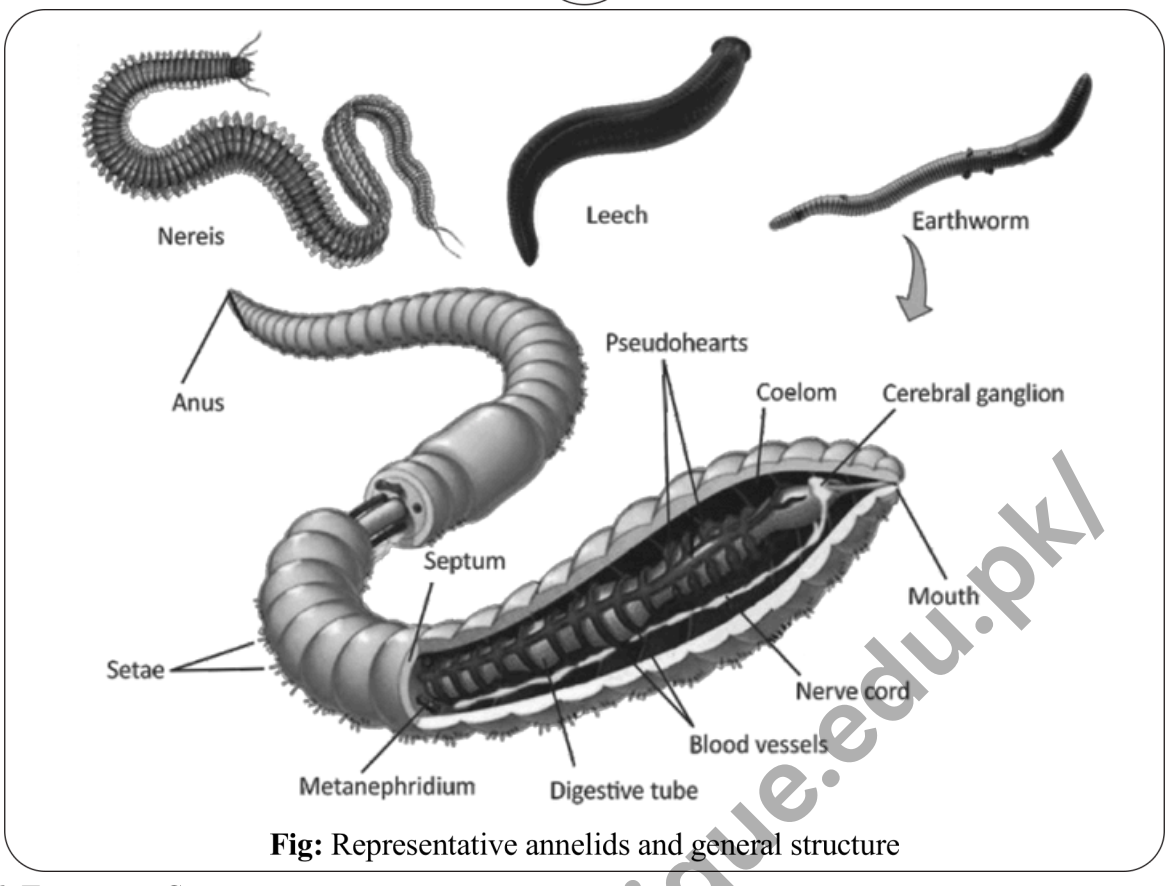


Fig: Representative annelids and general structure

6. Excretory System

Their excretory system consists of ciliated, funnel-shaped **metanephridia.** Each segment has **one pair** of metanephridia.

7. Circulatory System

They possess a **closed-type circulatory system.** Blood always flows in blood vessels. They have specialized pulsating blood vessels **(pseudohearts).** Blood of most annelids has respiratory pigment, haemoglobin, dissolved in blood plasma.

8. Respiratory System

Gaseous exchange occurs through the skin.

9. Nervous system

There is a **cerebral ganglion** or **brain** in the anterior segment. A **double,** longitudinal **ventral nerve cord** arises from brain and gives nerves in each segment. **Ganglia** are also present in each segment.

10. Receptors

They have **tactile receptors, chemoreceptors, balance receptors,** and **photoreceptors.** Some annelids also have well-developed eyes with lenses.

11. Reproductive System

Most annelids are **hermaphrodite** (e.g., earthworm, leech) and some are **unisexual** (e.g., nereis).

Q14. Elaborate the general characteristics of Phylum Arthropoda. 11401014

Ans. General characteristics of Phylum Arthropoda (literal meaning: jointed legs)

1. Habitat

Diverse groups such as insects, crustaceans, spiders, scorpions, and centipedes are included in this phylum. They are found in **every type of habitat.** Many of terrestrial members can also fly.

2. Body Symmetry

They are **triploblastic, bilateral symmetrical, protostome coelomates.** The coelom is reduced and is present only around reproductive and excretory systems.

3. Jointed Appendages

They have jointed appendages which are **modified for specialized functions** e.g., running, crawling swimming, capturing prey, respiration, reproduction etc. In different arthropods, the jointed appendages around the mouth, are modified in different ways and form mouth parts.

4. Body Structure

The body is **segmented.** Some segments are fused to form specialized body regions called **tagmata.** These include **head, thorax** and **abdomen.**

5. Exoskeleton and Ecdysis

They have exoskeleton or cuticle, which is **secreted** by the **epidermis** of body wall. It is made chiefly of **chitin.** In young arthropods, exoskeleton is **shed** from time to time. After shedding the exoskeleton, the animal grows at a fast rate and then re-secretes new exoskeleton. This process is called **ecdysis or molting.** This process is carried out by a hormone called **ecdysone.**

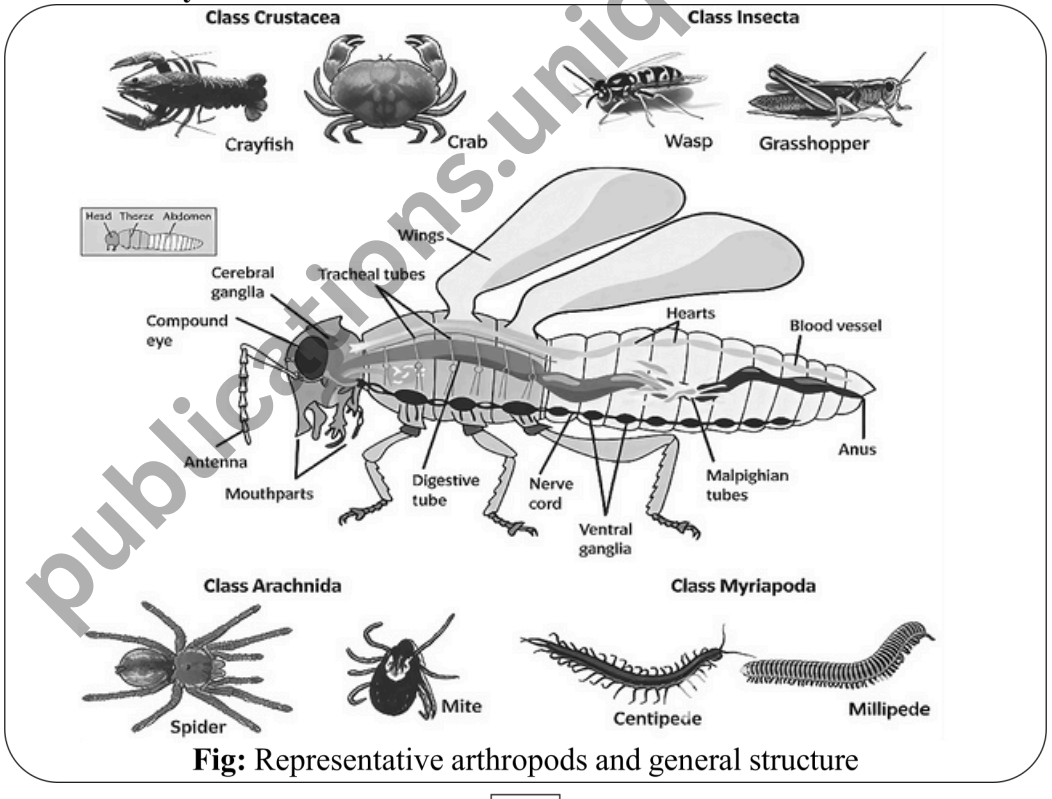


Fig: Representative arthropods and general structure

6. Circulatory System

They possess open-type circulatory system. Most of the time, blood flows in hemocoel, which is derived from an embryonic cavity called **blastocoel.** Their blood is colourless as it is without haemoglobin and is known as **haemolymph.**

7. Respiratory System

Most arthropods possess a respiratory system that consists of air tubes called **trachea**. Main tracheal tubes open out through openings called **spiracles**. Aquatic arthropods respire through gills.

8. Digestive System

Arthropods have **tube-like digestive system**. The alimentary canal is divided into different parts. (i.e. mouth, esophagous, crop, gizzard, mesenteron, ileum, colon, rectum and anus).

9. Excretory System

Their excretory system comprises of **Malpighian tubules.** These are narrow tubules projected from the alimentary canal, attached at the junction of midgut and hindgut. The nitrogenous wastes are excreted in the form of **solid uric acid crystals.**

10. Nervous System

They have well-developed **central nervous system** with three fused pairs of cerebral ganglia (brain) in head. There is a double ventral nerve cord which has ventral ganglia in each segment. Smaller nerves arise from ventral ganglia in each segment. They have well developed compound eyes and antennae. They can swim, crawl or fly depending on their habitat.

11. Reproductive System

They are unisexual and lay eggs.

12. Classes

i. Class Crustacean e.g., cray fish, crab.
ii. Class Insecta e.g., fly, mosquito, butterfly.
iii. Class Arachinida e.g., spider, mite, scorpion.
iv. Class Myriapoda e.g., centipede, millipede.

13. Important arthropods

Include insects (e.g., mosquito, butterfly, moth, wasp, beetles, grasshopper), crabs, lobsters, prawn, shrimps, crayfishes, spider, tick, mite, scorpion, centipedes and millipedes.

Q15. Explain the general characteristics of Phylum Echinodermata. **11401015**

Ans. General characteristics of Phylum Echinodermata (literal meaning: spiny skinned animals)

1. Habitat

They are exclusively marine animals. Some are flattened like **biscuit** (e.g., cake urchin), some are **star-shaped** with short arms (e.g., sea star or starfish), some are **globular** (e.g., sea urchin), some are star-shaped with long arms (e.g., brittle star), and some are **elongated** (e.g., sea cucumber).

2. Organization

They are **triploblastic** and **deuterostomes coelomates.** Their larvae are bilateral symmetrical but the adults show radial symmetry. In their radial symmetry, the body parts are arranged in five, or multiple of five, around an oral-aboral axis.

3. Skeleton

They possess a **calcareous endoskeleton** in the form of plates called ossicles. These plates are derived from mesoderm but come out of skin also and make spines on the skin.

4. Water-Vascular System

They have water-vascular system consisting of tubes and spaces present in the coelom. A ring canal surrounds the mouth. It opens outside through a sieve-like plate, called **madreporite.** Five (or a multiple of five) radial canals branch from the ring canal. Many lateral canals emerge from each radial canal and each lateral canal ends at a tube foot. Tube feet are the extensions of water vascular system.

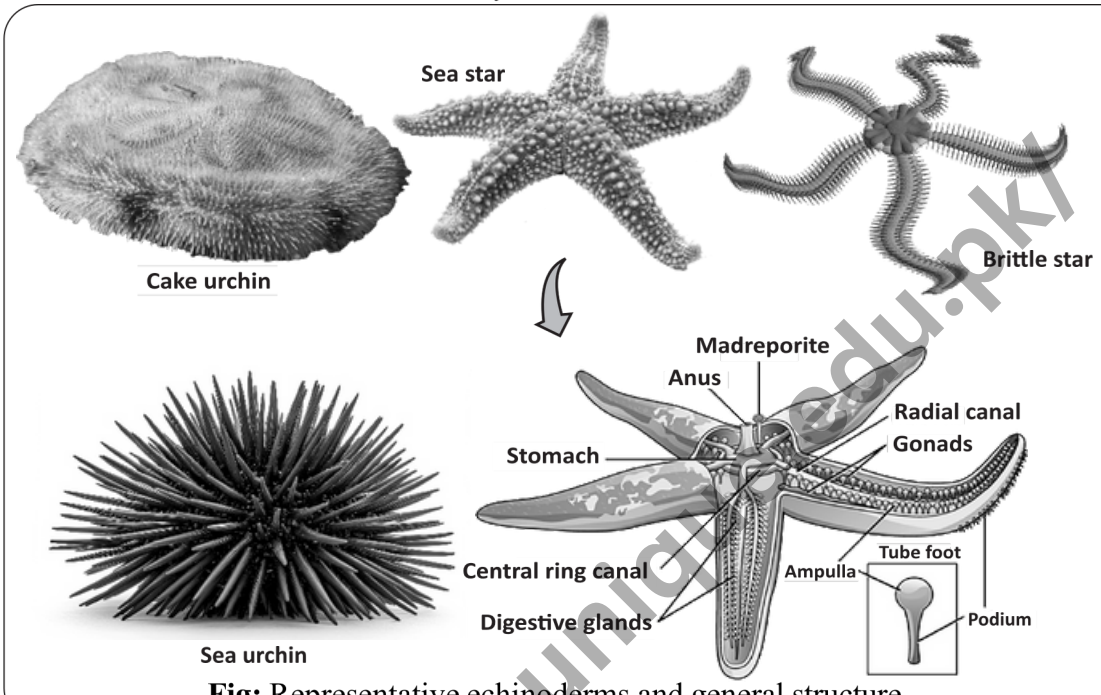


Fig: Representative echinoderms and general structure

5. Tube Feet

The tube feet extend and attach with some substrate. When water is drawn back from the sucked tube feet, they contracts and body is pulled.

6. Digestive System

Echinoderms possess **tube-like digestive system.** The mouth leads to oesophagus, stomach, intestine and rectum. The rectum opens out through anus.

7. Respiratory and excretory system

There are no specialized organs for respiration and excretion.

8. Nervous system

They possess a poorly developed nervous system made of a nerve net, a nerve ring, and five (or multiple of five) radial nerves. Most **sensory receptors** are distributed over the surface of the body and tube feet.

9. Reproduction

Asexual reproduction involves division of the body, followed by the regeneration of each half. Echinoderms are unisexual.

★**Regeneration in Echinoderms:** Many echinoderms are able to regenerate the lost parts, and some, especially sea stars and brittle stars, drop various part when they are under attack and then regenerate the lost parts.

Q16. Outline the major four characteristics to Chordata, also describe their major groups. **11401016**

Ans. Chordates are bilateral symmetrical, triploblastic, deuterostome coelomates. The following four characteristics are unique to chordates, present at some stage in development.

1. Notochord: All chordates develop notochord during embryonic life. It is a **rod-like** semi **rigid body of vacuolated cells.** It extends throughout the length of body between gut and dorsal nerve cord. The lower chordates retain this notochord throughout life. While, in vertebrates it is partly or entirely replaced by vertebral column, during development.

2. Pharyngeal slits: These are a series of openings in the lateral walls of pharynx. All chordates develop paired gill slits in embryonic stage. In some chordates (e.g., Amphioxus and fishes), these develop into gills. In some (e.g., most amphibians), these are functional for some period in their life history. In others (e.g., reptiles, birds and mammals), these are modified for various purposes.

3. Tubular nerve cord: In all chordates, a tubular nerve cord runs through the longitudinal axis of the body, just dorsal to the notochord. It expands anteriorly as a brain.

4. Post anal tail: All chordates develop a tail, posteriorly beyond the anal opening. Some chordates retain it throughout life while others degenerate it during embryonic life.

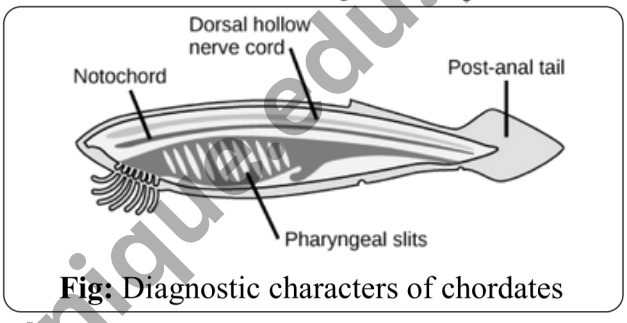


Fig: Diagnostic characters of chordates

Classification

Phylum Chordata includes two major groups i.e., **invertebrate chordates** and **vertebrates.**

Invertebrate Chordates (Lower Chordates)

i. Subphylum Urochordata includes the invertebrates chordates in which notochord and nerve cord are present only in their free-swimming larvae. Sea squirts are the examples of Urochordata.

ii. Subphylum Cephalochordata includes the invertebrate chordates in which notochord persists throughout life. Amphioxus is a common cephalochordate.

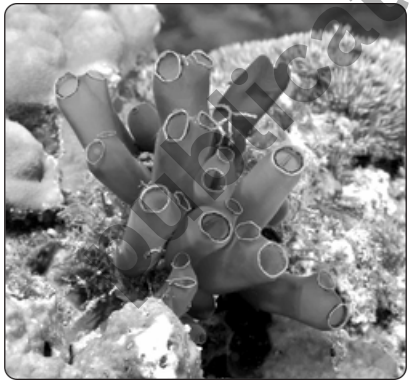


Fig: Sea squirts

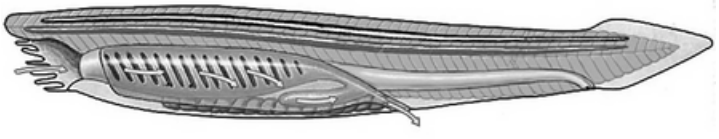


Fig: Amphioxus

Higher Chordates

Vertebrates: They have a vertebral column and cranium. Vertebrates are divided into seven classes which are placed into two groups.

CLASSIFICATION OF VERTEBRATES

Q17. Describe the basic characteristics of group Pisces. **11401017**

Ans. Basic characteristics of group pisces are as follows:

1. Habitat: Members of Class Pisces are aquatic vertebrates, meaning they live exclusively in freshwater or marine environments.

2. Streamlined Body: Their bodies are **streamlined** or **fusiform** (spindle-shaped) which helps in reducing water resistance during swimming.

3. Scales: The body is covered with scales (dermal in origin), such as **placoid, cycloid** or **ctenoid scales,** depending on the type of fish.

4. Skeleton: Skeleton can be **cartilaginous** (as in sharks and rays) or **bony** (as in most modern fish).

5. Respiratory System: Respiration takes place through **gills.** Gills are usually covered by an **operculum** in bony fishes.

6. Circulatory System: They have a **closed circulatory system.** The heart is **two-chambered** (one auricle and one ventricle). Blood circulation is **single** and **incomplete.**

7. Fins: Locomotion is achieved with the help of **paired** and **unpaired fins.** Fins also provide balance and direction during swimming.

8. Reproduction: Mostly are **oviparous** (egg-laying), but some are **viviparous** (give birth to young ones). Fertilisation may be **external** (common in bony fishes) or **internal** (common in cartilaginous fishes).

9. Ectothermic: Pisces are **ectothermic** (cold-blooded), meaning their body temperature varies with the environment.

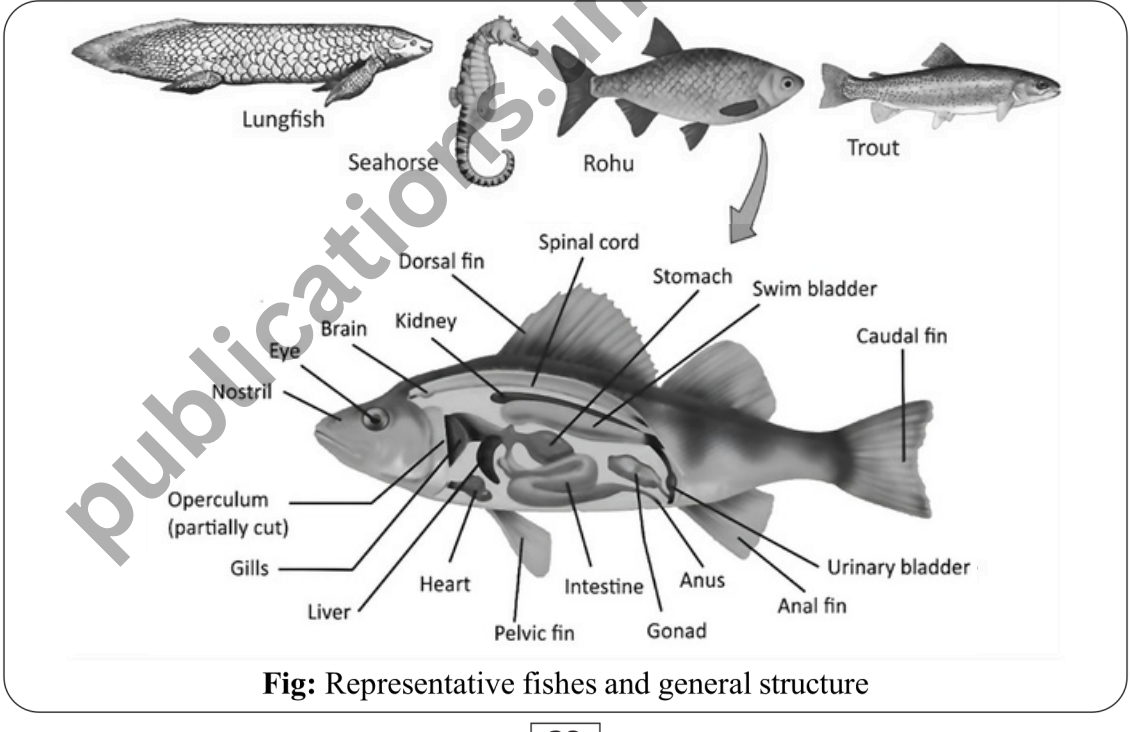


Fig: Representative fishes and general structure

	Class	Key Characteristics	Examples
Agnathans (Jawless Fishes)	Class Myxini	Mouth with four pairs of tentacles; five to fifteen pair of pharyngeal slits.	Hagfish
	Class Cephalispidomorphi	Sucking mouth, seven pair of pharyngeal slits	Lamprey
Gnathostomes (Jawed Fishes)	Class Chondrichthyes	Cartilaginous skeleton, tail fin with large upper lobe and lack swim bladder or lungs.	Sharks, skates ratfish
	Class Osteichthyes	Bony skeleton, pneumatic sac function as lungs or swim bladder.	Lungfish, Coelacanths

Q18. Describe the common traits of Class Amphibia. **11401018**

Ans. Common traits of Class Amphibia

It is the first class of tetrapods.

1. Skeleton: They have bony endoskeleton. Unlike fishes, amphibians have a neck. The first vertebra (cervical vertebra) moves against the back of skull and allows the skull to nod vertically.

2. Skin: Their skin is smooth (without scales) and moist. It helps in gas exchange, temperature regulation, and absorption and storage of water.

3. Heart: Their heart is **double-circuit.** It is **three-chambered,** with two atria and one ventricle.

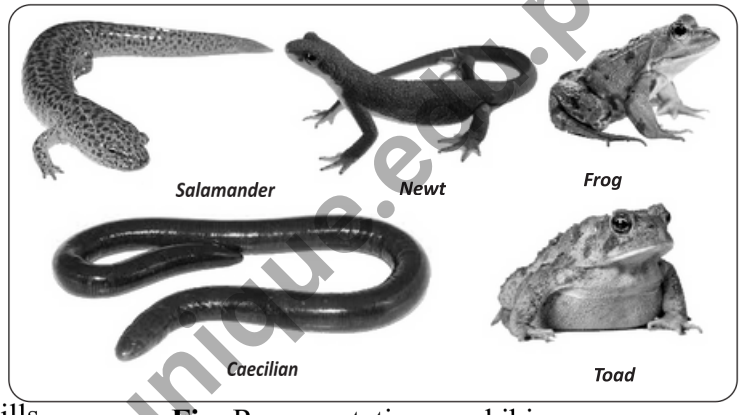


Fig: Representative amphibians

4. Respiration: They respire by gills in the larval stage and by lungs and skin in the adult stage.

5. Ectotherms: They depend on external heat source and so are ectotherms. They cannot regulate their body temperature and cannot maintain it constant, so, they are **poikilothermic** animals and **hibernate in winter.**

6. Examples: Salamander, newts, and mud puppies are **tailed** amphibians. Frogs and toads are **tail-less** amphibians, and caecilians are **legless** amphibians.

7. Reproductive System: Amphibians are unisexual. Fertilization is usually external.

Q19. Discuss the common characteristics of reptiles. **11401019**

Ans. Common traits of Class Reptiles

1. Amniotic Eggs: Reptiles are the first animal group that possess **amniotic eggs.**

2. Extra-Embryonic membranes: Amniotic eggs make protective extra-embryonic membranes i.e., **amnion, allantois,** and **chorion.** These membranes protect the embryo from drying out, nourish it and enable it to develop on land.

3. Food: The amniotic eggs also contain a large amount of yolk, the primary food supply for the embryo. Such eggs have abundant albumin, which provides additional nutrients and water.

4. Shell: The amniotic eggs are also covered with leathery calcareous shell which is partly permeable to gases but not to water.

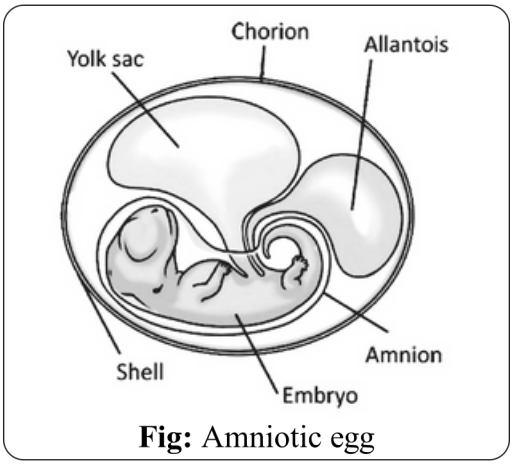


Fig: Amniotic egg

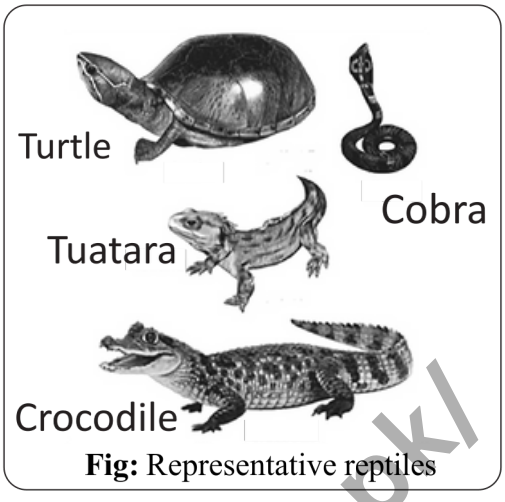


Fig: Representative reptiles

5. Skin: Reptiles have **dry** scaly skin.

6. Endoskeleton: The bony endoskeleton of reptiles is harder than amphibians. The skull is longer than amphibians. In reptiles, first two cervical vertebrae (atlas and axis) allow more movements of head.

7. Heart: In their heart, ventricle is incompletely partitioned, into left and right ventricles.

8. Thermoregulation: Reptiles, like amphibians, are **ectothermic** and use external heat source for thermoregulation. They cannot keep their body temperature at constant, and are **poikilotherms**.

9. Fertilization: Fertilization is internal, and are **oviparous** (egg-laying).

10. Examples: The present- day reptiles are lizards, snakes, tuatara and crocodiles.

Q20. Explain in detail the specific traits which belong to all Aves (birds). 11401020

Ans. Common traits of Class Aves

1. Feathers

Birds have a covering of feathers on the body. Feathers form the flight surfaces that provide lift and aid in steering. Feathers also prevent heat and water loss.

2. Thermoregulation

Birds are **endotherms.** It means that they can obtain heat from cellular processes. A source of internal heat allows them to maintain a nearly constant core temperature. The animals who can maintain their core temperature are known as **homeotherms.**

3. Body Plan

The body of birds is **streamlined** and **spindle shaped.** The forelimbs are modified into wings. Their bones are light due to **large air spaces.** The **sternum** (chest bone) bears a large bone called **keel** for the attachment of flight muscles.

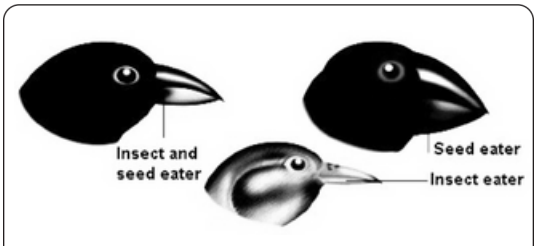


Fig: Bills and tongues are modified for a variety of feeding habits and food sources

4. Digestive System

In many birds a **diverticulum** of the oesophagus, called **crop,** is a storage structure that allows birds to quickly ingest large quantities of food. A

region of stomach, called **gizzard,** has muscular walls to crush food.

5. Heart: Their heart is **four chambered,** with complete separation of atria and ventricles, and have right aortic arch.

6. Nervous System: Birds have well developed nervous system. **Vision and hearing** are important senses for most birds.

7. Respiration

Their external nares open in pharynx through nasal passage ways. The **pharynx** leads to **trachea** and then **bronchi.** The organ of voice, called **syrinx,** is situated at the lower end of trachea. The bronchi lead to a complex system of **air sacs** that occupy much of the body and even extend to some of the bones. The air sacs connect to lungs, which are made of small air tubes called **parabronchi.**

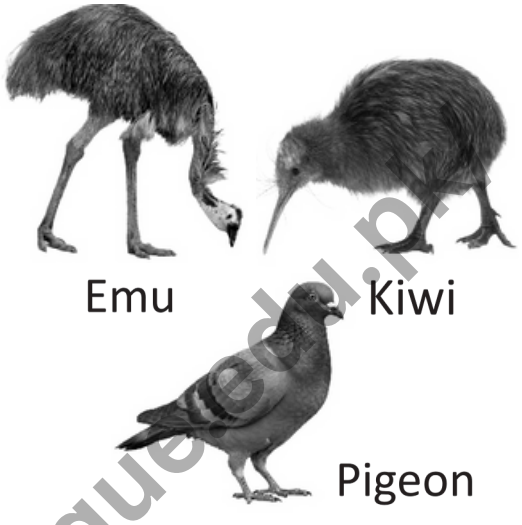


Fig: Representative birds

8. Bills

A lighter sheath called bill replaces the teeth. Bills and tongues are modified for a variety of feeding habits and food sources.

9. Fertilization

In birds, fertilization is internal and development is external i.e., they are **oviparous.**

10. Amniotic eggs: Like reptiles and egg laying mammals, birds have amniotic eggs with large amounts of yolk and albumin, covered with leathery shell.

11. Running Birds: Some birds have secondarily **lost** the power of **flight** and are called running birds e.g., ostrich, kiwi, rhea, cassowary, and emu.

12. Flying Birds: Most birds can fly, which include pigeon, parrot, crow, eagle, robin etc.

Q21. How mammals are most advanced class of Chordata? **11401021**

Ans. Advanced traits of Class Mammalia

1. Mammary glands

Mammalia includes the **group** of vertebrates which are **nourished** by **milk** from the **mammary glands** of **mother,** and have hair on their body. Mammary glands are functional in female mammals.

2. Skin

Mammals have skin glands, developed from epidermis. **Sebaceous** (oil) glands secrete oily secretion. **Sudoriferous** (sweat) glands release watery secretions used in evaporative cooling.

3. Teeth

Most mammals have **two sets** of teeth during their lives i.e., milk teeth and permanent teeth.

4. External ear or pinna

External ear or pinna is present. The middle ear has a chain of three bones i.e., **malleus, incus** and **stapes.**

5. Thermoregulation
Mammals are endothermic and homoeothermic animals.
6. Heart
They possess four-chambered heart, and have left aortic arch.
7. Diaphragm
They have a muscular diaphragm that separates the coelom into thoracic and abdominal cavities.
8. Larynx
They have well developed **voice apparatus** in the form of larynx (with vocal cords) and epiglottis.
9. Fertilization
In mammals, fertilization is internal.
10. Classification: There are three groups of mammals. They are **monotremes, placental** and **marsupials.**
i. Monotremes are egg-laying mammals that lay eggs in which whole development of their embryo proceeds. They are oviparous e.g., Duckbill platypus and echidna (spiny anteater).
ii. Marsupials have a pouch (marsupium) on the abdomen of female. These mammals give birth to immature young ones which complete their development in mothers' pouch. Opossum, kangaroo and Tasmanian wolf are the examples of such mammals.

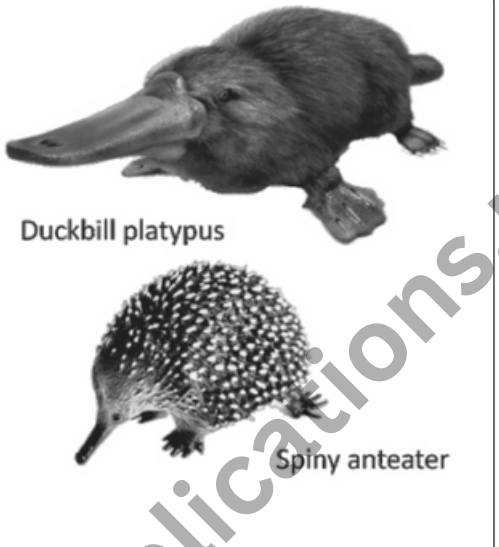


Fig: Representative egg-laying mammals

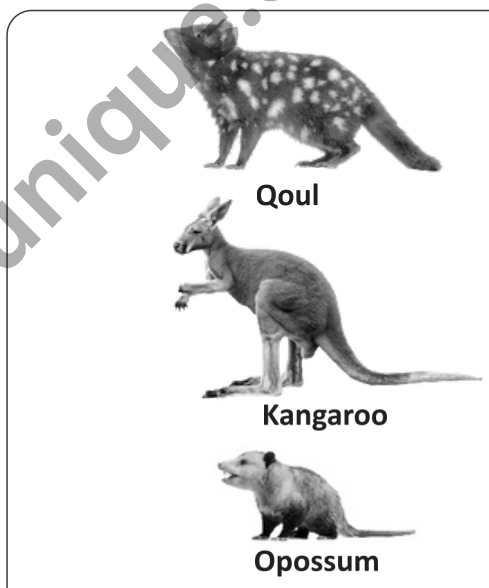


Fig: Representative pouched mammals

3. Placental mammals are the **most advanced mammals.** During development, a structure called placenta, is formed between mother's uterus wall and foetus body. The foetus is nourished and wastes from foetus are removed through this **placenta.** They give birth to young ones i.e. they are **viviparous.** Dolphin, rat, monkey, bat, elephant and human are some examples of placental mammals.

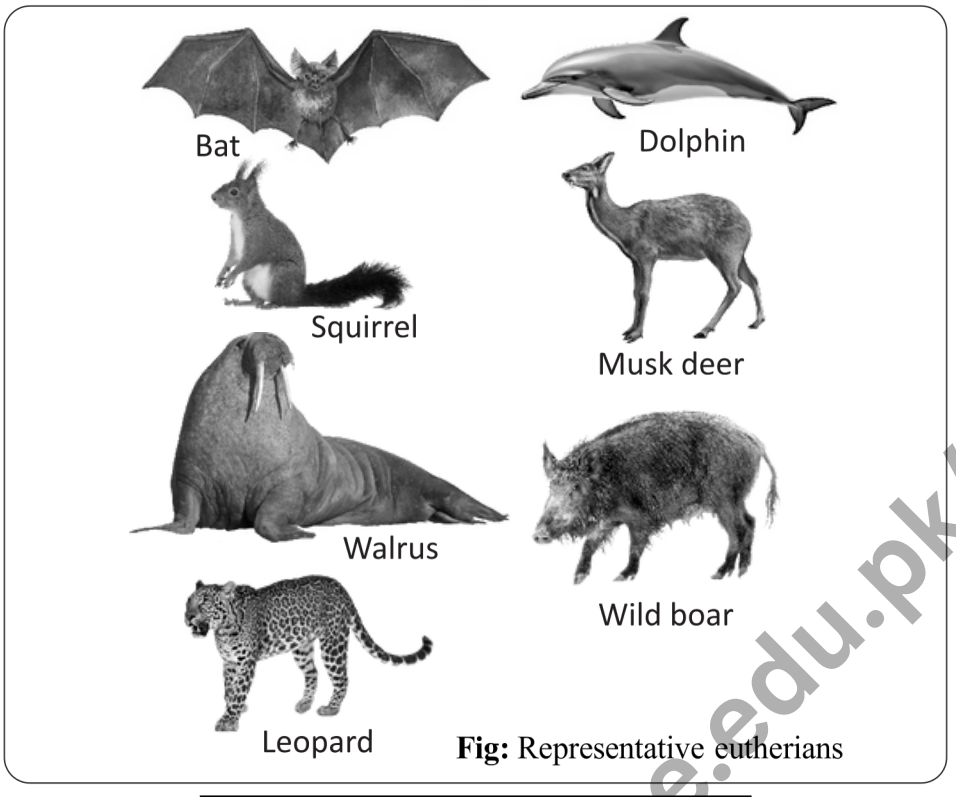


Fig: Representative eutherians

CLASSIFICATION OF VIRUSES

Q22. Why viruses are not the part of any domain/kingdom? **11401022**

Ans. Acellularity: Viruses are not considered organisms because they are acellular i.e.; not made of cells. They lack any of the characteristics of the three domains of life and are not classified in any domain and kingdom.

Structure of Viruses: A virus consists of **nucleic acid** (DNA or RNA) surrounded by a **protein coat.**

Reproduction: They cannot run any metabolism and depend upon the host cell (including plants, animals, and bacteria) to replicate and synthesize their proteins.

Classification: Viruses are classified based on several characteristics, including their genetic material, replication strategy, morphology, and the hosts they infect. The classification of viruses follows guidelines established by the International Committee on Taxonomy of Viruses (ICTV).

Q23. Write a note on classification of viruses on the basis of host range, morphology and genetic material. **11401023**

Ans.

1. Classification on the bases of Host Range

i. Animal Viruses: Infect animals, including humans. Examples: Influenza virus, Rabies virus.

ii. Plant Viruses: Infect plants e.g., Tobacco mosaic virus, Potato virus X.

iii. Bacteriophages: Infect bacteria e.g., T4 phage, Lambda phage.

iv. Archaea Viruses: Infect archaea e.g., Sulfolobus spindle-shaped virus.

2. Classification on the basis of Morphology

i. Helical Viruses: These have a capsid with a helical structure surrounding the nucleic acid.
Examples: Tobacco mosaic virus, Rabies virus.

ii. Icosahedral Viruses: These have a capsid with a symmetrical icosahedral shape (having 20 faces).
Examples: Adenoviruses, Herpesviruses.

iii. Complex Viruses: These have a complex structure, often with a combination of icosahedral and helical features, and sometimes additional structures like tails.
Examples: Bacteriophages (viruses that infect bacteria).

iv. Enveloped Viruses: These have an outer lipid envelope derived from the host cell membrane, surrounding their capsid.
Examples: Influenza virus, HIV.

v. Non-enveloped (Naked) Viruses: These lack an outer lipid envelope and consist only of a capsid enclosing the nucleic acid.
Examples: Poliovirus, Adenovirus.

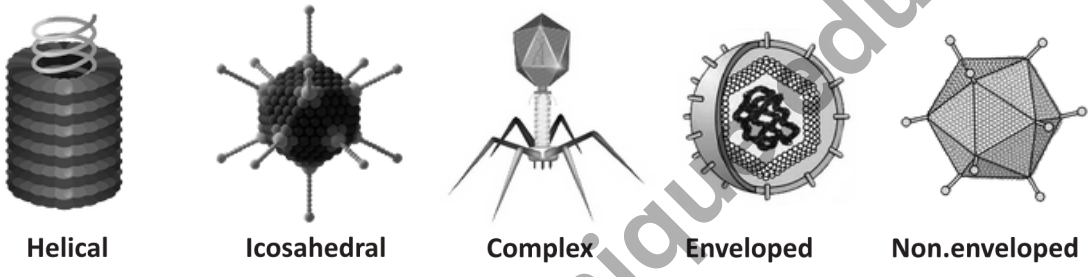


Fig: Basic shapes of viruses

3. Classification on the basis of Genetic Material

i. DNA Viruses: Viruses with DNA as their genetic material. This DNA can be single stranded (ssDNA) or double-stranded (dsDNA). Examples include:

- **dsDNA viruses**: Adenoviruses (cause respiratory infections), Herpes viruses (cause herpes, chickenpox).
- **ssDNA viruses:** Parvoviruses (cause gastroenteritis).

ii. RNA Viruses: Viruses with RNA as their genetic material. This RNA can be single stranded (ssRNA) or double-stranded (dsRNA). Examples include:

- **ssRNA viruses:** Coronaviruses (cause COVID-19), Influenza viruses (cause flu).
- **dsRNA viruses:** Rotaviruses (cause gastroenteritis).

4. Classification on the basis of Replication Strategy

i. Positive-Sense RNA Viruses: The RNA genome is directly translated into proteins by the host cell's ribosomes. Examples include **Poliovirus, Hepatitis C virus.**

ii. Negative-Sense RNA Viruses: The RNA genome is transcribed into mRNA by a viral RNA polymerase before translation. Examples include Rabies virus, Ebola virus.

iii. Reverse Transcribing Viruses: These viruses replicate through a DNA intermediate using the enzyme reverse transcriptase. They can have RNA or DNA genomes.

Examples:

- **RNA genome:** Retroviruses like HIV (cause AIDS).
- **DNA genome:** Hepadnaviruses like Hepatitis B virus.

★Q24. Describe the concept of an ecosystem and niche. **11401024**

Ans. Ecosystem

An ecosystem is a dynamic and interactive system composed of living organisms and their physical environment. It includes all the biotic factors as well as the abiotic factors.

i. Biotic Components

Biotic components include all living organisms including plants and animals supported by biosphere. Biosphere is spread out over the surface of the planet earth extending about 8-10 kilometers to the upper reaches of atmosphere and also the same distance into the depths of oceans.

ii. Abiotic Components

Abiotic components include all **non-living** components **air, water,** and **soil.** In ecological term they are called as: (a) atmosphere --- (atmo – air, sphere - place) (b) hydrosphere --- (hydro - water, sphere – place) (c) lithosphere --- (litho – earth-soil, sphere – place).

Niche

A niche refers to the role or function of an organism or species within an ecosystem. It includes its habitat, its interactions with other organisms (predation, competition, and symbiosis), and its role in energy flow within the ecosystem.

Factors

- Ecological niche with habitat also specifies how the organism gets its supply of energy and materials – for examples organism's predators, prey and competitor as well as its behaviour and interactions are considered elements of its niche.
- In addition, niche includes all the physical factors of the environment necessary for survival, such as range of temperature, amount of humidity, the pH of the water and soil.

Q25. Define Biodiversity. Explain the different levels at which biodiversity can be assessed. How do these levels contribute to our understanding of biological diversity and conservation efforts? **11401025**

Ans. Biodiversity

Biodiversity, a term derived from "biological diversity," refers to the **variety of life forms** present in different ecosystems, encompassing the diversity of species, genes, and ecosystems. It represents the richness and variability of living organisms and their interactions with each other and their environments.

Biodiversity Assessment Levels

The assessment of biodiversity involves multiple levels, each providing unique insights into the complexity of life.

i. Species Level: At the species level, biodiversity is assessed by **identifying and counting** the **different species** present within a given area. Species diversity includes not only the number of species but also their relative abundance and distribution.

By assessing biodiversity at species level helps the biologists to know about the threatened or endangered species in area of particular study and to take prompt actions to conserve them.

ii. Genetic Level: At the genetic level, biodiversity refers to the **variety of genetic information** contained within all individual organisms of a species. This genetic diversity is crucial for the adaptability and survival of species, enabling them to cope with environmental changes and challenges.

Assessment at genetic level helps the biologists in conservation of those species which have lesser genetic variety, because of fewer genetic variations in a species increases the risk of extinction.

iii. Ecosystem Level: At this level, biodiversity assessment includes the **range of habitats,** from forests and wetlands to grasslands and deserts. It involves understanding how different ecosystems function and how they contribute to overall ecological health.

It helps the biologists in the protection and conservation of habitats by restoration of degraded ecosystems and protecting those ecosystems which at risk of being degraded.

Q26. What is random sampling? Discuss the importance of random sampling methods in ecological studies. **11401026a**

Ans. Random Sampling

Sampling is a method of **investigation** the abundance and **distribution of species** and populations within a **given time** and in a **specific area.** There are **two** different types of sampling i.e. **random** and **systematic.**

In random sampling the **location of sampling** is selected **randomly** or due to chance.

Importance of Random Sampling in Determining Biodiversity

Random sampling is a fundamental technique in ecological studies for assessing biodiversity within a specific area. This method is crucial for several reasons:

1. Minimizes Bias: It ensures that every part of the study area has an equal chance of being sampled, which provides a more accurate representation of the overall biodiversity.

2. Provides Reliable Estimates: Random sampling allows for the collection of data that can be statistically analyzed to estimate species richness, abundance, and distribution.

3. Facilitates Comparisons: It enables comparisons between different areas or habitats by providing standardized methods of data collection.

4. Enhances Representativeness: By covering different parts of the study area, random sampling ensures that the sample represents the diversity of the entire area.

5. Supports Conservation Efforts: Accurate biodiversity assessments through random sampling are essential for identifying areas of high conservation value and for monitoring changes in biodiversity over time.

Q27. Describe the various methods to assess biodiversity and discuss their importance. **11401026b**

Ans. Methods to Assess Biodiversity

Various methods are employed for assessing the distribution and abundance of organisms in an area:

Methods to Assess Distribution

1. Quadrat Sampling

It involves dividing the **study area into a grid** and sampling within randomly selected **squares (quadrats)**.

Importance: This method is particularly **useful for studying plant populations** or sessile organisms. **For example,** in a forest, a researcher might lay out quadrats of a fixed size and record the presence or absence of each plant species within these quadrats.

2. Transect Sampling

It involves **laying out a line or strip** (transect) across the study area and recording species at regular intervals along this line.

Importance: This method is effective for **studying the distribution of species** across environments. **For example,** in a coastal zone, a transect can be laid from the high tide line to the low tide line, to record the types and abundance of intertidal organisms.

3. Aerial Surveys

Aerial surveys use aircraft or drones to observe and record the **distribution of organisms over large areas.**

Importance: For example, it can be used to track the distribution of bird species across a large wetland area or to monitor large mammal populations in savannas.

Fig: Methods to assess distribution of organisms

Methods to Assess Abundance

1. Point Counts: Point counts involve observing and recording the number of individuals of a species from a fixed point over a specified period. This method is commonly used for birds and other mobile animals.

2. Mark-Recapture: It involves capturing, marking (by tags, painting, bands), and releasing individuals of a species, then recapturing them later to estimate population size and density. This method is useful for animals that are difficult to count directly.

3. Quadrat Counts: In this method, researchers use quadrats to count the number of individuals of a species within each quadrat and then infer these counts to estimate overall abundance.

4. Capture-Recapture Methods: These models account for variables such as varying capture probabilities and movement between areas. This method helps in the estimation of a population size, where organisms (particularly animals) keep on moving between different areas.

5. Remote Sensing: Remote sensing uses **satellite or drone imagery** to assess the abundance and distribution of species, particularly for large-scale or inaccessible areas.

SPECIES AND SPECIATION

Q28. Define species and speciation. Explain the concept of species according to the biological species concept. How does this definition help in understanding species boundaries and the process of speciation? Provide examples to illustrate your points. **11401027**

Ans. Species

Definition: The term "species" is a fundamental concept in biology. A species is generally defined as a group of individuals that can interbreed and produce fertile offspring under natural conditions.

Characteristics

- Members of the same species **share common characteristics and genetic makeup,** which distinguishes them from individuals of other species.
  Identification of species by using physical traits and similarities can sometimes be problematic due to the existence of cryptic species - organisms that appear similar but are genetically distinct.
- German-American biologist, Ernst Mayr, emphasized **reproductive isolation** as the key criterion. According to this concept, species are groups of **interbreeding natural populations.** Members of different species do not typically mate or produce viable, fertile offspring.

Speciation

Definition: Speciation is the evolutionary process by which **new species arise** from a common ancestor. It involves the accumulation of genetic changes that lead to reproductive isolation between populations.

Mechanisms of Speciation

There are several mechanisms of speciation, for example:

1. Allopatric Speciation

It occurs when a population is geographically separated into two or more isolated groups. These groups experience different environments and evolve independently. Over time, the accumulated differences can become significant enough to prevent interbreeding, even if the geographical barrier is removed.

Example: An example is the speciation observed in Darwin's finches on the Galápagos Islands, where different populations adapted to diverse environments.

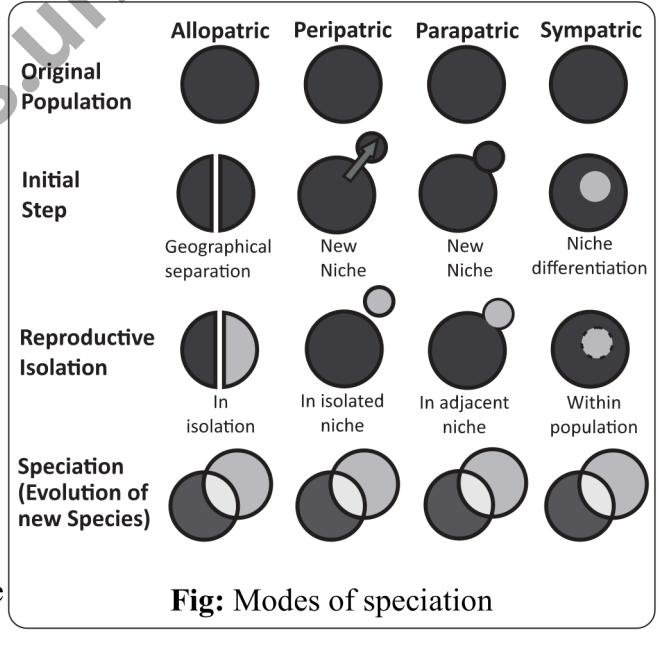


Fig: Modes of speciation

2. Peripatric Speciation

It involves a small, isolated population at the edge of a larger population. The small population undergoes rapid evolutionary changes, leading to divergence from the original population.

Example: An example can be seen in island species that evolve from a small founding population.

3. Parapatric Speciation

This occurs when populations are adjacent to each other but occupy different environments along a gradient. Gene flow between the populations is limited, and they evolve adaptations to their specific environments. Over time, this can lead to reproductive isolation.

Example: An example is the grass species ***"Anthoxanthum odoratum",*** which exhibits different adaptations to varying soil conditions across a gradient, leading to reproductive isolation in different soil types.

4. Sympatric Speciation

In this form, **new species** arise within the **same geographical area** without **physical barriers.** Sympatric speciation often occurs through mechanisms such as polyploidy (where an organism has multiple sets of chromosomes) or niche differentiation (where different subpopulations exploit different resources).

Example: For instance, certain plants can undergo polyploidy, leading to immediate reproductive isolation and the formation of new species.

MULTIPLE CHOICE QUESTIONS (EXERCISE)

1. Which domain of life is characterized by organisms that often inhabit extreme environments and have cell membranes with ether-linked lipids? **11401028**

(a) Bacteria (b) Archaea
(c) Eukarya (d) Protista

2. What is a key difference between the domains Bacteria and Archaea? **11401029**

(a) Bacteria have membrane-bound organelles, while Archaea do not.
(b) Bacterial cell walls have peptidoglycan, while Archaeal cell walls do not have it.
(c) Archaea are only found in extreme environments, while Bacteria are not.
(d) Bacteria are all unicellular, while Archaea include multicellular organisms.

3. Which of the following kingdoms includes organisms that are mostly unicellular, eukaryotic, and can be autotrophic or heterotrophic? **11401030**

(a) Fungi (b) Animalia
(c) Plantae (d) Protoctista

4. In which kingdom are organisms predominantly multicellular, autotrophic, and have cell walls made of cellulose?

(a) Animalia (b) Fungi **11401031**
(c) Plantae (d) Protoctista

5. Which of the following criteria is commonly used to classify viruses? **11401032**

(a) Their ability to cause specific diseases
(b) The type of nucleic acid they contain
(c) The colour of the virus particles
(d) Their mode of transmission

6. **Which virus group includes viruses such as Coronaviruses and influenza viruses?** 11401033
   (a) Double-stranded DNA viruses
   (b) Single-stranded DNA viruses
   (c) Double-stranded RNA viruses
   (d) Single-stranded RNA viruses
7. **At which level of biodiversity assessment do we evaluate the variety of different species within a particular habitat or ecosystem?** 11401034
   (a) Genetic diversity
   (b) Ecosystem diversity
   (c) Species diversity
   (d) Functional diversity
8. **Which method is best suited for assessing the distribution of species across a gradient of environmental conditions within a single geographical area?** 11401035
   (a) Quadrat Sampling
   (b) Point Counts
   (c)Transect Sampling
   (d) Remote Sensing
9. **Which of the following statements is true regarding the concept of a species?** 11401036
   (a) A species is always defined by its physical characteristics alone.
   (b) Different species can interbreed and produce fertile offspring.
   (c) Members of the same species are reproductively isolated from members of other species.
   (d) The concept of a species can be defined solely based on genetic similarity.
10. **What type of speciation occurs when populations are geographically separated by a physical barrier?** 11401037
    (a) Sympatric Speciation
    (b) Parapatric Speciation
    (c) Allopatric Speciation
    (d) Peripatric Speciation

SLO BASED MULTIPLE CHOICE QUESTIONS

Three-Domain System of Classification

11. **Who suggested that there are the separate groups of prokeryotes?**
    (a) Robert Whittaker 11401038
    (b) Carl Woese
    (c) F. Sanger
    (d) Frederich Meischer
12. **Domains suggested by Carl Woese in a 1990 includes.** 11401039
    (a) Domain Archaea
    (b) Domain Bacteria
    (c) Domain Eukarya
    (d) All of above
13. **Individual archaeans range from 0.1μm to over ……. In diameter.**
    (a) $10\mu m$ (b) $15\mu m$ 11401040
    (c) $20\mu m$ (d) $25\mu m$
14. **The archaeans which form aggregates or filaments ……. in length.** 11401041
    (a) $-100\mu m$ (b) $125\mu m$
    (c) $150\mu m$ (d) $200\mu m$
15. **The cell membranes of archaea contain lipids with ……. between glycerol and fatty acid chains.** 11401042
    (a) Glycosidic linkage
    (b) Peptide bond
    (c) Ether linkage
    (d) Ester linkage
16. **The lipids in the cell membranes of bacteria and eukarya have fatty acids attached to glycerol by ……** 11401043
    (a) Ester linkage
    (b) Glyosidic linkage
    (c) Phospho-diester linkage
    (d) Ether linkage

17. Which of the following is not present in the cell walls of archaea? 11401044
(a) Polysaccharides
(b) Proteins
(c) Peptidoglycan
(d) Both (a) and (b)

18. The archaeans which are vital part of sewage treatment are: 11401045
(a) Methanogens
(b) Halobacteria
(c) Thermococci
(d) Thaumarchaeota

19. Which process is the sole property of archaeans that bacteria and eukarya do not have? 11401046
(a) Photosynthesis
(b) Methanogenesis
(c) Cellular respiration
(d) Nitrogen fixation

20. Which one of the following does not belong to archaea? 11401047
(a) Firmicutes (b) Methanogens
(c) Thermococci (d) Halobacteria

21. The structure in bacteria that helps in genetic diversity and adaptation is:
(a) Flagella (b) Pili 11401048
(c) Fimbriae (d) Plasmids

22. The extremophiles which can thrive in low pH are called: 11401049
(a) Thermophiles (b) Halophiles
(c) Acidophiles (d) All of these

23. *E.coli* and *Helicobacter pylori* belongs to which group of domain bacteria:
(a) Proteobacteria 11401050
(b) Firmicutes
(c) Cyanobacteria
(d) Acidobacteria

24. Which one of the following belongs to Aquificae group of bacteria? 11401051
(a) *Treponema pallidum*
(b) *Acidobacterium*
(c) *Streptomyces*
(d) *Aquifex pyrophilus*

25. The structure that facilities intracellular transport in eukaryans is:
(a) Cytoskeleton (b) ER 11401052
(c) Golgi apparatus (d) Peroxisomes

26. The organelles of symbiotic origin are:
(a) Mitochondria & chloroplast 11401053
(b) Nucleus and mitochondria
(c) Chloroplast and RER
(d) Lysosomes and mitochondria

Taxonomic Hierarchy

27. The highest level of classification among all living organisms is: 11401054
(a) Kingdom (b) Phylum
(c) Class (d) Domain

28. The rank of taxonomic hierarchy in which organisms share a basic body plane and significant structural features is: 11401055
(a) Domain (b) Phylum
(c) Class (d) Order

29. In taxonomic hierarchy, the most specific level of classification is: 11401056
(a) Species (b) Genus
(c) Family (d) Order

30. Sparrow belongs to class: 11401057
(a) Mammalia (b) Aves
(c) Reptilia (d) Amphibia

Salient features of kingdoms of domain Eukarya

31. Amoebic dysentery is caused by a parasite: 11401058
(a) Plasmodium
(b) *Entamoeba histolytica*
(c) Trypanosoma
(d) Giant amoeba

32. Select the organism on the basis of features given heterotrophic (does not ingest food) cell wall made of a polysaccharide, unicellular or multicellular: 11401059
(a) Mushroom (b) Fern
(c) Lion (d) Euglena

33. Which of the following lacks conducting (xylem and phloem), no seed production and no flowers? 11401060
(a) Hornwort (b) Cedrus
(c) Capsicum (d) Mustard

Kingdom Animalia

34. Venus flower basket is the common name for: 11401061
(a) Leucosolenia (b) Spongilla
(c) Euplectella (d) Sycon

35. The layer of sponges which contains ameboid cells and is jelly-like is called: 11401062
(a) Pinacoderm (b) Choanoderm
(c) Mesohyle (d) Epidermis

36. Identify the cnidarian which can move freely: 11401063
(a) Hydra (b) Coral
(c) Obelia (d) Jelly fish

37. Nematocysts are the structures of defence and nutrition in: 11401064
(a) Cnidarians (b) Sponges
(c) Annelids (d) Nematodes

38. Polyps are cylindrical have functions in nutrition and are attached to the substrate at the: 11401065
(a) Oral end (b) Aboral end
(c) Lateral end (d) Cephalic end

39. Recognize the animal on the basis of information given below: 11401066
Lack respiratory and circulatory systems, tubular protonephridia cerebral ganglia in head and reproduce asexually by fission
(a) Sea anemone
(b) Tapeworm
(c) Roundworm
(d) Segmented worm

40. Which one of the following animal is pseudocoelomate? 11401067
(a) Planaria (b) Ascaris
(c) Liver fluke (d) Tapeworm

41. Select the class which does not belongs to Mollusca: 11401068
(a) Class arachnida
(b) Class gastropoda
(c) Class bivalvia
(d) Class cephalopoda

42. All molluscs have a rasping tongue-like organ called radula except: 11401069
(a) Gastropods (b) Bivalvia
(c) Cephalopoda (d) Both (a) and (c)

43. The segmented worm found in marine waters is: 11401070
(a) Nereis (b) Leech
(c) Earthworm (d) Lumbricus

44. The excretory system of annelids consists of ciliated, funnel shaped tubular structure called: 11401071
(a) Protonephridia
(b) Nephridia
(c) Nephron
(d) Metanephridia

45. Pulsating blood vessels (pseudo-hearts) closed type circulatory system, respiratory pigment hemoglobin are the characteristics of: 11401072
(a) Sponges
(b) Round worms
(c) Segmented worms
(d) Flat worms

46. The arthropods have an exoskeleton or cuticle which is secreted by the _____ of body wall: 11401073
(a) Exocuticle (b) Epidermis
(c) Gastrodermis (d) Endocuticle

47. Tagmata is the characteristic feature of: 11401074
(a) Echinoderms (b) Annelids
(c) Arthropods (d) Molluscs

48. Which one of the following is a crustacean? 11401075
(a) Crayfish (b) Spider
(c) Wasp (d) Centipede

49. Following are the classes of arthropods except: 11401076
(a) Myriapoda (b) Arachnida
(c) Crustacea (d) Gastropoda

50. Following animals are exclusively marine: 11401077
(a) Echinoderms (b) Arthropods
(c) Molluscs (d) Annelids

51. In echinoderms the calcareous endoskeleton in the form of plates called ossicles are derived from: 11401078
(a) Ectoderm (b) Mesoderm
(c) Endoderm (d) Pinacoderm

52. Which of the following is NOT a characteristics of nematodes? 11401079
(a) Unsegmented body
(b) Closed circulatory system
(c) Complete digestive system
(d) Pseudocoelom

53. Which of the following is a free living nematode? 11401080
(a) Ascaris (b) Hookworm
(c) Caenorhabditis (d) Pin worm

54. Nematodes possess a nervous system that includes: 11401081
(a) Ganglia in each segment
(b) A well developed brain
(c) a dorsal nerve cord
(d) A nerve ring and four longitudinal nerve cords

55. Nematodes are pseudocoelomates because they: 11401082
(a) Lack a body cavity
(b) Have a false-body cavity not-lined by mesoderm
(c) Have a true coelom
(d) Exhibit radial symmetry

56. The excretory system of nematodes is made up of: 11401083
(a) Malpighian tubules
(b) Nephridia
(c) Renette cells
(d) Flame cells

57. Annelids have circulatory system: 11401084
(a) Open (b) Closed
(c) Absent (d) Reduced

58. Which of the following is a hermaphroditic annelid? 11401085
(a) Nereis (b) Earthworm
(c) Leech (d) both (b) and (c)

59. The annelids which lack setae is: 11401086
(a) Earthworm (b) Leech
(c) Polychaete (d) Nereis

60. Metameric segmentation in annelids refers to: 11401087
(a) Ability to regenerate its lost parts
(b) Presence of jointed appendages
(c) Presence of notochord
(d) Division of body into similar segments

61. The mantle in molluscs secrete the following structure: 11401088
(a) Radula (b) Gills
(c) Foot (d) Shell

62. Squids and octopuses belong to which class of mollucs? 11401089
(a) Gastropoda (b) Cephalopoda
(c) Bivalvia (d) Polychaetaea

63. Excretion in molluscs is carried out by: 11401090
(a) Malpighian tubules
(b) Protonephridia
(c) Flame cells
(d) Nephridia

64. Radula or rasping-tongue in molluscs is primarily used for: 11401091
(a) Locomotion (b) Filtering
(c) Feeding (d) Excretion

65. Which of the following echinoderm is known for its ability to regenerate its lost / cut arms? 11401092
(a) Brittle star (b) Sea cucumber
(c) Cake urchin (d) Sea-urchin

66. Which of the following is not a characteristic feature of echinoderms? 11401093
(a) Deuterostome development
(b) Tube-feet
(c) Open circulatory system
(d) Calcareous endoskeleton

67. The madreporite in echinoderms is the part of ……. system: 11401094
(a) Excretory
(b) Nervous
(c) Reproductive
(d) Water vascular system

68. The adults of Echinodermata exhibit …….. symmetry: 11401095
(a) Radial (b) Bilateral
(c) Spherical (d) Both (a) and (b)

69. The water vascular system in echinoderms is basically used for: 11401096
(a) Locomotion (b) Reproduction
(c) Excretion (d) Respiration

70. Which one of the following arthropod respires through tracheal tubes? 11401097
(a) Prawn (b) Crab
(c) Spider (d) Lobster

71. The excretory structures in arthropods is: 11401098
(a) Crop
(b) Gizzard
(c) Mesenteron
(d) Malpighian tubules

72. The process of shedding old exoskeleton and forming new exoskeleton of large size in arthropods is termed as: 11401099
(a) Metamorphosis (b) Regeneration
(c) Ecdysis (d) Reproduction

73. The exoskeleton of arthropods is primarily composed by: 11401100
(a) Silica (b) Calcium carbonate
(c) Chitin (d) Cellulose

74. The unique and distinguishing characteristics of arthropods is: 11401101
(a) Closed type of circulatory system
(b) Flame cells
(c) Radial symmetry
(d) Jointed appendages

75. Which of the following is a common derived characteristic of all chordates at some stage of their life cycle? 11401102
(a) Amniotic egg
(b) Vertebral column
(c) Radial symmetry
(d) Post-anal tail

76. The tubular nerve cord in chordates is present: 11401103
(a) Lateral walls of pharynx
(b) Near the throat
(c) Dorsal to notochord
(d) Ventral to reproductive system

77. In urochordates the notochord is present:
(a) In adult stage 11401104
(b) Only in larval stage
(c) Throughout life
(d) Lack in all stages

78. Which class of fishes do not have jaws and possess cartilaginous endoskeleton? 11401105
(a) Cyclostomata (b) Chondrichthyes
(c) Osteichthyes (d) Both (b) and (c)

79. Sharks are different from other class of fishes because they: 11401106
(a) Possess internal fertilization
(b) Possess external fertilization
(c) Possess swim bladder
(d) Lack placoid scales

80. The swim bladder in bony fishes (osteichthyes) is used for: 11401107
(a) Digestion (b) Excretion
(c) Predation (d) Buoyancy

81. Which of the following is not a bony fish? 11401108
(a) Rohu (b) Trout
(c) Seahorse (d) Ray fish

82. The evolution of amniotic eggs was important for vertebrates because it: 11401109
(a) Allowed for external fertilization
(b) Enabled colonization of terrestrial habitats
(c) Reduced dependence on gills for respiration
(d) Is required for predation

83. Which of the following does not belongs to amphibians? 11401110
(a) Four-chambered heart
(b) External fertilization
(c) Moist skin
(d) Metamorphosis

84. The evolution of three chambered heart in amphibians resulted in: 11401111
(a) Complete separation of oxygenated and deoxygenated blood
(b) Double circuit circulation
(c) Reduced efficacy of gaseous exchange
(d) Both (a) and (c)

85. The feature absent in chondrichthyes but present in osteichthyes is: 11401112
(a) Cartilaginous endoskeleton
(b) Paired fins
(c) Dermal scales
(d) Swim bladder

86. Reptiles are different from amphibians in that reptiles: 11401113
(a) Have gills throughout their life
(b) Lay anamniotic eggs
(c) Lay amniotic eggs
(d) Have four limbs

87. Which of the following is not a present day reptile? 11401114
(a) Crocodiles (b) Tuatra
(c) Snakes (d) Salamander

88. In many birds there is a storage structure that allows birds to quickly ingest large quantities of food, it is: 11401115
(a) Gizzard (b) Crop
(c) Syrinx (d) Air sac

89. The birds which have secondarily lost their power of flight are called: 11401116
(a) Running birds (b) Flying birds
(c) Diving birds (d) Predatory birds

90. Which one of the following is a running bird? 11401117
(a) Parrot (b) Crow
(c) Robin (d) Emu

91. The adaptation in birds is a large bone, which allows attachment of major flight muscles, it is called: 11401118
(a) Keel (b) Scapula
(c) Suprascapular (d) Humans

92. If a vertebrate animal has a dry, scaly skin and lays leathery shelled eggs it most likely belongs to class: 11401119
(a) Amphibia (b) Reptilia
(c) Aves (d) Mammalia

93. The characteristics feature shared by amphibians and reptiles, but not by the birds is: 11401120
(a) Amniotic eggs
(b) Feathers
(c) Ectothermy
(d) Two chambered heart

94. Mammals include group of vertebrates which are nourished by milk from …… glands of mother: 11401121
(a) Endocrine (b) Mammary
(c) Memory (d) Prostate

95. Which one of the following mammal is a marsupial? 11401122
(a) Duck bill platypus
(b) Quoll
(c) Spiny ant-eater
(d) Horse

96. The mammals which lay eggs in which whole development of the embryo proceeds are called: 11401123
(a) Marsupials
(b) Placental
(c) Metatherians
(d) Egg-laying mammals

97. Which gland secretes sweat in mammals? 11401124
(a) Sebaceous gland
(b) Prostate gland
(c) Pineal gland
(d) Sudoriferous gland

Classification of viruses

98. Viruses are not considered organisms because they: 11401125
(a) Are acellular
(b) Cause disease
(c) Cannot be seen with naked eye
(d) Live in water

99. A Plant virus with a helical capsid is:
(a) Tobacco mosaic virus 11401126
(b) Adenovirus
(c) Herpes virus
(d) HIV

100. A researcher studying COVID-19 virus would classify it as a: 11401127
(a) ss RNA virus
(b) ss DNA virus
(c) ds DNA virus
(d) ds RNA virus

101. The viruses which lack an outer lipid envelope and consists only of a capsid enclosing the nucleic acid are called:
(a) Non-enveloped viruses 11401128
(b) Enveloped viruses
(c) Naked viruses
(d) Both (a) and (c)

102. Gastroenteritis is caused by: 11401129
(a) Parvoviruses (b) Adenoviruses
(c) Rotaviruses (d) Both (a) and (c)

103. The viruses in which RNA genome is directly translated into proteins by the host cells ribosomes are called:
(a) Positive sense RNA viruses 11401130
(b) Negative sense RNA viruses
(c) Reverse transcribing viruses
(d) All of them

104. Reverse transcribing viruses like HIV are unique because they: 11401131
(a) Lack a protein capsid
(b) Infect bacteria
(c) Convert RNA into DNA
(d) Convert DNA into RNA

Biodiversity

105. Role or function of an organism or species with in an ecosystem refers to: 11401132
(a) Niche (b) Alcove
(c) Slot (d) Recess

106. Mark-recapture method is particularly used for: 11401133
(a) Estimating abundance of easily observable species
(b) Counting species in quadrats
(c) Studying animals that are difficult to count directly
(d) Mapping large-scale distributions

107. Ernst Mayr's definition of species emphasizes: 11401134
(a) Reproductive isolation in natural populations
(b) Shared habitat preferences
(c) Identical DNA sequences
(d) Morphological similarities

108. Sympatric speciation differs from allopatric speciation because it: 11401135
(a) Requires geographical isolation
(b) Is driven only by mutation rates
(c) Involves only small populations
(d) Occurs through niche differentiation or polyploidy without physical barriers

109. Which of the following is an example of Peripatric speciation? 11401136
(a) Grasses adapting to soil gradients
(b) Reproductive isolation of grasses
(c) Undergoing polyploidy isolation
(d) Island species that evolve from a small founding population

110. The remote sensing method uses: 11401137
(a) Satellite or drone imagery
(b) Quadrates to count
(c) Observations and recording from a fixed point
(d) Marking and recapturing

ANSWER KEY

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

SHORT QUESTION ANSWERS (EXERCISE)

Q1. What are the three domains of life and how do they differ in terms of cellular structure? 11401138

Ans. Three Domains of Life

- In **1990,** American microbiologist **Carl Woese** classified living organisms into three domains i.e., domain **Archaea,** domain **Bacteria** and domain **Eukarya.**
- According to his three-domain system, domain **Archaea** and domain **Bacteria** contain prokaryotes but they differ in a number of features.

Cell structure

i. **Archaea:** They are prokaryotes, lacking membrane bounded organelles and true nucleus. Their cell membrane contains lipids with ether-linkage between glycerol and fatty acid chains.
ii. **Bacteria:** Like archaea, bacteria possess prokaryotic cell i.e., lack a true nucleus and membrane-bound organelles. Cell membrane have lipids with fatty acids attached to glycerol by ester linkages.
iii. **Eukarya:** They possess eukaryotic cells - with true nucleus enclosed by a nuclear membrane. Cells have membrane-bounded organelles e.g., mitochondria, chloroplasts.

Q2. Describe one key feature that differentiates Archaea from Bacteria. 11401139

Ans. Key feature: A key feature differentiating Archaea from Bacteria is the structure of their cell walls. The cell walls of archaea **lack cellulose and peptidoglycan.** Instead, they contain distinct polysaccharides and proteins. Some archaea have pseudopeptidoglycan.

On the other hand, bacterial cell walls contain peptidoglycan, a polymer consisting of sugars and amino acids that provides structural support.

Q3. Which kingdom is characterized by organisms with chitin in their cell walls and that are mostly decomposers? 11401140

Ans. Kingdom fungi is characterized by organisms which possess chitin (a polysaccharide) in their cell walls. They are called decomposers as they follow absorptive mode of nutrition and do not ingest food like other animals.

Examples: mushrooms, rusts, smuts and molds.

Q4. What type of speciation occurs when populations are geographically separated? 11401141

Ans. Allopatric speciation occurs when populations are geographically separated. These groups experience different environments and evolve independently.

Over time, the accumulated differences can become significant enough to prevent interbreeding, even if the geographical barrier is removed.

Example: Speciation observed in Darwin's finches on the Galápagos Islands, where different populations adapted to diverse environments.

Q5. What is the role of genetic drift in the process of speciation? 11401142

Ans. Genetic drift means change in the frequency of alleles at a locus in small population that occurs by chance. It plays important role in speciation by causing genetic divergence and creating new species.

Q6. What is the primary method used to assess species distribution along an environmental gradient? 11401143

Ans. Transect sampling is the primary and effective method used to assess species distribution across different conditions. It involves laying out a line or strip (transect) across the study area and recording species at regular intervals along this line.

Example: In a coastal zone, a transect can be laid from the high tide line to the low tide line, to record the types and abundance of intertidal organisms.

Q7. Which level of biodiversity assessment involves evaluating the variety of ecosystems in a region? 11401144

Ans. Ecosystem level involves in evaluation of variety of ecosystems in a region. Because at this level, biodiversity assessment includes the range of habitats, from forests and wetlands to grasslands and deserts. It involves understanding how different ecosystems function and how they contribute to overall ecological health.

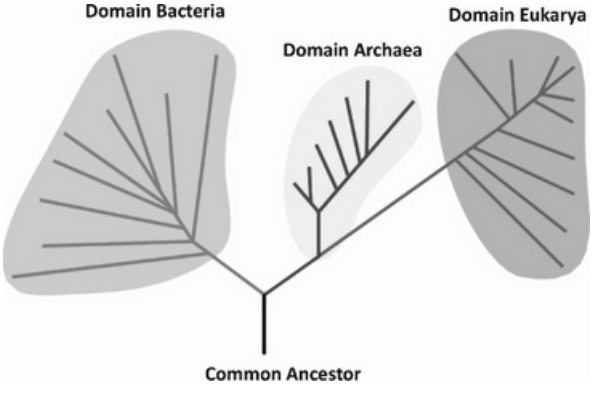
SLO BASED SHORT QUESTION ANSWERS

Three Domain System

★Q8. Define phylogeny. Define and draw phylogenetic tree. 11401145

Ans. Phylogeny: The evolutionary relationship among the organisms is called phylogeny.

Phylogenetic tree: The diagram which shows phylogeny is called phylogenetic tree or also termed as evolutionary tree.



Q9. Why did Carl Woese proposed the three-domain system and how does it differs from Whittaker's five kingdom system? 11401146

Ans. Woese proposed the three-domain system based on molecular evidence showing that prokaryotes are not a monophyletic group rather there are two separate groups of prokaryotes i.e. Archea and Bacteria.

Unlike **Whittaker's** five-kingdom system (which grouped all prokaryotes into Monera). Woese divided prokaryotes in two separate domains with Eukarya as the third domain.

Q10. What molecular evidence suggests that Archaea are more closely related to Eukarya than to Bacteria? 11401147

Ans. Evidences: Archaea share genetic sequences and the regulatory mechanisms with Eukarya, which are absent in Bacteria. This genetic similarity indicates that Archaea are more closely related to Eukarya than to Bacteria.

Q11. Define Domain. List the three domains suggested by Carl Woese. 11401148

Ans. Domain: In biological taxonomic hierarchy, the highest rank/ level of classification is termed as Domain (also called super kingdom).

In **1990** American microbiologist **Carl Woese** suggested that there are two separate groups of Prokaryotes, and classified living organisms into three domains.

i. Domain Archea
ii. Domain Bacteria
iii. Domain Eukarya

Q12. Describe the size range and reproduction in domain Archaea. 11401149

Ans. Individual archaeans: range from 0.1 μm to 15μm in diameter, some form aggregates or filament upto 200 μm in length.

Reproduction: Archea reproduce asexually by binary or multiple fission, fragmentation or budding. Mitosis and meiosis don't occur in archaea.

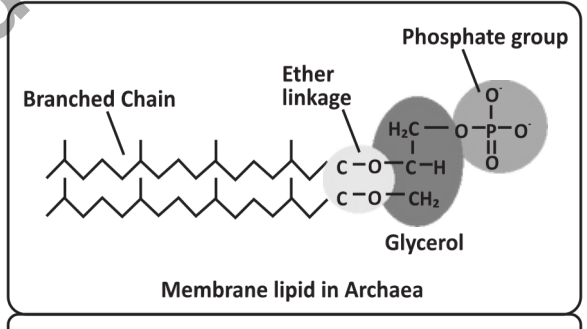
Q13. Compare the cell membrane of Archaea with bacteria and eukarya. 11401150

Ans. Cell Membrane

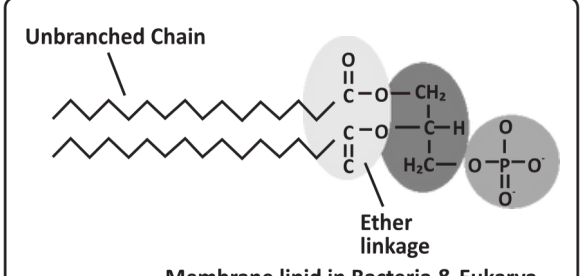
- The cell membrane of archaeans contain lipids with ether linkage between glycerol and fatty acid chains. While that of eukaryans and bacterial membrane lipids with ester-linkages between glycerol and fatty acid chains.
- Archaean fatty acid chains branched while that of eukaryans and bacterial are unbranched.

Q14. Draw the sketch of Archaean and Eukaryan membrane lipid. 11401151

Ans.



Membrane lipid in Archaea



Membrane lipid in Bacteria & Eukarya

Q15. How Archaea differs from Eukarya and Bacteria in cell wall composition? 11401152

Ans. Archaean cell wall contain distinct polysaccharides and proteins (lack cellulose and peptidoglycan).

Bacterial cell wall contain peptidoglycan (a polymer consisting of sugars and amino acids that provide structural support).

Eukaryotic cell wall in plants have cellulose and fungi have chitin.

Some archaea have pseudopeptidoglycan (differ from peptidoglycan in having sugars cross-linking patterns).

Q16. State the metabolic differences between Achaea and Eukarya or Bacteria. 11401153

Ans. Metabolic differences

- Archaea have unique metabolic processes like methanogenesis (production of methane) not found in bacteria or Eukarya.
- Bacteria exhibit metabolic pathways, including photosynthesis, nitrogen fixation and fermentation.
- Eukarya have more complex metabolic processes including cellular respiration, photosynthesis (in plants and algae), and various forms of fermentation.

★Q17. Discuss the role of different Archaea in the fields of biotechnology, sewage treatment and biomining or bioleaching. 11401154

Ans. Biotechnology

The archaeans which live in high acidity and alkalinity are source of enzymes that can function under harsh conditions e.g. enzymes of DNA replication have been extracted from theses archaeans which are used in cloning of DNA (PCR-Polymerase Chain Reaction), these enzymes work best at high temperatures.

Sewage treatment

The methanogen archaeans carry out anaerobic digestion and produce biogas.

Biomining

The acidophilic archaea are used to extract metals such as gold, cobalt and copper from ores.

Q18. Name the four major groups of Archaea, also write their habitats. 11401155

Ans. Major groups of Archaea

(i) Methanogens (produce methane as metabolic by-product)

(ii) Halobacteria (live in extremely saline environments)

(iii) Thermococci (found in hot environments)

(iv) Thaumarchaeota (involved in nitrogen cycle)

★Q19. Is there any link between Humans and Archaeans? 11401156

Ans. Yes, one of the major groups of Archaea i.e. methanogens are involved in production of intestinal gas leading to abdominal discomfort in humans. These are the part of normal flora of humans.

Q20. What kind of appendages do bacteria have? Write their roles. 11401157

Ans. Appendages: Bacteria possess flagella, pill and fimbriae, **flagella**-whip-like structures that enable locomotion **pili**-longer hair-like structures in some bacteria that help in conjugation i.e. exchange of genetic material with other bacteria. **Fimbriae** short hair-like protein appendages on bacterial surfaces, primarily involved in adhesion i.e. providing attachment to surfaces during colonization.

Q21. What are plasmids? Describe their structure and how they differ from bacterial chromosomal DNA? 11401158

Ans. Plasmids are extrachromosomal, small, circular DNA molecules that can be transferred between bacteria, aiding in genetic diversity and adaptation, while chromosomal DNA is a single circular DNA located in nucleoid region involved in reproduction.

Q22. Define EXTREMOPHILES and provide examples of the extreme conditions in which some bacteria can thrive. 11401159

Ans. Extremophiles are the organisms including some bacteria that thrive or growth in extreme environmental conditions, unsuitable for most life forms.

Examples

(i) Thermophiles: adapted to high temperature.

(ii) Halophiles: adapted to high salinity

(iii)Acidophiles: can thrive in low PH (acidic PH).

Q23. What are the similarities between archaea and bacteria? 11401160

Ans. Similarities

(i) Both archaea and bacteria possess prokaryotic cell, **lack a true nucleus** and membrane bound organelles.

(ii) Both possess a **single, circular** chromosome composed of **DNA,** located in the nucleoid region.

(iii) Both reproduce by asexual method especially **binary fission** and **fragmentation.**

Q24. Discuss the morphology of bacteria and archaea. 11401161

Ans. Morphology

Archaea occur in various shapes such as spherical, rod-shape, spiral, lobed or rectangular. Bacteria exhibit a variety of shapes. Such as cocci(spherical), bacilli (rod-shaped), spirilla (spiral shaped) and vibrios (comma-shaped).

Q25. List major groups of bacteria with examples. 11401162

Ans. Major groups of bacteria

(i) *Proteobacteria* e.g., ***Escherichia coli*, *Rhizobium*, *Helicobater pylori***

(ii) Firmicutes e.g., ***Bacillus subtilius, Lactobacillus, Clostridium botulinum.***

(iii) Actino bacteria e.g., ***Streptomyces, Mycobacterium tuberculosis***

(iv) Cyanobacteria e.g., ***Anabeana, Spiulina***

(v) Spirochaetes e.g., ***Treponema pallidum***

(vi) Acido bacteria e.g., ***Acidobacterium***

(vii) Aquificae e.g., ***Aquifex pyrophilus***

Q26. Eukaryotic cell is a highly organized structure having specialized organelles how it is functionally advantageous over prokaryotic cell? 11401163

Ans. Organized structures

Eukaryotic cells have true nucleus enclosed by a nuclear membrane, membrane bounded organelles e.g., mitochondria (makes cell energy efficient), chloroplasts (food factory) golgi apparatus, lysosomes, peroxisomes, cytoskeleton i.e., complex network of microtubules, microfilaments and intermediate filaments that provides structural support. Enables cell movement and facilitates intracellular support.

Q27. How the genetic material of eukaryotic cell is better than parokaryotic? 11401164

Ans. Genetic Material

The DNA of a Eukaryotic cells is organized into multiple linear chromosomes within the nucleus. Its DNA is associated with histone protein, which help in the organization and regulation of genes.

Q28. How does eukaryotes reproduce? 11401165

Ans. Reproduction

Most eukaryotes undergo sexual reproduction involving meiosis and fertilization leading to great genetic variety. Some eukaryotes can also reproduce asexually through mitosis, producing genetically identical offsprings.

Q29. Describe the evolutionary relationship of eukaryotic cell. How does endosymbiotic theory explains the origin of eukaryotic cells? 11401166

Ans. Origin of eukaryotic cells

Eukaryotes are believed to have originated through endosymbiosis where certain prokaryotic cells engulfed by host cells (mitochondria & chloroplast) leading to a symbiotic relationship.

Taxonomic Hierarchy

Q30. Define taxa, taxonomic hierarchy, enlist levels of taxonomic hierarchy starting from highest level. 11401167

Ans. Taxonomic hierarchy refers to the system of classifying organisms into categories or groups, to understand the relationship between different forms of life. While each level which represents a rank in the biological classification system or taxonomic hierarchy is termed as taxan (pl-taxa)

Order of taxonomic hierarchy

All organisms → domain → kingdom → phylum → class → order → family → genus → species

Q31. Differentiate between kingdom and phylum. 11401168

Ans.

Kingdom	Phylum
One of the highest taxonomic ranks, just below the domain, which groups together all forms of life that share fundamental characteristics.	The level of classification below kingdom, in which organisms share a basic body plan and significant structural features.
e.g. Animalia, plantae, Fungi are different kingdoms.	e.g., in Kingdom Animalia, the phylum chordata includes all animals with a notochord such as mammals, birds, reptiles, amphibians & fishes.

Q32. How organisms are categorized in class and order of taxonomic hierarchy? 11401169

Ans. Class

Class divides organisms within a phylum based on more specific common traits e.g. within phylum Chordata, class mammalia includes all mammals or animals, which are characterized by having hairs and mammary glands.

While order categorizes organisms within a class based on additional shared characteristics and evolutionary history e.g. within class mammalia the order primates includes humans, monkeys and apes which are characterized by their large brains and opposable thumbs (a thumb that can be placed opposite the other fingers of hand for secure grip).

Q33. How are genus and species inter-related? 11401170

Ans. Species is the most specific basic level of classification representing a single type of organisms which can interbreed and

produce fertile offsprings e.g. *Homo sapiens*, sapiens refers to modern humans.
On the other hand **genus** more specific rank within a family, grouping species that are very closely related and often visually similar e.g. within family Hominidae, the genus Homo includes humans and closet extinct relatives (Like Homo habilis, Homo erectus).

Q34. Write down the taxonomic hierarchy of humans and onions. 11401171

Ans.

Domain	Eukarya	Eukarya
Kingdom	Animalia	Plantae
Phylum	Chordata	Tracheophyta Angioperms
Class	Mammalia	Monocots
Order	Primates	Asparagales
Family	Hominidae	Amaryllidaceae
Genus	Homo	Allium
Species	*Homo Sapiens*	*Allium cepa*

Q35. Write down the biological classification of sparrow. 11401172

Ans.

Domain	Eukarya
Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Passeriformes
Family	Passeridae
Genus	Passer
Species	*Passer domesticus*

Salient Features of Kingdom of Domain Eukarya

Q36. Describe the salient features of kingdom Protista, enlist their major groups. 11401173

Ans. Salient Features

Kingdom Protista includes eukaryotes which are unicellular, colonial, filamentous or simple multicellular organisms. (that do not have specialized multicellular sex organs).

Major Groups

1. Animal like protists (protozoans) e.g. paramecium, amoeba, plasmodium, trypanosome.

2. Plant like protists (algae) e.g. euglena diatoms.

3. Fungi like protists myxomycota (slime molds) and oomycota (water molds).

Q37. Write a short note on major protists. 11401174

Ans. Group Protozoa

- Includes animal like protists
- They are unicellular and heterotrophic.
- e.g., paramecium, amoeba, plasmodium and trypanosoma.

Group Algae

- Includes plant-like protists
- Cell walls of cellulose
- Have chlorophyll and are autotrophs
- e.g., euglena, diatoms, green algae, brown algae etc.

Group Myxomycota & Oomycota

- Include Fungi like protists
- They have hyphae like structure
- Are saprophytic
- e.g., slime molds *(Physarum polycephalum),* water molds *(Phytophthora infestans)*

Q38. Write some important features of kingdom Fungi. 11401175

Ans. Important Features

- Fungi are eukaryotic heterotrophic (absorptive) organisms.
- Unicellular or multicellular

- Cells are covered by cell wall made up of chitin (a polysaccharide)
- Get nutrients in a unique way, they do not ingest food like animals and protists, rather absorb food from surroundings.
- Examples include **mushrooms, rusts, smuts, molds,** yeasts etc.

Q39. Brief about Major groups of Fungi. 11401176

Ans. Following are the major groups of fungi.

Zygomycota (Conjugating Fungi)

Includes fungi which lack septa in their hyphae (aseptate / non-septate / coenocytic hyphae) examples include *Rhizopus* (black bread molds) which grow on moist bread, fruits etc, *Spirobolus* (spitting fungus).

Ascomycota (Sac-fungi)

Largest group of fungi

Have spetate hypha (hyphae having septa or cross walls)

Examples include common molds, morels, truffles, cup-fungi, neurospora, yeasts.

Basidiomycota (Club-fungi)

Fungi with septate hyphae e.g. mushrooms, toadstools, puff balls, jelly fungi, bracket / shelf fungi, rusts and smut fungi.

Q40. Write down the characteristics and major groups of kingdom plantae. 11401177

Ans. Characteristics

Includes plants which are eukaryotic, multicellular organisms, having cell walls of cellulose.

- They are autotrophic (photosynthetic)
- Develop from embryos e.g. mosses, ferns, conifers, angiosperms.
- Plants are divided into two major groups
  a) Bryophytes (non-vascular plants)
  b) Tracheophytes (vascular plants)

Q41. Differentiate between vascular and non-vascular plants. 11401178

Ans.

Non-vascular plants	Vascular plants
• Called bryophytes • Lack conducting tissues (xylem & phloem) • e.g. liverworts, hornworts, mosses	• Called tracheophytes • Posses conducting tissues • e.g. seedless plants (ferns) seed plants (conifers and flowering plants)

Q42. Discuss the water flow system of sponges. 11401179

Ans. Water flow system

Sponges have two kinds of pores and a central cavity called spongocoel for filter feeding and water flow.

Pores

1. Ostia small incurrent pores through which water enters.

2. Osculum large excurrent pore, through which water leaves

Spongocoel the central cavity of sponges is called spongocoel.

Q43. Describe the layers / body structure of sponges. 11401180

Ans. Body structure

Body wall of sponges is made up of three layers.

- **Outer layer-**pinacoderm is made up of thin flat cells called pinacocytes.
- **Middle layer-**mesohyle is jelly-like layer, contains ambeboid cells.
- **Inner layer-**Choanoderm is third layer which lines the spongocoel, made up of choanocytes or collar cells.

Q44. Describe reproduction in sponges. What happens during unfavourable conditions? / How they reproduce during unfavourable conditions? 11401181

Ans. Reproduction in sponges

- Sponges reproduce sexually as well as asexually. But most sponges reproduce asexually by **budding** or **regeneration.**
- Some sponges form resistant capsules called **gemmules**, when parent sponge dies, it releases its gemmules.

On arrival of favourable conditions, ameboid cells came out of the gemmules and form a new sponge.

★Q45. How a commercial sponge is prepared? Also give examples of common sponges and uses. 11401181

Ans. Commercial sponge is prepared by drying, beating and washing a sponge until all cells are removed.

They are used in washing, bathing, used in surgical operations for fluids and blood absorption, also used for absorption of sound in building.

Examples: *Leucosolenia* *Spongilla* (Fresh water sponges)

Euplectella (Venus flower basket, marine sponges)

Q46. What are the key characteristics of cnidarians that distinguish them from other phyla? 11401182

Ans. Characteristics

Cnidarians are radially symmetrical', diploblastic animals (with epidermis and gastro-dermis),

- Possess cnidocytes containing nematocysts for defense and prey capture.
- They have gastrovascular cavity with single opening serving as both mouth and anus.

Q47. Compare the digestive systems of Cnidarians and Platyhelminthes, why might Platyhelminthes have om evolutionary advantage? 11401183

Ans. Digestive Systems

Cnidarians have a sac-like type digestive system with one opening, Platyhelminthes also have sac-type digestive system, but have branched gastro vascular cavities allowing better nutrient distribution.

Q48. Describe the general body plan of cnidarians? 11401184

Ans. Body Plan

The adult body of a cnidarian contains two tissue layers, i.e.

(i) Epidermis (derived from ectoderm)

(ii) Gastrodermis (derived from endoderm)

(iii) Mesoglea: A jelly like mesoglea in between epidermis and gastrodemis mesoglea contains amoeboid cells that have originated either from ectoderm or endoderm.

Q49. What are nematocysts? 11401185

Ans. Nematocysts

Cnidarians possess special cells called cnidocytes, which contain a special organelle called nematocysts.

Nematocysts defend the body and enable cnidarians to capture prey without complete muscles complementing their simple digestive system.

Q50. Which body forms are exhibited by cnidarians? 11401186

Ans. 1. Polyps

There are two body forms in cnidarians i.e. are cylindrical and are attached to a substrate at the aboral and they reproduce asexually by budding e.g. hydra.

2. Medusae

Medusae are umbrella like and are free swimming and use to reproduce sexually as they possess gonads e.g. jelly fish.

Q51. How flame cells are used to help in removal of nitrogenous waste in flat worms? 11401187

Ans. Removal of Waste

- Flatworms possess a network of tubular protonephridia (the excretory apparatus). These tubules have numerous branches. Which ends in a bulb-like cell, called flame cell.
- The cilia of flame cells beat to suck the interstitial fluid (the fluid present between cells) and move into the tubules (excretory ducts).
- The tubules filter waste materials (nitrogenous waste) from the fluid and release them out of body wall through an external opening called nephridiopore.

Q52. Describe the organization of body wall of flat worms. 11401188

Ans. Body Wall of Flat Worms

- Flatworms are triploblastic, acoelomate (having no body cavity), their tissues are derived from three embryonic layers, ectoderm (outer) endoderm (inner lines the gut) and mesoderm (middle) forming a loose connective tissue called parenchyma, which fills space between the body wall and body organs.
- They possess bilateral symmetry with distinct left and right sides, as well as dorsal and ventral sides.

Q53. Name the organisms belonging to phylum platyhelminthes. 11401189

Ans. Following are few examples of flat worms.

i. Planaria ii. Liver fluke
iii. Tapeworm

Q54. Describe the anatomy of parasitic round worms. 11401190

Ans. Anatomy

The parasitic round worms have excretory system of protonephridia and two excretory canals, which unite at the anterior end to form a single canal which opens outside through a nephridiopore on ventral surface.

Q55. Write names of some representative round worms. 11401191

Ans. Free living *Caenorhabditis elegans,* parasitic ascaris, hookworm, pinwarm whipworm.

Q56. Elaborate the body structure of molluscs. 11401192

Ans. Body Structure of Molluscs

Molluscs are triploblastic, coelomate protostomes (the coelomates in which blastopore form mouth, during embryonic development) their body is divided into three parts i.e.

a. Head,
b. Visceral mass (contains organs of digestion, excretion and reproduction),
c. Muscular foot (for locomotion).

Q57. What is mantle and radula in molluscs? 11401193

Ans. Mantle: Molluscs have an epitherial envelope around the visceral mass, called as mantle. The space between mantle and visceral mass is called mantle cavity. The outer surface of mantle secretes a calcareous shell in most of molluscs.

Radula: All molluscs (except bivalvia) have a rasping tongue like organ called radula. Which is used to scrap food (macrophageous type of feeding scraping feeding).

Q58. Briefly describe the cardiovascular system of molluscs. 11401194

Ans. Cardiovascular System

Except cephalopods, all the molluscs have open type of blood circulatory system where blood does not retain the vessel and directly bathes the cells in tissue space. Their heart consists up of single ventricle and two auricles.

★Q59. Why some molluscs possess open circulatory system and other molluscs have closed circulatory system? 11401195

Ans. Circulatory System

In open-type system, the blood does not retain the vessels, rather it directly bathes cells in tissue spaces (sinus), while the closed type system the blood flows in blood vessels and does not come in direct contact with tissues.

Cephalopod molluscs (octopus, cattle fish) are physically active, so the need more energy continuously that's why they need well maintained blood pressure, which is provided with closed type.

While other molluscs like snails, mussels, gastropods and bivalvia are not so physically active, that's why they need open type with low pressure.

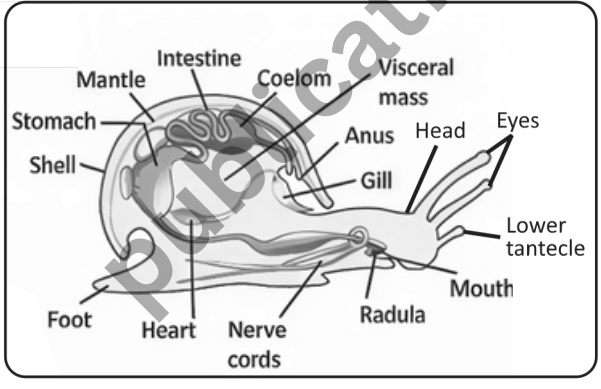
Q60. Classify molluscs with examples. 11401196

Ans. There are three classes of molluscs.

1. **Class gastropoda** – slug, garden snail.
2. **Class bivalvia** – freshwater mussel, oyster marine water muscle.
3. **Class cephalopoda** – cuttlefish, octopus.

Q61. Draw the labelled diagram of garden snail showing its anatomy. 11401197

Ans.



★Q62. Define segments in annelids. What is metameric segmentation? Why the annelids have segmented body? 11401198

Ans. Segmentation

The body of annelids is divided transversely into a number of parts called segments. These segments are indicated externally by constrictions in the form of little rings (annelid = little ring) and internally the segments are separated by cross walls called septa.

Each segment is provided with its own circulatory, excretory and neural elements, this type of segmentation is called metameric segmentation.

Q63. Enlist the representative animals belonging to annelida with their habitat. 11401199

Ans.

1. Nereis (marine water)
2. Leech (Fresh water)
3. Earthworm (damp soil)

Q64. Describe the nervous system of annelids, what type of receptors they possess? 11401200

Ans. Nervous System

The annelids possess cerebral ganglion or brain in the anterior segment. A double, longitudinal ventral nerve cord anus from brain and gives branches in each segment. Ganglia are also present in each segment.

Receptors: The annelids being advanced animals possess tactile (touch) receptors, chemoreceptors (which detect chemical concentrations) balance receptors and photo (light) receptors.

Q65. Arthropods possess very hard exoskeleton, then why they need to shed it? 11401200

Ans. Exoskeleton

Arthropods have exoskeleton or cuticle, secreted by the epidermis of body wall made up chitin (Polysaccharide) the young arthropods can't grow under this hard exoskeleton, so nature has provided them with a mechanism called molting or ecdysis during which the exoskeleton is shed from time to time.

After shedding the exoskeleton, the animal grows at a faster rate and then re secretes new exoskeleton, which is larger than the previous one.

Q66. What are tagmata? How do they differ from simple segmentation in ancestral annelids? 11401201

Ans. Tagmata

Tagmata are specialized, fused body regions (e.g. head, thorax, abdomen) in arthropods that is thought to be evolved from ancestral segmentation to enhance the functional efficiency, unlike the simple and uniform segments each having its own set of organs.

Q67. Brief about respiratory, excretory and nervous systems of arthropods. 11401202

Ans.

1. Respiratory System

Consists of air tubes called trachea, the main tracheal tube opens out through openings called spiracles, aquatic arthropods respire through gills.

2. Excretory System

Comprises of Malpaghian tubules these are narrow tubules projected from alimentary canal, attached at the junction of midgut and hindgut. The nitrogenous waster are excreted in the form of solid aric acid crystals.

3. Nervous System

A well-developed CNS with three fused pairs of cerebral ganglia (brain) in head. There is double ventral nerve which has ventral ganglia in each segment smaller nerves arise from ventral ganglia in each segment.

Q68. Classify arthropods with examples. 11401203

Ans.

1. Class Curstacea

Crayfish, crab, lobsters, prawn, shrimp

2. Class Insecta

Wasp, grasshopper, butterfly, dragonfly, lady bird, mosquito, wasp.

3. Class Arachnida

Mite, spider, scorpion, tick

4. Class Myriapoda

Centipede, millipede

Q69. What types of symmetry is possessed by echinoderms? 11401204

Ans. Symmetry

Echinoderms are triploblastic deuterostome coelomates, their larval forms exhibit bilateral symmetry but their adults show radial symmetry in which the body parts are arranged in five or multiples of five around the oral aboral axis.

Q70. Describe the water-vascular system of echinoderms. 11401205

Ans. Water-Vascular System

The water vascular system consists of tubes and spaces present in the coelom. A ring canal surrounds mouth, it opens outside through a sieve like plate, called madreporite which is connected to ring canal. From ring canal, there emerge lateral canals with each lateral canal ending into tube foot, which are the extensions of water vascular system. The tube feet extend and attach with substrate. When water is drawn back from the sucked tube feet. They contract and body is pulled.

Q71. Give examples of representative echinoderms with their body shapes.

Ans. 11401205

1. Cake urchin-biscuit shaped

2. Sea urchin-globular shaped
3. Sea cucumber-elongated body
4. Star fish (sea star)-star shaped with short arms
5. Brittle star-Star shaped with long arms.

Q72. Which unique characteristics are possessed by chordates? Name the diagnostic characters. 11401206

Ans. Key Characteristics

Following four characteristics are unique to chordates present at some stage in development.

1. Notochord
2. Pharyngeal slits
3. Tubular nerve cord
4. Post anal tail

Q73. Define notochord. In which animals it is present? 11401207

Ans. **Notochord** is a rod-like semi-rigid body of vacuolated cells (filled with proteinaceous material). Which extends throughout the length of body between gut and dorsal nerve cord during embryonic life.

Lower Chordates retain this notochord throughout life e.g. amphioxus. In **higher chordates** (vertebrates) it is partially or entirely replaced by vertebral column, during developmental stages.

Its primary purpose is to support and to stiffen the body that is to act as skeletal axis.

Q74. What are pharyngeal slits? Write their transformations in animals. 11401208

Ans. Pharyngeal slits are series of openings in the lateral walls of pharynx. All chordates develop paired gill. Slits in embryonic stages.

Transformations

- In some chordates (e.g. Amphioxus and fishes these develop into gill).
- In most amphibians these are functional for some period in their life history.
- In reptiles, birds and mammals these are modified for various purposes (e.g. formation of Eustachian tube in mammals).

Q75. Differentiate between Urochordata and Cephalochordata. 11401209

Ans.

Urochordata	Cephalochordata
Sub-phylum of chordata which includes invertebrate chordates notochord and nerve cord are present only in their free swimming larvae. e.g. sea squirts, Molgula.	Sub-phylum of chordata which includes invertebrate chordates in which notochord and nerve cord persists throughout the life. e.g., Amphioxus

Q76. Define and classify vertebrates.

Ans. Vertebrates 11401210

The animals (chordates) which have vertebral column and cranium, are called vertebrates.

Vertebrates are divided into seven classes which are placed into two groups.

Group Pisces includes 3 classes i.e. Cyclostomata, chondrichothyes and Osteichthyes, (don't have limbs).

Group Tetrapoda have four limbs, include 4 classes i.e. Amphibia, Reptilia, Aves and Mammalia.

Q77. Compare the arrangement of organs of class chondrichthyes with osteichthyes.
Ans. 11401211

Class Chondrichthyes	Class osteichthyes
• Cartilagenous skeleton	• Bony skeleton
• Body covered by placoid (tooth like) scales	• Body covered by dermal bony scales (ctenoid, ganoid, cycloid)
• Pectoral & pelvic fins are paired. Two dorsal fins.	• Possess both median (dorsal, caudal and ventral) and paired (pelvic and pectoral) fins.
• Fertilization internal e.g. skate, ray, sharks	• Fertilization external e.g. lung fish, rohu, trout.

Q78. If a frog and a lizard both laid eggs in the desert. Whose eggs would have a better chance of survival? Justify? 11401212

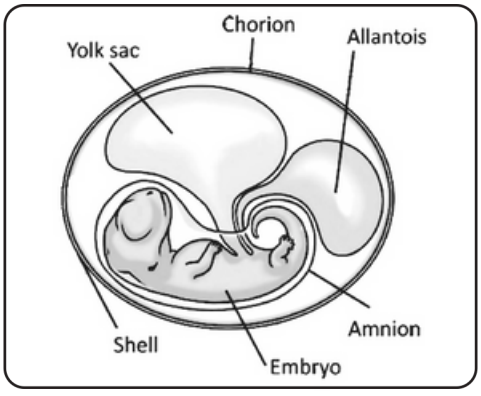
Ans. Amniotic Eggs

Lizard eggs will survive because they have amniotic eggs. Amniotic eggs make protective extra embryonic membranes i.e. amninon allantois and chorion. These membranes protect the embryo from drying out. Nourish it and enable it to develop on land.

The amniotic eggs also contain a large amount of yolk the primary food supply for the embryo. Such eggs also contain abundant albumin which provides additional nutrients and water. The amniotic eggs are also covered with leathery calcareous shell which is partly permeable to gases but not to water.

Q79. Draw the labelled sketch of an amniotic egg. 11401213

Ans.



Q80. Name the representative reptiles. 11401214

Ans. 1. Turtle 2. Cobra
3. Tuatara 4. Crocodile

Q81. Differentiate between ecothermic (poikilotherms) and endothermic (homeotherms). 11401215

Ans.

Poikilotherms	Homeotherms
• The animals which **can't regulate** their body temperature and can't maintain it constant, are called poikilotherms. • They depend on external source of heat; so are called **ectotherms.** • e.g. fishes, amphibians reptiles.	• The animals which **can maintain** their core temperature are called homeotherms. • They can obtain heat from cellular processes to maintain a nearly constant temperature, so are **endotherms.** • e.g. birds and mammals.

Q82. Why birds possess crop and gizzard? 11401216

Ans. Crop: In many birds, there is a sac-like or pouch like structure (diverticulum) of esophagous which is called crop.

It is a storage structure that allows birds to quickly ingest large quantities of food.

Gizzard is a region of stomach which has muscular walls to crush food (as the birds lack teeth).

Q83. Describe the anatomical perspective of respiratory system of birds?

Ans. Respiratory System 11401217

The birds have external nares, which open in pharynx through nasal passage ways. The pharynx leads to trachea and then to bronchi. The bronchi lead to a complex system of air sacs which connect to lungs. The lungs are made of small air tubes called parabronchi at the lower end of trachea, the organ of voice called syrinx is situated.

Q84. Why birds have different types of bills and tongues? Name some representative birds. 11401218

Ans. The bills (beaks) and tongues are of different shapes and sizes in order to adapt to specific diets feeding habits and food sources.

Emu, Kiwi, Pigeon, Sparrow, etc are some representative birds.

Q85. Differentiate between flying and running birds also write examples. 11401219

Ans. Flying birds are those which can fly e.g. pigeon, parrot, crow, eagle, robin etc. but some birds have secondarily lost the power of flight and are called running birds. e.g. ostrich, kiwi, rhea, crossway, emu, penguins etc.

Q86. Why mammals are called so? Write some distinguishing characteristics of mammals. 11401220

Ans. Characteristics of Mammals

Mammals are called mammals, because their females possess mammary gland, so they are nourished by milk from the mammay glands of mother and have hair on their body.

Skin

Mammals have skin glands developed from epidermis. Like, **sebaceous** (oil) glands, **sudoriferous** (sweat) glands.

Teeth

Most of them have two sets of teeth during their lives i.e. milk (deciduous) teeth and permanent teeth enter presence of external ear or pinna.

Middle ear bones i.e. malleus, incus and stapes.

Possess **diaphragm** that separates coelom into thoracic and abdominal cavities.

Q87. Make a clear-cut difference between oviparous viviparous and ovoviviparous, animals with examples. 11401221

Ans. Oviparous are those animals which lay eggs e.g. fishes, amphibians, reptiles and birds.

Viviparous are the animals which give birth to young ones.

Ovoviviparous are some rare animals which whole development of their embryo proceeds and are retained in mother's body. e.g. Duckbill platypus and echidna (spiny ant-eater).

Q88. Why some animals have pouch on abdomen? 11401222

Ans. Pouch in Mammals

Some mammals have a pouch or marsupium on the abdomen of their females because these mammals give birth to immature young ones which need to complete the remaining development in mother's pouch e.g. kangaroo opossum & Tasmanian wolf.

Q89. Placental mammals are most advanced. Justify? 11401223

Ans. Placental mammals are considered most advanced because, during developmental stages a structure called placenta, is formed between mother's uterus and foetus body. The foetus is nourished and wastes from foetus are removed through this

placenta. e.g. dolphin, rat, monkey, bat, elephant, humans etc.

★Q90. What do you know about prions and viroids? 11401224

Ans. Prions and viroids are also acellular entities. They are also not considered living organisms. Prions are composed of protein only and viroids are composed of circular RNA only. Both these particles cause infectious diseases in certain plants.

Examples: Potato **Spindle tuber** disease, chrysanthemum stunt disease etc.

Q91. Why viruses are not considered organisms? Write their composition.

Ans. Viruses are Acellular 11401225

Viruses are not considered organisms because they are acellular i.e. not made of cells. They lack any of the characteristics of the three domains of life and are not classified in any domain and kingdom.

A virus consists of nucleic acid (DNA or RNA) surrounded by a protein coat. They cannot run any metabolism and depend upon the host cell (including plants, animals, and bacteria) to replicate and synthesize their proteins.

Q92. On what basis, viruses are classified? Name the body who's guidelines are followed while classifying viruses? 11401226

Ans. Classification of Viruses

Viruses are classified based on several characteristics, including their genetic material, replication strategy, morphology, and the hosts they infect. The classification of viruses follows guidelines established by the International Committee on Taxonomy of Viruses (ICTV).

Q93. Classifying viruses on basis of host range also give examples. 11401227

Ans.

1. Animal Viruses: Infect animals, including humans. Examples: Influenza virus, Rabies virus.

2. Plant Viruses: Infect plants. Examples: Tobacco mosaic virus, Potato virus X.

3. Bacteriophages: Infect bacteria. Examples: T4 phage, Lambda phage.

4. Archaea Viruses: Infect archaea. Examples: Sulfolobus spindle-shaped virus.

Q94. How the viruses are classified on basis of morphology? Give examples. 11401228

Ans. 1. Helical Viruses: These have a capsid with a helical structure surrounding the nucleic acid.

Examples: Tobacco mosaic virus, Rabies virus.

2. Icosahedral Viruses: These have a capsid with a symmetrical icosahedral shape.

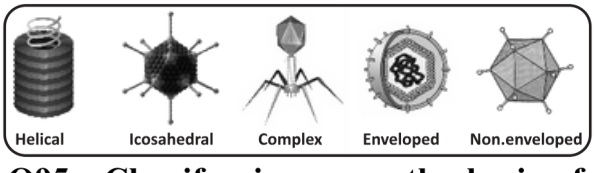
Examples: Adenoviruses, Herpesviruses.

3. Complex Viruses: These have a complex structure, often with a combination of icosahedral and helical features, and sometimes additional structures like tails.

Examples: Bacteriophages (viruses that infect bacteria).

4. Enveloped Viruses: These have an outer lipid envelope derived from the host cell membrane, surrounding their capsid. Examples: Influenza virus, HIV.

5. Non-enveloped (Naked) Viruses: These lack an outer lipid envelope and consist only of a capsid enclosing the nucleic acid. Examples: Polio virus, Adenovirus.



Q95. Classify viruses on the basis of genetic material. Also write examples with disease they cause. 11401229

Ans. 1. DNA Viruses: Viruses with DNA as their genetic material. This DNA can be single-stranded (ssDNA) or double-stranded (dsDNA). Examples include:

- **dsDNA viruses:** Adenoviruses (cause respiratory infections), Herpes viruses (cause herpes, chickenpox).

- **ssDNA viruses:** Parvoviruses (cause gastroenteritis).

2. RNA Viruses: Viruses with RNA as their genetic material. This RNA can be single-stranded (ssRNA) or double-stranded (dsRNA). Examples include:

- **ssRNA viruses:** Corona viruses (cause COVID-19), Influenza viruses (cause flu).
- **dsRNA viruses:** Rotaviruses (cause gastroenteritis).

Q96. Classify viruses on the basis of replication strategy. Write examples. 11401230

Ans. 1. Positive-Sense RNA Viruses

The RNA genome is directly translated into proteins by the host cell's ribosomes. Examples include Poliovirus, Hepatitis C virus.

2. Negative-Sense RNA Viruses

The RNA genome is transcribed into mRNA by a viral RNA polymerase before translation. Examples include Rabies virus, Ebola virus.

3. Reverse Transcribing Viruses

These viruses replicate through a DNA intermediate using the enzyme reverse transcriptase. They can have RNA or DNA genomes.

Examples include:

- **RNA genome:** Retroviruses like HIV (cause AIDS).
- **DNA genome:** Hepadnaviruses like Hepatitis B virus.

Biodiversity

Q97. Differentiate between ecosystem and niche. 11401231

Ans. Ecosystem

An ecosystem is a dynamic and interactive system composed of living organisms and their physical environment. It includes all the biotic factors as well as the abiotic factors.

Niche

A niche refers to the role or function of an organism or species within an ecosystem. It includes its habitat, its interactions with other organisms (predation, competition, and symbiosis), and its role in energy flow within the ecosystem.

Q98. Define biodiversity. List the levels of its assessment. 11401232

Ans. Biodiversity, a term derived from "biological diversity," refers to the variety of life forms present in different ecosystems, encompassing the diversity of species, genes, and ecosystems.

It represents the richness and variability of living organisms and their interactions with each other and their environments it is assessed at three levels.

1. Species level
2. Genetic level
3. Ecosystem level

Q99. What is the difference between assessing biodiversity at species level and genetic level? 11401233

Ans. Species Level: At the species level, biodiversity is assessed by identifying and counting the different species present within a given area. Species diversity includes not only the number of species but also their relative abundance and distribution.

Genetic Level: At the genetic level, biodiversity refers to the variety of genetic information contained within all individual organisms of a species. This genetic diversity is crucial for the adaptability and survival of species, enabling them to cope with environmental changes and challenges.

Q100. Enlist the reasons for the cruciality of random sampling in determining biodiversity. 11401234

Ans. Random sampling is a fundamental technique in ecological studies for assessing biodiversity within a specific area. This method is crucial for several reasons.

- It minimizes bias ensuring the equivalent chance of sampling from every part
- It provides reliable estimates allowing collection of data for statistical analysis.
- This method facilitates comparisons between different areas.
- Enhances representativeness by covering different parts of study area.
- It supports conservation efforts for monitoring changes in biodiversity over time.

Q101. Enlist the methods to assess distribution of biodiversity. 11401235

Ans. Distribution of Biodiversity

The distribution of biodiversity can be assessed by using the following methodology.

1. Quadrat sampling
2. Transect sampling
3. Aerial surveys

Q102. Compare the quadrant sampling & transect sampling methods, also give the advantages.

Ans. 11401236

1. Quadrat Sampling

It involves dividing the study area into a grid and sampling within randomly selected squares (quadrats). This method is particularly useful for studying plant populations or sessile organisms. For example, in a forest, a researcher might lay out quadrats of a fixed size and record the presence or absence of each plant species within these quadrats.

2. Transect Sampling

It involves laying out a line or strip (transect) across the study area and recording species at regular intervals along this line.

- This method is effective for studying the distribution of species across environments. For example, in a coastal zone, a transect can be laid from the high tide line to the low tide line, to record the types and abundance of intertidal organisms.

Q103. Name the methods to assess biodiversity by abundance. 11401237

Ans.

1. Point counts
2. Mark recapture
3. Quadrat Counts
4. Capture recapture methods
5. Remote sensing

Specie and Speciation

Q104. Define the terms specie and speciation. 11401238

Ans. Species

The term "species" is a fundamental concept in biology. A species is generally defined as a group of individuals that can interbreed and produce fertile offspring under natural conditions. Members of the same species share common characteristics and genetic makeup, which distinguishes them from individuals of other species.

Speciation

Speciation is the evolutionary process by which new species arise from a common ancestor. It involves the accumulation of genetic changes that lead to reproductive isolation between populations. There are several mechanisms of speciation.

Q105. Differentiate between allopatric and Peripatric speciation. 11401239

Ans.

Allopatric speciation	Peripatric speciation
• It occurs when a population is geographically separated into two or more isolated groups. • Over time, the accumulated differences can become significant enough to prevent interbreeding, even if the geographical barrier is removed. • An example is the speciation observed in Darwin's finches on the Galápagos Islands, where different populations adapted to diverse environments.	• It involves a small, isolated population at the edge of a larger population. The small population undergoes rapid evolutionary changes, leading to divergence from the original population. • An example can be seen in island species that evolve from a small founding population.

Q106. Compare Parapatric and Sympatric speciation. 11401240

Ans.

Parapatric speciation	Sympatric speciation
• This occurs when populations are adjacent to each other but occupy different environments along a gradient. • Gene flow between the populations is limited, and they evolve adaptations to their specific environments. Over time, this can lead to reproductive isolation. • An example is the grass species *"Anthoxanthum odoratum"*, which exhibits different adaptations to varying soil conditions across a gradient, leading to reproductive isolation in different soil types.	• In this form, new species arise within the same geographical area without physical barriers. • Sympatric speciation often occurs through mechanisms such as polyploidy (where an organism has multiple sets of chromosomes) or niche differentiation (where different subpopulations exploit different resources). • For instance, certain plants can undergo polyploidy, leading to immediate reproductive isolation and the formation of new species.

INQUISITIVE QUESTIONS

Q1. Compare and contrast the domains Archaea and Bacteria and discuss how these differences reflect their evolutionary histories. 11401241

Ans. See Q2. and Q3. of theory.

Q2. Explain the concept of a species according to the biological species concept. How does this definition help in understanding species boundaries and the process of speciation? Provide examples to illustrate your points.

Ans. See Q27. of theory. 11401242

Q3. Describe the major groups of Kingdom Protista and Kingdom Fungi. 11401243

Ans. See Q6. of theory.

Q4. Describe the general characteristics of following animal phyla.

(i) Phylum Cnidaria
(ii) Phylum Platyhelminthes
(iii) Phylum Mollusca
(iv) Phylum Arthropoda
(v) Phylum Echinodermata 11401244

Ans. **(i)** See Q9. of theory.
(ii) See Q10. of theory.
(iii) See Q12. of theory.
(iv) See Q14. of theory.
(v) See Q15. of theory.

Q5. Describe the general characteristics of phylum Chordata.

Ans. See Q16. of theory. 11401245

Q6. Write notes on the three groups of mammals. 11401246

Ans. See Q21. of theory.

Q7. Discuss the mechanisms of allopatric and sympatric speciation.

Ans. See Q28. of theory. 11401247

Q8. Outline the major classification systems for viruses based on their structural features and replication methods. Discuss the significance of these classifications in virology. 11401248

Ans. See Q23. of theory.

Q9. Explain the different levels at which biodiversity can be assessed. How do these levels contribute to our understanding of biological diversity and conservation efforts? 11401249

Ans. See Q25. of theory.

Q10. Discuss the importance of random sampling methods in ecological studies.
Ans. See Q26. of theory. **11401250**

Q11. Describe the concept of an ecosystem and niche. **11401251**
Ans. See Q24. of theory.

INQUISITIVE QUESTIONS

Q1. How are viruses classified based on their nucleic acid content and replication method? **11401252**

Ans: Classification on the basis of Genetic Material

1. DNA Viruses: Viruses with DNA as their genetic material. This DNA can be single stranded (ssDNA) or double-stranded (dsDNA).

Examples:

- **dsDNA viruses:** Adenoviruses (cause respiratory infections), Herpesviruses (cause herpes, chickenpox).
- **ssDNA viruses:** Parvoviruses (cause gastroenteritis).

2. RNA Viruses: Viruses with RNA as their genetic material. This RNA can be single stranded (ssRNA) or double-stranded (dsRNA).

Examples:

- **ssRNA viruses**: Coronaviruses (cause COVID-19), Influenza viruses (cause flu).
- **dsRNA viruses:** Rotaviruses (cause gastroenteritis).

Classification on the basis of Replication Strategy

1. **Positive-Sense RNA Viruses:** The RNA genome is directly translated into proteins by the host cell's ribosomes. Examples include Poliovirus, Hepatitis C virus.
2. **Negative-Sense RNA Viruses:** The RNA genome is transcribed into mRNA by a viral RNA polymerase before translation. Examples include Rabies virus, Ebola virus.
3. **Reverse Transcribing Viruses:** These viruses replicate through a DNA intermediate using the enzyme reverse transcriptase. They can have RNA or DNA genomes.

Examples:

- **RNA genome:** Retroviruses like HIV (cause AIDS).
- **DNA genome:** Hepadnaviruses like Hepatitis B virus.

Q2. What may be the drawback in the definition of species according to the biological species concept? **11401253**

Ans. According to biological species concept (BSC), a species is a group of naturally interbreeding population that are reproductively isolated from other such groups in nature.

Drawback

It is not suitable for the organisms reproducing asexually.

Q3. How does biodiversity help maintain balance in an ecosystem? **11401254**

Ans. Biodiversity is the variety of life forms present in different ecosystems. It is pivotal to maintain the balance of ecosystem. Organisms reproduce that results in population increase that is regulated by the predators that prey they organisms.

- Decomposers recycle the nutrients and minerals in soil and make it fertile.
- Pollinators help in the process of pollination, which is source of food for animals.