

Unit 1: Biodiversity & Classification

Short Questions

SHORT QUESTION ANSWERS (EXERCISE)

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

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

- 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.
- 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.

- 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.

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?

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?

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?

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?

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?

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.

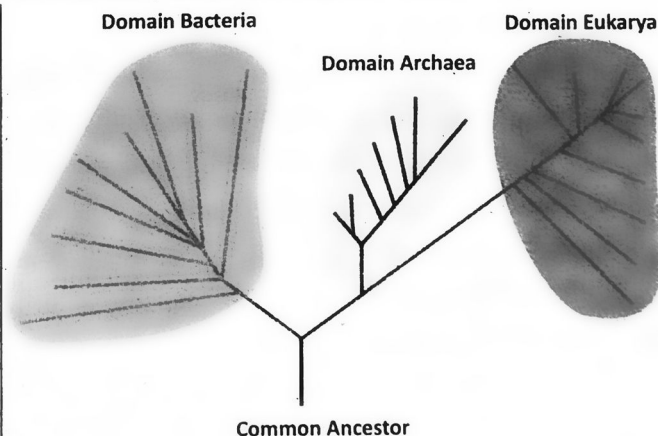
SLO BASED SHORT QUESTION ANSWERS

Three Domain System

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

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?

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?

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.

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.

Ans. Individual archaeans: range from 0.1 μm to 15 μm 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.

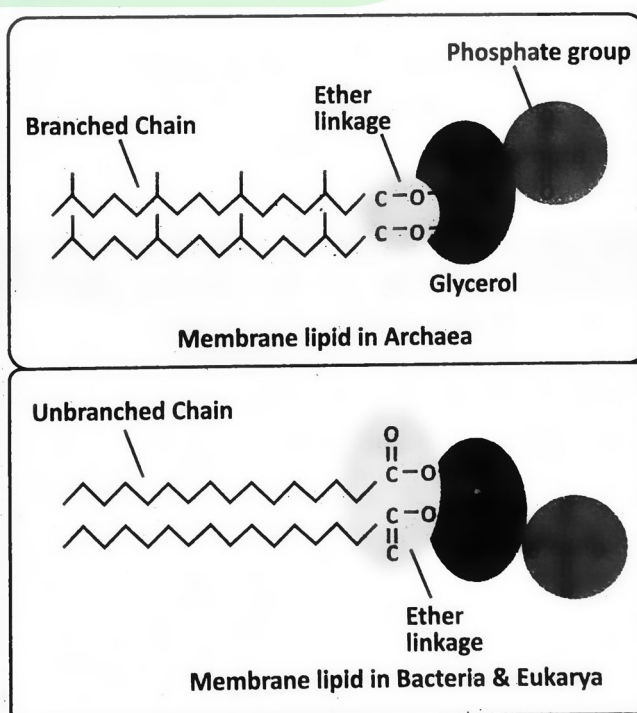
Q13. Compare the cell membrane of Archaea with bacteria and eukarya.

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.

Ans.



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

Ans. Archaeal 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 Archaea and Eukarya or Bacteria.

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.

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 these 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.

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?

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.

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?

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.

Ans. Extremophiles are the organisms including some bacteria that thrive or grow 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?

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.

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.

Ans. Major groups of bacteria

- (i) *Proteobacteria* e.g., *Escherichia coli*, *Rhizobium*, *Helicobacter pylori*
- (ii) Firmicutes e.g., *Bacillus subtilis*, *Lactobacillus*, *Clostridium botulinum*.
- (iii) Actino bacteria e.g., *Streptomyces*, *Mycobacterium tuberculosis*
- (iv) Cyanobacteria e.g., *Anabaena*, *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?

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 prokaryotic?

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?

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?

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.

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 taxon (pl-taxa)

Order of taxonomic hierarchy

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

Q31. Differentiate between kingdom and phylum.

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?

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?

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.

Ans.

Domain	Eukarya	Eukarya
Kingdom	Animalia	Plantae
Phylum	Chordata	Tracheophyta Angiosperms
Class	Mammalia	Monocots
Order	Primates	Asparagales
Family	Hominidae	Amaryllidaceae
Genus	Homo	Allium
Species	<i>Homo Sapiens</i>	<i>Allium cepa</i>

Q35. Write down the biological classification of sparrow.

Ans.

Domain	Eukarya
Kingdom	Animalia
Phylum	Chordata
Class	Aves
Order	Passeriformes
Family	Passeridae
Genus	Passer
Species	<i>Passer domesticus</i>

Salient Features of Kingdom of Domain Eukarya

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

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.

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.

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.

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, *Spirobohus* (spitting fungus).

Ascomycota (Sac-fungi)

Largest group of fungi

Have septate hypha (hyphae having septa or cross walls)

Q41. Differentiate between vascular and non-vascular plants.

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.

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.

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.

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)

Q43. Describe the layers / body structure of sponges.

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 ameboid 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?

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, ameoboid 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.

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?

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 an evolutionary advantage?

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?

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 gastrodermis mesoglea contains amoeboid cells that have originated either from ectoderm or endoderm.

Q49. What are nematocysts?

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?

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?

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.

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.

Ans. Following are few examples of flat worms.

- Planaria
- Liver fluke
- Tapeworm

Q54. Describe the anatomy of parasitic round worms.

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.

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

Q56. Elaborate the body structure of molluscs.

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.

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

Q57. What is mantle and radula in molluscs?

Ans. Mantle: Molluscs have an epithelial 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.

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?

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 they 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.

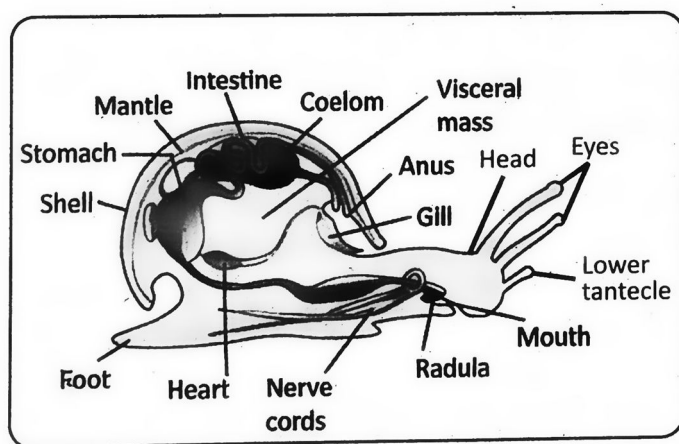
Q60. Classify molluscs with examples.

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.

Ans.



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

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.

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?

Ans. Nervous System

The annelids possess cerebral ganglion or brain in the anterior segment. A double, longitudinal ventral nerve cord runs 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?

Ans. Exoskeleton

Arthropods have exoskeleton or cuticle, secreted by the epidermis of body wall made up of 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?

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.

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 Malpighian tubules these are narrow tubules projected from alimentary canal, attached at the junction of midgut and hindgut. The nitrogenous wastes are excreted in the form of solid uric 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.

Ans.

1. Class Crustacea

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?

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.

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.

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.

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?

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.

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.

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

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, chondrichthyes 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.

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?

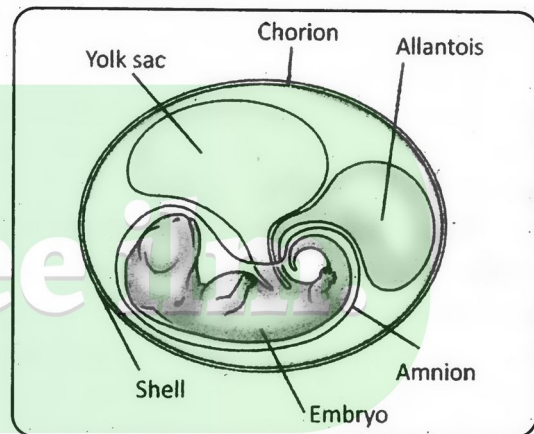
Ans. Amniotic Eggs

Lizard eggs will survive because they have amniotic eggs. 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.

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.

Ans.



Q80. Name the representative reptiles.

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

Q81. Differentiate between ectothermic (poikilotherms) and endothermic (homeotherms).

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?

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

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.

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.

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.

Ans. Characteristics of Mammals

Mammals are called mammals, because their females possess mammary gland, so they are

nourished by milk from the mammary 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.

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?

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?

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?

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

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?

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.

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.

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.

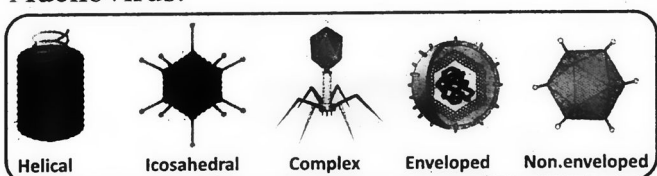
Examples: Adenoviruses, Herpesviruses.

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.

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.

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.

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.

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?

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.

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.

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.

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.

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.

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.

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.**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 "<i>Anthoxanthum odoratum</i>", 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.

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.

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

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

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.

Q6. Write notes on the three groups of mammals.

Ans. See Q21. of theory.

Q7. Discuss the mechanisms of allopatric and sympatric speciation.

Ans. See Q28. of theory.

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

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?

Ans. See Q25. of theory.

Q10. Discuss the importance of random sampling methods in ecological studies.

Ans. See Q26. of theory.

Q11. Describe the concept of an ecosystem and niche.

Ans. See Q24. of theory.

INQUISITIVE QUESTIONS

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

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?

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?

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.