# 4 Animal Kingdom

*Though you may have seen a king cobra dance to the sounds of a snake charmer, you are unlikely to find one in the wild. The longest venomous snakes are king cobras. When provoked, they will rear up about a third of their length, which can reach up to 15 feet. That means you'll have a 5-foot snake staring you down, with a 10-foot snake coiled behind you.*

## Topic Notes

- *Classification and Fundamental Features of Phylum*
- *Features of Hemichordates and Chordates*

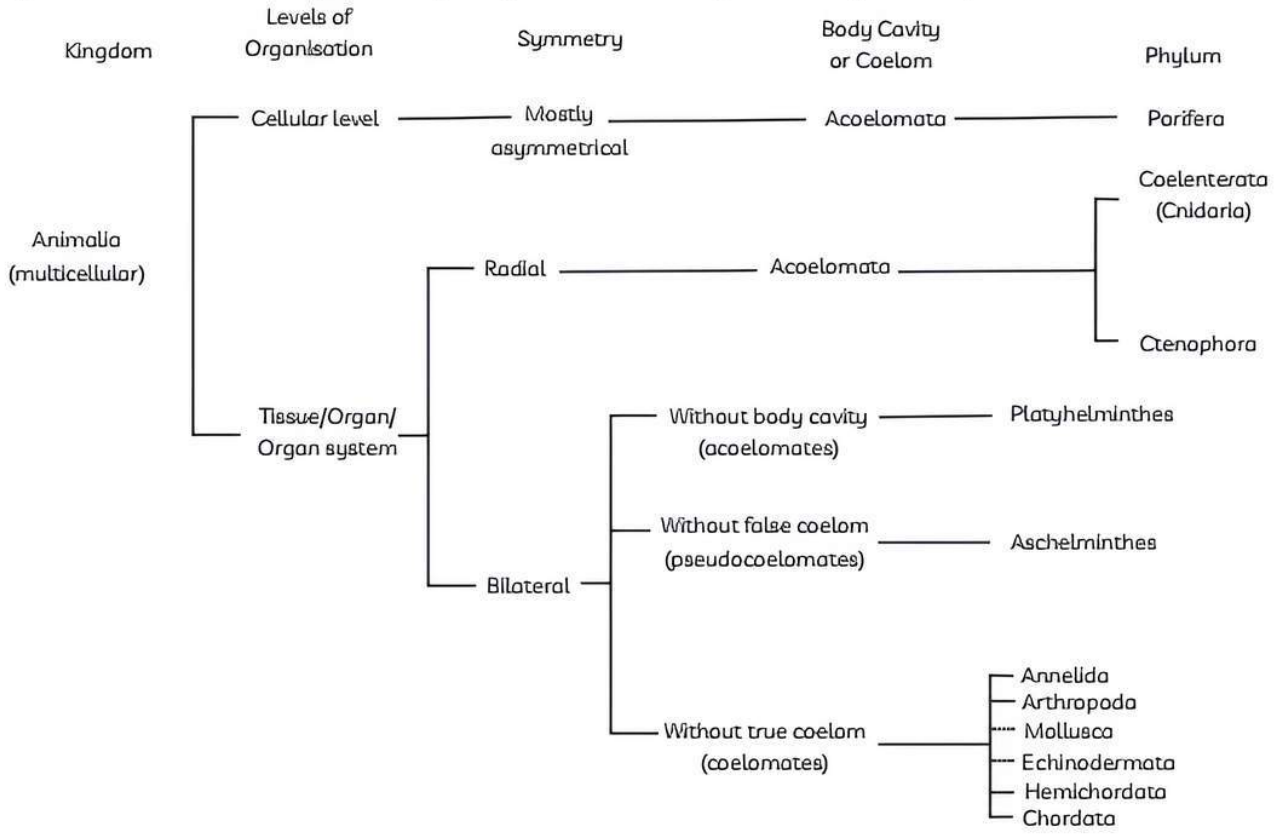
# CLASSIFICATION AND FUNDAMENTAL FEATURES OF PHYLUM

1

## TOPIC 1

## FEATURES OF DIFFERENT PHYLUMS IN NON-CHORDATA

Have you ever wondered why we need to classify animals? So, the answer is there are over a million species of animals and they have completely different structures and forms. Their classification helps us to assign them a systematic position.




*Broad classification of Kingdom Animalia based on common fundamental features*

### Phylum Porifera

This phylum includes all the sponges *i.e.*, pore-bearing animals. All sponges are generally marine. They have a cellular level of organisation and are mostly asymmetrical. They are diploblastic (derived from only two germ layers ectoderm and endoderm). The body of sponges is porous and the pores are of two types— Ostia (minute pores) and Osculum.

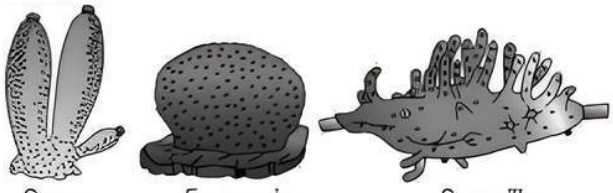
Water enters into their body through ostia into the central cavity, spongocoel and goes out through the osculum. They have a water transport or canal system. The function of canal system is food gathering, respiratory exchange and removal of waste. Cells called as choanocytes or collar cells line up the spongocoel and the canals. A skeleton is made up of spicules or spongin fibres. Digestion is intracellular.

They are hermaphrodites (sexes are not separate, *i.e.* eggs and sperms are produced by the same individual). Fertilisation is internal and development is indirect (larvae stage is present which is morphologically different from an adult). Asexual reproduction occurs by fragmentation and budding and sexual reproduction is by the formation of gametes.

**Examples:** *Sycon* (Scypha), *Spongilla* (Freshwater sponge) and *Euspongia* (Bath sponge).

**Important**

- *Digestion is of two types: Intracellular and extracellular.*
- *Intracellular is the digestion inside the cell and is less efficient. Example: Amoeba*
- *Extracellular is the digestion outside the cell and is more efficient. Example: Man*



*Sycon* *Euspongia* *Spongilla*

**Example 1.1:** Case Based:

*Rishi is a 12th-grade boy who loves to learn about sea animals. So one day, he went for Scuba diving. He was very excited regarding learning about different kinds of sea animals. When he entered the sea, he saw a different world. He was so amazed. He saw some plant-like structures that are sessile. This thing excites him. He observed that it had pores all over its body. He recalled that they belong to the Kingdom Porifera, which he learned about in 11th grade biology textbook. But he has the following queries.*

(A) How Rishi identified that the structures which he saw belong to Porifera?

(B) What is the pathway of water transport in poriferans?

(C) Members of Phylum Porifera are:

(a) mostly terrestrial

(b) only freshwater

(c) only marine

(d) generally marine but some are found in freshwater

(D) Which of the following statements are correct for Phylum Porifera?

(I) Water enters through osculum.

(II) Fragmentation is the method of asexual reproduction.

(III) Sexes are not separate.

(IV) Skeleton is made up of spicules and calcium.

(V) Development is indirect.

Options:

(a) (I), (II) and (III) (b) (II), (III) and (V)

(c) (I) and (III) (d) (II), (IV) and (V)

(E) Assertion (A): Sponges exhibit a cellular level of organisation.

Reason (R): In sponges, cells are arranged as loose cell aggregates.

(a) Both A and R are true and R is the correct explanation of A.

(b) Both A and R are true and R is not the correct explanation of A.

(c) A is true but R is false.

(d) A is false but R is true.

**Ans.** (A) The structure is sessile. The main characteristic feature of the poriferans on the basis of which he distingulshes them is the presence of pores all over their bodies. The members of this phylum are known as sponges *i.e.*, pore-bearing animals.

(B) Sponges have a water transport and canal system. They have two types of pores all over their bodies, *i.e.*, ostia and osculum. Water enters their bodies through minute pores called ostia and goes out through the osculum.

(C) *(d) generally marine but some are found in freshwater*

**Explanation:** Sponges are not terrestrial. These sponges are generally marine and few of them are freshwater.

**Example:** *Spongilla lacustris.*

(D) *(b) (II), (III) and (V)*

**Explanation:** Water enters through the ostia, not the osculum. Their skeleton is made up of spicules or spongin fibres. Asexual reproduction takes place through budding and fragmentation. Poriferans are hermaphrodites (sexes are not separate). Development occurs through many larval stages.

(E) *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** Sponges are primitive multicellular animals. In them, cellular level of organisation is present in which the cells are arranged as loose cell aggregates.

## Phylum Coelenterata (Cnidaria)

All the members of this phyla are aquatic, mostly marine. They are sessile or free-swimming. They show

radial symmetry and are diploblastic. Cnidarians are the first multicellular animals that show tissue level of organisation.

They have a central gastro vascular cavity having a single opening, mouth on hypostome. Digestion is extracellular and intracellular. Cnidarians exhibit two basic body forms called polyp and medusa. Polyp is a cylindrically shaped body and is sessile, *e.g., Hydra, Adamsia, etc.* Medusa is umbrella-shaped and is free-swimming like *Aurelia* or jellyfish.

Some members of the cnidaria show metagenesis. Metagenesis is the alternation of asexual and sexual phases in their life cycle *i.e.*, polyps reproduce medusa asexually and medusa form polyps sexually *e.g., Obelia*. In corals, the skeleton is composed of calcium carbonate.

**Examples:** *Physalia* (Portuguese man of war), *Adamsia* (Sea anemone), *Pennatula* (Sea pen), *Gorgonia* (Sea fan) and *Meandrina* (Brain coral).

*Aurelia (medusa)* *Adamsia (polyp)* *Cnidoblast*

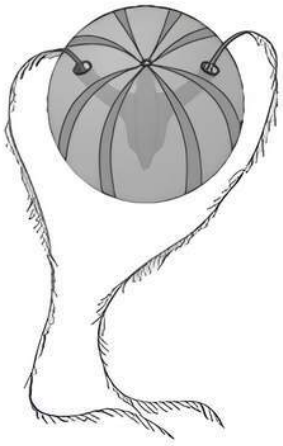
**Important**

➥ *The epidermis of coelenterates contains cnidoblasts (stinging cells). Name of the phylum is cnidaria due to the presence of these stinging cells. A cnidoblast has a nematocyst (stinging organ) which is present on the tentacles. Cnidoblasts are used for anchorage, defence and for the capturing of prey.*

## Phylum Ctenophora

They are also known as comb jellies or sea walnuts. Members of ctenophores are exclusively marine. They have radial symmetry, diploblastic and have tissue level of organisation. Comb-like eight external rows of ciliary plates called comb plates are present on their body which help in swimming or locomotion, that is why ctenophores are commonly called comb jellies.

They show bioluminescence (the property of living organisms to emit light). Fertilisation is external and development is indirect. They are hermaphrodites and only sexual reproduction is seen. **Examples:** *Pleurobrachia* and *Ctenoplana*.



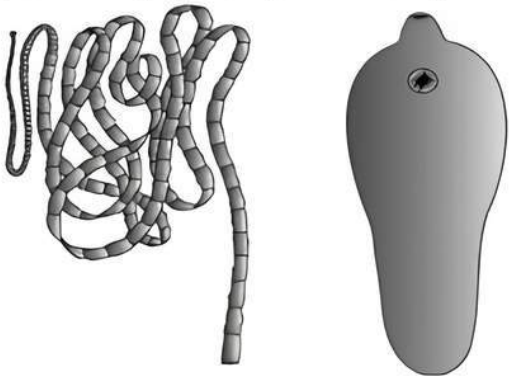
*Pleurobrachia*

## Phylum Platyhelminthes

They are called flatworms because they have a dorso-ventrally flattened body. They show bilateral symmetry and triploblastic and have an organ level of organisation. They are acoelomates (without coelom). Flatworms are mostly endoparasites.

In parasitic forms, hooks and suckers are present and they do not have a digestive tract as they absorb the digested food directly from the host through their body surface. For osmoregulation and excretion, flame cells are present. Fertilisation is internal and development is indirect. *Planarians* possess high regeneration capacity.

**Examples:** *Taenia* (Tapeworm) and *Fasciola* (Liver fluke).



*Taenia (Tapeworm)* *Fasciola (Liver fluke)*

**Example 1.2: What are the peculiar features that you find in platyhelminthes?**

**Ans.** The peculiar features are:

(1) They have a dorso-ventrally flattened body and are thus named as flatworms.
(2) Hooks and suckers are present in parasitic forms.
(3) Flame cells help in osmoregulation and excretion.
(4) *Planaria* possess high regeneration capacity.

## Phylum Aschelminthes

The body is circular in cross-section, they are termed as roundworms. Many roundworms live as

parasites in plants and animals, and are also free-living and generally aquatic. They are bilaterally symmetrical, triploblastic with organ system level of organisation and are pseudocoelomates (false coelom-mesoderm is present as scattered pouches). Alimentary canal is complete with a muscular pharynx. Ammonia is the main excretory waste and is removed from the body through excretory pore.

Male Female

*Ascaris (Roundworm)*

They are dioecious, *i.e.* sexes are separate. Females are longer than males and fertilisation in internal. Development may be direct (the offspring resembles to the parent) or indirect.

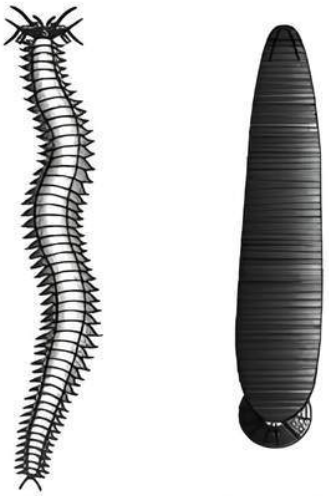
**Examples:** *Ascaris* (Roundworm), *Wuchereria* (Filarial worm), *Ancylostoma* (Hookworm).

## Phylum Annelida

They are also known as segmented animals. They are bilaterally symmetrical, triploblastic, coelomate (true coeloms present) and have organ system level of organisation. Blood vascular system is of a closed type. The annelids are characterised by metameric segmentation. The segments are called metameres. Because of the segments the phylum is named as Annelida (Latin, *annulus*: little ring).

They possess circular and longitudinal muscles which are smooth and help in locomotion. *Nereis*, an aquatic annelid, possess lateral appendages known as parapodia, which help in swimming. Osmoregulation and excretion are through a coiled tubular structure called nephridia. Neural system consists of paired ganglia that are connected by lateral nerves to a double ventral cord. *Nereis* is dioecious but earthworms and leeches are monoecious. Reproduction is sexual.

**Examples:** *Nereis*, *Pheretima* (Earthworm) and *Hirudinaria* (Blood-sucking leech).



*Nereis* *Hirudinaria*

## Phylum Arthropoda

Arthropoda is the largest phylum of Kingdom Animalia. This phylum includes insects. Over two third of all named species on earth are arthropods. They occur on land, in soil and water, and are parasites also. They have an organ system level of body organisation. They are generally triploblastic and their body is bilaterally symmetrical. Externally their body is segmented. It consists of the head, thorax and abdomen. The body is covered by thick, non–living chitinous cuticles which form the exoskeleton.

The characteristic feature of arthropods is jointed appendages. Respiratory organs are gills, book gills, book lungs or tracheal system. Sensory organs like antennae and eyes (simple or compound) are present and the circulatory system is of open type. Malpighian tubules are present for excretion. Balancing organs or statocysts are present. Sexes are separate (dioecious). Fertilisation is generally internal. They are mostly oviparous. Development may be direct or indirect.

**Examples:** Economically important species— *Apis* (Honey bee), *Bombyx* (Silkworm), *Laccifer* (Lac insect).

Vectors— *Anopheles*, *Culex* and *Aedes* (Mosquitoes).

Gregarious pest— *Locusta* (Locust).

Living fossil— *Limulus* (King crab).

*Locust*

*Butterfly*

*Scorpion*

*Prawn*

**Example 1.3: What are the reasons that you can think of for the arthropods to constitute the largest group of the animal kingdom?**

**Ans.** The Phylum Arthropoda is the largest phylum in the animal kingdom with altogether 83% of the total known species of animals. The main reason for them to have a such large number of members are:

(1) They have jointed legs that allow more and easy mobility on loud.

(2) Hard exoskeleton made up of chitin protects them from extreme conditions as well as from predators.

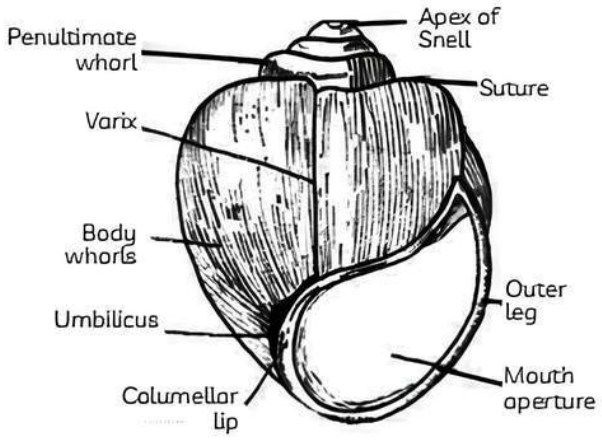
(3) The hard exoskeleton also reduces the water loss from the body of arthropods that make them survive in water as well as terrestrial conditions.

## Phylum Mollusca

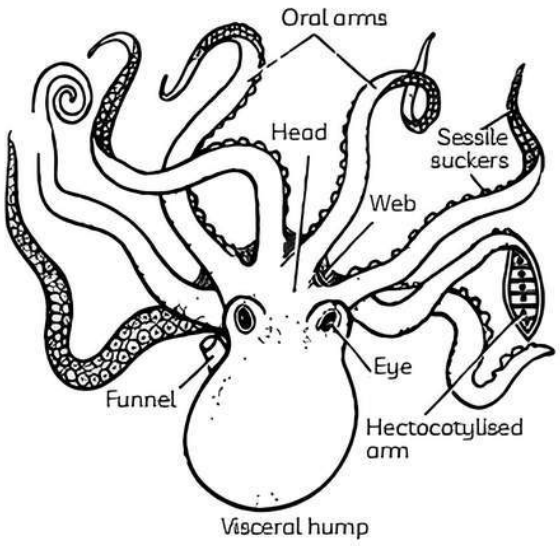
Phylum Mollusca is the second largest phylum after arthropods. They are also known as soft-bodied animals. They are terrestrial or aquatic. They are bilaterally symmetrical, triploblastic, coelomate (true coeloms present) and have an organ system level of organisation. The body of molluscs is unsegmented with a distinct head, muscular foot and visceral hump. Body is covered by a calcareous shell.

Mantle is a thin, soft and spongy layer of skin which is formed over a visceral hump and the space between the mantle and hump is called the mantle cavity (containing feather-like gills helping in respiration and excretion). Head region has sensory tentacles. Mouth contains a rasping organ for feeding called radula. They are dioecious and oviparous with indirect development.

**Examples:** *Pila* (apple snail), *Pinctada* (pearl oyster), *Sepia* (cuttlefish), *Loligo* (squid), *Octopus* (devil fish), *Aplysia* (sea-hare), *Dentalium* (tusk shell) and *Chaetopleura* (chiton)




*Pila*



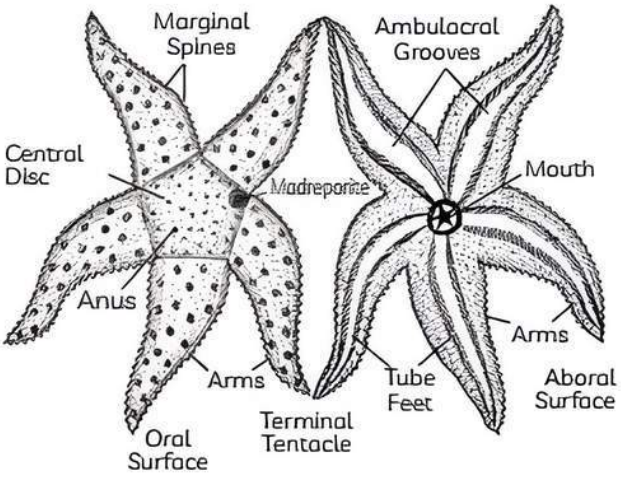

*Octopus*

## Phylum Echinodermata

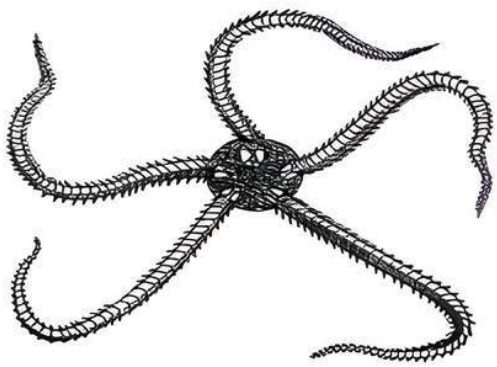
They are also known as spiny bodies animals. Their endoskeleton is of calcareous ossicles. All are marine with organ system level of organisation, triploblastic and coelomate animals. The symmetry is bilateral in larvae but radial in adults. Digestive system is complete and both mouth (ventral) and anus (dorsal) are present.

The main characteristic feature of echinoderms is the presence of the water vascular system. It helps in locomotion, capture, transport of food and respiration. Excretory system is absent and sexes are separate. Fertilisation is external and development is indirect with free-swimming larvae.

**Examples:** *Asterias* (starfish), *Echinus* (sea urchin), *Antedon* (sea lily), *Cucumaria* (sea cucumber) and *Ophiura* (brittle star)




*Asterias (starfish)*



*Ophiura*

**Example 1.4:** Case Based:

*Insects and other arthropods exhibit such striking diversity. One can find that most of the species on earth are arthropods. Because of its diversity, it is the largest phylum of the Animalia. They are found in various places. They occur on land, in soil and water, and as parasites. They have jointed appendages. Honey bees, silkworms, mosquitos, scorpions and butterflies all come under this. They have many respiratory organs like gills, book grills, book lungs and tracheal system. Their body is covered by a chitinous exoskeleton. They are mostly oviparous.*

(A) What is the rigid shell of the arthropods called?

(B) What are the advantages of having jointed legs in arthropods?

(C) What is the characteristic feature of arthropods?
(a) Segmented body
(b) Presence of flame cells
(c) Jointed appendages
(d) Water vascular system

(D) Which of the following belongs to the Phylum Arthropoda?
(a) *Pila* (b) *Nereis*
(c) *Octopus* (d) *Locust*

(E) Assertion (A): *Anopheles* and *Lucifer llmulus* are arthropods.
Reason (R): They both have jointed appendages and chitinous exoskeleton.
(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

**Ans.** (A) The body of arthropods is covered by a chitinous exoskeleton. It is a rigid structure which protects their body.

(B) Arthropods with jointed appendages had a far wider range of motion and flexibility.

(C) *(c) Jointed appendages*

(D) *(d) Locust*
**Explanation:** *Pila* belongs to molluscs. *Nereis* is of Phylum Annelida. *Octopus* belongs to molluscs and locust is of the Phylum Arthropoda.

(E) *(a) Both A and R are true and R is the correct explanation of A.*
**Explanation:** *Anopheles* and *Lucifer limulus* both belong to the Phylum Arthropoda. They all have jointed appendages and a chitinous exoskeleton.

# OBJECTIVE Type Questions

[ 1 mark ]

## Multiple Choice Questions

1. Characteristic feature of Phylum Arthropoda is:
(a) Dorso-ventrally flattened body
(b) Alternation of generation
(c) Body is divided into segments
(d Jointed appendages [NCERT Exemplar]

**Ans.** *(d) Jointed appendages*
**Explanation:** Jointed appendages is the characteristic feature of Phylum Arthropoda (*arthros*-joint, *podos*-appendages). The dorso-ventrally flattened body is the feature of platyhelminthes. Alternation of generation is found in Coelenterata. Body is divided into segments in annelida.

**Related Theory**

➥ *These jointed appendages include legs, wings and mouthparts. Appendages are the outgrowth that is connected to the body of organisms and jointed appendage refers to appendages that have joints.*

2. Which of them is not the fundamental feature of the classification of Animalia?
(a) Coelom
(b) Germ layer
(c) Level of organisation
(d) Morphology

**Ans.** *(d) Morphology*

**Explanation:** Morphology cannot be the feature of classification as there are differences in structure and form of different animals. Some common fundamental features on the basis of which animals are classified are coelom, germ layer, symmetry, level of organisation, notochord, etc.

**3. Match the following list of animals with their level of organisation.**

| Level of Organisation | Animal |
|---|---|
| (A) Organ level | (i) *Pheretima* |
| (B) Cellular aggregate level | (ii) *Fasciola* |
| (C) Tissue level | (iii) *Spongilla* |
| (D) Organ system level | (iv) *Obelia* |

**Choose the correct match showing division of labour with animal examples.**

**(a) (B)-(i), (C)-(ii), (D)-(iii), (A)-(iv)**

**(b) (B)-(i), (D)-(ii), (C)-(iii), (A)-(iv)**

**(c) (D)-(i), (A)-(ii), (B)-(iii), (C)-(iv)**

**(d) (A)-(i), (D)-(ii), (C)-(iii), (B)-(iv)**

**[NCERT Exemplar]**

**Ans.** *(c) (D)-(i), (A)-(ii), (B)-(iii), (C)-(iv)*

**Explanation:** Organ level of body organisation is present in *Fasciola*; Cellular aggregate level of body organisation is present in *Spongilla*; Tissue level is present in *Obelia*; Organ system level of body organisation is present in *Pheretima*.

**4. Phylum Mollusca can be distinguished from other invertebrates by the presence of:**

**(a) Mantle and non-segmented body**

**(b) Mantle and segmented body**

**(c) Bilateral symmetry and triploblastic**

**(d) Jointed appendages**

**Ans.** *(a) Mantle and non-segmented body*

**Explanation:** Members of molluscs have a non-segmented body with a distinct head, muscular foot, and visceral hump. Mantle is formed over the visceral hump. The other characteristics mentioned are shared with the other members of the phylum.

**5. Read the following statements and select the correct ones.**

**(I) Circulatory system in arthropods is of open type.**

**(II) *Nereis* is dioecious.**

**(III) Parapodia are present in Phylum Echinodermata.**

**(IV) In aschelminthes, males are longer than females.**

**Options:**

**(a) (I) and (IV)** **(b) (I), (II), (III), (IV)**

**(c) (III) and (IV)** **(d) (I) and (II)**

**Ans.** *(d) (I) and (II)*

**Explanation:** In arthropods, the circulatory system is of open type. *Nereis* is dioecious but options (III) and (IV) are incorrect as parapodia are present in Phylum Annelida and in aschelminthes, females are longer than males.

**6. The given characteristic features represent which phylum?**

**(I) Their body is porous.**

**(II) Spongocoel is lined by choanocytes or collar cells.**

**(III) They have a cellular level of organisation.**

**(IV) Water transport or canal system is present.**

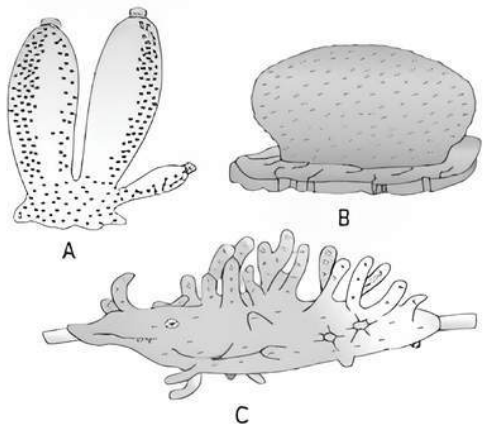
**Select the correct option:**

**(a) Echinodermata** **(b) Ctenophora**

**(c) Porifera** **(d) Platyhelminthes**

**Ans.** *(c) Porifera*

**7. Examine figures A, B and C. In which one of the four options all the items A, B and C are correctly identified?**




| | A | B | C |
|---|---|---|---|
| (a) | *Sycon* | *Euspongia* | *Spongilla* |
| (b) | *Euspongia* | *Songilla* | *Sycon* |
| (c) | *Spongilla* | *Sycon* | *Euspongia* |
| (d) | *Euspongia* | *Sycon* | *Spongilla* |

**Ans.** *(a) A - Sycon; B - Euspongia, C- Spongilla*

**Explanation:** All the figures (A, B and C) are the examples of Phylum Porifera. A, B and C are respectively *Sycon*, *Euspongia* (also called horny sponge) and *Spongilla*. They are primitive, sessile, aquatic, water-dwelling filter feeders that pump water through their bodies to filter out particles of food matter.

**8.** Statement A: Water current flowing through the canal system is of prime importance for the sponges.

Statement B: It doesn't help sponges in nutrition.

(a) Both A and B are correct.
(b) Both A and B are incorrect.
(c) Only A is correct.
(d) Only B is correct.

**Ans.** *(c) Only A is correct.*

**Explanation:** Because they lack specific organs to perform each of their different jobs, sponges are uncommon organisms. The network of chambers and canals known as a water current system, through which water flows to feed and oxygenate the sponge, is the most crucial component. The garbage is also removed and gametes and larvae are spread via the water current system.

## Assertion-Reason (A-R)

**Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options given below:**

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

**9.** Assertion (A): Platyhelminthes are generally hermaphrodites.

Reason (R): In platyhelminthes, fertilisation is internal.

**Ans.** *(b) Both A and R are true and R is not the correct explanation of A.*

**Explanation:** Platyhelminthes are hermaphrodites *i.e.*, sexes are not separate and both sexes are present in one organism. They show internal and cross fertilisation where male gametes of one organism fertilise female gametes of another organism, but it is not the correct explanation of the assertion.

**10.** Assertion (A): *Obelia* shows metagenesis.

Reason (R): Polyps produce medusa asexually and medusa form the polyp sexually.

**Ans.** *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** Cnidarians which exist in both forms (polyps and medusa) exhibit alternation of generation, which is called metagenesis. It means polyps produce medusa asexually and medusa forms the polyp sexually.

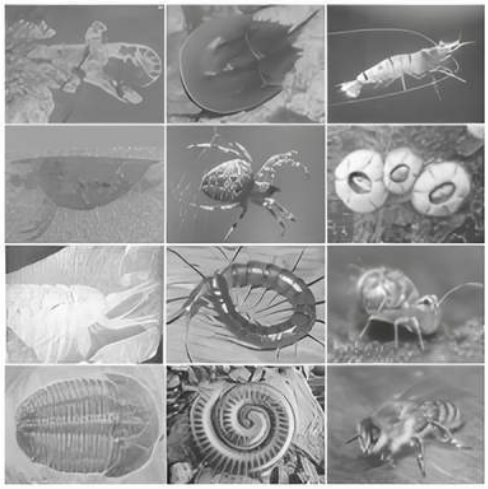
**11.** Assertion (A): Echinodermata show metagenesis.

Reason (R): Adult echinoderms show radial symmetry but larvae show bilateral symmetry.

**Ans.** *(d) A is false but R is true.*

**Explanation:** Metagenesis is present in Phylum Coelenterata (Cnidaria) and not in Echinodermata.

**12.** Arthropods play extremely important roles in maintaining the ecosystem and can also be beneficial for humans. For example, many insects pollinate plants, produce useful substances, act as pest control, and serve as food for other animals and also for humans. Others, such as mites, isopods, myriapods, and insects, are scavengers or decomposers, breaking down dead plants and animals and converting them into soil nutrients.



Assertion (A): Arthropoda is the largest phylum of the Kingdom Animalia.

Reason (R): Most of the species on earth are arthropods *i.e.*, nearly two-thirds of all the named species.

**Ans.** *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** Arthropoda is the largest phylum of the Kingdom Animalia which includes insects. Over two-thirds of all named species on earth are arthropods.

**13.** Assertion (A): Notochord is an ectodermally-derived solid rod-like structure.

Reason (R): Notochord is absent in all non-chordates.

**Ans.** *(d) A is false but R is true.*

**Explanation:** Notochord is a mesodermally derived rod-like structure. It is flexible in nature. In non-chordates, notochord is not formed.

# CASE BASED Questions (CBQs)

[ 4 & 5 marks ]

**Read the following passages and answer the questions that follow:**

**14.** *Nereis, an aquatic form is an example of Phylum Annelida. The body surface of annelida is divided into segments or metameres. For osmoregulation and excretion, nephridia are present. For locomotion, longitudinal and circular muscles are present. They are coelomate animals (mesoderm is present between ectoderm and endoderm). Nereis also possess lateral appendages and parapodia which help in swimming. Neural system consists of paired ganglia. Nereis is dioecious but earthworms and leeches are monoecious.*

**(A) Organisms belonging to Phylum Annelida are ..... animal.**

**(B) Which type of muscle is present in annelida for locomotion?**

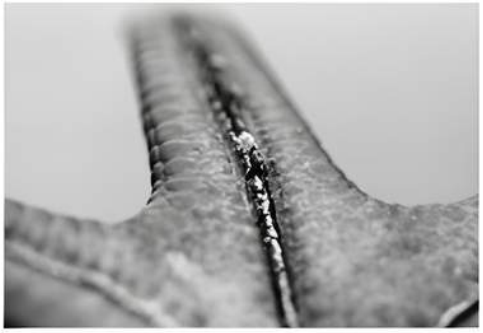
**(C) What do you mean by monoecious and dioecious?**

**Ans.** (A) Coelomate: Annelids are coelomate animals (mesoderm is present between ectoderm and endoderm).

(B) Longitudinal and circular muscle. They are the smooth muscles which help in locomotion of animals.

(C) Monoecious means sexes are not separate e.g., Tapeworm and earthworm. Dioecious means sexes are separate, male and female are distinct, e.g., *Nereis*.

**15.** *Water vascular systems in echinoderms are unique, functional, and play an extremely important role in the functioning of the entire animal. They are composed of hundreds to thousands of tube feet located in the ambulacral grooves. As a result, this system is also known as the ambulacral system. Water-filled canals and reservoirs control the tube feet hydraulically. Tubefeets perform various functions as a result. Echinoderms have special structures for breathing as well.*



**(A) Which of the following is true about the haemal system in echinoderms?**
- **(a) They have a two-chambered heart.**
- **(b) It is an open type.**
- **(c) They possess myoglobin pigment.**
- **(d) They possess haemoglobin.**

**(B) In echinoderms, the respiratory structure is:**
- **(a) dermal branchiae**
- **(b) bursae**
- **(c) tube feet**
- **(d) All of the above**

**(C) Tubefeet are helpful to echinoderms, in:**
- **(a) food capture and locomotion**
- **(b) paralysing the prey**
- **(c) the production of leucocytes**
- **(d) all of the above**

**(D) Which of the following is correct about the origin of an ambulacral system?**
- **(a) Ectodermal** **(b) Mesodermal**
- **(c) Coelomic** **(d) Endodermal**

**(E) Which of the following belongs to the phylum echinodermata?**
- **(a) *Octopus*** **(b) *Asterias***
- **(c) *Dentalium*** **(d) *Fasciola***

**Ans.** (A) *(b) It is an open type.*

**Explanation:** There is no respiratory pigment or heart in the haemal system. It belongs to the open type and is enclosed within the coelomic perihaemal channels.

(B) *(d) all of the above*

**Explanation:** Dermal branchiae, bursae and tube feet, all these structures perform respiration in echinoderms.

(C) *(d) all of the above*

**Explanation:** Tubefeet help echinoderms in locomotion, respiration and food capture.

(D) *(c) Coelomic*

**Explanation:** Ambulacral system is coelomic in origin.

(E) *(b) Asterias*

**Explanation:** *Octopus* and *Dentalium* belong to Phylum Mollusca, while *Fasciola* belongs to Phylum Platyhelminthes.

**16.** *In 2020, India has battled its worst desert locust outbreak in decades with infestations in Gujarat, Rajasthan, Maharashtra, Madhya Pradesh, Punjab, Haryana and Uttar Pradesh. The swarms of desert locusts, known for*

*feeding on green leaves, caused extensive damage to vegetation.*

*Locust is a large, mainly tropical grasshopper, with strong powers of flight and it migrates in vast swarms causing widespread crop loss. Locusts entered Rajasthan from Pakistan earlier this month and then drifted into other parts of western India.*

*Locusts aren't dangerous as long as they are individual hoppers/moths or small isolated groups of insects, in what is called the "solitary phase". It is when their population grows to large numbers – the resultant crowding induces behavioural changes and transformation from the "solitary" to "gregarious" phase – then they start forming swarms. A single swarm contains up to 40-80 million adults in one square km and these can travel up to 150 km in one day. Locusts are edible insects. Several cultures throughout the world consume insects, and locusts are considered a delicacy and eaten in many African, Middle Eastern, and Asian countries.* **[Delhi Gov. QB 2022]**

**(A) Locust belongs to which phyla of the animal kingdom?**

**(a) Insecta** **(b) Arthropoda**

**(c) Mollusca** **(d) Cnidaria**

**(B) Assertion(A): Locust are gregarious pests.**

**Reason(R): A single swarm contains up to 40-80 million adults in one square km.**

**(a) Both A and R are true and R is the correct explanation of A.**

**(b) Both A and R are true and R is not the correct explanation of A.**

**(c) A is true but R is false.**

**(d) A is false but R is true.**

**(C) Read the following statements.**

**Statement I: The swarms of desert locusts, known for feeding on green leaves and caused extensive damage to vegetation**

**Statement II: Locusts are not always dangerous and do not usually attack humans.**

**(a) Only I is true.**

**(b) I and II are true.**

**(c) I is true but II is false.**

**(d) I is false but II is true.**

**(D) Which of the following statements about locust is not true?**

**(a) Locusts are not edible insects.**

**(b) Locust form swarm.**

**(c) Locusts are not harmful in their solitary phase.**

**(d) Locust is a large, mainly tropical grasshopper.**

**Ans.** (A) *(b) Arthropoda*

(B) *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** Locusts are gregarious. A large swarm can consist of billions of locusts spread out over an area of thousands of square kilometres, with a population of up to 80 million per square kilometre (200 million per square mile).

(C) *(b) I and II are true.*

(D) *(a) Locusts are not edible insects.*

**Explanation:** Locusts are large insects and convenient for research and classroom study of zoology. They are edible by humans. They have been eaten throughout history and are considered a delicacy in many countries.

**17.** *Coral reefs are very beautiful, brightly coloured backgrounds for serene snorkelling experiences. The stunning colours in corals come from a marine alga called zooxanthellae, which live inside them. These algae do photosynthesis for the corals so that the corals get energy to grow and reproduce. When corals get environmental stresses like heat or pollution, they react by expelling these algae, leaving a ghostly, transparent skeleton behind. This is known as 'coral bleaching'. Without zooxanthellae, most corals starve and would die. At least a quarter of the world's marine life needs coral reefs around the world are disappearing fast.*

*At the local level, water pollution, overfishing and coastal development are taking their toll on coral reefs. At the worldwide level, carbon pollution is warming our oceans and causing corals releases carbon pollution into the air, which is heating our planet and warming our oceans. If we continue to pollute the air and the ocean with carbon emissions at our high*

*rate, coral reefs around the world will face a catastrophic future in the coming decades - in our lifetime.* **[Delhi Gov. QB 2022]**

**(A) To which of the following phylum do coral reefs belong?**

**(a) Echinodermata (b) Platyhelminthes**

**(c) Cnidaria (d) Porifera**

**(B) Corals are made by deposition of:**

**(a) endoskeleton made up of silica**

**(b) exoskeleton made of protein fibre**

**(c) exoskeleton made up of calcium carbonate**

**(d) endoskeleton made up of protein fibres**

**(C) Which one of the following could not be a possible reason for coral bleaching?**

**(a) Water pollution**

**(b) Carbon pollution**

**(c) Soil pollution**

**(d) Overfishing and coastal development**

**(D) The type of association shown by zooxanthellae and corals is known as:**

**(a) Commensalism (b) Symbiotic**

**(c) Predation (d) Parasitism**

**(E) Assertion(A): Coral reefs are very beautiful, brightly coloured backgrounds for serene snorkelling experiences.**

**Reason(R): A marine algae zooxanthellae live inside them and do photosynthesis.**

**(a) Both A and R are true and R is the correct explanation of A.**

**(b) Both A and R are true and R is not the correct explanation of A.**

**(c) A is true but R is false.**

**(d) A is false but R is true.**

**Ans.** (A) *(c) Cnidaria*

(B) *(c) Exoskeleton made up of calcium carbonate*

**Explanation:** Coral animals secrete an exoskeleton, which is composed of calcium carbonate. Massive reef structures are formed when each individual stony coral organism—or polyp—secretes a skeleton of calcium carbonate.

(C) *(c) Soil pollution*

(D) *(b) Symbiotic*

**Explanation:** Most reef-building corals contain photosynthetic cells, called zooxanthellae, that live in their tissues. The corals and these special cells have a mutualistic relationship.

(E) *(a) Both A and R are true and R is the correct explanation of A.*

## VERY SHORT ANSWER Type Questions (VSA)

[ 1 mark ]

**18. Molluscs have an organ which helps in eating food. What is it?**

**Ans.** It is Radula, a rasping organ for feeding or cutting the food in molluscs.

**19. We all have some sort of organs for respiration in our bodies. What are the respiratory organs in arthropoda?**

**Ans.** In arthropoda, respiratory organs are gills, book gills, book lungs or tracheal system.

**20. Identify the structure shown below. Also, write its function.**

**Ans.** The structure is of Cnidoblast. It is used for anchorage, defence and for the capture of prey.

**21. You must have read about this structure in the chapter. Identify and define.**

**Ans.** The structure is of Medusa. It is one of the basic body forms of cnidarians. It is umbrella-shaped and free-swimming. *e.g., Aurelia.*

**22. Why is the segmentation in flatworms referred to as pseudosegmentation?**

**[Delhi Gov. QB 2022]**

**Ans.** Pseudometamerism or pseudosegmentation means body segments are external and every segment is independent of others.

**Caution**

➥ *When the body is externally and internally divided into segments with a serial repetition of organs in each segment, the segmentation is said to be metameric.*

**23. Explain locomotion in Ctenoplana.**

**Ans.** In Ctenoplana, comb-like eight external rows of ciliary plates called comb plates are present on the body which help in the locomotion.

## SHORT ANSWER Type-I Questions (SA-I)

[ 2 marks ]

**24. Mention one example each for animals with chitinous exoskeleton and those covered by a calcareous shell. [NCERT Exemplar]**

**Ans.** The body of arthropods (like cockroach) is covered by chitinous exoskeleton and molluscan (like *Pila*) body is covered by a calcareous shell

**25. *Taenia solium* is an endoparasite of man. Write any four characters using which we can identify this organism. [Diksha]**

**Ans.** Characters on which we can identify the *Taenia solium* (tapeworm) are:

(1) Absence of digestive system.
(2) Presence of hooks and suckers.
(3) Hermaphrodite.
(4) Flame cells help in osmoregulation and excretion.

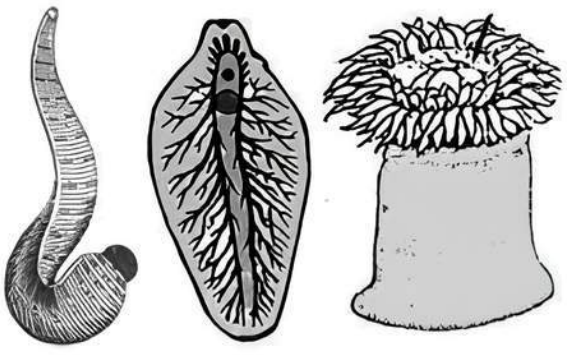
**26. What is the mantle cavity in molluscs?**

**Ans.** A soft and spongy layer of skin forms a mantle over the visceral hump. The space between the hump and mantle is called the mantle cavity in which feather-like gills are present. Water conduction occurs by capillary action because it lacks appropriate vasculature.

## SHORT ANSWER Type-II Questions (SA-II)

[ 3 marks ]

**27. Identify the given images and write their phyla.**



(A) (B) (C)

**Ans.** (A) *Hirudinaria* (Blood-sucking leech) and it belongs to Phylum Annelida.

(B) *Fasciola* (liver fluke) and it belongs to Phylum Platyhelminthes.

(C) *Adamsia* (Sea anemone) and it belongs to Phylum Coelenterata.

**28. Transport or canal system in Porifera helps in exchange of gases, distribution of food, water removal, gathering of food and formation of a new individual. Is this true? Why or why not?**

**Ans.** This statement is true.

Transport or canal system in Porifera helps in exchange of gases, distribution of food, water removal and gathering of food. Canal systems can't help in formation of a new individual. Porifera undergoes either fragmentation or sexual reproduction to form a new individual.

## LONG ANSWER Type Questions (LA)

[ 4 & 5 marks ]

**29. Differentiate between the following:**

**(A) Oviparity and viviparity**

**(B) Direct and indirect development**

**(C) Notochord and nerve cord**

**(D) Polyp and medusa**

**[NCERT Exemplar]**

**Ans.**

| (A) | Oviparity | Viviparity |
|---|---|---|
| | In this, Oviparous animals give birth to their young ones by laying an egg. | In this, viviparous animals give birth to the live young ones. |
| (B) | **Direct development** | **Indirect development** |
| | It is a type of development in which an embryo develops into a mature individual without involving a larval stage. | It is a type of development that involves a sexually immature larval stage. |

| (C) | Notochord | Nerve cord |
|---|---|---|
| | It is a mesodermally derived rod-like-structure formed on the dorsal side during embryonic development in some animals and it is the part of the skeletal system. | It is a part of the nervous system. |
| | **Polyp** | **Medusa** |
| | It is a sessile and cylindrical form like *Hydra*, *Adamsia*, etc., | It is umbrella-shaped and free-swimming like *Aurelia* or jellyfish. |

# FEATURES OF HEMICHORDATES AND CHORDATES

2

## TOPIC 1

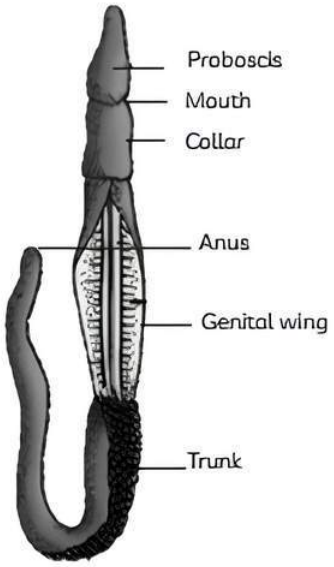
## HEMICHORDATA

Due to similarities with chordates, earlier Hemichordata is considered as a subphylum under Phylum Chordata. However, recently it is placed under a separate phylum under non-chordata (Invertebrata).

The members of Phylum Hemichordata mostly live in burrows and are mostly marine. Their body is soft, worm-like and can be divided into proboscis, collar and trunk. They are bilaterally symmetrical with three germ layers *i.e.*, triploblastic. Hemichordates have organ system level of body organisation with complete digestive tract. They have a stomochord which is a hollow outgrowth, arises from the roof of the buccal cavity, called "Buccal diverticulum" present in proboscis. Respiration takes place through branchial position of pharynx-bearing gill silts. The blood vascular system is open type and blood is colourless. Excretion is done by single proboscis gland or glomerulus situated in the proboscis. Nervous system is primitive, consisting mainly of an intraepidermal nerve plexus. Sensory cells of the epidermis act as sense organs.

Reproduction is mostly sexual. Sexes are separate or united. Gonads are in one pair or in several pairs. Fertilisation is external and development is mostly indirect through a free-swimming larva.

**Examples:** *Balanoglossus* and *Saccoglossus*.




*Balanoglossus*

**Important**

➥ *Hemichordata is commonly called as Acorn worms or tongue worms due to their appearance. Proboscis and a collar together form the acorn which is used for burrowing in mud.*

## TOPIC 2

## CHORDATA

### Diagnostic Characters of Chordata

All the chordates possess some fundamental characters:

(1) **Notochord:** It is a solid unjointed, stiff but flexible rod-like structure situated on the dorsal side between the dorsal hollow of nerve cord and alimentary canal.

(2) **Dorsal hollow nerve cord:** The nerve cord of chordates is always hollow and lies dorsal to the notochord.

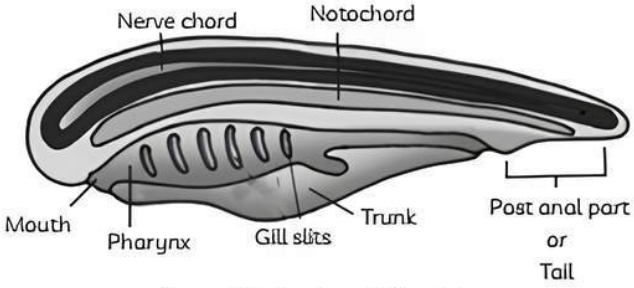
(3) **Pharyngeal gill slits:** All the chordates have at some stage of life, a series of paired narrow openings, the gill slits on the lateral sides of the pharynx.

(4) **Post-anal tail:** It is a post-anal part of the organism's body which is reduced or absent in many adult chordates.

### Other Characters of Chordates

Chordates are bilaterally symmetrical and have three germinal layers, *i.e.* triploblastic, segmentation, coelomate, and possess organ system level of organisation. They have special organs for respiration and excretion. They possess a complete digestive tract and a closed circulatory system.

In chordates, the sexes are separate. Sexual reproduction is the common process of reproduction. Asexual reproduction is not seen.




*General body plan of Chordate*

**Comparison of Chordates and Non-chordates**

| S. No. | Chordates | Non-chordates |
|---|---|---|
| (1) | Notochord present. | Notochord absent. |
| (2) | Central nervous system is dorsal and hollow. | Central nervous system is ventral and solid. |
| (3) | Pharynx perforated by gill slits. | Gill slits are absent. |
| (4) | Heart is ventral. | Heart is dorsal (if present). |
| (5) | A post-anal tail is present. | A post-anal tail is absent. |

## Classification of Chordata

The Phylum Chordata is divided into three Subphyla– Urochordata or Tunicata, Cephalochordata and Vertebrata. The first two subphylums Urochordata and Cephalochordata are primitive chordates without a vertebral column and they are grouped together as Protochordates or acronic (without cranium, *i.e.* brainbox). The vertebrates are higher chordates with vertebral columns.

### Subphylum 1: Urochordata

The Urochordates are marine animals. Remarkable character of Urochordata is that the notochord is found only in the tail of the larva and disappears in the adult form. This subphylum is also called as Tunicata because the adult body is generally enclosed within a leathery test or tunic form by cellulose-like organic substance termed as tunicin.
**Examples:** *Ascidia, Salpa, Doliolum, Herdmania.*

### Subphylum 2: Cephalochordata

The Cephalochordates are marine animals. Remarkable character of cephalochordates is that the notochord extends up to the anterior end of the body *i.e.*, from head to tail and persists throughout their life. Cephalochordata show progressive metamorphosis (changes from less developed larva to a well-developed adult).

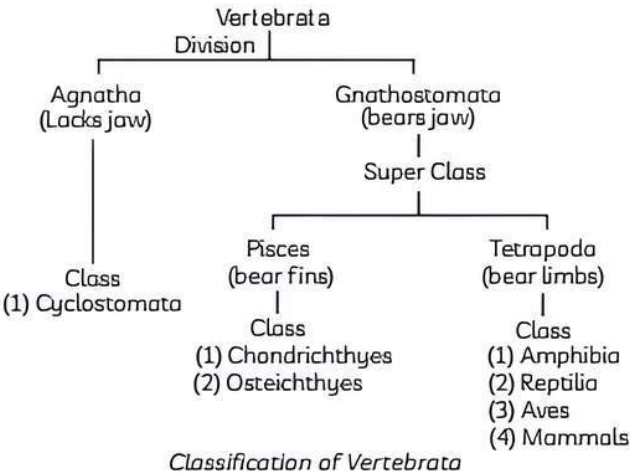
**Examples:** *Branchiostoma (Amphioxus or Lancelet).*

### Subphylum 3: Vertebrata

The Vertebrates are advanced chordates. The notochord is only present in the embryonic stage, it is replaced by a cartilaginous or bony vertebral column in the adult, hence called Vertebrata. There are some more basic features of vertebrates:

(1) The Subphylum Vertebrata is also known as Craniata because they have a cranium (brain box).
(2) The epidermis consists of many layers of cells. Epidermis may bear an exoskeleton of scales, feathers or hairs.
(3) Digestive tract is complete.
(4) Endoskeleton is formed of cartilage or cartilage and bones.
(5) Heat is ventrally situated with two, three or four chambers.
(6) There is a closed circulatory system consisting of blood vascular and lymphatic systems. RBCs are present.
(7) Respiratory organs may be gills, skin, buccopharyngeal cavity and lungs.
(8) A pair of kidney is present for excretion and osmoregulation.
(9) Nervous system consists of central nervous system (brain and spinal cord), peripheral and autonomic nervous system.
(10) Sense organs are eyes, ears, tongue, nasal chambers and skin.
(11) Endocrine glands are found in all vertebrates.

The subphylum Vertebrata can be further divided into two— Agnatha and Gnathostomata.




*Classification of Vertebrata*

**Important**

➥ *All vertebrates are chordates, but all chordates are not vertebrates.*

**Example 2.1:** **Case Based:**

*The Phylum Chordata is divided into three—Urochordata, Cephalochordata and Vertebrata. The first two subphylums are small groups of primitive chordates without a vertebral column. The urochordates are marine, mostly sessile, filter-feeding invertebrate chordates. Some are planktonic and a few are colonial. The notochord occurs only in the tail of the larva and disappears in the adult. The nerve cord is present in the larva but is replaced by a single ganglion in adult. The pharyngeal slits are numerous and persist in adults. The tail may or may not persist throughout life. Body is generally enclosed in tests. More chordate larva changes into a degenerate adult.*

**(A) Tunicates are the example of the subphylum:**

**(a) Urochordata** **(b) Cephalochordata**

**(c) Hemichordata** **(d) None of these**

**(B) Notochord is restricted to the anterior part of proboscis in animals of which of the following group?**

**(a) Hemichordata** **(b) Urochordata**

**(c) Cephalochordata** **(d) Chordata**

**(C) What are Urochordata, Hemichordata and Cephalochordata collectively known as?**

**(D) What is retrogressive metamorphosis? Give an example.**

**(E) Assertion (A): Agnatha is the most primitive craniate.**

**Reason (R): Agnatha has jaws and paired appendages.**

**(a) Both A and R are true and R is the correct explanation of A.**

**(b) Both A and R are true and R is not the correct explanation of A.**

**(c) A is true but R is false.**

**(d) A is false but R is true.**

**Ans.** **(A)** *(a) Urochordata*

**Explanation:** Urochordates are called tunicates because they have a leathery covering or coating called a tunic which provides protection.

**(B)** *(a) Hemichordata*

**Explanation:** In hemichordates, the digestive tract is complete. Proboscis contains a hollow outgrowth from the gut called stomochord and is regarded as notochord in the past.

**(C)** The Chordate is a group in which there are organisms which have nerve cords. It is grouped into three subphylums as Hemichordata, Urochordata and Cephalochordata which are collectively known as protochordates or lower chordates. They all are marine and lack skull or cranium and jaw, and do not have a vertebral column.

**(D)** Retrogressive metamorphosis is a biological process in which an animal physically develops by cell growth and differentiation and an active larva transforms into an inactive or sessile adult. Example: Metamorphosis in *Herdmania* (Urochordata).

**(E)** *(c) A is true but R is false.*

**Explanation:** Agnatha are the most primitive members of the vertebrates or craniates and they differ from all other vertebrates in many respects as they lack jaw and paired appendages and notochord is persistent.

**Class 1: Cyclostomata**

The distinguishing features of the class are as follows:

(1) Primitive marine vertebrates. All the members are ectoparasite on some fishes.

(2) Long, elongated body with cartilaginous endoskeleton.

(3) Ectoparasites having circular jawless, mouths for sucking blood of host fishes.

(4) Respiratory system contains 6-15 pairs of gill slits.

(5) Paired fins and scales are absent.

(6) Circulatory system is a closed-type with two-chambered heart.

(7) They migrate to fresh water for spawning and die shortly after spawning. Larvae undergo metamorphosis and then migrate back to sea.

**Examples:** *Petromyzon* (Lamprey) and *Myxine* (Hagfish)

*A Jawless Vertebrate - Petromyzon*

**Class 2: Chondrichthyes**

The distinguishing features of this class are:

(1) Mostly marine, bearing cartilaginous exoskeleton.

(2) Dorsoventrally flattened streamlined body.

(3) Cold-blooded (poikilothermous) - body temperature is variable and they are unable to regulate their body temperature.

(4) Predacious- preying on other animals.

(5) Ventral mouth with powerful jaws and teeth modified as backwardly directed placoid scales.

(6) Tough skin with minute placoid scales (spiny, tooth-like projections).

(7) Respiratory system includes a pair of gill slits without operculum (gill cover).

(8) Absence of air bladder. Thus, buoyancy is absent, so, they must swim constantly to avoid sinking.

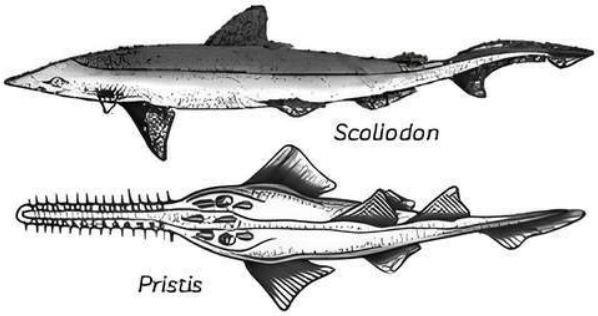
(9) Circulatory system consists of a two-chambered heart (one auricle and one ventricle).

(10) Some have special defence organs like electric organs in *Torpedo* and poison sting in *Trygon*.

(11) Sexes are distinct and fertilisation is internal. Pelvic fins bear Claspers for copulation in males.

(12) Viviparous means to give birth to young ones and have placenta for nourishment inside the parent's body.

**Examples:** *Scoliodon* (Dogfish), *Pristis* (Sawfish), *Carcharodon* (great white shark) and *Trygon* (sting ray).



*Scoliodon*

*Pristis*

**Class 3: Osteichthyes**

The characteristic features of the class are as follows:

(1) Includes both marine and freshwater fishes having bony endoskeleton.

(2) Streamlined body to facilitate movement through water.

(3) Anterior mouth, mostly located at the terminal end.

(4) Respiratory system has four pairs of gills and gill slits covered by gill covers (operculum).

(5) Cycloid (smooth-edged scales), ctenoid scales, impermeable to water present on skin.

(6) Swim bladder present to regulate buoyancy and enable the fish to stay at a depth.

(7) Circulatory system with two-chambered heart (one auricle and one ventricle).

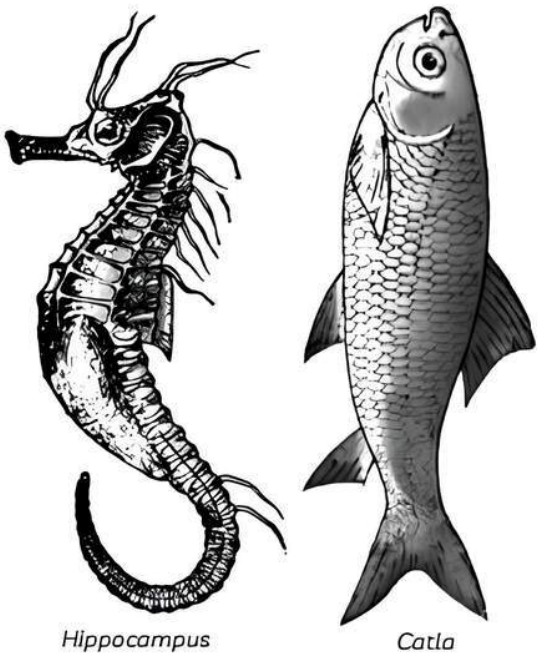
(8) Cold-blooded animals (poikilotherms), body temperature is variable and are unable to regulate body temperature.

(9) Sexes are separate with external fertilisation.

(10) Oviparous (egg-laying).

(11) Direct development and some fishes show parental care.

**Examples:** *Exocoetus* (Flying fish), *Hippocampus* (Sea horse), *Labeo* (Rohu), *Catla* (Catla), *Clarias* (Magur), *Betta* (Fighting fish) and *Pterophyllum* (Angelfish).



*Hippocampus* *Catla*

**Example 2.2: 'All vertebrates are chordates but all chordates are not vertebrates'. Justify the statement.**

**Ans.** The characteristic features of the Phylum Chordata, include the presence of a notochord and paired pharyngeal gill slits. In subphylum Vertebrata, the notochord present in embryos gets replaced by a cartilaginous or bony vertebral column in adults. Therefore, all vertebrates are chordates but all chordates are not vertebrates.

**Example 2.3: How important is the presence of an air bladder in Pisces?**

**Ans.** Air bladder in Pisces regulates buoyancy and helps in floating. It prevents them from sinking. Air bladder is present only in Class Osteichthyes but it is not present in Class Chondrichthyes, so they have to swim constantly to avoid sinking.

**Class 4: Amphibia**

The distinguishing features of Class Amphibia are as follows:

(1) First animals to survive on land but needs water for some activities, *i.e.* amphibious in nature (can live on land as-well-as in water).

(2) Body divisible into head and trunk with two pairs of pentadactyl limbs, sometimes tail is present.

(3) Moist skin, presence of mucus glands with absence of scales.

(4) Sense organs— Eyes with moveable eyelids, tympanum acting as an ear.

(5) Cloaca-serving as a common opening for the alimentary canal, urinary tract and reproductive tract opening outside through cloacal aperture.

(6) Respiration through gills, lungs and skin.

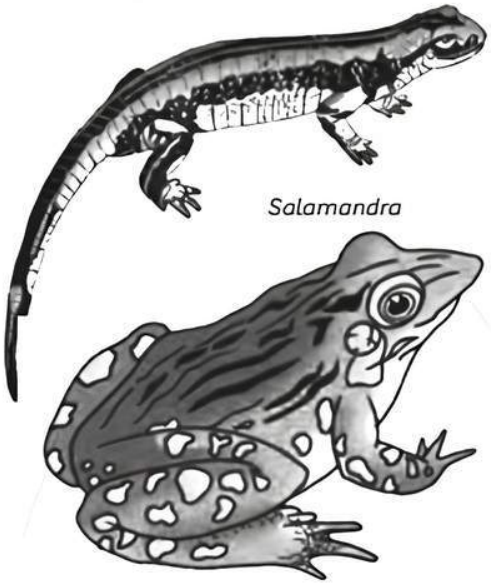
(7) Circulatory system consists of a three-chambered heart having two auricles and one ventricle.

(8) Cold-blooded with most of the forms, hibernating in winter and aestivating in summer.

(9) Sexes are distinct with external fertilisation.

(10) Oviparous (egg-laying).

**Examples:** *Bufo* (Toad), *Rana* (Frog), *Hyla* (Tree frog), *Salamandra* (Salmander) and *Ichthyophis* (limbless amphibian).



*Salamandra*

*Rana*

**Class 5: Reptilia**

The characteristic features of Class reptilia are as follows:

(1) The name reptilia represents their creeping or crawling mode of locomotion, mostly terrestrial.

(2) Dry and rough skin with presence of scales or scutes and absence of glands.

(3) Shed off their scales periodically as skin cast. Example: snakes, lizards.

(4) Tympanum is present but no external ear openings.

(5) In a few reptiles, the limbs are absent, if present then there are the two pairs of pentadactyl limbs.

(6) Respiration occurs through lungs.

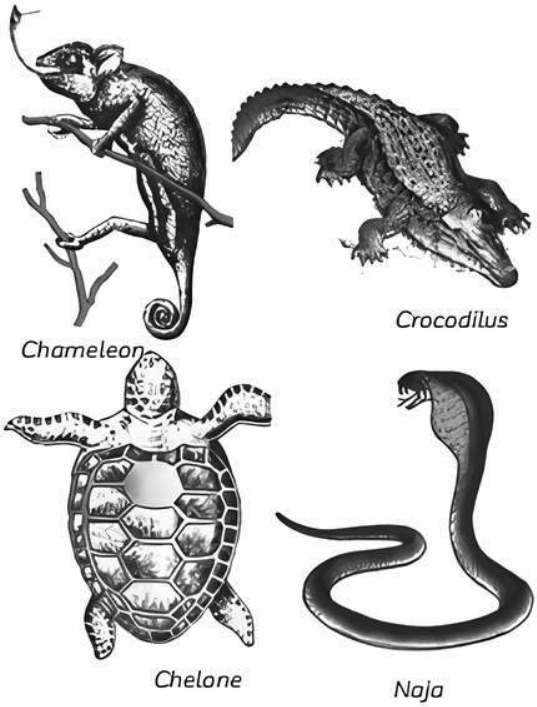
(7) Circulatory system with a three-chambered heart (two auricles and one ventricle), except Crocodiles which have a four-chambered heart.

(8) Cold-blooded (poikilotherms).

(9) Oviparous (egg-laying).

(10) Direct development, embryonic membranes are formed during development.

**Examples:** *Chelone, Testudo, Chameleon, Calotes, Crocodilus, Alligator, Hemidactylus* and Poisonous snakes— *Naja, Bangarus and Vipera.*



*Chameleon*

*Crocodilus*

*Chelone*

*Naja*

**Class 6: Aves**

The distinguishing features of Class Aves are as follows:

(1) Warm-blooded (homeotherms), body temperature is regulated, as they are able to maintain a constant body temperature.

(2) Unique features are presence of feathers, two pairs of limbs with forelimbs modified into wings for flight and hind limbs adapted for walking, perching and swimming.

(3) Upper jaw and lower jaw modified into beaks adapted to various feeding modes.

(4) Dry skin, with absence of glands except the oil gland present on the tail.

(5) Delicate and light body with bony endoskeleton, bones are pneumatic *i.e.*, contain air cavities to reduce weight which helps in flight.

(6) Lack teeth and swallow the unmasticated food, therefore, the digestive tract has additional chambers called crops and gizzard. Crop stores and softens the food and gizzard help in crushing the food.

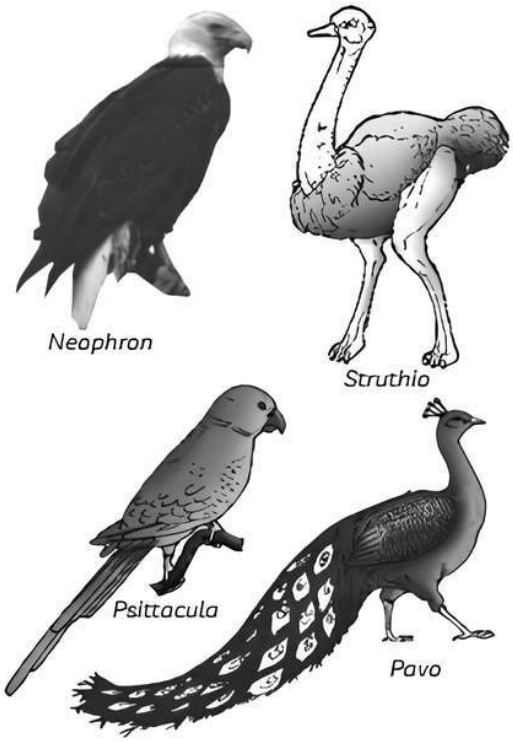
(7) Respiration through lungs only with a thin-walled air sac associated with lungs to supplement respiration.

(8) Circulatory system contains a four-chambered heart (two auricles and two ventricles), this facilitates in keeping the oxygenated and deoxygenated blood separate.

(9) Oviparous (egg-laying).

(10) Internal fertilisation, with direct development and embryonic membranes, are formed.

**Examples:** *Corvus* (Crow), *Columba* (Pigeon), *Psittacula* (Parrot), *Struthio* (Ostrich), *Pavo* (Peacock), *Aptenodytes* (Pigeon) and *Neophron* (Vulture).




**Class 7: Mammalia**

The characteristic features of Class Mammalia are as follows:

(1) Primarily terrestrial, occur in all sorts of habitats and show great diversity in habits.

(2) Warm-blooded animals (homoiotherms), maintaining a constant body temperature.

(3) Certain unique features of mammals are:

(i) Presence of mammary glands (milk -secreting), thus named as mammals and they nourish their young ones with milk.

(ii) Presence of hair on the skin which helps in controlling the body temperature.

(iii) Possess external ears with large fleshy pinnae.

(iv) Each jaw of the mammal contains different types of teeth.

(4) Two pairs of pentadactyl limbs are present that are adapted for walking, running, climbing, and swimming.

(5) Respiration takes place by lungs.

(6) Circulatory system contains a four-chambered heart (two auricles and two ventricles), which keeps both the blood (oxygenated and deoxygenated) separate.

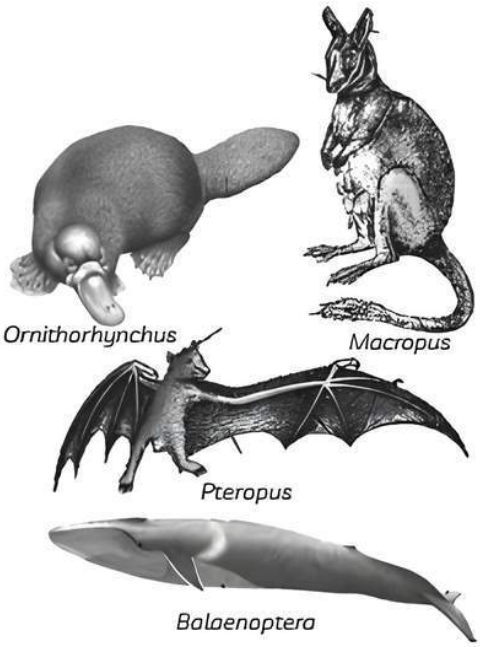
(7) Sexes are separate with internal fertilisation.

(8) Viviparous (give birth to young ones).

(9) Development is direct and takes place in the uterus of the female.

**Examples:** Oviparous— *Ornithorhynchus (Platypus).*

Viviparous— *Marcopus (Kangaroo), Pteropus (Flying Fox), Camelus (Camel), Macaca (Monkey), Rattus (Rat), Canis (Dog), Felis (Cat), Balaenoptera (Blue whale).*




**Example 2.4:** **Case Based:**

*The Gnathostomata are advanced craniates. They possess jaws, paired appendages, exoskeleton. Notochord is usually replaced by a vertebral column. There are 10 or 12 pairs of cranial nerves. The Gnathostomata is divided into six living classes— Chondrichthyes, Osteichthyes, Amphibia, Reptilia, Aves and Mammalia. First two classes include the fishes and are often combined together as superclass Pisces. They have paired appendages in the form of fins. The remaining four classes are grouped together as the superclass Tetrapoda. They have paired appendages in the form of limbs. Fishes and amphibians lack embryonic membranes and birds, reptiles and mammals develop special embryonic membranes.*

**(A) The group Amniota includes:**

**(a) Reptiles and birds**

**(b) Reptiles and mammals**

**(c) Fishes and Amphibians**

**(d) Reptiles, Birds and Mammals**

**(B) Which of the following statements is true?**

**(a) All chordates are vertebrate.**

**(b) Non chordates have a vertebral column.**

**(c) All vertebrates are chordates.**

**(d) Invertebrates possess a tubular nerve cord.**

**(C) Why should the birds feed more often than lizards?**

**(D) What are the factors that have made reptiles true land animals?**

**(E) Assertion (A): Avian bones are pneumatic.**

**Reason (R): This makes the body light for flight in the air.**

(a) **Both A and R are true and R is the correct explanation of A.**

(b) **Both A and R are true and R is not the correct explanation of A.**

(c) **A is true but R is false.**

(d) **A is false but R is true.**

**Ans.** (A) *(d) Reptiles, Birds and Mammals*

**Explanation:** Reptiles, birds and mammals develop special embryonic membranes, *i.e.* amnion, chorion, allantois and yolk-sac in their embryos for protection, nutrition and gas exchange. They together are called Amniota.

(B) *(c) All vertebrates are chordates.*

**Explanation:** All vertebrates are chordates but all chordates are not vertebrates. As the chordata include the presence of a notochord and paired pharyngeal gill slits, the notochord present in embryos gets replaced by a vertebral column in vertebrates. But in cephalochordates, notochord persists throughout the life and in urochordates, the notochord is present in larval stages.

(C) Birds are endothermic animals. They have to produce heat by metabolism to maintain body temperature and this needs food frequently.

(D) Four factors that have made reptiles true land animals are:

(1) Horny scales which check loss of water.

(2) Internal fertilisation, as gametes cannot survive on land.

(3) Shell around the egg to check desiccation.

(4) Fluid-filled amnion around the embryo to provide an aquatic environment for development on land.

(E) *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** The bones of birds are pneumatic, *i.e.* they contain air cavities which help them to increase their buoyancy and help them in flight and these bones help to reduce weight.

# OBJECTIVE Type Questions

[ **1** mark ]

## Multiple Choice Questions

**1. The organism which shows a link between non–chordates and chordates is:**

(a) ***Peripatus*** (b) ***Balanoglossus***

(c) ***Sphenodon*** (d) ***Crocodilus***

**Ans.** *(b) Balanoglossus*

**Explanation:** *Balanoglossus* is a connecting link between non-chordates and chordates as it shows some features of both chordates and non-chordates like notochord and pharyngeal gill slits while *Peripatus* is a connecting link between Annelida and Arthropoda and *Sphenodon* is a link between amphibians and reptiles.

**Related Theory**

➥ *Hemichordata is a connecting link between non-chordates and chordates as it shares some common features of both. Hemichordates refer to half chordates.*

**2. Which of the following characters is not a unique feature of subphylum Vertebrata?**

(a) Dorsal nerve cord

(b) Ventral muscular heart

(c) Presence of notochord in adult

(d) Two pairs of pentadactyl limbs

**Ans.** *(c) Presence of notochord in adult*

**Explanation:** In vertebrates, the notochord is only present in the embryonic stage, it is replaced by the vertebral column in adults. Whereas all the other characteristics like dorsal nerve cord, ventral muscular heart and two pairs of limbs are the unique features of Subphylum Vertebrata.

**3. In which class, the alimentary canal has additional chambers of crop and gizzard?**

(a) Pisces (b) Amphibia

(c) Reptilia (d) Aves

**Ans.** *(d) Aves*

**Explanation:** As Aves lacks teeth, their alimentary canal has an additional chamber for storing and crushing the food, *i.e.* crop to soften and store the food and gizzard helps in churning the food whereas all the three other classes have teeth for crushing the food.

**4. Notochord is found in:**

(a) all vertebrates

(b) all chordates

(c) only Hemichordates

(d) urochordates and cephalochordates

**Ans.** *(b) all chordates*

**Explanation:** All the chordates possess four important features either in the embryonic or adult stage— Notochord, dorsal nerve cord, pharyngeal gill slits and tail, whereas vertebrates do not have a notochord at any point of their development.

**5. Which of the following groups of animals are homeotherms, *i.e.* able to maintain a constant body temperature?**

(a) Reptiles (b) Aves
(c) Amphibians (d) Pisces

**Ans.** *(b) Aves*

**Explanation:** Birds are homeotherms. They are warm-blooded animals and are able to maintain a constant body temperature whereas other classes are poikilotherms, *i.e.* cold-blooded animals.

**6. Which one of the following is oviparous?**

(a) *Platypus* (b) Flying fox
(c) Elephant (d) Whale

[NCERT Exemplar]

**Ans.** *(a) Platypus*

**Explanation:** *Platypus* is the only mammal which lay eggs in the nest and is called oviparous while flying foxes, elephants and whales are viviparous; they give birth to young ones.

**Related Theory**

*Platypus is a connecting link between reptiles and mammals as they have similar features to both species. Shows similarity with mammals by the presence of mammary glands and hair and has some common features with reptiles like egg laying and some endoskeleton features.*

**7. The structure as notochord present in Hemichordates is called:**

(a) Stomochord (b) Collar
(c) Proboscis (d) Genital wing

**Ans.** *(a) Stomochord*

**Explanation:** In hemichordates, the body is divisible into three parts— Proboscis, collar, and trunk. Proboscis contains a hollow outgrowth from the gut called stomochord which acted as a notochord in the past.

**8. Subphyla Urochordates and cephalochordates are often referred to as:**

(a) Craniata (b) Protochordates
(c) Hemichordates (d) All of these

**Ans.** *(b) Protochordates*

**Explanation:** Protochordates are lower chordates. They are also known as acraniata *i.e.*, they lack a brain box. They are divided into two subphyla—Urochordates and Cephalochordates whereas craniata are all chordates which contain brain boxes.

**9. What are the remarkable features of Class Mammalia?**

(a) Skin with sweat gland and with hairy coat.
(b) Buccal cavity with thecodont, heterodont and diphyodont teeth.
(c) Presence of mammary glands.
(d) All of the above

**Ans.** *(d) All of the above*

**Explanation:** Mammals have sweat, and milk glands and a hairy coat which conserves body heat and have well-developed buccal cavities and have mammary glands for the nourishment of young ones.

**10. Which one of the following animals is not correctly matched with its feature?**

| Animal | Characteristic feature |
|---|---|
| (a) *Platypus* | Oviparous mammalian |
| (b) *Struthio* | Flightless bird |
| (c) *Alligator* | Short and blunt snout |
| (d) *Python* | Have fangs |

**Ans.**

| *(d) Animal* | *Characteristic feature* |
|---|---|
| *Python* | *Have fangs* |

**Explanation:** Python is not a poisonous snake and they do not possess poison teeth called fangs. Fangs are specialised for injecting poison in the head from poison glands whereas *Platypus* is oviparous. *Struthio* is a flightless bird and alligators have short and blunt snouts.

**11. Which of the following are not the characteristics of Osteichthyes?**

(I) Cycloid scales
(II) Placoid scales
(III) Presence of operculum
(IV) Covered gill slits
(V) Presence of swim bladder
(VI) Dorsal mouth

Options:

(a) (II) and (VI) (b) (I) and (III)
(c) (IV) and (V) (d) (II), (III) and (IV)

**Ans.** *(a) (II) and (VI)*

**Explanation:** Bony fishes have cycloid scales which are impermeable to water, gill slits are covered by gill covers, have mouth at terminal end and swim bladder is present which act as buoyancy regulator.

**12.** Statement A: Birds and mammals are endothermic.

Statement B: They generate heat by metabolism to keep themselves warm.

(a) Both A and B are correct.
(b) Both A and B are incorrect.
(c) Only A is correct.
(d) Only B is correct.

**Ans.** *(a) Both A and B are correct.*

**Explanation:** Ectotherms are organisms with a body temperature that varies with the ambient temperature because they are unable to maintain a steady temperature. They are also referred to as poikilotherms or cold-blooded creatures. Consider fish and amphibians. While endotherms, often known as warm-blooded animals or homeothermic beings, maintain a steady body temperature. Birds and mammals are two examples.

**13.** Statement A: Bats and whales are classified as amphibians.

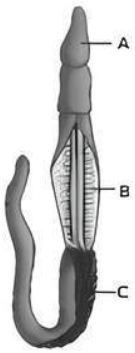
Statement B: Bats and whales have hairs on their body

(a) Both A and B are correct.
(b) Both A and B are incorrect.
(c) Only A is correct.
(d) Only B is correct.

**Ans.** *(d) Only B is correct.*

**Explanation:** Because they both have a four-chambered heart, are warm-blooded creatures, have mammary glands, and give birth to young ones, bats and whales fall within the category of mammals. However, the four-chambered heart is also found in birds and reptiles.

**14.** Which among the following is correct about the following diagram?




(a) A- helps in excretion; B-has mouth and helps in peristalsis of food; C-has gills and helps in respiration
(b) A- mouth and helps in peristalsis of food; B- has gills and helps in respiration; C- has brain and central nervous system
(c) A- helps in excretion; B- has gills and helps in respiration; C- has mouth and helps in peristalsis of food
(d) A- has mouth and helps in peristalsis of food; B- has brain and central nervous system; C- helps in excretion

**Ans** *(a) A- helps in excretion; B-has mouth and helps in peristalsis of food; C-has gills and helps in respiration*

**Explanation:** Hemichordates have three main body parts. They are Proboscis, Collar and Trunk. Proboscis helps in excretion. Collar has a mouth and helps in peristalsis of food. Trunk has gills and helps in respiration.

**15.** Statement A: Avian bones are pneumatic.

Statement B: This makes the body heavier for flight in the air.

(a) Both A and B are correct.
(b) Both A and B are incorrect.
(c) Only A is correct.
(d) Only B is correct.

**Ans.** *(c) Only A is correct.*

**Explanation:** Birds have unusually sophisticated pneumatic bones because their bodies are continuously breathable because to the air sacs that fill their bones. In essence, their lungs are connected to their bones.

**16.** An example of bilaterally symmetrical organism is:

(a) Starfish (b) Human beings
(c) *Amoeba* (d) Earthworm

[Diksha]

**Ans.** *(b) Human beings*

**Explanation:** Bilateral symmetry is characteristic of the vast majority of animals including insects, fishes, amphibians, reptiles, birds, mammals and most crustaceans. So human beings are bilaterally symmetrical while starfish and earthworm have radial symmetry and *Amoeba* has irregular growth patterns of the body.

**17.** Honeybee, house-fly, butterfly, prawn and crab belong to phylum:

(a) Chordata (b) Hemichordate
(c) Arthropoda (d) Mollusca [Diksha]

**Ans.** *(c) Arthropoda*

## Assertion-Reason (A-R)

Given below are two statements labelled as Assertion (A) and Reason (R). Select the most appropriate answer from the options given below:

(a) Both A and R are true and R is the correct explanation of A.
(b) Both A and R are true and R is not the correct explanation of A.
(c) A is true but R is false.
(d) A is false but R is true.

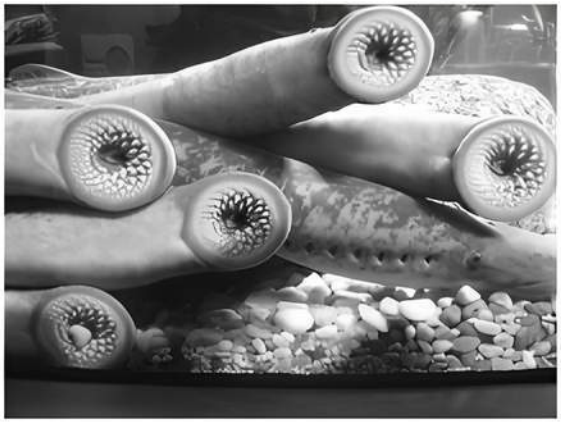
**18.** Assertion (A): Bats and Whales are mammals.

Reason (R): They are viviparous.

**Ans.** *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** Mammals are viviparous, *i.e.* they give birth to their young ones and provide nourishment during development inside the parent body with the help of placenta. Examples: Whales and bats.

**19.** **Sea lampreys are anadromous; from their lake or sea habitats, they migrate up rivers to spawn. Females deposit a large number of eggs in nests made by males in the substrate of streams with moderately strong current. Spawning is followed by the death of the adults. Larvae burrow in the sand and silt bottom in quiet water downstream from spawning areas and filter-feed on plankton and detritus.**



Assertion (A): *Petromyzon* – the lamprey is an ectoparasite.

Reason (R): Lamprey attaches to a fish and makes punctures in its body.

**Ans.** *(a) Both A and R are true and R is the correct explanation of A.*

**Explanation:** Lamprey is an ectoparasite, *i.e.* they are found attached on the surface of fish. They feed on the larger fish by suctorial mouth and make punctures in the body with the teeth and sucks blood and flesh.

**20.** Assertion (A): Chondrichthyes fishes stay at a particular depth in water without swimming.

Reason (R): They do not have a swim bladder which acts as a buoyancy regulator.

**Ans.** *(d) A is false but R is true.*

**Explanation:** Chondrichthyes fishes swim constantly in water as they lack a swim bladder which regulates buoyancy.

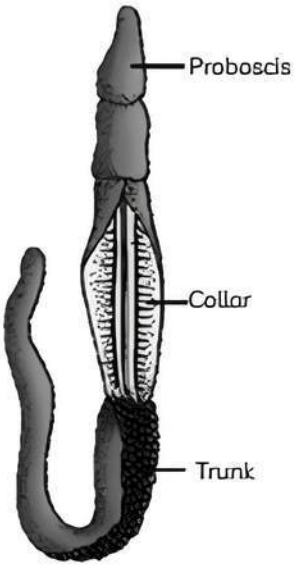
## CASE BASED Questions (CBQs)

[ **4** & **5** marks ]

**Read the following passages and answer the questions that follow:**

**21.** *The diverse array of codon reassignments demonstrate that the genetic code is not universal in nature. Exploring mechanisms underlying codon reassignment is critical for understanding the evolution of the genetic code during translation. Hemichordata, comprising worm-like Enteropneusta and colonial filter-feeding Pterobranchia, is the sister taxon of echinoderms and is more distantly related to chordates.*

*Observe the following diagram and answer the following questions.*




*Balanoglossus*

(A) From which subphylum this organism belongs to?

(B) Hemichordata, Chordata and Echinodermata are ..... .

(C) (i) Why is it not a true chordata?

(ii) These animals are also known as?

**Ans.** (A) *Balanoglossus* belongs to Hemichordata which means half cord.

(B) Hemichordata, Chordata and Echinodermata are Deuterostomes.

(C) (i) Hemichordata is not considered as chordata because they do not possess true characteristics of Phylum Chordata as they lack true notochord.

(ii) These animals are also known as acorn worms.

**22.** *Ramesh was amazed after observing the following picture of a snake, which was shedding its skin. He confirmed this phenomenon from his teacher, who explained to him about reptiles. He said reptiles are also called creeping vertebrates. They show crawling movements, their body is covered with dry and rough skin without glands and contains horny epidermal scales which sloughed off periodically. They have a well-developed digestive system, respiration takes place through lungs, heart is mostly three chambered but in some, it's four-chambered. They are oviparous and development is direct.*

(A) Which of the following reptiles is with a four-chambered heart?

(a) King Cobra (b) Crocodile

(c) Turtle (d) Chameleon

(B) Which of the following classes have scutes and scales on their skin?

(a) Mammals (b) Birds

(c) Reptiles (d) Amphibians

(C) What do you mean by moulting in reptiles?

(a) Shedding of skin

(b) Shedding of hairs

(c) Shedding of tail

(d) Both (b) and (c)

(D) What is the common feature between amphibians and insects?

(a) Larval form

(b) Metamorphosis

(c) Both (a) and (b)

(d) Metagenesis

(E) What is the difference between the epidermis of vertebrates and invertebrates?

| | Vertebrates | Invertebrates |
|---|---|---|
| (a) | Stratified | Simple |
| (b) | Simple | Stratified |
| (c) | Stratified | Stratified |
| (d) | Simple | Simple |

**Ans.** (A) *(b) Crocodile*

**Explanation:** Only crocodiles contain four-chambered hearts with two auricles and two ventricles but most reptiles have a three-chambered heart.

(B) *(c) Reptiles*

**Explanation:** Reptiles have a remarkable feature of having dry and rough skin with scales and scutes present on them.

(C) *(a) Shedding of skin*

**Explanation:** All reptiles shed their skin periodically throughout their life and this process is known as moulting or sloughing.

(D) *(c) Both (a) and (b)*

**Explanation:** The common feature between amphibians and insects are larval forms and metamorphosis.

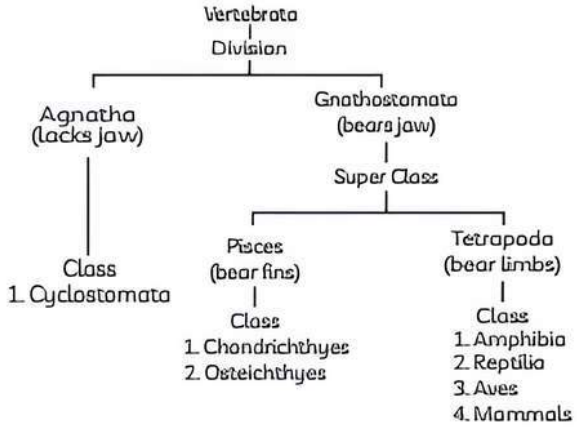
(E)

| (a) | *Vertebrates* | *Invertebrates* |
|---|---|---|
| | *Stratified* | *Simple* |

**Explanation:** Epidermis is stratified epithelium in vertebrates and a simple epithelium in invertebrates.

**23.** **Vertebrates are animals that have a spine. They share common characteristics, including bone structure and major parts of the skeleton, and that vertebrates can be organised into five classes: mammals, birds, fish, reptiles, and amphibians. Each class of vertebrates can be distinguished from the others by its common characteristics, including body covering, body temperature, means of breathing, birth method, and other distinguishing features.**

**The Subphylum Vertebrata is further divided as follows:**




**(A) Why are all vertebrates chordates?**

**(B) Name one organism which belongs to Class Cyclostomata.**

**(C) Give two differences between Agnatha and Gnathostomata.**

**Ans.** (A) The fundamental characteristic of Phylum Chordata is the presence of notochord, a dorsal nerve cord, pharyngeal gill slits and a tail and the animal belongs to vertebrates possess notochord during embryonic stage which is then replaced by vertebral column in adult form. Hence, all vertebrates are chordates.

(B) *Petromyzon*, the lamprey belongs to Class Cyclostomata.

(C) Two differences between Agnatha and Gnathostomata:

| Agnatha | Gnathostomata |
|---|---|
| Mouth is circular and jawless. | Mouth is present with the jaws. |
| Notochord is persistent. | Notochord is replaced by a vertebral column. |

## VERY SHORT ANSWER Type Questions (VSA)

[ **1** mark ]

**24. Give one unique feature of urochordates.**

**Ans.** In urochordates, the notochord is found only in the larval tail.

**25. Why can't fishes survive out of water?**

**Ans.** Because fishes get oxygen from water and when taken out of water, they die due to suffocation.

**26. Which gland is found on the tail of birds?**

**Ans.** Oil glands.

**27. Name the organ which is hydrostatic in function in bony fishes.**

**Ans.** Swim bladder.

**28. What kind of epidermis is found in Phylum Vertebrata?**

**Ans.** Stratified epithelium is found in Phylum Vertebrata.

**Related Theory**

*Stratified epithelium comprises the epidermis of skin in vertebrates as its primary functions are protecting the underlying structure, secretion and absorption.*

**29. Name the integumentary glands present in mammals.**

**Ans.** Sweat glands, tear glands, oil glands and mammary glands.

## SHORT ANSWER Type-I Questions (SA-I)

[ **2** marks ]

**30. How will you differentiate between Chondrichthyes and Osteichthyes?**

**[NCERT Exemplar]**

**Ans.**

| S. No. | Features | Chondrich-thyes | Osteich-thyes |
|---|---|---|---|
| (1) | Habitat | Mostly marine | Marine and fresh-water |
| (2) | Endoskele-ton | Cartilaginous | Bony |
| (3) | Scales | Placoid | Cycloid |
| (4) | Swim bladder | Absent | Present |
| (5) | Gill slits | Uncovered | Covered by operculum |
| (6) | Mouth | Ventral | Terminal |

*(Any four)*

**31. What are pneumatic bones and why are they important for birds?**

**Ans.** Pneumatic bones are present in birds. They are hollow bones and filled with air instead of bone marrow which makes the body light. They are important for birds as these bones contain air sacs due to which respiration is more effectively performed while flying. And it also reduces the weight of the bird's body which helps them in flight.

## SHORT ANSWER Type-II Questions (SA-II)

[ 3 marks ]

**32. Identify the important characters of the following organisms mentioned below.**

**(A) Cyclostomes**

**(B) Chondrichthyes**

**(C) Osteichthyes**

**(D) Amphibian**

**(E) Cephalochordata**

**(F) Vertebrate** **[Diksha]**

**Ans.** (A) Circular mouth

(B) Have cartilaginous endoskeleton.

(C) Have bony endoskeleton

(D) Cutaneous respiration, metamorphic life, three-chambered heart

(E) Having notochord at anterior region

(F) Notochord replaced by a vertebral column

**33. Reptiles show advancement over the amphibians. Discuss.**

**Ans.** Reptiles show advancement over the amphibians in having:

(1) Horny epidermal scales which prevent loss of water.

(2) Claws for defensive mechanisms.

(3) Neck vertebrae for neck movement.

(4) Development of ribs which increase efficiency of lung respiration.

(5) They have eggs with shells for protection on land.

(6) Embryonic membranes for nourishment of the embryo within the eggshell.

**34. Identify the important characters A, B, C, D, E and F of the organisms mentioned in the following grid.**

| | |
|---|---|
| Cyclostomes | A. |
| B. | Chondrichthyes |
| C. | Osteichthyes |
| Amphibian | D. |
| E. | Cephalochordate |
| Vertebrate | F. |

**[Diksha]**

**Ans.** A. Circular mouth.

B. Have cartilaginous endoskeleton.

C. Have bony endoskeleton.

D. Having no neck/cutaneous respiration/ metamorphic life cycle/three-chambered heart/amphibious life.

E. Having notechord at anterior region.

F. Notochord replaced by Vertebral column.

**35. (A) How are Amphibians, Aves and Mammals different from one another, with respect to their processes considering- (i) and (ii) Amphibians, Reptiles, Aves**

**(i) reproduction**

**(ii) respiration**

**(B) Write any four important characters of Mammals.** **[Diksha]**

**Ans.** (A) (i) External, internal; internal

(ii) By cutaneous, lungs and gills in amphibians; by lungs in Aves and Reptiles.

(B) (1) Having- Mammary glands, external body hair, defined head, thorax, abdomen region, viviparous, having five-fingered limbs.

(2) Presence of endoskeleton in vertebrates. Exoskeleton in an invertebrate.

(3) Presence of two pairs of locomotory organs in vertebrates.

**36. What are the features of Class Aves which help them in flying?** **[Delhi Gov. QB 2022]**

**Ans.** There are several features of birds that allow them to fly:

(1) Their anterior limbs have transformed into wings attached to a well-developed pectoral musculature.

(2) They have lightweight bones with internal spaces filled with air. These bones are called pneumatic bones. This feature reduces the density of body of the animal, facilitating flight.

(3) They have no colon or bladder to accumulate faeces or urine. Their excretion is Uric acid which requires the least water and the least storage place.

(4) Birds have aerodynamic bodies and lungs with specialised air sacs. *(Any three)*

**37.** **Give the differences between Chordata and Non-chordata.** **[NCERT Exemplar]**

**Ans.**

| S. No. | Chordata | Non-chordata |
|---|---|---|
| (1) | Notochord is present at some stage in the life of chordate. | Notochord is not present at any stage in the life of a non-chordate. |
| (2) | Pharynx gill slits are present at some stage of life. | Pharynx gill slits are absent. |
| (3) | Post-anal tail is present at some stage in life of chordate. | Post-anal tail is absent at any stage in the life of non-chordate. |
| (4) | Digestive tract is complete. | Digestive tract may be complete, incomplete or absent. |
| (5) | Circulatory system is closed, and heart is ventral. | Circulatory system may be closed, open or absent and heart is dorsal if present. |
| (6) | Respiratory pigment is haemoglobin present in RBCs (red blood cells). | RBCs are absent and other respiratory pigment is found in plasma. |

## LONG ANSWER Type Questions (LA)

[ **4** & **5** marks ]

**38.** **Give the location and one function for each of the following:**
**(A) Proboscis gland**
**(B) Amnion**
**(C) Claspers**
**(D) Coat of feathers**
**(E) Sweat glands**

**Ans.** (A) **Proboscis gland:** It is found in the Hemichordata *i.e.*, *Balanoglossus*. The main function of the proboscis gland is excretion, it is associated with glomerulus.

(B) **Amnion:** It is present in reptiles, birds, and mammals as a membrane which encloses the embryo and forms a fluid–filled cavity. The main function of amnion is to protect the embryo from physical damage and provides nourishment.

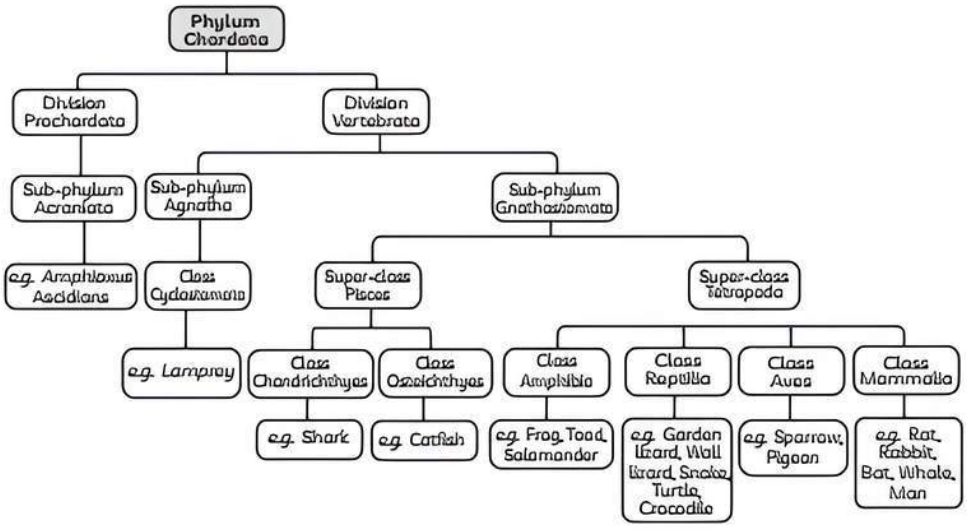
(C) **Claspers:** It is found in males of some cartilaginous fishes as copulatory organs. Its main function is during copulation which serves to transfer sperm into female cloaca.

(D) **Coat of feathers:** The feathers are present on the skin of the Aves's body. Its main function is to regulate their body temperature, also help in flight and provide colouration to birds.

(E) **Sweat glands:** Sweat glands are present throughout the skin of mammals. Its main function is to regulate body temperature and excrete out some waste products from the body.

**39.** **Draw the flowchart of the classification of Phylum Chordata.**

**Ans.**



**40. Name the following organism with their respective class.**

**(A) A vertebrate which is jawless.**

**(B) A limbless reptile.**

**(C) A fish having an electric organ.**

**(D) Organism that forms connecting link between fish and amphibians.**

**(E) Two mammals which lay eggs.**

**Ans.** (A) *Petromyzon* belongs to Class Cyclostomata.

(B) *Snake* belongs to Class Reptilia.

(C) *Torpedo* belongs to Class Chondrichthyes.

(D) *Protopterus* belongs to Class Osteichthyes.

(E) *Platypus* and *Echidna* belong to Class Mammalia.

**41. All the chordates possess four important features either in embryonic or adult stage. Explain them.**

**Ans.** They are:

(1) **Notochord:** It is a solid rod-like structure situated at mid dorsal line between the alimentary canal and nerve cord. It provides support and strength to the system. It persists throughout life in lower chordates but is replaced by the vertebral column in adults.

(2) **Dorsal hollow nerve cord:** The nerve cord persists throughout life in most chordates. It develops in embryos from a plate of ectoderm. It is located above the notochord. Further, the nerve cord in chordates develops into the central nervous system which includes brain and spinal cord.

(3) **Pharyngeal gill slits:** It is located at the lateral sides of pharynx. It also persists throughout life in lower chordates and is modified for jaw support, and hearing in adult forms in chordates.

(4) **Tail:** It is a post-anal part of the body. Its main function is to provide propulsive force in aquatic animals. Tail is reduced or absent in many adult chordates.