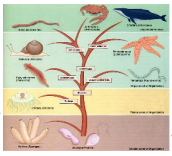


Chapter - 4

Animal Kingdom

Point to Remember

Basis of Classification :

Animals are classified on the basis of following few fundamental features—

1. **Levels of Organisation :**
   (1) Cellular level : Cells are arranged as loose cell aggregates, *e.g.,* sponges.
   (2) Tissue level : The cells performing the same function are arranged into tissues, *e.g.,* Coelenterates.
   (3) Organ level : Tissues are grouped together to form organs, each specialised for a particular function. *e.g.,* platyhelminthes.
   (4) Organ system level : organs are associated to form functional systems *e.g.,* Annelids, Arthropods, Molluscs, Echinoderms and Chordates.
   Example : Circulatory System.

   Open type : Blood pumped out through heart. Not confined to blood vessels. Cells and tissues are directly bathed in it.

   Closed types : Blood is circulated through blood vessels (arteries,veins and capillaries)
2. **Symmetry :**
   - **Asymmetrical :** Cannot be divided into equal halves through median plane *e.g.,* Sponges.
   - **Radial symmetry :** Any plane passing through central axis can divide organism into identical halves. *e.g.,* coelentrates,Ctenophores and echinoderms.
   - **Bilateral symmetry :** Only one plane can divide the organism into two identical left and right halves *e.g.,* Annelids and Arthropods.
3. **Germinal Layers :**

   Diploblastic : Cells arranged in two embryonic layers *i.e.,* external ectoderm and internal endoderm. (Mesoglea may be present in between ectoderm and endoderm) *e.g.,* porifers and Coelentrates. (Cnidarians)

   Triploblastic : Three layers present in developing embryo *i.e.,* ectoderm, mesoderm and endoderm. *e.g.,* Platyhelminthes to Chordates.

4. **Coelom** (Body cavity which is lined by mesoderm)

   Coelomates : Have coelom *e.g.,* Annelids, Arthropods, molluscs, Echinoderms, Chordates etc.

   Pseudocoelomates : No true coelem as mesoderm is present in scattered pouches between ectoderm and endoderm. *e.,g.,* Aschelminthes.

   Acoelomates : Body cavity is absent *e.g.,* Platyhelminthes.

5. **Segmentation** (A) True Metamerism : Found Annelida,Arthropoda, Chordata :
   - Segmentation is external as well as a internal in Annelids.
   - Segmentation is external in Arthropods.
   - Segmentation is internal in chordates.
   - **Metamerism :** If body is externally and internally divided into segments (metameres) with serial repetition of atleast some organs, then phenomenon is called metamerism *e.g.,* Earthworm. (B) Pseudometamerism : Found in tapeworm. The proglottids (segments of tapeworm) budded off from neck not embryonic in origin.

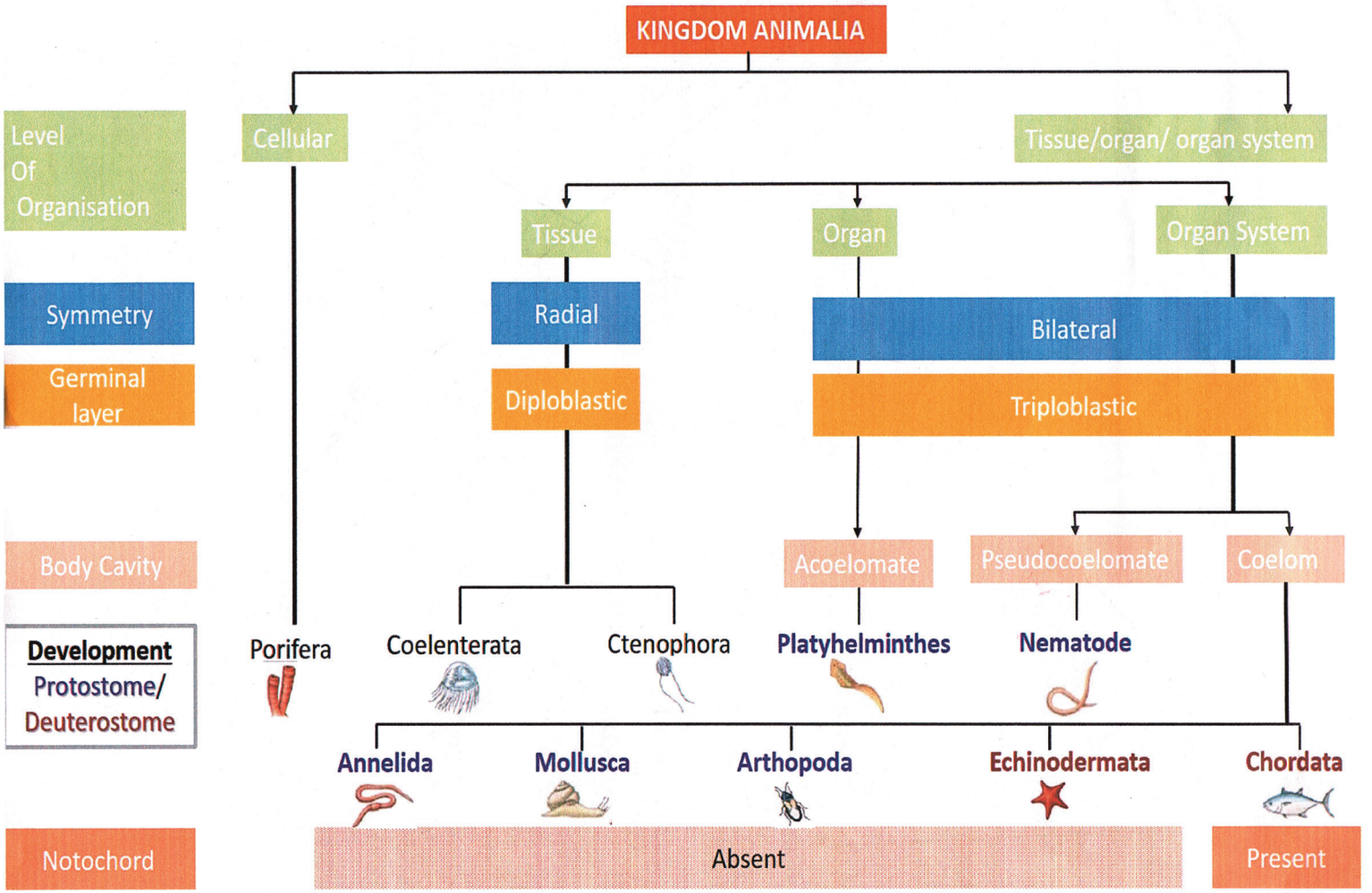
6. **Notochord :**
   - Rod-like structure formed during embryonic development on the dorsal side. It is mesodermally derived *e.g.,* Chordates.
   - Non-chordates do not have notochord .*e.g.,* porifera to echinoderms.

Phylum Porifera :

- Also called sponges.
- Are usually marine and asymmetrical.
- Have cellular level of organisation and diploblastic animals.
- Food gathering, respiratory exchange and removal of wastes occurs through water canal system. Digestion intracellular.
- Ostia (minute pores on body), spongocoel (body cavity) and osculum help in water transport. They are lined by choanocytes (collar cells).
- *Body wall* has skeleton of spicules or spongin fibres.
- Animals are hermaphrodite. Fertilisation internal. Development is indirect (*i.e.,* has a larval stage distinct from adult stage) *e.g.,* ***Sycon, Euspongia. Spongilla*** (Fresh water sponge)

Phylum Coelenterata :

- Also called Cnidarians.
- Are usually marine and radially symmetrical.
- Sessile or free swimming.


KINGDOM ANIMALIA
Level Of Organisation
Cellular
Tissue/organ/ organ system
Tissue
Organ
Organ System
Symmetry
Radial
Bilateral
Germinal layer
Diploblastic
Triploblastic
Body Cavity
Acoelomate
Pseudocoelomate
Coelom
Development
Protostome/
Deuterostome
Porifera
Coelenterata
Ctenophora
Platyhelminthes
Nematode
Annelida
Mollusca
Arthopoda
Echinodermata
Chordata
Notochord
Absent
Present

- Have tissue level of organisation.
- Are diploblastic (with mesogloea)
- Capture of prey, anchorage and defence occurs through cnidoblasts/cnidocytes (have stinging capsules nematocytes) present on tentacles.
- Digestion extracellular and intracellular.
- Have a central gastro-vascular cavity and an opening, hypostome.
- Body wall of some composed of calcium carbonate. e.g. corals.
- exhibit two body forms : polyp and medusa *e.g.,* ***Hydra, Aurelia.***
- Alternation of generation between body forms called **metagenesis** ocurs in ***Obelia*** where :

Medusa (free swimming & umbrella shaped) $\underset{\text{Asexually}}{\overset{\text{sexually}}{\rightleftharpoons}}$ Polyp. (Sessile and cylindrical)

- *e.g.,* ***Physalia, Adamsia, Pennatula, Gorgonia,Meandrina.***

Phylum Ctenophora :

- Also called as sea walnuts or comb jellies.
- Are exclusively marine, radially symmetrical.
- Have tissue level organisation, are diploblastic.
- Digestion both extra and intracellular.
- Body has eight external rows of ciliated comb plates for locomotion.
- Show Bioluminescence (Property of living organisms to emit light).
- Hermaphrodite (sexes are not separate).
- Only sexual reproduction occurs. Exernal fertilization. Indirect development.
  e.g., ***Ctenoplana, Pleurobrachia.***

Phylum Plathyhelminthes :

- Also called as 'flat worms'.
- Have dorsoventrally flattened body. Are mostly endoparasites in animals.
- Are bilaterally symmetrical, triploblastic, acoelomate,with organ level of orgnisation.
- Absorb nutrients through body surface.
- Parasitic forms have hooks and suckers.
- 'Flame cells' help in osmoregulation and excretion.

- Sexes not separate.
- Fertilisation internal. Many larval stages present. ***Planaria*** has high regeneration capacity. *e.g.,* ***Taenia, Fasciola.***

Phylum Aschelminthes :

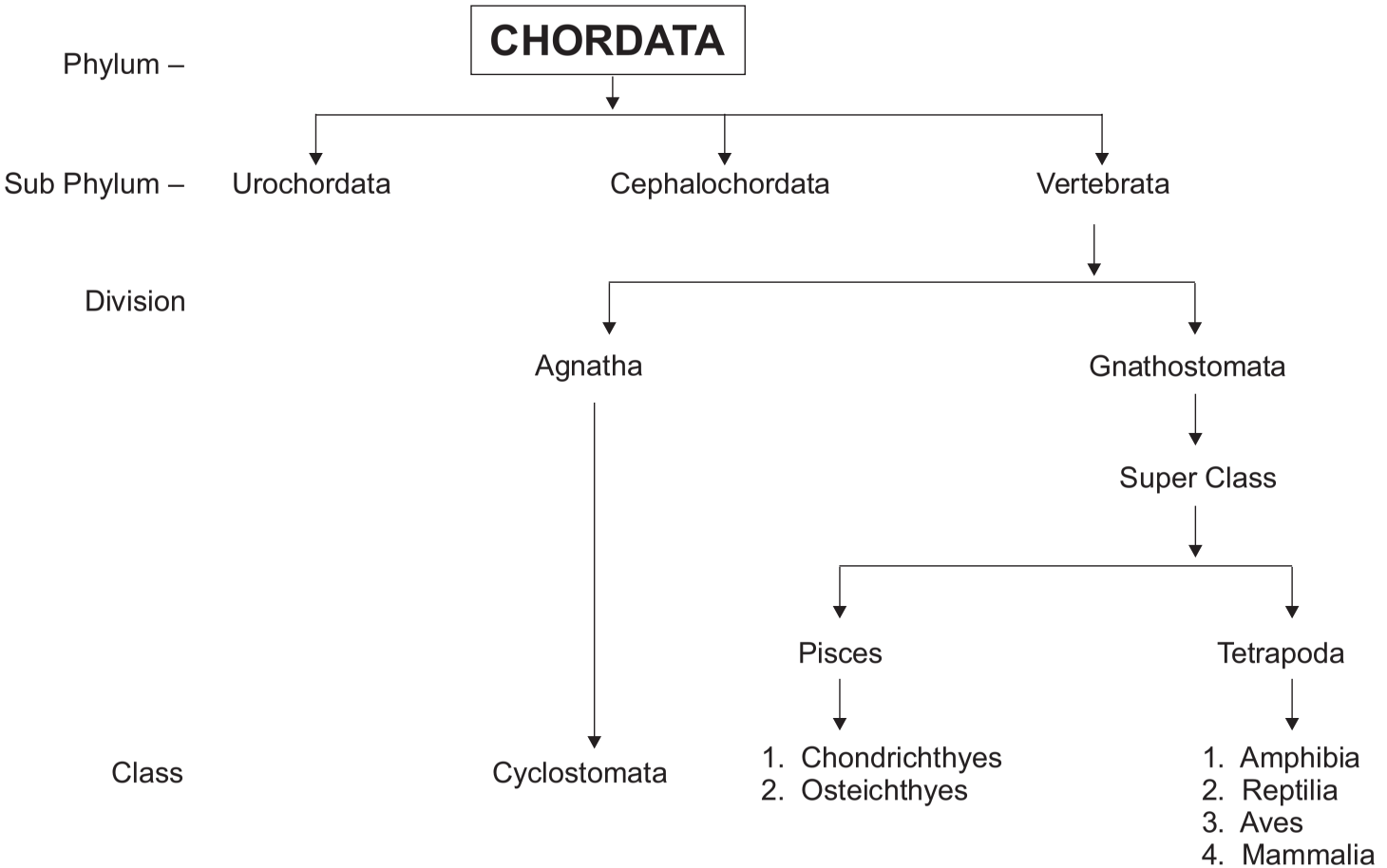
- Also called 'round worms'.
- May be free living, parasitic, aquatic or terrestrial.
- Are bilaterally symmetrical, triploblastic, pseudocoelomate.
- Alimentary canal complete (has muscular pharynx), wastes removed through excretory pore.
- Sexes separate. (dioecious)
- Females longer than males.
- Fertilisation internal. Development direct or indirect. *e.g.,* ***Ascaris,Wuchereria, Ancylostoma.***

Phyum Annelida :

- Are aquatic or terrestrial, free-living or parasitic.
- Are bilaterally symmetrical, triploblastic, organ-system level of organisation and metamerically segmented body.
- Are coelomate animals.
- Have longitudinal and circular muscles for locomation.
- Have closed circulatory system.
- ***Nereis*** (dioecious and aquatic annelid) has lateral appendages called parapodia for swimming.
- Have nephridia for osmoregulation and excretion.
- Neural system consists of paired gangila connected by lateral nerves to a double ventral nerve cord.
- Reproduction is sexual.
- *e.g.,* Earthworm (*Pheretima*) and Leech (*Hirudinaria*) which are hermaph rodites **(*i.e.*, monoecious)**.

Phylum Arthropoda :

- Largest phylum of Animalia.
- Are bilaterally symmetrical, triplobastic, segmented externally and organ system level of organisation, coelomate.
- Body divisible into head, thorax, abdomen and has a chitinous exoskeleton. Jointed appendages are present.


Phylum –
CHORDATA
Sub Phylum –
Urochordata
Cephalochordata
Vertebrata
Division
Agnatha
Gnathostomata
Super Class
Pisces
Tetrapoda
Class
Cyclostomata
1. Chondrichthyes
2. Osteichthyes
1. Amphibia
2. Reptilia
3. Aves
4. Mammalia

- Respiration by gills, book gills, book lungs or tracheal system. Excretion through **malpighian tubules**.
- Sensory organs : Antennae, eyes; Organs of balance : ***Statocysts.***
- Fertilisation usaully internal. Development is indirect or direct. Are mostly oviparous.

  e.g., ***Apis, Bombyx, Laccifer, Anopheles, Culex, Aedes, Locusta, Limulus.***

Phulum Mollusca :

- Second largest phylum of Animalia.
- Terrestrial or aquatic
- Are bilaterally symmetrical, triplobastic and organ system level of organisation, coelomate.
- Body vidisble into ***head, muscular foot*** **and** ***visceral hump*** and is covered by calcareous shell and is unsegmented.
- ***Mantle*** : Soft and spongy layer of skin; *Mantle cavity* : Space between visceral hump and mantle.
- Respiration and excretion by feather like gills in mantle cavity.
- Head has sensory tentacles. Radula a rasping organ for feeding in mouth.
- Are oviparous, dioecious, have indirect development.

  e.g., ***Plia, Pinctada, Octopus, Sepia, Loligo, Aplysia, Dentalium, Chaetopleura.***

Phylum Echinodermata :

- Are spiny bodied organisms with endoskeleton of calcareous ossicles.
- Are exclusively marine, **radially symmetrical** in **adult** but **bilaterally symmetrical in larval stage.** Organ system level of organisation.
- Triploblastic and coelomate.
- Digestive system complete. Mouth ventral, Anus on dorsal side.
- Food gathering, respiration, locomotion carried out by ***water vascular system.***
- Excretory system is absent.
- Reproduction–sexual, sexes are separate.
- Fertilisation external. Development indirect (free swimming larva)
- *e.g.,* ***Asterias, Cucumaria, Antedon, Echinus, ophiura.***

Phylum Hemichordata :

- Represents small group of worm-like organisms.
- Was earlier placed as sub-phylum of Phyum Chordata.

- Bilaterally symmetrical, triploblastic and coelomate with organ system level of organisation.
- Body cylindrical, has proboscis, collar and trunk.
- Circulatory System–open.
- Respiration by gills, excretion by proboscis gland.
- Sexes separate, external fertiliastion, indirect development.

  e.g, ***Balanoglossus, Saccoglossus*****.**

Phylum Chordata :

- Presence of ***Notochord.***
- Have **dorsal hollow nerve cord.**
- Have **paired pharyngeal gill slits.**
- Bilaterally symmetrical, triploblastic, coelomate, organ system level of organisation.
- Heart is ventral.
- Post anal tail present, closed circulatory system.

(i) Sub-Phyla Urochordata /Tunicata

- Notocohord present only in larval tail.

  e.g., ***Ascidia, Salpa, Doliolum***

(ii) Sub-phyla Cephalochordata

- Notochord extends from head to tail (Persistent)

  e.g., ***Amphioxus.***

(iii) Sub-Phyla Vertebrata

- Have notochord only during embryonic period.
- Notochord gets replaced by bony or cartilaginous vertebral column.
- Have ventral muscular heart, kidneys for excretion and osmoregulation, paired appendages (fins or limbs)

Vertebrata have two Division :

(a) Agnatha (Lacks Jaw) : Class : Cyclostomata

- Live as ectoparasites on some fishes.
- Have sucking and circular mouth without jaws.
- Have 6-15 paris of gill slits for respiration.
- No scales, no paired fins.
- Cranium and vertebral column is cartilagenous.

- Marine, Migrate to fresh water for spawning and die after spawning.
- Larva returns to ocean after metamorphosis.

  e.g., ***Petromyzon, Myxine***

(b) Gnathostomata (Bear Jaws)–divides into two super classes :

Super-class : Pisces

1. **Class : Chondrichthyes :**
   - Have cartilagenous endoskeleton, are marine with streamlined body.
   - Mouth ventral.
   - Gill slits without operculum (gill cover).
   - Skin has placoid scales; jaws–very powerful.
   - No air bladder, so swim constantly to avoid sinking.
   - Teeth are backwardly directed, modified placoid scales.
   - Notochord is persistent throughout life.
   - Two chambered heart; poikilotherms (cold-blooded)
   - Sexes separate; males have ***claspers*** on pelvic fins.
   - Internal fertilisation; viviparous.

     e.g., **Torpedo, Trygon, Scoliodon, *Pristis, Carcharodon***
2. **Class : Osteichthyes**
   - Have bony endoskeleton, Aquatic
   - Mouth is usually terminal. Body-Streamlined
   - Four pairs of gill slits covered by operculum, heart two chambered, cold blooded.
   - Skin has cycloid/ctenoid scales.
   - Have air bladder which regulates buoyancy.
   - Sexes separate.
   - Usually oviparous, fertilisation external.
   - Development direct.
   - *e.g.,* ***Hippocampus, Labeo, Catla, Betla, Clarias, Exocoetus***

Sub-Phylum Vertebrata : Gnathostomata

Super Class : Tetrapoda

1. **Class : Amphibia**
   - Can live in aquatic as well as terrestrial habitats.
   - Body divisible into head and trunk, paired limbs.

- Skin moist. No scales.
- Tympanum represents ear. Eyes have eyelids.
- Cloaca is the common chamber where alimentary canal, urinary and reproductive tracts open.
- Respiration by gills, lungs or skin.
- Heart is 3-chambered; cold-blooded; Sexes separate; fertilisation external.
- Oviparous. Indirect development.
- *e.g.,* ***Bufo, Rana, Hyla, Salamandra, Ichthyophis***

2. Class : Reptilia

- Creep or crawl to locomote. Mostly terrestrial.
- Body has dry and cornified skin and epideremal ***scales or scutes.***
- Tympanum represents ear.
- Limbs, when present, are two pairs
- Snakes and lizards shed scales as ***skin cast***.
- Heart 3-chambered but 4-chambered in crocodiles.
- Sexes Separate; fertilisation internal.
- Oviparous. Direct development.
- *e.g.,* ***Testudo, Naja, Vipera, Calotes, Crocodilus, Hemidactylus***

3. Class : Aves

- Presence of feathers except flightless birds and beak (modified jaws) without teeth.
- Forelimbs are modified into wings.
- Hind limbs have scales, modified for walking, swimmng or clasping.
- Skin is dry as no glands on skin except oil gland at base of tail.
- Endoskeleton bony with air cavities (pneumatic) and hollow bones to assist in flight.
- Crop and Gizzard—Additional chamber in digestive tract.
- Air sacs are connected to lungs to supplement respiration.
- Warm blooded (homoiothermous), Heart–Four chambered.
- Sexes separate, fertilization internal
- Oviparous. Direct development.
- *e.g.,* ***Columba, Struthio, Pavo, Corvus, Neophron, Pstittacula, Aptenodytes.***

4. Class : Mammalia

- Have mammary glands to nourish young ones.
- Have two pairs of limbs, adapted to perform special work.

- Skin has hairs.
- External ears or, pinna present.
- Different types of teeth in jaw.
- Homoiothermous; Heart–Four chambered, Lungs for respiration.
- Sexes are separate, fertilisation internal.
- Viviparous. Direct development.
- *e.g.,* ***Rattus, Canis, Elephas, Equus.*** Oviparous mammal is ***Ornithorhynchus.***

Questions

Very Short Answer Questions (1 mark each)

1. What is mesogloea ? Where is it found.
2. When is the development of an organism called as Indirect ?
3. Why are corals important ?
4. What is the difference between class Amphibia and class Reptilia in respect of their skin ?
5. Which phylum consists of organisms with cellular level of organisation ?
6. Name the arthropod which is a (i) Living fossil, (ii) Gregarious pest.
7. Which organ helps in excretion in (i) Arthropods, (ii) Hemichordates ?
8. Why the segmentation in flatworms referred as pseudo-segmentations?

Short Answer Questions-I (2 marks each)

9. Distinguish between poikilothermous and homoiothermous organisms.
10. Define metagenesis with a suitable example.
11. List the characteristic features of class Mammalia.
12. How will you distinguish between male and female round worms?
13. How the water vascular system of echinoderms is different from porifearans?
14. What do you understand by the term ‘indirect development’?

Short Answer Questions-II (3 marks each)

15. What is the difference between organisms on the basis of the coelom ? Give examples for each.
16. Compare the water transport (vascular) system of poriferans and the echinoderms.

17. What are the feature of class Aves which help them in flying ?
18. Write any three adaptations observed in Aves.

Long Answer Questions (5 marks each)

19. Distinguish between the chordates and non-chordates.
20. Differentiate between class Chondrichthyes and class Osteichthyes.

Answers

Very Short Answers (1 mark each)

1. Undifferentiated layer present between ectoderm and endoderm. It is found in Coelenterates.
2. Have a larval stage morphologically distinct from adult.
3. Have skeleton composed of calcium carbonatge which gets deposited and can lead to formation of land forms, *e.g.,* Lakshadweep (a coral island).
4. **Class Amphibia :** Have moist skin without scales.
Class Reptilia : Have dry cornified skin with scales.
5. Phylum Porifera.
6. (*i*) ***Limulus*** (King crab), (ii) ***Locusta*** (Locust)
7. (*i*) Malpighian tubules, (ii) Proboscis gland.
8. Refer to point to remember on page 28.

Short Answers-I (2 marks each)

9. **Poikilothermous** (cold blooded); Lack ability to regulate their body temperature.
Homoiothermous (Warm) : Can regulate body temperature.
10. Refer 'Points to Remember'.
11. Refer 'Points to Remember'.
12. Refer page no. 52, NCERT, Text book of Biology class XI.
13. Refer page no 50 and 54, NCERT, Text book of Biology class XI.
14. Development through larval state.

Short Answers-II (3 marks each)

15. Refer 'Points to Remember".
16. Refer 'Points to Remember, NCERT, Text Book of Biology for Class XI.
17. Wings, bones long and hollow with air cavities, air sacs connected to lungs to supplement respiration.
18. Refer to point to remember on page 36.

Long Answers (5 marks each)

19. Refer Table 4.1, page 55, NCERT, Text Book of Biology for Class XI.

20. Refer 'Points to Remember'.

21. **Case Study**

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 tool on coral reefs. At 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 coming decades - in our lifetime.

1. To which of the following phylum coral reefs belong?

   (a) Echinodermata

   (b) Platyhelminthes

   (c) Cnidaria

   (d) Porifera

Ans.: (c)

2. 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

3. Which one 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

Ans. : (c)

4. The type of association shown by zooxanthellae and corals is known as
   (a) Commensalism
   (b) Symbiotic
   (c) Predation
   (d) Parasitism

Ans.: (b)

5. Assertion : Coral reefs are very beautiful, brightly coloured backgrounds for serene snorkelling experiences
   Reason: A marine algae zooxanthellae live inside them and do photosynthesis
   (a) Both assertion and reason are correct and reason is correct explanation of assertion
   (b) The assertion is incorrect, but the reason is correct
   (c) Both assertion and reason are incorrect
   (d) The assertion is correct, but the reason is incorrect

Ans.: (a)

22. Case Study

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 and 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 insect, 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.

1. Locust belongs to which phyla of animal kingdom :
   (a) Insecta
   (b) Arthropoda
   (c) Mollusca
   (d) Cnidaria

Ans.: (b)

2. **Assertion :** Locust are gregarious pests
   Reason : A single swarm contains up to 40-80 million adults in one square km
   (a) Both assertion and reason are correct and reason is correct explanation of assertion
   (b) The assertion is incorrect, but the reason is correct
   (c) Both assertion and reason are incorrect
   (d) The assertion is correct, but the reason is incorrect

Ans.: (a)

3. Read the following statement

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

Statement II : Locust are not always dangerous and do not usually attack human
   (a) Only I if true
   (b) I and II are true
   (c) I is true but II is false
   (d) I is false but II is true

Ans. : (b)

4. Which of the following statement about locust is not true.
   (a) Locusts are note edible insects
   (b) Locust form swarm
   (c) Locust are not harmful in its solitary phase
   (d) Locust is a large, mainly tropical grasshopper

Ans. : (a)