ANIMAL KINGDOM

Contents

Syllabus

ANIMAL KINGDOM

Classification Basis, Phylum-Chordata, Nemaherdata

Name : _____ **Contact No.** _____

ANIMAL KINGDOM

LEVEL - I

1. Radial symmetry shows by -
(A) Echinodermata (B) eteuopuora
(C) Coelenterata (D) All of these

2. Asymmetrical animal example is -
(A) Sponge (B) Annelids (C) Arthropodes (D) Sea anemones

3. Triploblastic Animal example -
(A) Coelenterata (B) Platyhelminthues-chordata
(C) Porifera (D) Ctenophora

4. Aschelminthes is -
(A) Acoelomate (B) Pseudocoelomate
(C) Schizocoelomate (D) Enterocoelomates

5. Tube within tube body plan present in -
(A) Aschelminthes (B) Ctenophora
(C) Spange (D) Flate worm

6. Select right example of protostomes -
(A) Annelida (B) Arthropode (C) Round worms (D) All of these

7. Excretory organ of flatworm is -
(A) Body surface (B) Nephridia (C) Coxal gland (D) Flame cell

8. Radula present in which phylum -
(A) Mollusca (B) Ctenophora (C) 1 & 2 (D) Cyclostomata

9. Cell aggregate body plam present in -
(A) Sponge (B) Coelenterata (C) Inseet (D) All of these

10. Pentaradial symmetry is found in -
(A) Echinodermata (B) Annelida (C) Porifera (D) Arthropode

11. A marine carticaginous fish that can produce electric current is -
(A) Pristis (B) Torpedo (C) Trygon (D) Scolioden

12. Ophiura is example of phylum -
(A) Hemichordate (B) Mollusea (C) Echinodermata (D) Arthropode

13. Acorn or tengue worm is -
(A) Saccoglossus (B) Balanoglossus (C) Cephalodiscus (D) Asterias

14. Doliolum is example of -
(A) Vertebrate (B) Cephalochordate (C) Urochero (D) None of these

15. Petromyzon is -
(A) Ostracodermi (B) Placodermi (C) Cyclostomata (D) Chondrichthyes

16. Fossil bird is -
(A) Kiwi (B) Archaeopteryx
(C) Emu (D) Milvus

17. Placoid-cycloid scals match is -
(A) Scolioden-cabeo (B) Rohu-petromyzon
(C) Trygen-starfish (D) Chiamara-catla

18. Sea fan is -
(A) Gargenia (B) Physalia (C) Adamasia (D) Aunelia

19. Vsed in experiments on regeneration -
(A) Fasciola (B) Taenia (C) Dugesia (D) All of these

20. Batn sponge is -
(A) Pheronema (B) Euplectella (C) Sycan (D) Euspong

Answer Key (Level - I)

1.	D	**2.**	A	**3.**	B	**4.**	B	**5.**	A	**6.**	D
7.	D	**8.**	A	**9.**	A	**10.**	A	**11.**	B	**12.**	C
13.	B	**14.**	C	**15.**	C	**16.**	B	**17.**	A	**18.**	A
19.	C	**20.**	D								

LEVEL - II

1. Cartilage fish is -
(A) Labco (B) Scolioden (C) Eatala (D) Avabas

2. Cold blooded animal is -
(A) Pigeon (B) Frog (C) Wall lizard (D) 2 & 3

3. Crocodiles have chamber heart is -
(A) 2-chamber (B) 3-chamber (C) 4-chamber (D) Heart is absent

4. Limbless Amphibian is -
(A) Snake (B) Cyprio (C) Ichthyophis (D) Harpoden

5. How many living speeies are present in class reptalia -
(A) About 6000 (B) About 5000 (C) About 10,000 (D) About 40,000

6. Pneumatics bones are present in -
(A) Mammals (B) Pishes (B) Birds (D) Amphibian

7. Tunicabs is -
(A) Proto cherdales (B) Cephalochordates
(C) Urocherdales (D) Vertebrate

8. What kinds respiratory organ pre. in todpole -
(A) Skin (B) Lungs (C) Gills (D) Operculum

9. What kind or body scales are present in any fishes -
(A) Ctenoid (B) Plaeoid (C) Sphenoid (D) All

10. Comb plate present in -
(A) Cyclostomata (B) Ctenophora (C) Mollusea (D) Colentratu

11. Organ level of organisation present in -
(A) Coelentrata (B) Platyhelminthes (C) Annelida (D) Mollusca

12. Cellular level of organisation present -
(A) Protozoa (B) Porifera (C) Coelentrala (D) Platyhelminthes

13. Caval system present in -
(A) Arthropod (B) Porifera (C) Echinodermas (D) Hemichordate

14. Metagenesis present in which type phynum -
(A) Porifera (B) Annelida (C) Cnidaria (D) Cetenophora

15. Bioluminescence show by -
(A) Echinodermata (B) Coelentrata (C) Cetenophora (D) All of these

16. Segmentatim in the body is first obscrved in -
(A) Aschelminthes (B) Platyhelminthes (C) Annelida (D) Cnidoblast

17. Blind sac body plam present in -
(A) Porifera (B) Coelenterata (C) Mollusca (D) All of these

18. Select wrong exoskeletan of animal -
(A) Shell of molluscs (B) Scales of reptiles
(C) Fcatrers of birds (D) Cuticle of fishes

19. Select wrong option for Aves -
(A) Nucleated RBC (B) 3-chamber cloaca
(C) Homcotnermal lwam blooded (D) 10 pair of crainal nerves

20. Haemocyanin pigment content -
(A) CO (B) Cu (C) Fe (D) Ni

Answer Key (Level - II)

1.	B	**2.**	D	**3.**	C	**4.**	C	**5.**	A	**6.**	C
7.	C	**8.**	C	**9.**	A	**10.**	B	**11.**	B	**12.**	B
13.	B	**14.**	C	**15.**	C	**16.**	B	**17.**	B	**18.**	D
19.	D	**20.**	B								

LEVEL - III

1. Which one is not correct -
(A) Humans - Ureotelic
(B) Birds - Uricotelic
(C) Lizards - Uricotelic
(D) Whale - Ammonotelic

2. Jacabsan organs which are additional
(A) Rat (B) snake (C) Man (D) All of these

3. Select wrong match -
(A) Metamaric segmentation - Annelida
(B) book lungs kebelts - scorpian
(C) organ - mollusca
(D) Ophiura - Feather star

4. Gill silts present in cyclostomata -
(A) 6-10 pairs (B) 6-15 paris (C) 2-15 pairs (D) None of these

5. Jaw less fish present in -
(A) Osteichthyes (B) Chondrichthyes (C) Ostracodermi (D) 2 & 3

6. Flying fish is -
(A) Anabas (B) Protopterus (C) Exocoetus (D) Catla

7. Largest reptiles is -
(A) Crocodiles (B) Komodo dragan (C) Pythnon (D) None of these

8. Which one is correct match -
(A) Aves - Avas
(B) Cephalo chardala - doliolum
(C) Amphibian - Aligatro
(D) All of these

9. Select right/correct option -
(A) Placoid scales - scolioden
(B) Cycloid scales - labeo
(C) Ctenoid scales - Catla
(D) All of these

10. 4 pair gills present in -
(A) Scoliodon (B) Labeo (C) Myxine (D) Peteromyzon

11. Bony fish is -
(A) Pristis (B) Sphyrna (C) Trygen (D) Labeo

12. Select wrong match is -
(A) Echinus - Sea urchin
(B) Julus - millil
(C) Pinctoda - Pearloyester
(D) Loa-loa - pinorin

13. Select correct match -
(A) Physalia - sea fan
(B) Adamasia - Sea fan
(C) Adamasia - sea anemone
(D) Velella - Stag horn ceral

14. Group which show lack of digestive track -
(A) Annelida (B) Porifera (C) Arthopoda (D) Molluscs

15. dog tope worm is -
(A) Taeuia (B) Planaria (C) Echinococcus (D) All of these

16. Select wrong match is -
(A) Sycon - crown sponge (B) Spongilla - Batnspong
(C) Euplectella - Venus honler basket (D) Euspongia - Batnspong

17. Space between the lump & the montle present in mollusca -
(A) Keber's organ (B) Gills (C) Eyes (D) Radula

18. Probasis present in -
(A) Mollusca (B) Arthropod (C) Hemichordate (D) Pisces

19. Internal shell absent in -
(A) Sepia (B) Loligo (C) Octopus (D) All of these

20. Select correct match is -
(A) Prawn - gills (B) Scorpian - Book lungs
(C) Cockroach - trachea (D) King crab = Trachea

Answer Key (Level - III)

1.	D	**2.**	B	**3.**	D	**4.**	B	**5.**	D	**6.**	C
7.	C	**8.**	A	**9.**	D	**10.**	B	**11.**	D	**12.**	D
13.	C	**14.**	B	**15.**	C	**16.**	C	**17.**	B	**18.**	C
19.	C	**20.**	D								

Animals : Features & Basis of Classification

The classification helps in easy indentification and also in assigning a systematic position to newly described species.

Inspite of differences in structure and form of different animals, there are fundamental features common to various individuals in relation to the arrangement of cells, body symmetry, neature of coelom, patterns of digestive, circulatory or reproductive systems. These features are used as the basis of animal classification.

Levels of Organisation

All members of **Animalia** are multicellular, heterotrophic eukaryotes. But, all of them do not exhibit the same pattern of organisation of cells. The cells in their body are of several types. These are organised into several functional units of progressively increasing complexity.

The animal body shows four basic levels of structural organisation as given below :

1. Cellular Level

In thie level, the body shows some division of labour among cells. They are remarkable independent and can change their form and function. It is found in **sponges.** The body consists of many cells arranged as loose cell aggregates but, cells do not form tissues.

2. Tissue Level

Here, in coelenterates, the arrangement of cell is more complex. The cells performing the same function are arranged into tissues, hence is called tissue level of organisation.

3. Organ Level

In Platyhelminthes and other higher phyla, tissue are grouped together to form organs, each specialised for a particular function, i.e., organ level organisation is present.

4. Organ System Level

In animals like annelids, arthropods, molluscs, echinoderms and chordates, organs have associated to form functional systems, each system concerned with a specific physiological function. This is called organs system level of organisation. Organ systems in different groups of animals exhibit various patterns of complexities.

Like the digestive system in Platyhelminthes has only a single opening to the outside of the body that serves as both mouth and anus and is thus, called **incomplete.**

A complete digestive system has two openings, i.e., mouth and anus.

Symmetry

The symmetry refers to the arrangement of parts on the opposite sides of the body of a three dimensional animal.

On the basis of symmetry, animals can be of following types

1. Asymmetrical

Animals in which, any plane passes through the centre does not divide them into equal halves such animals are called asymmetrical, e.g., Sponges.

2. Symmetrical

The body of some animals can be divided into two similar equal halves by one or more planes. Such animals are called symmetrical.

The symmetry can be further divided as

i. Radial Symmetry

When an plant passing through the central axis of body divide the organism into two identical halves, its called radial symmetry, e.g., Coelenterates, ctenophora and echinoderms.

ii. Bilateral Symmetry

In some animals, body can be divided into identical and right halves in only one plane. This is called bilateral symmetry, e.g., Annelids, arthropods, etc.

- When the body can be divided into two similar halves by one or two vertical planes only, the radial symmetry is called **biradial symmetry.** e.g., sea anemones.
- **Spherical symmetry** is found in animals like Volv some sponges and corals. The body of the individed can be divided into similar halves by any plane pass through the centre.
- Adult sponges are asymmetrical, however they start their life form as a radial symmetrical larva.

Diploblastic and Triploblastic Organisation

Germ layers are group of cells behaving as a unit during early stages of embryonic development. It differentiate to give rise to all the tissues/organs of the fully formed individuals.

On the basis of germ layers animals are classified as follows

1. Diploblastic

Animals in which the cell are arranged in two embryonic layers-an external ectoderm and an internal endoderm, are called diploblastic animals. In addition, an undifferentiated layer, mesoglea is present in between the ectoderm and the endoderm e.g., Coelenterates.

2. Triploblastic

The animals in which the developing embryo has a third germinal layer mesoderm, in between the ectoderm and endoderm are called triploblastic animals. e.g., All animals form phylum-Platyhelminthes to phylum-Chlordata.

Coelom

The body cavity (between the body wall and gut wall) which is lined by mesoderm is called coelom. The presence or absence of coelom is very important in classification.

On the basis of coelom, animals can be classified in three different groups

1. Acoelomates

The animals in which the body cavity is absent are called acoelomates, e.g., Poriferans, platyhelminthes, coelenterates, ctenophors and flatworms.

2. Pseudocoelomates

In some animals, the body cavity is lined by mesoderm. Instead, the mesoderm is present as scattered pouches in between the ectoderm and endoderm. Such a body cavity is called **pseudocoelom** and the animals possessing them are called pseudocoelomates, e.g., Aschelminthes.

3. Coelomates

The animals having true coelom are called coelomates. A true **coelom** arises within mesoderm and is therefore, lined by mesodermal tissues, i.e., externally by **parietal peritoneum** and internally by **visceral peritoneum.**

Knowledge Plus

- A true coelom appeared for the first time in annelids.
- Origin of coelom is an important step in animal evolution.
- In arthropods, true coelom is reduced and blood fills the viscera.

Body Plant

Animals have three types of body plants. There are

Animals

Cell Aggregate Plan	Blind Sac Body Plan	Tube within Tube Plant
A cluster of cells with a limited division of labour in which tissues or organs are absent. Example Sponges.	Cells are organised into tissues. There is division of labour and each tissue performs a specific task. Single opening of the body for ingestion and egestion. Example Coelenterates, flatworms, ctenophores.	Level of organisation is organ system, Propen digestive canal is present, having two openings, i.e, one for ingestion and other for egestion. Example Aschelminthes.

The body plans of all higher invertabrates and vertebrates cannot be described due to increase in their body complexity. However, on the basis of their development from blastopore, there can be classified as :-

Protostomes	Deuterostomes
Mouth develops from blastopore region and anus develops later. Example Annelida, mollusca, arthropoda and roundworms.	Anus develops first from blastopore region and mouth develops later. Example Echinoderms and chordates.

Segmentation

In some animals, the body is externally and inernally divided into segments or somites with a serial repetition of at least some organs.

Segmentation can be of following two types :

1. Metameric Segmentation

A segmentation that simultaneously divides body both externally and internally is called **metamerism** or **metameric segmentation.** This kind of segmentation is found in annelids, arthropods and chordates.

2. Pseudometamerism

If is found in tapeworm, the body is divisible into parts or segments called **proglottides.** They develop from the neck but are not embryonic in origin. Such a repetition which appears due to repeated budding is known as false **segmentation** or **pseudometameris.**

Notochord

It is a mesodermally derived rod-like structure formedo n the dorsal side during embryonic development in some animals.

Animals with notochord are called **chordates** and those animals which do not form this structure are called non-chordates, e.g., Porifera to echinoderms.

Other Important Features

Apart from the basic features of body, size and shape, animals also possess some other important features too.

Some of them are given below :

1. Cephalisation

It is the differentiation of head in anterior part of the body. It involves the concentration of nervous tissue and sense organs in the head.

2. Appendages

The projecting structures of the body that perform specific functions like locomotion, capturing of food, sensation, etc, are called **appendages**, e.g., Wings, fins, limbs, tentacles, parapodia, setae, etc.

3. Digestive System

Digestive tract is the passage through which food is taken for digestion, absorption and egestio. The digestive tract that has a single opening for both ingestion and egestion is called **incomplete digestive tract**, e.g., in flatworms and coelenterates.

The digestive tract with two external openings, one for ingestion and other for egestion is called **complete digestive tract**, It is present in aschelminthes and high animals.

4. Respiratory System

Respiration occurs in different ways in different animals :

(i) They tiny aquatic animals like *Amoeba*, Hyd etc. respire through the body surface. This called **body surface respiration.**

(ii) Larger aquatic animals have special organs call gills for respiration. This is called branch respiration, e.g., In prawns, fishes and mussels.

(iii) The land animals respire through lungs. This called **pulmonary respiration**. It occurs in frog, snails, lizards, birds and mammals.

(iv) Insects have **tracheal respiration**, which occur through trachea i.e., an intercommunicating tube through which gas exchange occurs.

(v) In animals like earthworm, leech, frogs etc. skin acts as respiratory surface. This is called **cutaneous respiration.**

(vi) Scorpions have **book lungs** and king crabs have **book gills** for resipration.

(vii) In frog, gas exchange also occurs through the lining of buccopharyngeal cavity. Hence, call **buccopharyngeal respiration.**

Frogs have three modes of respiration i.e., Cutaneous, buccopharyngeal and pulmona

5. Circulatory System

The circulatory system is responsible for the transport materials in the body. It consists of a fluid called blood vessels and a heart.

The circulatory system is closed when blood flow within the blood vessels.

If blood flows in spaces, and the **sinuses** are without proper boundries. In insects such as prawn and Pila, blood is colourled that contains **haemocyanin** (a copper containing pigment) while, in vertebrates, blood containing **haemoglobin** (an iron-containing pigment).

6. Excretory System

Excretory system is involved in the removal nitrogenous waste products from the body of organism with the help of excretory organs.

The excretion occurs in different ways in different organisms. Such as

(i) The excretory organs are absent in those organisms where organisation level is below the tissue level. Here, each individual cell takes part in excretion.

(ii) In animals like sponges, coelenterates, all the cells are in contact with water. Excretion occur by **general body surface.**

(iii) In vertebrates, kidneys are the excretory organs.

Based on excretory products animals can be classified into four categories as given below :

(i) **Aminotelic**, excretory product is amino acids, e.g., Starfish, Unio, etc.

(ii) **Ammonotelic**, excretory product is ammonia, e.g., most invertebrates and some molluscs.

(iii) **Ureotelic**, excretory product is urea, e.g., Cartilaginous fishes, snail, prawn, mammals and aquatic reptiles.

(iv) **Uricotelic**, excretory product is uric acid, e.g., Insects, terrestrial crustaceans, lizards, snakes, birds etc.

7. Nervous System

The nervous system is the aggregation of **nerve cells** that help in coordinating and controlling various activities of the body.

8. Endocrine System

The endocrine glads are also called **ductless glands.** These secrete hormones. Endocrine glands occur in all vertebrates and in some invertebrates (like insects).

9. Sensory System

This system consists of specialised cells, tissues and organs which can pick up a stimulus and transmit the same to the nervous system.

Sensory system consists of different structure in different organisms, e.g., Antennal (tactile and smell), tentacles (tactile), skin (tactile), statocyst (balancing), ear (hearing), olfactory epithelium (smell), taste buds (taste), eyes (vision), lateral line organs (current receptors), etc.

10. Skeletal System

Skeletal system is a hard, internal or external framwork that provides support and shape to the body. Some animals which are devoid of a skeleton have soft body, e.g., Platyhelminthes, aschelminthes, annelida.

Skeleton system can be of following types ;

i. Exoskeleton

It is the hard supporting and protective framwork present on exterior of the body. It is made of non-living matter, e.g., External shells of molluscs, cuticle of arthropods, scales of fishes and reptiles, feathers of birds, hair, hoofs, nails, horns and claws of mammals.

ii. Endoskeleton

It is a hard supporting framwork present in the interior of the body. In invertebrates such as sponges, it is made up of calcareous or siliceous spicules. In vertebrates, it is composed of hard living tissues called cartilages and bones. Endoskeleton supports whole body of an organism.

11. Sex

Animals generally have sex organs to produce sexual reproduction. When both male and female sex organs are found in some individual, it is called hermaphrodite or bisexual or monoecious, e.g., Liver fluke, tapeworm, earthworm, leech, etc.

The animals with either female or male sex organ is known as unisexual or dioecious, e.g., Frog, lizards, birds, dog, etc. When male and female can be distinguished on the basis of external features, the condition is called **sexual dimorphism**, e.g., Lion and liones, man and women, peacock and peahen, etc.

12. Reproduction

Reproduction in organisms can be either asexual or sexual.

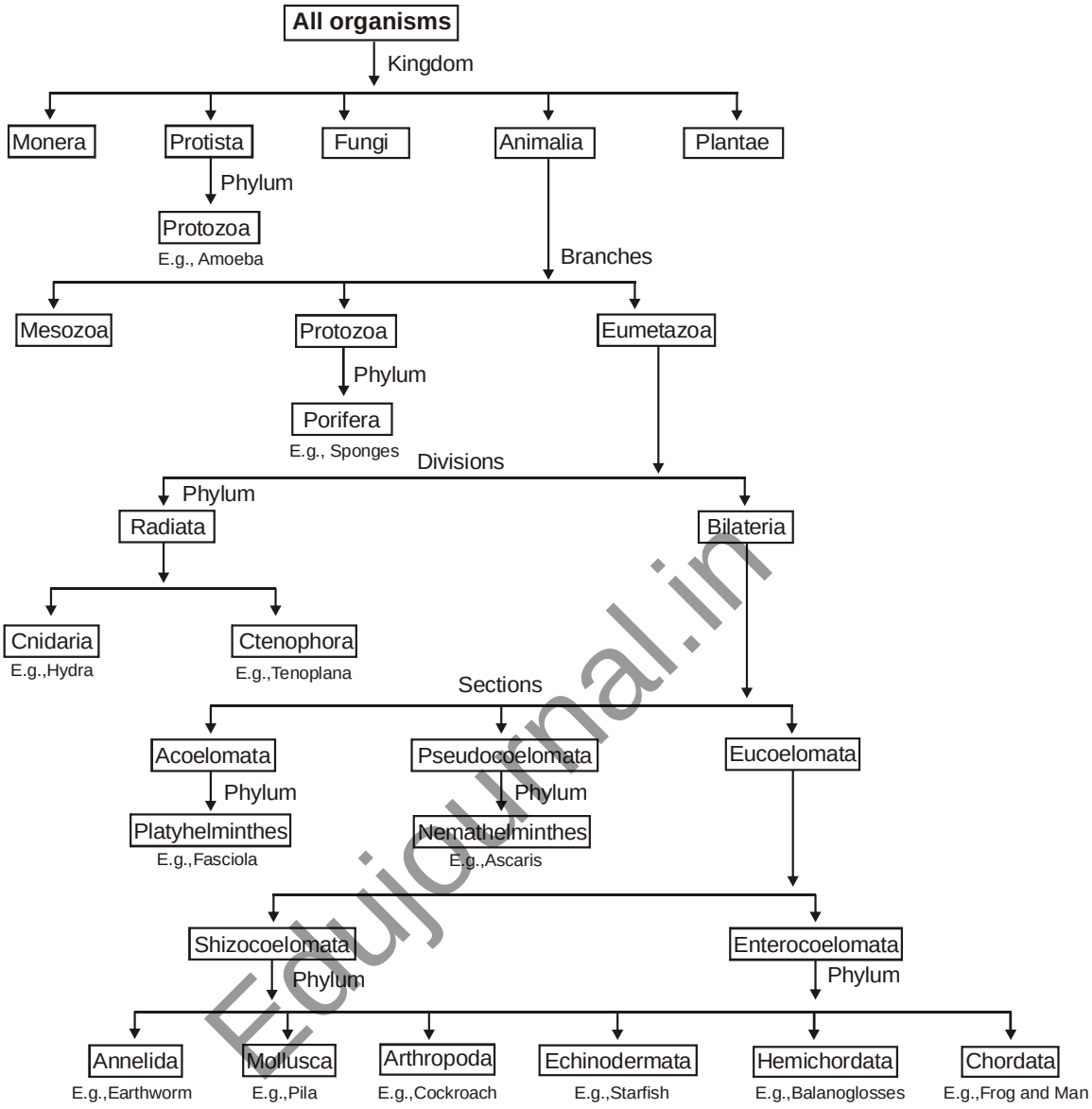
i. Asexual Reproduction

This kind of reproduction does not involve fusion of gametes. It is found in lower animals like sponges, coelenterates, annelids, platyhelminthes. The common methods are budding, fussion, fragmentation and regeneration.

ii. Sexual Reproduction

It involves formation and fusion of gametes. The male gametes called sperm are motile while, the female gametes called ova are generally non-motile.

Nemaherdata



Phylum-Protozoa (Goldfuss)

(i) Protozoans are the first formed (Gr. Protos = first + zoon = animals) animals which are one-called.

(ii) Protozoa exhibit 'Protoplasmic level of organisation.'

(iii) Body symmetrical or asymmetrical, free-living or parasitic.

(iv) Locomotion is effected by flagella, cilia or pseudopodia.

(v) Excretion and respiration occurs by diffusion.

(vi) Nutrition is holophytic (*Euglena*), holozoic (*Amoeba*), saprozoic (Mastigophora).

(vii) Osmoregulation takes place in Protozoa with the help of **contractile vacuole.**

(viii) Nitrogenous waste material in Protozoa is **ammonia**.

(ix) Reproduction occurs by asexual and sexual methods.

(x) Classification of Protozoa is mainly based on **locomotory organelles.**

Classification

Phylum-Protozoa is divided into four classes :

Class - **Sarcodina**, e.g., Amoeba, Entameoba histolytica

Class - **Flagellata**, e.g., Euglena, Trypanosoma

Class - **Sporozoa**, e.g., Plasmodium, Monocystis

Class - **Ciliata**, e.g., Paramecium, Opalina

Phylum-Porifera (Robert Grant)

(i) Sponges have **no tissues.**

(ii) The cavity common to all sponges is **spongocoel** lined with flagellated choanocytes.

(iii) **Choanocytes** or collar cells are present only in sponges.

(iv) Different types of canal system in sponges are **asconoid, syconoid** and **leuconoid.**

(v) Sponges have numerous mouthlets (**ostia**) and one exit (**osculum**).

(vi) Skeletion of sponges is secreted by **Scleroblast.**

(vii) All sponges are hermaphrodites. Reproduction is asexual or sexual. Sex cells (sperms and ova) arise from undifferentiated **archaeocytes.**

(viii) Classification of sponges is primarily based on skeleton.

(ix) Excretion and respiration occur by diffusion.

(x) Development is indirect or direct. The common larval forms are **parenchymula** (Leucosolenia and Clathrina), **amphiblastula** (Sycon), etc.

Classification

Phylum-Porifera is divided into three classes :

Class - **Calcarea or Calcispongiae,**
e.g., *Laucosolenia, Sycon.*

Class - **Hexactinellida or Hyalospongiae,**
e.g., *Euplectella, Hyalonema*.

Class - **Demospongiae,**
e.g., *Spongilla, Cliona, Euspongia*.

Phylum-Cnidaria (Coelenterata)

(Leuckart)

(i) Cnidarians are radially symmetrical animals with cells **tissue grade of body organisation.**

(ii) Body wall is **diploblastic** with two germ layers : **ectoderm** and **endoderm** (gastroderm).

(iii) The body cavity is known as **coelenteron** or **gastro-vascular cavity.**

(iv) Asexual phase is generally **polyp** and sexual phase is **medusa.**

(v) Some members like *Physalia* (Portuguese man of war) exhibits **polymorphism.**

(vi) The most characteristic feature of coelenterates is the presence of **nematocysts or stinging cells.**

(vii) **Nematocysts** are mainly concerned with food capture, defense and attachement.

(viii) Respiratory, circulatory and excretory systems are absent.

(ix) Reproduction is both asexual and sexual, larval stages are **Planula** (*Obelia*) and **Ephyra** (*Aurelia*).

Classification

Phylum-Cnidaria is divided into three classes ;

Class - **Hydrozoa**, e.g., *Hydra, Obelia, Physalia*

Class - **Scyphozoa**, e.g., *Aurelia* (*jellyfish*)

Class - **Anthozoa**, e.g., *Metridium, Gorgonia.*

Phylum-Platyhelminthes

(Gegenbaur)

(i) Flatworms are **triploblastic**, bilaterally symmetrical, **asoelomate.**

(ii) Flatworms have **tissue organ-system level of organization.**

(iii) **Anus is absent** like coelenterates, with **blind-sac body plan.**

(iv) Excretory organs are protonephridia or solenocytes or flame cells.

(v) Digestive, excretory, nervous and reproductive systems are present.

(vi) Cephalization (differentiation of head) begins in flatworms.

(vii) Monoecious or hermaphrodites with well-developed reproductive system.

(viii) Life cycle complicated with many larval stages.

Classification

Phylum-Platyhelminthes is divided into three classes :

Class - Turbellaria, e.g., *Planaria*

Class - Trematoda, e.g., *Fasciola*

Class - Cestoda, e.g., *Tapeworm* (*Taenia*)

Phylum-Nemathelminthes

(Gegenbaur)

(i) **Tube within a tube** body plan and organ-system grade of body organization is present.

(ii) These are **triploblastic**, bilaterally symmetrical and **pseudocoelomate.**

(iii) A **syncytial** or cellular epidermis, is present that is generally without cilia.

(iv) Excretory system consists of **protonephridia** and canals.

(v) Skeletal, respiratory and circulatory system are absent.

(vi) Reproductive system well-developed. Usually **unisexual** with **sexual dimorphism.**

(vii) Development may be direct or indirect. During indirect development a larva is present. **Filariform** larva is present in *Ancylostoma* (hookworm), microfilaria larva is found in *Wuchereria* (filarial worm) and rhabditiform larva is present in *Ascaris* and *Enterobius* (pinworm).

Classification

Phylum-Nemathelminthes is divided into two classes :

Class - **Rhabditea**, e.g., *Ascaris, Wuchereria*

Class - **Enoplea**, e.g., *Trichinella, Trichuris*

Phylum-Annelida (Lamarck)

(i) Annelids are bilateral **eucoelomate** (with true coelom), **schizocoelic** segmented worms.

(ii) Annelids are characterized by **metameric segmentation.**

(iii) Presence of satae which are chitinous and unjointed.

(iv) Alimentary canal is straight, excretory organs are **nephridia.**

(v) Blood vascular system is usually closed type. Blood is red due to the presence of repiratory pigment **haemoglobin or erythrocruorin**, found dissolved in the plasma.

(vi) Development is mostly direct. If there is indirect development (e.g., *Nereis*), it includes a trochophore larva,

Classification

On the basis of number and presence or absence of steae phylum-Annelida is divided into three classes.

Class - Polychaeta, e.g., *Nereis, Aphrodite*

Class - Oligochaeta, e.g., Earthworm (*Pheretima*)

Class - Hirudinea, e.g., *Hirudinaria.*

Phylum-Arthropoda (Vonsei Blod)

(i) Arthropods are **bilaterally symmetrical**, triploblastic and **metamerically segmented.**

(ii) Each segment basically bears a pair of lateral jointed appendages adapted for good ingestion, locomotion, respiration , copulation, etc.

(iii) Exoskeleton is light weight, tough and composed of structrual polysaccharide **chitin.**

(iv) Body cavity is a fluid filled **haemocoel.**

(v) Circulatory system open type with dorsal heart, arteries and sinuses.

(vi) Muscular system well-developed, muscle fibres always striated.

(vii) Respiration by **gills** or **trachea** or **book lungs.**

(viii) Excretion **green or coxal glands** or by **Malpighian tubules.** Excretory product is **uric acid.**

(ix) Sexes mostly separate with sexual dimorphism. Paired reproductive organs and ducts are present.

(x) Fertilization typically internal, in female's body. Eggs megalecithal. Oviparous or viviparous.

Classification

On the basis of body divisions and presence or absence of certain appendages phylum-Arthropoda is divided into four sub-phyla :

Sub-Phylum	-	**Onychophora**, e.g., *Peripatus*
Sub-Phylum	-	**Trilobitomorpha**, e.g., *Triarthrus*
Sub-Phylum	-	**Chelicerata**
Class	-	Merostoma, e.g., *Limulus* (the king-crab)
Class	-	Arachnida, e.g., *Palamnaeus* (scorpion)
Sub-Phylum	-	Mandibulata
Class	-	Crustacea, e.g., *Palaemon*, Cancer
Class	-	Myriapoda, e.g., *Scolopendra* (centipede), *Thyroglutus* (millipede)
Class 3	-	Insecta, e.g., *Periplaneta*, *Musca*

Economic Importance of Insects

(i) The study of insects in know as **Entomology.**

(ii) Insecta can be divided into two series :

(a) Harmful insects (b) Beneficial insects

Harmful Insects

(a) Harmful insects can be divided into six series ;

- Pests of agriculture
- Pests of store-grains
- Household pests
- Pests of domestic animals
- Disease carriers
- Poisonous insects

(b) Some important agricultural pests are : grasshoppers and locusts, cotton bollworms (pests of cotton), *Pyrilla* (sugarcane leaf-hopper), *Aphids* (pests of vegetables).

(c) Some important store-grain pests are :

Rice weevil	Sitophilus oryzae
wheat weevil	Trogoderma granarium
Red flour beetle	Tribolium confusum
Pulse beetle	Callosobruchus chinensis

(d) Some important store-grain pests are :

Cockroaches	Periplaneta
Houseflies	Musca
Mosquitoes	Anopheles, Culex and Aedes
Termites	Odontotermes

Disease Carrier Insects	
Housefly	Anthrax, diarrhoea, tuberculosis, leprosy, typhoid, cholera, etc.
Mosquitoes	Malaria, filariasis, dengue fever, yellow fever, etc.
Kissing bug	Chagas disease
Rat flea	Bubonic plague
Sand fly	Kala-azar
Tse-tse fly	African sleeping sickness
Bed bug	Typhus fever

(e) Honey, bees, wasps, bedbugs and mosquitoes are poisonous insects.

Beneficial Insects

Honey Bee

- A colony of honey bee consists of three castes, viz, **queen**, **drone** and **worker.**
- Bee rearing is called **apiculture.**
- Diploid fertilized eggs give rise to queen and workers and unfertilized haploid produced males and drones.
- Natural **parthenogenesis** occurs in honey bee.
- Bee wax is a secretory product of **hypodermal glands** of the abdomen of worker bee.
- Honey is stored in the cell of comb.
- **Karl Von Frisch** decoded the language of dance by bees.
- Mouthparts of honey bee are **chewing and lapping type.**
- Different species of honey bee are : *Apis mellifera*, *A.dorsata, A.indica, A.florea.*
- 'Royal jelly' is secreted by by worker bees.
- Honey bee is one of the most important pollinator in agriculture.

Silk Moth

- Silk is produced by an insect called silk moth.
- *Bombyx mori* is the **mulberry silkworm.**
- **Silk** is obtained from cocoon.
- Caterpillar feeds on mulberry leaves, its **salivary gland secretes liquid silk.**
- Silk thread is formed of two proteins namely **fibroin** and **sericin.**
- Natural silk contains nitrogen.

Lac Insects

- Lac is produced commercially by an insect *Tachardia lacca* (*Laccifer lacca*).
- Lac is secretion of mainly female.
- Lac is resinous substance.
- Lac is actually **secreted for its protection** and not for the food of the insect.

Red Ants

(i) Red ants are used for the production of formix acid.

(ii) Most molluscs secrete a **shell** of calcium carbonate that protects and supports their soft tissues.

(iii) The body is covered by a skin fold **mantle** which secretes the shell.

(iv) Body cavity is a reduced **haemocoel.**

(v) Molluscs typically employ a feeding organ called **redula.**

(vi) Circulatory system mainly of **open type.** Blood with **amoebocytes**, respiratory pigment is copper containing **haemocyanin** dissolved in plasma.

(vii) Sense organs include eyes, statocysts and **osphradia** (chemoreceptor to test chemical nature of water).

(viii) Fertilization is generally external, development direct or through free larval forms like trochophore, veliger, glochidium, etc.

Classification

Molluscs are classified into seven classes.

Class - **Monoplachophora**, e.g., *Neopilina* (a living fossil and connecting link between annelids and molluscs)

Class - **Aplacophora**, e.g., *Chaetoderma*

Class - **Polyplacophora**, e.g., *Chiton*

Class - **Scaphopoda**, e.g., *Dentalium*

Class - **Gastropoda**, e.g., *Pila, Aplysia*

Class - **Pelecypoda**, e.g., *Unio*

- **Pearl industry** was introduced first in Japan by **Kokichi Mikimoto** in 1890.

Class - Cephalopoda, e.g., Sepia, Octopus (the foot is located on the head)

Phylum-Echinodermata (Jacob Klein)

(i) Echinoderms are triploblastic, radially symmetrical often pentamerous, larva with bilateral symmetry.

(ii) Echinoderms are marine.

(iii) Echinoderms are uncephalized (head absent), the oral-aboral axis is perpendicular to the pentamerous plane.

(iv) A calcareous endoskeleton is present in the form of ossicles bearing protective spines.

(v) The **water vascular system** is a unique organ system that functions in locomotion, feeding, respiration and excretion.

(vi) Locomotion by external **tube feet** connected with water vascular system.

(vii) Usually dioecious, fertilization external.

(viii) Development is indirect through free swimming larval stages.

Classification

- Phylum-Echinodermata is divided into five classes :

Class - **Asteroidea**, e.g., *Asterias* (starfish)

Class - **Ophiuroidea**, e.g., *Ophiothrix* (brittle-stars)

Class - **Echinoidea**, e.g., *Echinus* (sea urchin) (commonly known as **Aristotle's lantern**)

Class - **Holothuroidea**, e.g., *Cucumaria*, (sea cucumber)

Class - **Crinoidea**, e.g., *Antedon* (feather star).

Phylum-Chordata

(i) Three primary chordate characters are :
- **(a)** Presence of notochord.
- **(b)** Presence of single dorsal tubular nerve cord.
- **(c)** Presence of paired pharyngeal clefts.

(ii) Presence of a post **anal tail**.

(iii) Bilateral symmetry and metameric-segmentation.

(iv) Presence of true (**schizocoel** in vertebrates and **enterocoel** in protochordates).

(v) Blood vascular system closed, heart ventral with RBCs.

(vi) Sexes saparate with rare exceptions.

(vii) Phylum-Chordata is divided into three sub-phylum-**Urochordata**, **Cephalochordata** and **Vertebrata**.

Sub-Phylum-Urochordata

(a) *Notochord* only in the tail region of larva.

(b) Commonly called 'tunicates'

(c) **Retrogressive metamorphosis** results in the degeneration in adult, e.g., *Herdmania* (sea squirt).

Sub-Phylum-Cephalochordata

(a) **Adult** with notochord extending from head to tail, hence, the name Cephalochordata.

(b) Coelom enterocoelous.

(c) Circulatory system closed but without heart.

(d) Excretion by protonephridia with **solenocytes.**

(e) Nerve cord dorsal, tubuar without genglia and brain, e.g, Amphioxus.

Sub-Phylum-Vertebrata (Craniata)

(a) Vertebrates have well-developed **cranium** and vertebral column.

(b) Notochord is embryonic in adult replaced by vertebral column.

(c) Vertebrates are divided into two divisions :
- (i) **Agnatha** (without jaws), e.g., Petromyzon.
- (ii) **Gnathostomata** (with jaws), e.g., Pisces, Amphibia, Reptilia, Aves, Mammalia.

Class-Pisces (Fishes)

(a) Study of the fishes is Ichthyology.

(b) Endoskeleton is cartilaginous or bony.

(c) Heart two-chambered. It is venous heart pumping impure blood only.

(d) Kidneys **mesonephric**. Excretion **ammonotelic** or **ureotelic**.

(e) Lateral line receptros present.

(f) Fishes are cold blooded.

(g) Fertilization internal or external, e.g., *Scoliodon, Gambusia, Latimeria, Anguilla*.

Class-Amphibia

(a) Amphibians are cold blooded.

(b) Amphibians originated during Devonian period of Palaeozoic era.

(c) Endoskeleton bony, skull **dicondylic** (with two occipital condyles).

(d) Respiration by lungs, skin and buccal lining. Larvae and certain aquatic forms with external gills.

(e) Heart three-chambered with two auricles and one ventricle.

(f) Fertilization mostly external.

(g) Extraembryonic membranes are absent (**anamniota**).

(h) Larva **tadpole** which metamorphosis into adult, e.g., Rana tigrina, Bufo melanostictus, Alytes, Salamandra.

Class-Reptilia

(a) **Herpetology** is the study of reptiles.

(b) Mesozoic era is called **Golden Age of Reptiles.**

(c) Skin dry, cornified and devoid of glands.

(d) T-shaped **interclavicle** present.

(e) Heart is usually **three-chambered** or partially **four chambered. Crocodiles** have four-chambered heart.

(f) Kidneys are **metanephric**. Excretion uricotelic.

(g) Cranial nerves are 12 pairs but 10 pairs in snakes.

(h) Larval stage is absent.

(i) Foetal membrane is present.

(j) Fertilization is internal.

(k) **Jacobson's organ** in the roof of buccal cavity concerned with smell, well-developed in snakes and lizards.

(l) Skull is **monocondylic.**

(m) Reptiles are cold-blooded animals.

(n) **Urinary bladded** is absent in snakes and crocodiles.

(o) **Saurology** is the study of lizards.

(p) **Serpentology** is the study of snakes.

Class-Aves

(a) **Ornithology** is the study of birds.

(b) **Salim Ali** was a famous ornithologist and known as **Bird man of India.**

(c) Birds are **feathered, bipeds** and **air breathing.**

(d) Jaw bones are prolonged into toothless **beak.**

(e) Skin without glands, only cutaneous gland is **uropygial gland** or **preen gland** at tail base.

(f) The largest and most powerful flight muscle is **pectoralis major.**

(g) Bones are pneumatic or hollow and have **no bone marrow.**

(h) Skull is monocondylic.

(i) Both clavicles and a single interclavicle fused to form a V-shaped bone called **furcula** or **wishbone.**

(j) Crop secretes **pigeon milk** during breeding season.

(k) A sound box or **syrinx** producing voice.

(l) Heart is competely **four-chambered.**

(m) Females are **oviparous.**

(n) Birds are **warm-blooded** animals.

Class-Mammalia

(a) **Coenozoic** era is know as **Age of Mammals.**

(b) The study of mammals is called **Mammalogy.**

(c) Most important character of mammals is the presence of **mammary glands.**

(d) Presence of a **muscular diaphragm** separating thoracic cavity from abdominal cavity.

(e) Presence of **seven cervical vertebrae.**

(f) Teeth heterodont, thecodont and diphyodont.

(g) Respiration by lungs (pulmonary).

(h) Heart is **four-chambered.**

(i) Erythrocytes are **small, circular** and **non-nucleated.**

(j) Kidneys are **metanephric,** Excretion is **ureotelic.**

(k) Brain is highly developed with **corpus callosum** connecting cerebral hemispheres.

(l) Mammalas are **viviparous**, e.g., man, rabbit, duckbilled platypus, kangaroo (*Macropus*), etc.

(m) Class-Mammalia is divided into two sub-class-**Prototheria**-egg laying mammals (Oviparous) e.g., Duck-billed platypus.

Theria (Viviparous) e.g., Man, Rabbit, Monkey, *Macropus*.