Animal Kingdom: Non-Chordates

1A Chapter

1 INTRODUCTION

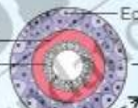
- **What is the need to classify animals?**
- Classification helps in assigning a systematic position to newly described species.
- **Characteristics of members of kingdom Animalia** – • Eukaryotic organisms • Division of labour • Definite growth pattern • Capable of locomotion • Multicellular and their cells lack cell wall • Heterotrophic with holozoic mode of nutrition • Sensory and neuromotor mechanism → **With some exceptions (Poriferans)**

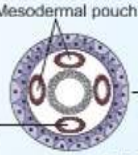
2 BASIS OF ANIMAL CLASSIFICATION

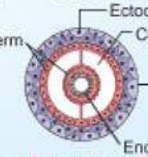
- There are fundamental features common to various individuals and have certain distinct characters which are specific to each phyla/class.

Broad Classification

Hierarchy	Level of Organisation	Types of Symmetry	Germ Layers	Body Cavity/Coelom (mesodermal lining)	Phylum(s)	Metamerism/ Segmentation	Notochord
Simple	Cellular	**Asymmetrical** – Any plane passing through the centre does not divide the organism into 2 equal halves	Not specified (loose cell aggregates)	**Acoelomates** (No body cavity)	Porifera	×	Absent
					Coelenterata	×	
					Ctenophora	×	
	Tissue	**Radial** – Any longitudinal plane passing through the central axis of the body divides the organism into 2 identical halves	**Diploblastic** – Ectoderm, **Undifferentiated mesoglea**, Endoderm	**Acoelomates** (No body cavity)	Platyhelminthes	×	
	Organ	**Bilateral** – Only one longitudinal plane passing through the centre of the body divides the organism into identical right and left halves	**Triploblastic** – Ectoderm, Mesoderm, Endoderm	**Pseudocoelomate** – Scattered pouches of mesoderm between ecto and endoderm	Aschelminthes	×	
Complex	Organ system (Each system with a specific physiological function)			**True coelomates** – Body cavity lined by mesoderm	Annelida	✓	Present
					Arthropoda	✓	
					Mollusca	×	
					Echinodermata	×	
					Hemichordata	×	
					Chordata	✓	







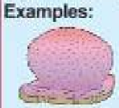
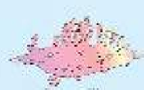
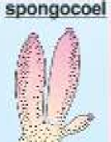
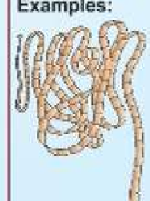
- **Metameric Segmentation** – Body is externally and internally divided into segments with a serial repetition of at least some organs
- **Notochord** – Mesodermally derived rod like structure formed on the dorsal side during embryonic development in some animals
- **Animals without notochord** – Non-chordates (Porifera to echinoderms)
- **Animals with notochord** – Chordates
- About 2/3rd of all species on earth are **Arthropods** (Most abundant are insects)

Some Conclusions From Classification:

- Poriferans are mostly asymmetrical organisms with cellular level of organisation.
- **All diploblastic organisms have radial symmetry and are acoelomates.**
- Bilateral symmetry is most advanced form of symmetry that arose with motile organisms.
- **Platyhelminthes are first triploblastic, bilaterally symmetrical acoelomates.**
- Echinoderms have radial symmetry at adult stage and bilateral in the larval stage.

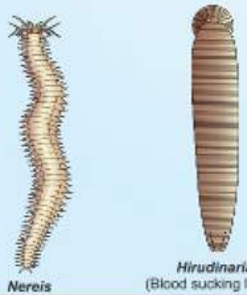
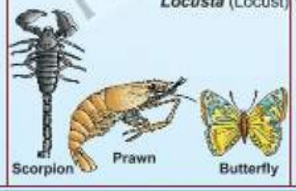
'X' indicates absence
'+' indicates presence

3 COMPARATIVE ACCOUNT FROM PORIFERA TO ASCHELMINTHES

Parameters	Porifera (Sponges)	Coelenterata (Cnidaria)	Ctenophora (Sea walnuts)	Platyhelminthes (Flatworms)	Aschelminthes (Round worms)
Habitat/Habit	Mostly marine, some are fresh water (*Spongilla*)	Mostly marine, some are fresh water (*Hydra*), sessile or free swimming	Exclusively marine	Free living or parasitic	Aquatic, terrestrial, parasitic in plants and animals
Exoskeleton	X	Coral forms have skeleton of $CaCO_3$	X	X	X
Endoskeleton	Spicules/spongin fibres	X	X	X	X
Digestive system/ Digestion	❍ Digestive system absent ❍ **Intracellular digestion**	❍ Digestive system **incomplete** ❍ Mouth on hypostome leading to body cavity **Gastro-vascular** cavity ❍ **Intra and extracellular digestion**	❍ Extracellular and intracellular digestion	❍ Digestive system **incomplete with single opening** ❍ **Extracellular digestion** ❍ Some forms absorb food directly from body surface	❍ Complete alimentary canal with **muscular pharynx** ❍ Extracellular digestion
Respiratory structure	Cell surface	Body wall		Free living-body surface	Free living-body surface
Circulatory system	Circulating fluid = water				
Excretory system/ Surface	Body surface			**Flame cells** (Protonephridia) for excretion and osmoregulation	Excretory tube opens out through **excretory pore**
Nervous system	X	**Neurons appear**	+	+	+
Asexual reproduction	Fragmentation, gemmule formation	Budding	X	High regeneration-*Planaria* capacity	X
Sexual reproduction	❍ Present ❍ Hermaphrodites	Present	❍ Present ❍ Hermaphrodites	❍ Present ❍ Hermaphrodites	**Distinctly dioecious**
Fertilization	Internal	External		Internal	
Development	Indirect, **larva morphologically distinct from adult**	Indirect/direct	Indirect	Indirect through many larval stages	Indirect/direct (young one resembles adult)
Unique features and examples	❍ **Water canal system** ↓ **Functions** – Food gathering; Respiratory exchange; Removal of wastes **Parameters** / **Ostia** / **Osculum**: ❍ Number: Many / Usually one ❍ Location: Body surface / Body surface ❍ Size: Minute / Large ❍ Water flow: Entry / Exit ❍ **Choanocytes**/collar cells line the **spongocoel** (central cavity). **Examples:**  *Euspongia* (Bath sponge)  *Spongilla* (Fresh water sponge)  *Sycon* (Scypha)	❍ Name derived from cnidoblasts/ cnidocytes containg **nematocysts**, present on body and tentacles. → **Functions** – Anchorage, Defense; Capture of prey ❍ ***Obelia* exhibits 2 basic forms:** **Polyp** → Asexually → **Medusa** Sessile / Free swimming Cylindrical / Umbrella like Alternation of generation/ Metagenesis Medusa → Sexually → Polyp **Examples:** ***Physalia*** (Portuguese man-of-war), ***Pennatula*** (Sea-pen), ***Gorgonia*** (Sea-fan), ***Meandrina*** (Brain coral)  *Adamsia* (Sea anemone)  *Aurelia* (Jelly fish)	❍ 8 **external rows of comb plates** for locomotion, hence, called **comb jellies** ❍ **Exhibit Bioluminescence** *i.e.*, property to emit light **Examples:** ***Ctenoplana***,  *Pleurobrachia*	❍ **Dorsoventrally** flattened body ❍ Hooks and suckers present in parasitic forms ❍ **1st ones with bilateral symmetry** **Examples:**  *Taenia* (Tapeworm)  *Fasciola* (Liver fluke)	❍ Circular in **cross-section** ❍ **1st ones with complete alimentary canal** ❍ **Females longer than male** ❍ **Posterior end curved in males** **Examples: *Wuchereria*** (Filaria worm), ***Ancylostoma*** (Hookworm) *Ascaris* (Round worm)  Male Female

4 COMPARATIVE ACCOUNT FROM ANNELIDA TO HEMICHORDATA

- **All have complete alimentary canal with extracellular digestion**
- **All can reproduce sexually and are usually oviparous**

Parameters	Annelida (Segmented worms)	Arthropoda (Joint appendages) **Largest Phylum**	Mollusca/Soft bodied **Second Largest Phylum**	Echinodermata (Spiny skinned)	Hemichordata (Half chordates)
Habitat	Aquatic and Terrestrial			Exclusively marine	
Body divisions/ appearance	Distinct segments metameres/annuli	Head, thorax, abdomen	Head, muscular foot visceral hump	Star like	Proboscis, collar, trunk (worm like)
Locomotory structure	○ Longitudinal and circular muscles ○ Parapodia/lateral appendages in some	Joined appendages	Muscular foot	**Water vascular system**	X
Exoskeleton	X	Chitinous/Cuticle	Calcareous shells	Spines	X
Digestive system	+	+	Mouth with file like rasping organ, **radula** for feeding	**Mouth**-lower side/ventral **Anus**-upper side/dorsal	+
Respiratory system/ surface	Body surface	Gills, book gills, tracheal system, book lungs	Feather like gills in mantle cavity	Water vascular system	Gills
Circulatory system	Closed	Open			
Excretory system	Nephridia	Malpighian tubules	Gills	X	Proboscis gland
Nervous system	Paired ganglia with double ventral nerve cord		+	+	+
Sense organs	Eyes, Tentacles	Eyes (simple, compound), Antennae, Statocyst (balancing)	Tentacles	+	+
Mono/Dioecious	**Monoecious** – Earthworm, Leech **Dioecious** – *Nereis* (aquatic form)	Mostly dioecious	Usually dioecious	Dioecious	
Fertilization	External/internal	Usually internal	External	Usually external	External
Development	Direct/Indirect		Indirect	Indirect with free swimming larva	Indirect
Unique features and Examples	○ **1° ones with metameric segmentation and true coelom** **Examples:** ***Pheretima*** (Earthworm)  ***Nereis*** ***Hirudinaria*** (Blood sucking leech)	**Examples:** ○ Economically important insects - ***Apis*** (Honey bee), ***Bombyx*** (Silkworm), ***Laccifer*** (Lac insect) ○ Vectors - ***Anopheles***, ***Culex***, ***Aedes*** (Mosquitoes) ○ Living fossil - ***Limulus*** (King crab) ○ Gregarious pest -  ***Locusta*** (Locust)  ***Scorpion*** ***Prawn*** ***Butterfly***	○ Soft and spongy layer of skin forms a **mantle** over the **visceral hump**. ○ Space between hump and mantle is **mantle cavity**. **Examples:** ***Sepia*** (Cuttlefish), ***Loligo*** (Squid), ***Pinctada*** (Pearl oyster), ***Dentalium*** (Tusk shell), ***Chaetopleura*** (Chiton), ***Aplysia*** (Seahare)  ***Pila*** (Apple snail)  ***Octopus*** (Devil fish)	○ **Water vascular system** that helps in – Locomotion – Capture and transport of food – Respiration ○ Presence of **Calcareous ossicles** **Examples:** ***Cucumaria*** (Sea cucumber), ***Echinus*** (Sea urchin), ***Antedon*** (Sea lily)  ***Asterias*** (Star fish)  ***Ophiura*** (Brittle star)	○ Presence of **rudimentary stomochord** ○ Earlier considered as subphylum under phylum Chordata but now placed as separate phylum under non-chordata **Examples:** ***Saccoglossus***  ***Balanoglossus***

Sharpen Your Understanding

1. All of the following are basis of classification of animals **except** [NCERT Pg. 46]
   (1) Number of cells
   (2) Body symmetry
   (3) Nature of coelom
   (4) Arrangement of cells
2. Organ level of organisation is present in the members of which phylum? [NCERT Pg. 46]
   (1) Cnidaria (2) Ctenophora
   (3) Platyhelminthes (4) Porifera
3. What is **true** for open circulatory system? [NCERT Pg. 47]
   (1) Cells and tissues are directly bathed in blood
   (2) Capillaries are present
   (3) Blood is circulated only through a series of vessels of varying diameter
   (4) Present in earthworm
4. Digestive system in phylum Platyhelminthes [NCERT Pg. 47]
   (1) Has two openings to the outside of the body
   (2) Has one opening to the outside of the body
   (3) Is absent in most of the members
   (4) Opens through excretory pore to the outside of the body

NCERT Based MCQs

5. When any longitudinal plane passing through the central axis of the body divides the organism into two identical halves, it is called [NCERT Pg. 47]
   (1) Bilateral symmetry
   (2) Radial symmetry
   (3) Asymmetry
   (4) Biradial symmetry
6. Choose the **odd** one w.r.t. coelenterates [NCERT Pg. 47]
   (1) Ectoderm (2) Endoderm
   (3) Mesoderm (4) Mesoglea
7. Triploblastic acoelomate animals belong to which phylum? [NCERT Pg. 48]
   (1) Ctenophora (2) Platyhelminthes
   (3) Aschelminthes (4) Annelida
8. Presence of truly coelomate animals ranges from phylum [NCERT Pg. 48]
   (1) Aschelminthes to Chordata
   (2) Annelida to Chordata
   (3) Platyhelminthes to Chordata
   (4) Ctenophora to Chordata
9. Metameric segmentation is present in [NCERT Pg. 52]
   (1) *Pheretima* (2) *Ascaris*
   (3) *Balanoglossus* (4) *Pila*
10. Which of the following is **incorrect** w.r.t. notochord? [NCERT Pg. 48]
    (1) Ectodermally derived
    (2) Rod-like structure
    (3) Present on the dorsal side
    (4) Absent in animals ranging from phylum Porifera to Echinodermata
11. Select the **correct** option w.r.t. sponges [NCERT Pg. 49]
    (1) All are marine
    (2) All are asymmetrical
    (3) Collar cells line spongocoel only
    (4) Usually monoecious
12. Choose the **correct** match w.r.t. excretory structure [NCERT Pg. 51-54]
    (1) *Fasciola* – Excretory tube
    (2) *Ancylostoma* – Flame cells
    (3) *Laccifer* – Malpighian tubules
    (4) *Chaetopleura* – Proboscis gland
13. Select the **incorrect** match w.r.t. fertilisation [NCERT Pg. 49-54]
    (1) Sponges – Internal
    (2) Ctenophores – External
    (3) Roundworms – Internal
    (4) Echinoderms – Internal

14. All are **correct** w.r.t. respiratory organ of animal shown below, **except**

[NCERT Pg. 53]

(1) Feather like gills
(2) Present in visceral hump
(3) Help in respiration and excretion
(4) Present in the members of second largest phylum

15. Match column-I with column-II and choose the **correct** option [NCERT Pg. 49-54]

Column-I	Column-II
a. *Asterias*	(i) Jointed appendages
b. *Sycon*	(ii) Canal system
c. *Apis*	(iii) Excretory system is absent
d. *Nereis*	(iv) Parapodia

(1) a(iii), b(ii), c(i), d(iv)
(2) a(ii), b(iii), c(iv), d(i)
(3) a(i), b(ii), c(iii), d(iv)
(4) a(iv), b(iii), c(ii), d(i)

16. Sexes are separate in [NCERT Pg. 52]

(1) *Pleurobrachia* (2) *Nereis*
(3) *Taenia* (4) *Hirudinaria*

17. Development may be **direct or indirect** in the members of which phylum? [NCERT Pg. 49-52]

(1) Porifera
(2) Ctenophora
(3) Platyhelminthes
(4) Aschelminthes

18. All are the functions of water vascular systemin echinoderms **except** [NCERT Pg. 54]

(1) Locomotion
(2) Reproduction
(3) Respiration
(4) Capture and transport of food

19. Match column-I with column-II and choose the **correct** match. [NCERT Pg. 49-54]

Column-I	Column-II
a. *Euspongia*	(i) Calcareous shell
b. Corals	(ii) Exoskeleton of calcium carbonate
c. *Pinctada*	(iii) Spongin fibres
d. *Echinus*	(iv) Calcareous endoskeleton

(1) a(iii), b(iv), c(i), d(ii)
(2) a(iii), b(ii), c(i), d(iv)
(3) a(iv), b(iii), c(ii), d(i)
(4) a(i), b(ii), c(iii), d(iv)

20. In most of the members of largest phylum, the body consists of [NCERT Pg. 53-54]

(1) Head, muscular foot and visceral hump
(2) Head, thorax and abdomen
(3) Proboscis, collar and trunk
(4) Cephalothorax and abdomen

Thinking in Context

1. _____ members of Animalia are multicellular. [NCERT Pg. 46]

2. When body of an organism can be divided into identical left and right halves by only one longitudinal plane, it is called _____ symmetry. [NCERT Pg. 47]

3. Animals in which the cells are arranged in two embryonic layers an external _____ and an internal _____, are called _____ animals. [NCERT Pg. 47]

4. The body cavity which is not lined by mesoderm, instead, the mesoderm is present as scattered pouches, is called _____. [NCERT Pg. 48]

5. The animals in which body cavity is absent are called _____. [NCERT Pg. 48]

6. When body is _____ and _____ divided into segments with a serial _____ of at least some organs is called metameric segmentation. [NCERT Pg. 48]

7. Canal system of sponges helps in _____, _____ and _____. [NCERT Pg. 49]

8. In sponges, water enters through minute pores called _____ into a central cavity called _____, from where it goes out through _____. [NCERT Pg. 49]

9. In metagenesis, polyps produce medusae _____ and medusae form polyps _____. [NCERT Pg. 50]

10. The name Cnidaria is derived from the _____ present on the _____ and the _____. [NCERT Pg. 50]

11. In ctenophores, body bears _____ external rows of _____ which help in _____. [NCERT Pg. 51]

12. Some Platyhelminths absorb nutrients from the host directly through their _____. [NCERT Pg. 51]

13. Aschelminths are parasites in _____ and _____. [NCERT Pg. 52]

14. In roundworms, alimentary canal is complete with a well developed _____. [NCERT Pg. 52]

15. Annelids possess _____ and _____ muscles which help in _____. [NCERT Pg. 52]

❑ ❑ ❑

16. *Nereis* possesses lateral appendages, _____ which help in _____. [NCERT Pg. 52]

17. The body of arthropods is covered by _____. [NCERT Pg. 53]

18. In cuttle fish, mantle cavity is the space between _____ and _____. [NCERT Pg. 53]

19. In molluscs, _____ contains a file like rasping organ for _____, called _____. [NCERT Pg. 53]

20. Adult echinoderms are _____ symmetrical but larvae are _____ symmetrical. [NCERT Pg. 54]

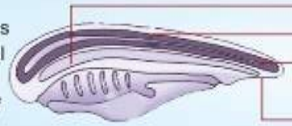
Animal Kingdom: Chordates

1B
Chapter

1 PHYLUM-CHORDATA

General Features :

- Triploblastic organisms
- Bilaterally symmetrical
- Coelomates
- Organ-system level of organisation
- Closed circulatory system



Basic plan of a chordate

Salient features	Chordates	Non-chordates
Notochord	✓	×
Central nervous system	Dorsal, hollow and single	Ventral, solid and double
Paired pharyngeal gill slits	✓	×
Post anal tail	✓	×
Position of heart	Ventral	Dorsal (if present)

2 CLASSIFICATION OF CHORDATES

Sub-phyla

Parameters	Urochordata/ Tunicata	Cephalochordata	Vertebrata
	Protochordates		
Habitat	Exclusively marine		Variety of habitats - Polar ice caps, deserts, mountains, forests, grasslands and dark caves
Notochord	Only in larval tail	Extends from head to tail and persists throughout their life	Present in embryonic stage and is replaced by cartilaginous or bony vertebral column in the adult
Examples	*Salpa*, *Doliolum*	*Branchiostoma* (Amphioxus or Lancelet)	*Scoliodon* (Dog fish), *Rana* (Frog), *Crocodilus* (Crocodile), *Pavo* (Peacock), *Canis* (Dog)

Ascidia

Pavo (Peacock)

Neophron (Vulture)

Chelone (Turtle)

Chameleon (Tree lizard)

All vertebrates are chordates but all chordates are not vertebrates.

3 CLASSIFICATION OF VERTEBRATES

Division

Parameters	Agnatha	Gnathostomata
• Jaws	Absent	Present
• Fins/limbs	Unpaired fins	Paired fins or limbs
• Sexes are separate	–	✓

Super class

Pisces
- Bear fins

Tetrapoda
- Bear two pairs of limbs

Class: Cyclostomata

Class: Chondrichthyes & Osteichthyes

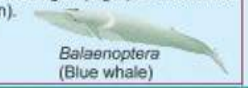
Class: Amphibia, Reptilia, Aves, Mammalia

4 CYCLOSTOMATA

Parameters	
Habitat	Marine
Habit	Ectoparasite on fishes
Temperature regulation	No (Poikilothermous)
Exoskeleton	Scales are absent
Endoskeleton	Cartilaginous cranium and vertebral column
Appendages	Unpaired fins
Digestive system	Circular and sucking mouth without jaws
Respiratory system	6-15 pairs of gill slits
Circulatory system	Closed type
Excretory system	Kidneys
Reproductive system	○ Migrate to fresh water for spawning ○ After spawning, the adult dies within few days
Development	○ Indirect Larvae return to ocean after metamorphosis
Examples	*Myxine* (Hag fish), *Petromyzon* (Lamprey)

Petromyzon (Lamprey)

5 COMPARATIVE ACCOUNT OF GNATHOSTOMATES

Characteristics	Chondrichthyes	Osteichthyes	Amphibia	Reptilia	Aves	Mammalia
Habitat	Marine	Both marine and fresh water	Both on land and in water	Mostly terrestrial		Terrestrial, aquatic
Habit	Predaceous	–	Dual life	Creeping and crawling	Most of them can fly except flightless birds	Limbs adapted to fly and live in water
Temperature regulation	**Poikilothermous** (Cold blooded)				**Homeothermous** (Warm blooded)	
Exoskeleton	**Placoid scales** for tough skin	**Cycloid** and **ctenoid** scales	○ Scales are absent ○ Skin is moist	Epidermal scales or scutes with dry cornified skin	○ Scales on hindlimbs ○ Body covered by feathers and skin is dry	Skin may possess hair
Endoskeleton	Cartilaginous	Bony			Bony (Fully ossified) **Pneumatic bones**	Bony
Digestive system	○ Ventral mouth ○ Teeth are modified scales & backwardly directed ○ Powerful jaws	Terminal mouth	Cloaca present	–	○ Additional gizzard and crop ○ Beak present	Different types of teeth in the jaws
Respiratory system	Gill slits **without operculum**	4 pairs of gill slits **with operculum**	Gills, skin and lungs	Lungs	○ Lungs, ○ **Air sacs** supplement respiration	Lungs
Circulatory system	2 chambered heart with 1 auricle and 1 ventricle		3 chambered heart with 2 auricles and 1 ventricle	3 chambered heart with 2 auricles and 1 ventricle **except crocodile (4 chambered heart)**	4 chambered heart with 2 auricles and 2 ventricles	
Excretory system	Kidneys (Excretion and Osmoregulation)					
Sense organs ○ Eye	Eyes present		Eyes with eyelids			
○ Ear	Tympanum absent		Tympanum represents ear	Tympanum represents ear & many reptiles do not have external ear opening	Tympanum represents ear, many birds have external ear opening	**External ear/pinna present**
Fertilisation	Internal as **pelvic fins** of males bear **claspers**	Usually external	External	Internal		
Oviparous/ Viviparous	Many are viviparous	Mostly oviparous	Oviparous			Viviparous **except** egg laying **Platypus**
Development	Direct		Indirect	Direct		
Unique features	○ Streamlined body ○ Notochord persists throughout life ○ **Absence of air bladder,** hence, swim continuously to avoid sinking **Examples :** *Carcharodon* (Great white shark), *Trygon* (Poisonous sting ray), *Torpedo* (Electric ray)  *Scoliodon* (Dog fish)  *Pristis* (Saw fish)	○ Streamlined body ○ They have air bladder/ swim bladder that regulated **buoyancy** **Examples :** **Marine** – *Exocoetus* (Flying fish),  *Hippocampus* (Sea horse) **Fresh water** – *Labeo* (Rohu), *Clarias* (Magur); Aquarium – *Betta* (Fighting fish), *Pterophyllum* (Angel fish).  *Catla* (Katla),	○ Body divided into head and trunk, tail in some e.g. Salamander ○ Alimentary canal, urinary and reproductive tracts open into a common chamber called **cloaca** **Examples :** *Bufo* (Toad), *Hyla* (Tree frog) *Ichthyophis* (Limbless amphibia)  *Rana* (Frog)  *Salamandra* (Salamander)	Snakes and lizards shed their scales as **skin cast** **Examples :** *Chelone* (Turtle), *Testudo* (Tortoise), *Calotes* (Garden lizard), *Alligator* (Alligator). *Hemidactylus* (Wall lizard), **Poisonous snakes** – *Bangarus* (Krait), *Vipera* (Viper)  *Crocodilus* (Crocodile)  *Naja* (Cobra)	○ Forelimbs modified into wings ○ Hindlimbs of birds are modified for walking, swimming or clasping the tree branches ○ Skin is dry without glands **except oil gland** at the base of tail **Examples :** **Flying birds** *Corvus* (Crow), *Columba* (Pigeon) **Flightless birds** *Aptenodytes* (Penguin)  *Struthio* (Ostrich)  *Psittacula* (Parrot)	○ Presence of **mammary glands** to nourish young ones **Examples :** **Oviparous**  *Ornithorhynchus* (Platypus) **Viviparous** *Macropus* (Kangaroo), *Pteropus* (Flying fox), *Camelus* (Camel), *Macaca* (Monkey), *Rattus* (Rat), *Canis* (Dog), *Felis* (Cat), Elephas (Elephant), *Equus* (Horse) *Delphinus* (Common dolphin), *Panthera tigris* (Tiger), *Panthera leo* (Lion).  *Balaenoptera* (Blue whale)

Sharpen Your Understanding

1. Chordates are characterised by the presence of [NCERT Pg. 54]
   (1) Double, ventral, solid nerve cord
   (2) Notochord
   (3) Dorsal heart
   (4) Only organ level of organisation
2. Select the **correct** statement w.r.t. notochord in urochordates. [NCERT Pg. 55]
   (1) Present in larval tail only
   (2) Extends from head to tail in adults
   (3) Persists throughout the life of organism
   (4) Replaced by vertebral column
3. Chordates differ from non-chordates in all **except** [NCERT Pg. 55]
   (1) Presence of paired pharyngeal gill slits
   (2) Position of heart
   (3) Presence of post anal tail
   (4) Presence of three germ layers
4. All chordates are **not** vertebrates because [NCERT Pg. 47]
   (1) Notochord is not replaced by a cartilaginous or bony vertebral column in protochordates
   (2) Notochord is present in all vertebrates throughout life
   (3) Ventral muscular heart is present
   (4) Kidneys are present for excretion and osmoregulation
5. Which of the following is **not** a feature of vertebrates? [NCERT Pg. 55]
   (1) Ventral muscular heart
   (2) Kidneys for osmoregulation
   (3) Paired fins or limbs
   (4) Dorsal, single, solid nerve cord
6. Select the **incorrect** statement w.r.t. chordates. [NCERT Pg. 55]
   (1) Notochord is dorsal to nerve cord
   (2) Notochord is dorsal to gut
   (3) Nerve cord is dorsal to gut
   (4) Nerve cord is dorsal, single and hollow
7. Poikilotherms with internal fertilization, oviparity and direct development are all, **except** [NCERT Pg. 55]
   (1) *Ascidia*
   (2) *Aligator*
   (3) *Hemidactylus*
   (4) *Chameleon*
8. How many among following are able to maintain constant body temperature and can fly? [NCERT Pg. 58]

   Pteropus, Neophron, Columba, Struthio, Pavo, Macaca

   (1) One (2) Three
   (3) Two (4) Four

NCERT Based MCQs

9. Select the mismatch w.r.t. scientific name in column I and common name in column II. [NCERT Pg. 55]

	Column I	Column II
(1)	*Clarias*	Magur
(2)	Dog	*Canis*
(3)	*Calotes*	Garden lizard
(4)	*Corvus*	Crow

10. Which of the following is a jawless vertebrate? [NCERT Pg. 56]
    (1) *Petromyzon*
    (2) *Scolidon*
    (3) *Calotes*
    (4) *Macropus*
11. Choose the **odd** one w.r.t. cyclostomes. [NCERT Pg. 56]
    (1) Sucking and circular mouth
    (2) Absence of jaws
    (3) Scales are absent
    (4) Presence of paired fins
12. In chondrichthyes, scales are [NCERT Pg. 56]
    (1) Cycloid
    (2) Ctenoid
    (3) Placoid
    (4) Ganoid

13. Chondrichthyes differ from Osteichthyes in possessing [NCERT Pg. 57]
(1) Bony endoskeleton (2) Air bladder
(3) Claspers (4) Operculum

14. Cloaca is present in [NCERT Pg. 57]
(1) *Rana, Ichthyophis*
(2) *Pteropus, Felis*
(3) *Labeo, Exocoetus*
(4) *Camelus, Delphinus*

15. Which of the following animal is a homeotherm and is oviparous? [NCERT Pg. 58]
(1) *Aptenodytes*
(2) *Elephas*
(3) *Pristis*
(4) *Exocoetus*

16. Choose the **mismatch**. [NCERT Pg. 60]

(1)	*Columba*	–	Pneumatic bones
(2)	*Equus*	–	Similar types of teeth
(3)	*Crocodilus*	–	Scutes
(4)	*Neophron*	–	Air sacs connected to lungs

17. Select the **odd** one w.r.t. external fertilization. [NCERT Pg. 57]
(1) *Carcharodon*
(2) *Betta*
(3) *Bufo*
(4) *Pterophyllum*

18. Which of the following is **incorrect** w.r.t. Aves? [NCERT Pg. 58]
(1) Forelimbs have scales
(2) Crop and gizzard are the additional chambers in the digestive tract
(3) Endoskeleton is fully ossified
(4) Air sacs supplement respiration

19. Exclusive characters of members of class mammalia are all of the following **except** [NCERT Pg. 60]
(1) Mammary glands
(2) Hair
(3) Pulmonary respiration
(4) Ear pinnae

20. Four-chambered heart and epidermal scales on body are present in [NCERT Pg. 58]
(1) *Bufo* (2) *Pristis*
(3) *Crocodilus* (4) *Canis*

Thinking in Context

1. Protochordates inhabit _____ water exclusively [NCERT Pg. 55]

2. Subphyla _____ and _____ are often referred as protochordates. [NCERT Pg. 55]

3. Cyclostomes have an elongated body bearing _____ pairs of gill slits. [NCERT Pg. 56]

4. Cyclostomes are _____ but migrate for spawning to_____ [NCERT Pg. 56]

5. After spawning, within a few days, adult cyclostomes _____. Their larvae, _____, return to the ocean. [NCERT Pg. 56]

6. In Chondrichythyes, mouth is located _____ and in bony fishes, it is mostly _____ in position. [NCERT Pg. 56]

7. _____ are modified placoid scales in cartilaginous fishes and are _____ directed. [NCERT Pg. 56]

8. Electric organ is present in _____ and poison sting is present in _____ [NCERT Pg. 57]

9. Due to the absence of air bladder, _____ fishes have to swim constantly to avoid sinking. [NCERT Pg. 56]

10. In amphibians, body is divisible into _____ and _____. _____ may be present in some. [NCERT Pg. 57]

11. _____, _____ and _____ opens into a common chamber called cloaca. [NCERT Pg. 57]

12. In amphibians, respiration occurs through _____, _____ and _____. [NCERT Pg. 57]
13. In reptiles, body is covered by _____ and _____ skin, _____ scales or _____. [NCERT Pg. 58]
14. Snakes and lizards shed their scales as _____ [NCERT Pg. 58]
15. In Aves, skin is dry without glands except the _____ at the base of the _____ [NCERT Pg. 58]
16. The characteristic feature of Aves are the presence of _____ [NCERT Pg. 58]
17. In Aves, jaws are modified into _____ and forelimbs are modified into _____ [NCERT Pg. 58]
18. The skin of mammals is unique in possessing _____ [NCERT Pg. 60]
19. The digestive tract of birds has additional chambers, the _____ and _____ [NCERT Pg. 58]
20. In Aves, air sacs connected to lungs _____ respiration. [NCERT Pg. 59]

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