

# **XI – BIO-ZOOLOGY**

**Name :**

**Class : Sec:**

**School :**

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## CHAPTER 1 THE LIVING WORLD

**Answer the following:**

### **1. Differentiate between probiotic and pathogenic bacteria.**

<b>Probiotic bacteria</b>		<b>Pathogenic bacteria</b>	
1.	Probiotic bacteria are beneficial bacteria.	1.	Pathogenic bacteria are harmful bacteria.
2	The bacteria which cause fermentation are examples of probiotic bacteria.	2	The disease causing bacteria such as Mycobacterium tuberculosis are pathogenic.

### **2. Why mule is sterile in nature?**

Mule gets one set of chromosomes (32) from male parent, horse and one set of chromosomes (31) from female parent, donkey. These two sets of chromosomes do not match with each other and cannot produce gametes by meiosis. Hence mule is sterile in nature.

### **3. List any five salient features of the family Felidae.**

The species in the Felidae family are carnivores or omnivores.

- Felids are generally solitary with a few exceptions.
- They have sharp vision, hearing and a strong sense of smell.
- They have short faces and their paws have toes in the 5 forefeet and 4 toes in the hind feet.
- Most Felids live in the wild e.g. cat, tiger, lion, cheetah.

### **4. What is the role of Charles Darwin in relation to concept of species?**

Charles Darwin's book on Origin of Species explains the evolutionary connections of species by the process of natural selection.

### **5. Why elephants and other wild animals are entering into human living area?**

Elephants and other wild animals enter into human living area because of the loss of their habitat, deforestation, mono-culture vegetation by destroying

**6.What is the difference between a Zoo and wild life sanctuary?**

<b>Zoo</b>		<b>Wild Life Sanctuary</b>	
1.	Zoo is a place where animals and birds are in captivity of artificially created habitat.	1.	Wild life sanctuary is the natural habitat of wild animals and birds.
2.	Public can have easy access to the zoo.	2.	Public does not have easy access to the wild life sanctuaries.
3.	Zoo is based on commercial aspects.	3.	Sanctuaries are non-commercial.
4.	Animals are caged and hence they are not free to roam about.	4.	In a sanctuary, animals can roam about freely.

**7. Can we use recent molecular tools to identify and classify organisms?**

The recent molecular taxonomical tools can be used to identify and classify the organism. The following molecular techniques and approaches are used in molecular tools.

- (a) DNA bar coding – Short genetic marker in an organism’s DNA to identify whether it belongs to a particular species.
- (b) DNA hybridization – Measures the degree of genetic similarity between pools of DNA sequences.
- (c) DNA finger printing – to identify an individual from a sample of DNA by looking at unique patterns in their DNA.

(d) Restriction Fragment Length Polymorphism (RFLP) Analysis- difference in homologous DNA sequences can be detected by the presence of fragments of different lengths after digestion of DNA samples.

(e) Polymerase chain reaction (PCR) sequencing- to amplify a specific gene, or

### **8. Explain the role of Latin and Greek names in Biology.**

Aristotle (384 to 322 BC) was the first to classify all animals in his *Historia Animalium* in Latin. He classified the living organisms into plants and animals. Animals were classified as walking (terrestrial), flying (birds), and swimming (aquatic) based in their locomotion.

He classified the animals with red blood cells as *Enaima* and those without red blood cells as *Anaima*. Though his method of classification had limitation, his contribution to biology was remarkable. Theophrastus did his research on the classification of plants. He was known as the Father of Botany

### **9. What may be the reasons for the extinction of Dinosaurs? If you know the reasons for their extinction, why Sparrows are listed as endangered species?**

The extinction of the dinosaurs is an enigma that has captivated scientists for well over a century. We find the fossilized remains of giant reptiles all over the earth.

Yet we do not see any of the creatures alive today. If sparrows are not there the population of birds of prey may also be affected. Apart from this, every constitute of an ecosystem is important from an ant to an elephant. We are eliminating species by species which are important links which make the web of life. Today it's these species which are getting extinct

## CHAPTER 2 KINGDOM ANIMALIA

### Answer the following:

#### 1. Why are spongin and spicules important to a sponge?

Spongin and spicules provide support and supports the soft body parts of the sponges. The spicules give the sponges rigidity and form to the sponges

#### 2. What are the four characteristics common to most animals?

The characteristics common to most animals are the arrangement of cell layers.

- The levels of organization.
- Nature of coelom.
- The presence or absence of segmentation and notochord.
- Organization of the organ system.

#### 3. List the features that all vertebrates show at some point in their development.

All vertebrates possess notochord during embryonic stay. It is replaced by vertebra) column. All vertebrates possess paired appendages such as fins or limbs. Skin is covered by protective skeleton comprising of scales. Features hairs, claws, nails etc. Respiration is aerobic through gills, skin, buccopharyngeal cavity' and lungs. All vertebrates have a muscular heart with two, three or four chambers and kidneys for excretion and osmoregulation.

#### 4. Compare closed and opened circulatory system.

Closed circulatory system:

- The circulation in which blood is present inside the blood vessels is called closed circulatory' system
- It is found in higher organisms, e.g. annelids, cephalochordates and vertebrates.

Open circulatory system:

- The circulation in which blood remains filled in tissue spaces due to the absence of blood vessels is called open circulatory system
- It is found in lower organisms. e.g. arthropods, molluscs and echinoderms.

## 5. Compare schizocoelom with enterocoeloni.

Schizocoelom:

- The coelom which is formed by splitting of Mesoderm is called schizocoelom.
- It is found in lower invertebrates like annelids, arthropods and molluscs.

Enterocoeloni:

- The coelom which is formed from the Mesodermal pouches of archenteron is called enterocoelom.
- It is found in echinoderms, hemichordates and chordates.

## 6. Identify the structure that the archenteron becomes in a developing animal.

The archenteron becomes the cavity of the digestive tract.

## 7. Observe the animal below and answer the following questions

(a) Identify the animal

(b) What type of symmetry does this animal exhibit?

(c) Is this animal Cephalized?

(d) How many germ layers does this animal have?

(e) How many openings does this animal's digestive system have?

(f) Does this animal have neurons?



(a) Sea anemone (Adarnasia)

(b) Radial symmetry

(c) No

(d) Two (ectoderm and endoderm)

(e) One

(f) No.

## 8. Choose the term that does not belong in the following group and explain why it does not belong?

Notochord, cephalisation, dorsal nerve cord and radial symmetry.

- Notochord, cephalisation and dorsal nerve cord are the characteristic features of chordates. The radial symmetry is not a characteristic feature of chordate. It is the feature of cnidarian and adult echinoderms. Hence it does not belong to the group.

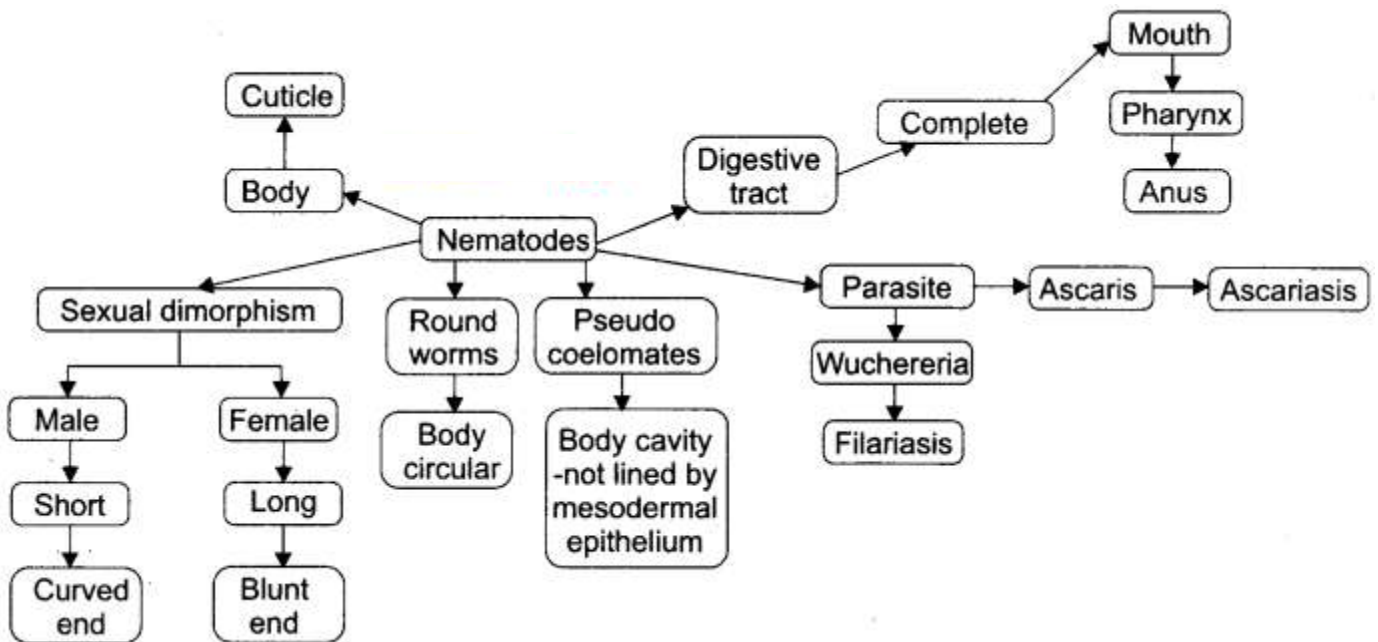
**9. Why flat worms are called acoelomates?**

Flat worms are called acoelomate because they do not possess a body cavity.

**10. What are flame cells?**

Flame cells are the specialized excretory cells in flat worms. They help in excretion and osmoregulation.

**11. Concept Mapping – Use the following terms to create a concept map that shows the major characteristic features of the phylum nematoda: Round worms, pseudocoelomates, digestive tract, cuticle, parasite and sexual dimorphism.**



**12. In which phyla is the larva trochopore found?**

Annelida.

**13. Which of the chordate characteristics do tunicates retain as adults?**

Ventral and tabular heart. Respiration is through gill slits.



**14. List the characteristic features that distinguish cartilaginous fishes with living jawless fishes.**

Cartilaginous Fishes:

- These have powerful jaws which help in predation.
- These are free living predatory fishes.
- These are advanced over jawless fishes.
- These have a tough skin covered by dermal
- Respiration is by lamelliform gills without operculum.
- Paired fins are present.
- Fertilization is internal
- Viviparous e.g. Scoliodon

Living Jawless Fishes:

- They do not have jaws and the mouth is circular and suctorial.
- These are ectoparasites on fishes.
- These are primitive over cartilaginous fishes.
- The skin is soft and devoid of scales.
- These have six to fifteen pair of gills slits.
- Paired fins are absent.
- Fertilization is external
- Oviparous, e.g. Lamprey

**15. List three features that characterise bony fishes.**

- These fishes have bony endoskeleton.
- The skin is covered by ganoid, cycloid or ctenoid scales.
- Gills are covered by an operculum.
- They are ammonotelic.
- They have mesonephric kidneys.
- External fertilization is seen.

**16. List the functions of air bladder in fishes.**

Air bladder helps in gaseous exchange.

- It helps in maintaining buoyancy.

**17. Write the characteristics that contributes to the success of reptiles on land.**

The characteristics that contribute to the success of reptiles on land are as follows:

- The presence of dry and cornified skin with epidermal scales or scutes which prevent the loss of water.
- The presence of metanephric kidney.
- They are uricotelic (they excrete uric acid to prevent the loss of water).

**18. List the unique features of bird's endoskeleton.**

- The endoskeleton of birds is bony
- The long bones are hollow with air cavities (pneumatic)
- The body is covered by feathers.

**19. Could the number of eggs or young ones produced by an oviparous and viviparous female be equal? Why?**

No. The number of eggs or young ones produced by an oviparous and viviparous female cannot be equal. When the oviparous animals lay eggs in the external environment or in the medium, the chance of survival and successful development into the adults are not certain. But in case of viviparous animals, young ones are nurtured by the

**DISTINGUISH**

**1. Distinguish invertebrates and chordates.**

Invertebrates:

- The major group of animals which do not have notochord or vertebral column are Invertebrates.
- These are lower animals.

Chordates:

- The major group of animals which have notochord or vertebral column are chordates.
- These are higher animals.

**2. Distinguish between invertebrates and vertebrates.**

Invertebrates:

- The major group of animals which do not have notochord or vertebral column are Invertebrates.
- These are lower animals.

Vertebrates:

- The major group of animals which have vertebral column are vertebrates
- These are higher animals.

**3. What are choanocytes?**

The inner layer of sponges have a special type of cells called choanocytes. These

flagellated collar cells create and maintain water flow through the sponge. It helps in respiration and digestion.

#### **4. Distinguish between open type of circulation and closed type of circulation.**

Open Type of circulation:

- The circulation in which blood remains filled in tissue spaces is known as open type of circulation.
- This is seen in lower organisms, e.g. arthropods, molluscs, echinoderms and urochordates.

Closed type of circulation:

- The circulation in which blood flows inside the blood vessels is known as closed type of circulation.
- This is seen in higher organisms, e.g. Annelids, cephalochordates and vertebrates.

#### **5. Distinguish between Diploblastic animals and triploblastic animals.**

Diploblastic animals:

- The animals in which the cells are arranged in two embryonic layers, the ectoderm and endoderm are called diploblastic animals.
- These are lower organisms, e.g. Cnidaria and ctenophora

Triploblastic animals:

- The animals in which the cells are arranged in three embryonic layers, the ectoderm, mesoderm and endoderm are called triploblastic animals.
- These are higher organisms, e.g. Platyhelminthes to mammalia.

#### **6. What are asymmetrical animals?**

The animals which lack a definite body plan and any plane passing through the center of the body does not divide them into two equal halves are known as asymmetrical animals, e.g. Sponges.

#### **7. What is radial symmetry?**

When any plane passing through the central axis of the body divides an organism into two identical parts, it is called radial symmetry, e.g. Cnidarian.

#### **8. What is bilateral symmetry?**

The symmetry in which the animals have two similar halves on either side of the central plane is bilateral symmetry, e.g. Flatworms and annelids.

#### **9. What is biradial symmetry?**

The symmetry in which the animals have two planes of symmetry, longitudinal and sagittal axis and longitudinal and transverse axis is biradial symmetry, e.g. Ctenophores.

#### **10. What are the advantages of bilateral symmetrical animals?**

The bilaterally symmetrical animals can seek food, locate mates, escape from

predators and move more efficiently. These animals have dorsal ventral sides and anterior, posterior ends, right and left sides. They exhibit cephalization with sense organs and brain at the anterior end of the animal.

### **11. What are acoelomates?**

The animals which do not possess a body cavity are called acoelomates. The body is solid without perivisceral cavity. These have restricted free movement of internal organs, e.g. Flatworms.

### **12. What are pseudocoelomates?**

The animals which have the body cavity that is not fully lined by the mesodermal epithelium are called pseudocoelomates. The pseudocoel is filled with pseudocoelomic fluid. It acts as a hydrostatic skeleton and allows free movement of visceral organs and circulation of nutrients e.g. Roundworms.

### **13. What are eucoelomates?**

Eucoelomates are the animals which have true coelom that develops with the mesoderm and is lined by mesodermal epithelium called peritonium.

### **14. Distinguish between schizocoelomates and enterocoelomates**

Schizocoelomates:

In schizocoelomates, the body cavity is formed by splitting of mesoderm, e.g. Annelids, arthropods and molluscs.

Enterocoelomates:

In enterocoelomates, the body cavity is formed from the mesodermal pouches of archenteron. e.g. Echinoderms, hemichordates and chordates.

### **15. Distinguish between parazoa and eumetazoa.**

Parazoa:

These include multicellular animals whose cells are loosely arranged without the formation of tissues or organs, e.g. Sponges

Eumetazoa:

These include multicellular animals with well defined tissues, organs and organ systems.

### **16. Distinguish between radiata and bilateria.**

Radiata:

- These include radially symmetrical animals.
- There are diploblastic e.g., Cnidarians and ctenophores

Bilateria:

- These include bilaterally symmetrical animals.
- There are triploblastic. e.g. Flat – worms

### **17. Distinguish between protostomia and deuterostomia.**

Protostomia:

- These include the eumetazoans in which embryonic blastopores develops into mouth.
- Acoelomata, pseudocoelomata and schizocoelomata are the three sub divisions of this division.

Deuterostomia:

- These include the cutnetazoans in which embryonic blastopore develops into anus.
- Enterocoelmata is the only one subdivision of this division.

### **18. What is canal system?**

The water transport system in sponges through which water enters through minute opores and goes out through the large opening called osculum. It helps in nutrition, circulation, respiration and excretion.

### **19. Distinguish between ostia and osculum.**

Ostia:

- The minute pores lining the body wall of sponges are called ostia.
- Water enters through ostia.

Osculum:

- The large opening in sponges is called osculum.
- Water goes out through osculum.

### **20. What spongocoel?**

The central cavity of the sponges is called spongocoel.

### **21. What are choanocytes?**

Choanocytes are the collar cells lining the spongocoel and the canals of sponges. These are helpful in creating water current in sponges.

### **22. Distinguish between asexual reproduction and sexual reproduction.**

Asexual Reproduction:

- The reproduction without involvement of gametes is called Asexual Reproduction.
- Zygote is not formed.

Sexual Reproduction:

- The reproduction with the involvement of gametes is called sexual reproduction.
- Zygote is formed by the process called fertilization.

### **23. Name the larvae of sponges.**

Parenchymula and amphiblastula.

### **24. What is indirect development?**

The development with different types of larval stages is called indirect development.

**25. What is holozoic nutrition?**

The nutrition in which solid food materials are taken in by animals is called holozoic nutrition.

**26. What are cnidocytes or cnidoblasts or nematocysts?**

The stinging cells found on the tentacles of cnidarians are called cnidocytes or cnidoblasts or nematocysts. They are useful for anchorage, defense and capturing prey.

**27. What is coelenteron?**

The central visceral cavity of cnidarians is called coelenteron.

**28. Distinguish between polyp and medusa.**

Polyp:

- The sessile body form of cnidarians is called polyp.
- It is the asexual generation

Medusa:

- The free living body form of cnidarians is called medusa.
- It is the asexual generation

**29. What is metagenesis or Alternation of generation?**

The cnidarians exhibit sexual and asexual forms that alternate with each other. This is called metagenesis or Alternation of generation.

**30. Name the larva of cnidarians?**

Planula larva.

**31. What are lasso cells or colloblasts?**

The special cells of ctenophores which helps in food capture are lasso cells or colloblasts.

**32. Name the larva of ctenophores?**

Cydippid larva.

**33. What are solanocytes?**

The specialized excretory cells of flatworms, flame cells are called solanocytes.

**34. What are the larvae of flatworms?**

Miracidium, Sporocyst, redia, cercaria and metacercaria.

**35. What is regeneration?**

The ability to regrow the lost parts is called regeneration, e.g. Planaria.

**36. What is metamerism? –**

The body of annelids are divided into segments. This phenomenon is known as metamerism.

**37. Name the respiratory pigments of annelids?**

Haemoglobin and chlorocruorin.

**38. Name the larva of annelids.**

Trochophore larva.

**39. What is moulting or ecdysis?**

The chitinous exoskeleton of arthropods is shed periodically. This process is known as moulting or ecdysis.

**40. What are the respiratory organs of arthropods?**

Gills, Book gills, Book lungs and trachea.

**41. Name the sensory organs of arthropods?**

Antennae, Simple and compound eyes and statocysts.

**42. What are ctenidia?**

The feather like gills of molluscs are called ctenidia.

**43. What is radula?**

The rasping organ found in the mouth of molluscs is called radula.

**44. What is the function of ospharidium?**

Ospharidium are helpful to test the purity of water.

**45. Name the respiratory pigment of molluscs.**

Haemocyanin, a copper containing pigment.

**46. Name the larva of molluscs?**

Veliger larva.

**47. What is water vascular system?**

The system which helps in nutrition and respiration in echinoderms is called water vascular system. Water enters into the body through special organs.

**48. Name the larva of hemichordates?**

Tornaria larva.

**49. What are urochordates?**

The chordates which have notochord only in the tail region of the larval stage are called urochordates e.g. Ascidian.

**50. Distinguish between Agnatha and Gnathostomata.**

Agnatha:

- These include jawless fish-like aquatic vertebrates.
- They do not have paired appendages.

Gnathostomata:

- These include jawed vertebrates.
- They have paired appendages.

**51. What are poikilothermic?**

The animals which change their body temperature according to the environment are called poikilothermic.

**52. What is anadromous migration?**

The migration of marine fishes to fresh water body like rivers for spawning is known as anadromous migration.

**53. Distinguish between oviparous and viviparous animals.**

Oviparous animals:

- The egg laying animals are known as oviparous animals.
- They lay eggs containing yolk for embryonic development e.g. birds.

Viviparous animals:

- The animals which give birth to young ones are called viviparous animals.
- The developing embryo derives nutrients from the parent, e.g. man

**54. What are Ammonotelic animals?**

The animals which excrete ammonia dissolved in water are called ammonotelic animals. More water is spent, e.g. fishes.

**55. What are ureotelic animals?**

Answer:

The animals which excrete urea along with water are called ureotelic animals. Less water is spent e.g. man.

**56. What are ureotelic animals?**

The animals which excrete uric acid in the form of pellets are called ureotelic animals. Very less water is spent e.g. birds.

**57. Distinguish between hibernation and aestivation.**

Hibernation:

- The dormancy period for animals during winter is called hibernation.
- It is known as winter sleep.

Aestivation:

- The dormancy period for animals during summer is called Aestivation.
- It is known as summer sleep.

**58. Distinguish between cleidoic eggs and non-cleidoic eggs.**

Cleidoic eggs:

- The eggs which have a thick and hard outermost shell are cleidoic eggs.
- This is a terrestrial adaptation, e.g., Reptiles and birds.

Non Cleidoic eggs:

- The eggs which do not have a protective shell are non – Cleidoic eggs
- This is seen in aquatic animals, e.g., Fishes, amphibians.

**59. What is rhamphotheca?**

The horny covering on the beak of birds is called rhamphotheca.

**60. Name some flightless birds.**

Ostrich, kiwi and penguin.

**61. Distinguish between poikilothermic and homeothermic.**

Poikilothermic:



- The animals which change their body temperature according to the environment are called poikilothermic animals.
- These cold blooded animals, e.g., fishes, amphibians and reptiles.

Homeothermic:

- The animals which maintain constant body temperature irrespective of environmental changes are called homeothermic animals.
- These are warm blooded animals, e.g., birds and mammals.

## **62. Explain various patterns of organisation in animals.**

Animals exhibit different patterns of organisation:

Cellular level of organisation :

- Cells are loosely arranged without the formation of tissues.
- There is division of labour among the cells, e.g., sponges.

Tissue level of organisation :

- Cells which perform similar function are grouped into tissues.
- The tissues perform a common function, e.g., cnidarians.

Organ level of organisation :

Different kinds of tissues aggregate to form an organ to perform a specific function e.g., flatworms and other hyper phyla.

Organ system level of organisation :

- The tissues are organised to form organs and organ systems.
- All the organ system function in a coordinated manner.

## **63. Explain symmetry in animals.**

Symmetry is the body arrangement in which parts lie on opposite side of the axis are identical. If the animals lack a definite body plane or irregular shaped and any plane passing through the center of the body does not divide them into two equal halves, these are known as asymmetrical, e.g., sponges, adult gastropods.

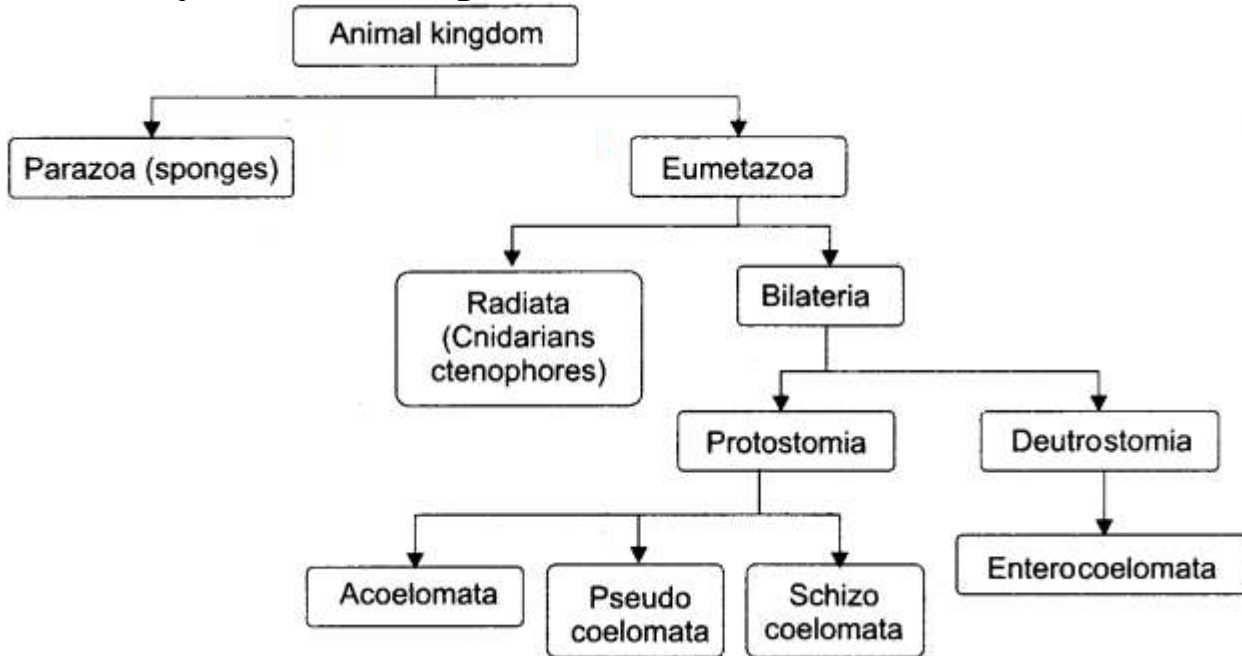
When any plane passing through the central axis of the body divides an organism into two equal parts, it is known as radial symmetry. They have a top and bottom side, e.g., cnidarians. Echinoderms have five planes of symmetry and show pentamerous radial symmetry. Animals which have two pairs of symmetrical sides are biradially symmetrical. Animal which have two similar halves on either side of the control plane show bilateral symmetry.

## **64. Classify animals based on coelom.**

The cavity between the body wall and the gut wall is called coelom. If the animals do not have coelom, they are called acoelomates. e.g., flatworms. In some animals, the body cavity is not fully lined by the mesodermal epithelium. The mesoderm is formed as scattered pouches between the ectoderm and endoderm. Such a body cavity is called a pseudocoel. The animals which have pseudocoel e.g. round worms.

If the coelom develops within the mesoderm and is lined by mesodermal epithelium it is called eucoelom. The animals which have true coelom are called eucoelomates. If the body cavity is formed by splitting of mesoderm, the animals are called schizocoelomates e.g., Annelids, arthropods and molluscs. If the body cavity is formed from the mesodermal ‘ pouches of archenteron, the animals are called enterocoelomate animals, e.g., echinoderms, hemichordates and chordates.

**65. Classify the animal kingdom.**



**66. Write the general characters of the phylum porifera.**

- They are aquatic, asymmetrical.
- They have pores all over the body.
- They are multicellular with cellular level of organisation. Tissues are not formed.
- They have canal system for circulation of water.
- They have skeleton made of calcareous or siliceous spicules.
- Nutrition is holozoic and digestion intracellular.
- Asexual reproduction by fragmentation and gemmule formation.
- Indirect development with parenchymula and amphiblastula larvae, e.g., Sycon and Spongilla.

**67. Write the general characters of the phylum cnidaria.**

- The cnidaria are aquatic, radially symmetrical and diploblastic.
- The tentacles have stinging cells called cnidocytes or cnidoblasts or nematocysts.
- They exhibit tissue level of organisation.

- They have a central gastrovascular cavity called coelenteron.
- Digestion is by both extracellular and intracellular.
- Alternation of generation is seen in cnidarians which have polyp and medusa forms.
- Development is indirect with planula larva e.g. Physalia.

**68. Write the general characters of the phylum ctenopora?**

- The animals are marine, diploblastic and radially symmetrical.
- They have eight external rows of ciliated comb plates which help in locomotion.
- Bioluminescence is seen.
- They lack nematocysts but have lasso cells which help in food capture.
- Digestion is by both extracellular and intracellular.
- Sexual reproduction is seen.
- Fertilization is external and development is indirect.
- Cydippid larva is seen, e.g., Pleurobrachia.

**69 Write the general characters of flatworms.:**

- The flatworms are flat, bilaterally symmetrical, triploblastic animals.
- These are acoelomates with organ system level of organisation.
- They are endoparasites. They have hooks or suckers or both.
- They show pseudosegmentation.
- Flame cells or solenocytes are the excretory cells.
- Sexes are not separate.
- Fertilization is internal. Development is indirect with many larval stages like miracidium sporocyst, redia, cercaria and metacercaria. e.g., Taenia and liver fluke.

**70. Write the general characters of the phylum aschelminthes.**

- The body of these worms is circular.
- They are free living or parasite.
- They are triploblastic, pseudocoelomates with organ system level of organisation.
- Body is covered by cuticle.
- Digestive system is complete with mouth, pharynx and anus.
- Excretory system consists of renet glands.
- Sexes are separate. Sexual dimorphism is seen.
- Fertilization is internal.
- Development may be direct or indirect, e.g., Ascaris.

**71. Write the general characters of the phylum annelida?**

- They are aquatic or terrestrials, free living or parasitic.
- They are triploblastic, bilaterally symmetrical, schizocoelomates with organ system level of organisation.
- The body is metamerically segmented.
- Longitudinal and circular muscles help in locomotion.
- Closed type of circulation is seen.
- Respiratory pigments are present.
- Sexual reproduction is seen. Development is direct or indirect with a trochophore larva e.g., earthworm.

**72. Write the general characters of the phylum arthropoda.**

- These are bilaterally symmetrical, triploblastic, schizocoelomate, segmented animals.
- They have organ system grade of organisation.
- They have jointed appendages.
- Body is covered by chitinous exoskeleton. Body is divided into head, thorax and abdomen.
- Body cavity is filled with colourless blood. It is called haemocoel.
- Respiratory organs are gills, book gills, book lungs, trachea.
- Open type circulation is seen.
- Sense organs are present.
- Fertilization is internal, e.g., Limulus and insects.

**73. Write the general characters of the phylum mollusca.**

- Molluscs are terrestrial or aquatic with organ system level of organisation.
- They are triploblastic, bilaterally symmetrical, coelomate animals.
- Body is divided into head, foot and visceral hump.
- The digestive system is complete.
- Nephridia are the excretory organs.
- Open type of circulatory system is seen.
- Blood contains copper containing respiratory pigment called hemocyanin.
- They are oviparous.
- Development is indirect with a veliger larva, e.g., Pila and Octopus.

**74. Write the general characters of the phylum echinodermata.**

- The adults are radially symmetrical but the larvae are bilaterally symmetrical.
- They have mesodermal endoskeleton of calcareous ossicles called spines.
- Water vascular system is present.
- Tube feet are the organs of locomotion, respiration and capture of food.

- The digestive system is complete with mouth on the ventral side and anus on the dorsal side.
- Excretory organ are absent.
- Open type of circulatory system is present.
- Reproduction is by sexual method.
- Fertilization is external.
- Indirect development with bilaterally symmetrical larval forms, e.g., starfish.

**75. Write the general characters of hemichordata.**

- The Hemichordates have both invertebrate and vertebrate characters.
- They are worm like, tubicolous animals.
- They are bilaterally symmetrical, triploblastic coelomate animals with organ system level of organisation.
- The body is divided into proboscis, collar and trunk.
- They are ciliary feeders.
- Circulatory system is simple and open.
- Excretion is by a single proboscis gland or glomerulus situated in the proboscis.
- Sexes are separate.
- Fertilization is external.
- Development is indirect with tomaria larva, e.g., Balanoglossus.

**76. Write the general characters of urochordates or tunicates.**

- They are marine, sessile, pelagic or free swimming.
- Body is unsegmented and covered by a test or tunic.
- Ault forms are sac like.
- Coelom is absent.
- Notochord is present only in the tail region of the larval stage.
- Heart is ventral and tubular.
- Nerve cord is present only in the larval stage.
- They are hermaphrodites and development is indirect with a free swimming tadpole larva.
- Retrogressive metamorphosis is seen e.g. Ascidia.

**77. Write the general characters of cephalochordates.**

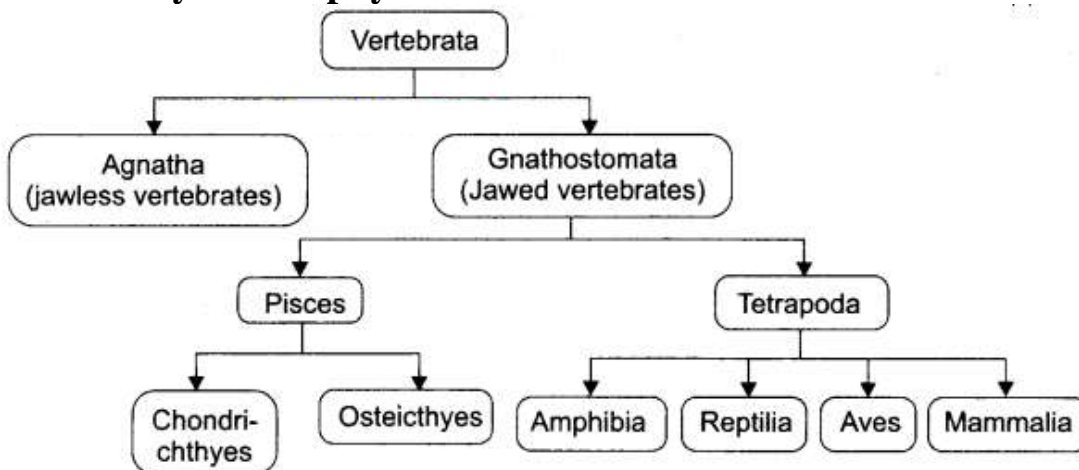
- They are marine found in shallow waters.
- They lead a burrowing mode of life.
- They are fish like with notochord, nerve cord and pharyngeal gill slits throughout their life.
- Closed type of circulatory system is seen without heart.

- Excretion is by protonephridia.
- Sexes are separate.
- Fertilization is external.
- Development is indirect with a larva e.g. Amphioxus.

**78. Write the general character of the subphylum vertebrata.**

- The vertebrates have notochord during embryonic stage. In adult, it is replaced by vertebral column. ,
- They have paired appendages.
- The skin is covered by protective skeleton like scales, feathers, hairs, claws, nails etc.
- Respiration is by gills, skin, buccopharyngeal cavity and lungs.
- They have a ventral heart with two, or three or four chambers.

**79. Classify the subphylum Vertebrata.**



**80. Write the general characters of the class Cyclostomata.**

- They are primitive, poikilothermic, jawless aquatic vertebrates.
- Body is slender and eel-like with six to fifteen pairs of gill slits.
- Mouth is circular without jaws and suctorial.
- Heart is two chambered. Closed types of circulation is seen.
- No paired appendages.
- Cranium and vertebral column are cartilaginous, e.g. Petromyzon.

**81. Write the general characters of the class chondrichthyes.**

- They are cartilaginous marine fishes. .
- Notochord is persistent throughout life.
- The skin is covered by dermal placoid. scales.
- Caudal fin is heterocercal.
- Jaws are powerful.
- Respiration is by lamelliform gills without operculum.

- Mesonephric kidneys are present.
- They have two chambered heart.
- They are ureotelic.
- They are poikilothermic and viviparous.
- Sexes are separate and fertilization is internal, e.g., Scoliodon.

**82. Write the general characters of the class Osteichthyes.**

- They are marine or freshwater fishes.
- They have bony endoskeleton.
- The body is spindle-shaped.
- The skin is covered by ganoid, cycloid or ctenoid scales.
- Respiration is by four pairs of gills covered by operculum.
- Air bladder is present which helps in gaseous exchange (lung fishes) for maintaining buoyancy.
- They have two chambered heart.
- They have mesonephric kidneys and ammonotelic.
- Lateral line sense organ is present.
- External fertilization is seen and most forms are oviparous e.g. Labeo and Catla.

**83. Write the general characters of the class Amphibia.**

Amphibians are adapted to live both in water and on land.

- They are poikilothermic.
- The body is divisible into head and trunk.
- They have two pairs of limbs.
- The skin is smooth or rough, moist, pigmented and glandular.
- Eyes have eyelids.
- Respiration is by gills, lungs and through the skin.
- Heart is three chambered.
- Kidneys are mesonephric and ureotelic.
- Sexes are separate and fertilization is external.
- They are oviparous and development is indirect, e.g. Bufo and Rana.

**84. Write the general characters of the class Reptilia.**

- They are mostly terrestrial.
- The body is covered by dry and cornified skin with scales.
- They have three chambered heart.
- They are poikilothermic.
- They are oviparous and they lay cleidoic eggs.
- They have metanephric kidney and are uricotelic.

- Fertilization is internal, e.g. Chelone and Chameleon.

**85. Write the general characters of the class Aves.**

- They have feathers on the body.
- The forelimbs are modified into wings. The hind limbs are adapted for walking, running, swimming and perching.
- The skin has oil gland.
- The exoskeleton consists of feathers, scales, claws on legs.
- The bones are pneumatic.
- Respiration is by lungs with air sacs.
- The heart is four chambered with right systemic arch.
- They are homeothermic.
- Migration and parental care are seen.
- Urinary bladder is absent.
- Females have only left ovary.
- They are oviparous. The eggs are cleidoic.

**86. Write the general characters of the class Mammalia.**

- The body is covered by hairs.
- They have mammary glands.
- They have two pairs of limbs adapted for walking, running, climbing, burrowing, swimming and flying.
- The skin has sweat glands, scent glands and sebaceous glands.
- Exoskeleton includes horny epidermal horns, spines, claws, nails, hooves and bony dermal plates.
- They have thecodont, heterodont and diphyodont teeth.
- External ears or pinnae are present.
- Heart is four chambered with left systemic arch.
- RBCs are non-nucleated.
- They have metanephric kidneys and they are ureotelic.
- They are homeothermic.
- Sexes are separate and fertilization is internal e.g. Platypus, kangaroo, elephants and mammals.



## CHAPTER 3 TISSUE LEVEL OF ORGANISATION

### Answer the following:

#### 1. Some epithelia are pseudostratified. What does this mean?

Pseudostratified epithelial cells are columnar, but unequal in size. Although the epithelium is single layered yet it appears to be multilayered due to the fact that nuclei lie at different levels in different cell

#### 2. Differentiate white adipose tissue from brown adipose tissue.

Adipose tissue:

- Adipose tissue is the group of fat cells.
- It stores fats.
- It releases energy while fasting.

Brown Adipose Tissue:

- Adipose tissue which contains abundant mitochondria are called brown adipose tissue.
- It is used to warm the blood stream to warm the body.
- It produces heat by non-shivering thermogenesis.

#### 3. Why blood is considered as a typical connective tissue?

Blood is considered as a typical connective tissue because it is the fluid connective tissue containing plasma, RBCs, WBCs and platelets. It functions as the transport medium for the cardiovascular system carrying nutrients, nitrogenous wastes and respiratory gases throughout the body.

#### 4. Differentiate between elastic fibres and elastic connective tissue.

Elastic fibres:

- It contains elastin and other proteins and glycoproteins.
- It attaches muscles and bones and one bone to another bone.
- It withstands tensile stress when pulling force is applied in one direction or in many directions.

Elastic connective tissue:

- It contains high proportion of elastic fibres.
- It is found in the walls of large arteries, ligaments associated with vertebral column and within the walls of the bronchial tubes.
- It allows recoil of tissues after stretching.

#### 5. Name any four important functions of epithelial tissue and provide at least one example of a tissue that exemplifies each function.

1. Secretion and absorption :

Cuboidal epithelium in kidney tubules, ducts. Columnar epithelium found in the digestive tract.

2. Filtration :

Squamous epithelium found in the glomerulus of kidney.

3. Ciliated epithelium :

Found in the bronchi, uterine tubes propels the materials due to ciliary actions.

**6. Write the classification of connective tissue and their functions.**

There are four main classes of connective tissues.

- Connective tissue proper
- Cartilage
- Bones
- Blood

The major functions of connective tissues are binding and support, protection, insulation and transportation of substances.

**7. What is an epithelium? Enumerate the characteristic features of different epithelia.**

Epithelial tissue is sheet of cells that covers the body surface or lines the body cavity.

- Simple epithelium is single layered.
- Squamous epithelium is made of flattened cells with irregular boundaries.
- Columnar epithelium is made of column like cells with round to oval nuclei at the base.
- Ciliated epithelium has cilia at the free end.
- Compound epithelium is made of multi-layered cells.

**8. Stratified epithelia are “built” for protection or to resist abrasion. What are the simple epithelia better at?**

The simple epithelia are better at absorption, secretion of mucus, enzymes and other substances.

**9. What type of connective tissue is damaged when one get cut on his index finger accidentally?**

The Areolar connective tissue is damaged when finger gets cut.

**10. The stored lipids are in the form of adipose tissue. Are they coloured? Why?**

The white adipose tissue is called white fat. The adipose that has abundant mitochondria is called Brown fat.

**11. You are looking at a slide of a tissue through the compound microscope and you see striped branching cells that connect with one another. What type of muscle are you viewing?**

I am viewing the skeletal muscle.

**12. A player has sustained a severe injury during football practice and was told that he has a torn knee cartilage. Can he expect a quick uneventful recovery?**

**Explain your response.**

The knee cartilage is an important connective tissue. Since the knee moves during locomotion, a quick, uneventful recovery cannot take place. Complete rest to the knee joint is necessary.

**13. An overweight high school student, is overheard telling her friend that she is going to research how she can transform some of her white fat to brown fat. What is her rationale here (assuming it is possible)?**

The white fat stores nutrients while the brown fat warms the body. The student feels that she may bring down her weight by converting brown fat to white fat.

**14. Differentiate Simple epithelium and compound epithelium.**

Simple epithelium:

- It consists of a simple layer.
- It helps in protection, absorption, filtration, excretion, secretion and sensory reception.

Compound epithelium:

- It is multilayered.
- It provides protection against chemical and mechanical stresses.

**15. Explain the types of simple epithelium.**

Simple epithelium is a simple layered sheet of cells that covers the body surface or lines the body cavity.

Types:

1. Squamous epithelium:

It is made of flattened cells with irregular boundaries. It is found in glomeruli, air sacs of lungs, lining of heart, blood vessels.

2. Cuboidal epithelium:

It is made of cube like cells. It is found in kidney tubules, ducts and glands. It is important for secretion and absorption.

3. Columnar epithelium :

It is made of column like cells. It lines the digestive tract. It is important for secretion and absorption.

4. Ciliated epithelium :

It has cilia at the free end. It is found in bronchi, uterine tubes. It is helpful in propelling materials.

5. Glandular epithelium :

Cuboidal or columnar epithelium specialized for secretion is called glandular epithelium. E.g., goblet cells and salivary gland.

**16. Distinguish between exocrine glands and endocrine glands.**

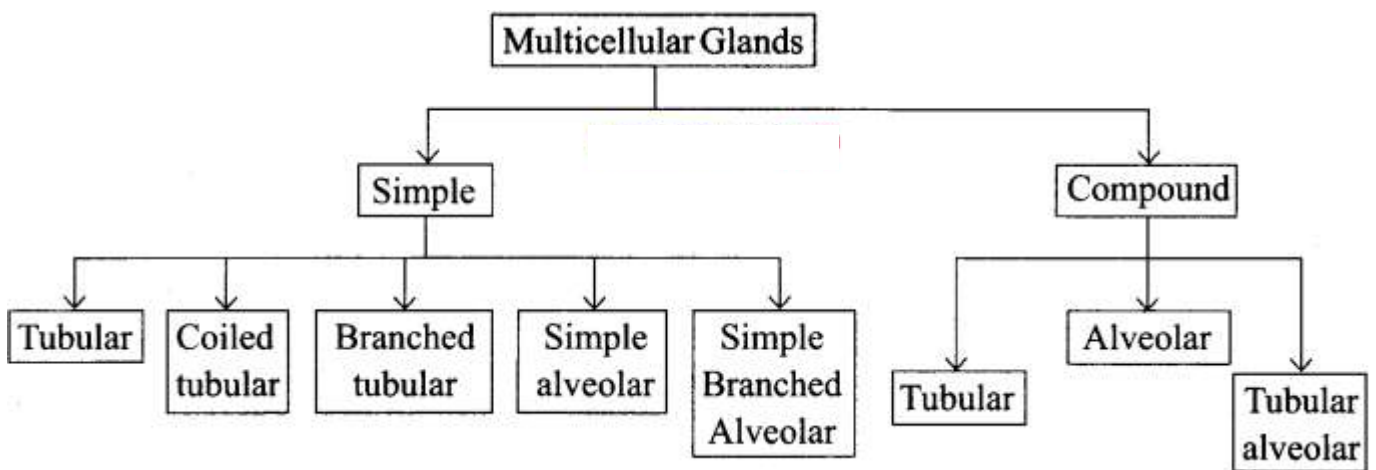
Exocrine glands:

- These glands release their products through ducts.
- These secrete mucous, saliva, ear wax, oil, milk, digestive enzymes etc. e.g., salivary glands

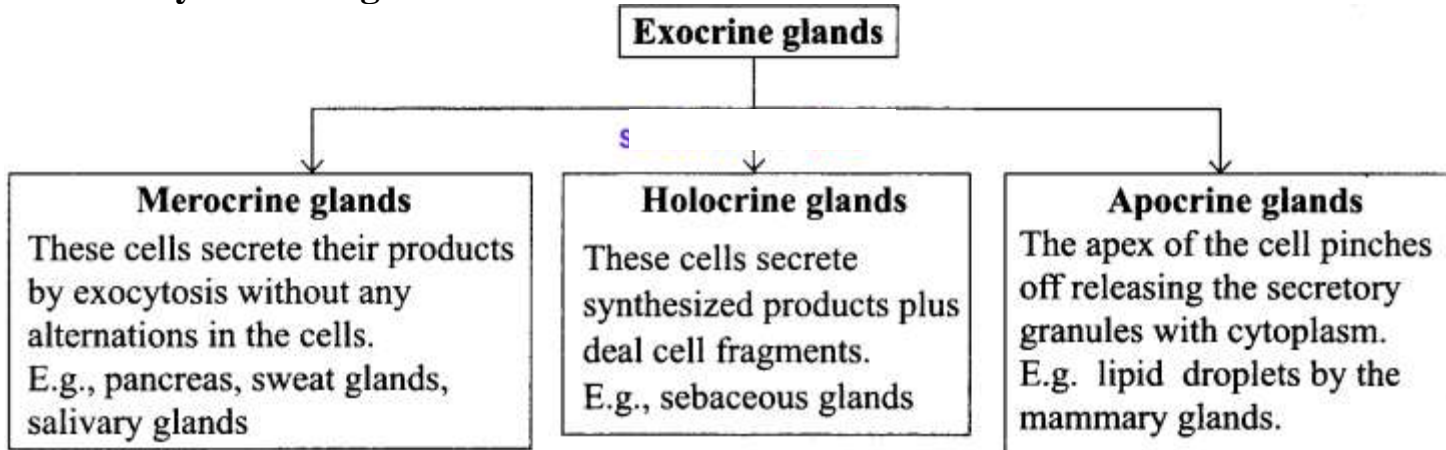
Endocrine glands:

- These are ductless gland and their secretions are released directly into the blood.
- These secrete hormones, e.g., Pituitary gland

**17. Classify multicellular exocrine glands based on their structure.**



**18. Classify exocrine glands based on mode of secretion.**



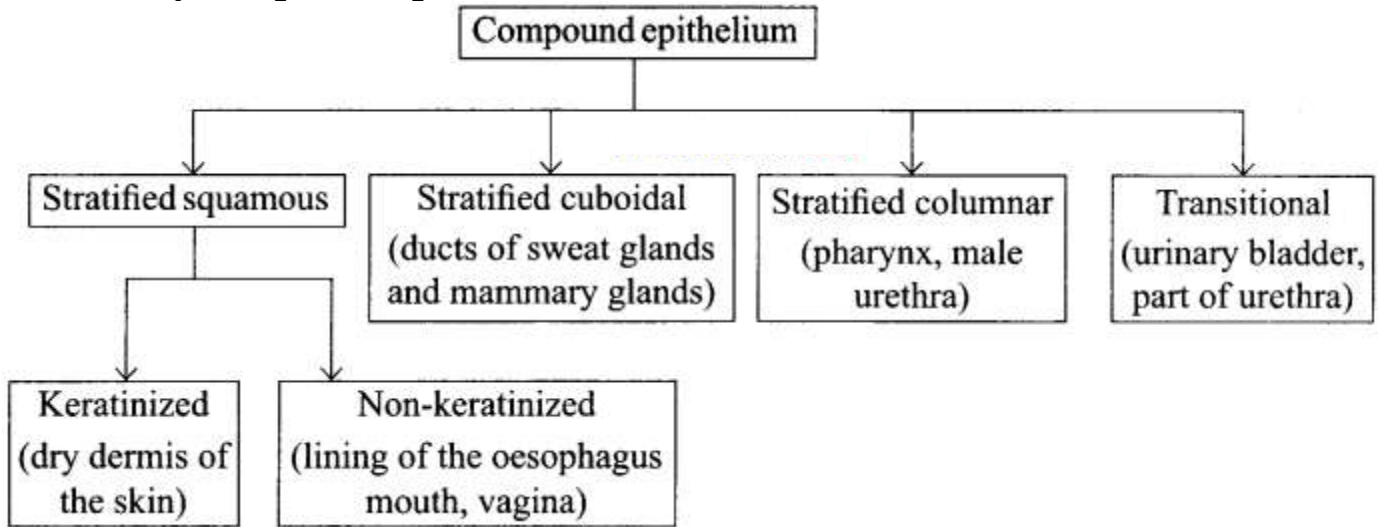
**19. Explain compound epithelium.**

Compound epithelium is made up of multilayered cells.

- These protect organs against chemical and mechanical stresses.

- These cover the dry surface of the skin, moist surface of the buccal cavity, pharynx, inner lining of ducts of salivary glands and pancreatic ducts.

**20. Classify compound epithelium.**



**21. Write a short note on specialized junctions of epithelia.**

All cells of epithelia are held together with little intercellular material forming specialized junctions. These provide structural and functional links between the cells. Three types of cell junctions, tight, adhering and gap junctions are found in animal tissues.

Tight junctions help to stop substances from leaking across the tissue. Adhering junctions cement the neighbouring cells together. Gap junctions facilitate the transfer of ions, small and big molecules between the adjoining cells by connecting the cytoplasm of these cells.

**22. Write a short note on connective tissue.**

Connective tissue develops from the mesoderm. Proper, cartilage, bones and blood are the four main classes of connective tissues. Binding, support, protection, insulation and transportation of substances are the major functions of connective tissue.

**23. What are the types of proper connective tissues?**

Loose connective tissue and dense connective tissues.

**24. Write a short note on loose connective tissues.**

In this tissue, the cells and fibres are loosely arranged in semifluid ground substances, e.g., fibroblasts, macrophages, fat cells and mast cells. Areolar connective tissue present beneath the skin acts as a support framework for epithelium. It acts as a reservoir of water and salts for the surrounding body tissues. Hence, these are called tissue fluid.

Adipose tissue is similar to areolar tissue in structure and function. It is located beneath the skin, surrounding the kidneys, eyeball, heart etc. Adipocytes store fat. It

is called white fat. The adipose tissue which contains a lot of mitochondria is called brown fat or brown adipose tissue. Reticular connective tissue is filled with fibroblasts called reticular cells. These cells store fats and the excess nutrients.

### **25. Distinguish between tendons and ligaments.**

Tendons:

Tendons attach skeletal muscles to bones

Ligaments:

Ligaments attach one bone to another.

### **26. Explain specialised connective tissues.**

Cartilage :

The intercellular material of cartilage is solid and pliable and resists compression. Cells of cartilage (chondrocytes) are enclosed in small cavities within the matrix secreted by them. Cartilage is present in the tip of nose, outer ear joints, ear pinna, between adjacent bones of the vertebral column, limbs and hands on adults.

Bones :

Bones have a hard and non-pliable ground substance rich in calcium salts and collagen fibres. Bones support and protect softer tissues and organs. Osteoblasts are present in the spaces called lacunae.

Blood :

It is the fluid connective tissue. It contains RBCs, WBCs and platelets. It functions as a transport medium for nutrients, wastes and respiratory gases.

### **27. Explain the types of muscle.**

Each muscle is made of long, cylindrical fibres. They are composed of fine fibrils called myofibrils. Muscle fibres contract and relax. Skeletal muscle is attached to skeletal bones. It is striped or striated. It is the voluntary muscle. The smooth muscle fibres are fusiform and do not have striations. It is an involuntary muscle. Cardiac muscle tissue is present in the heart. It is striated and branched and involuntary.

### **28. Write a note on neural tissue.**

Neurons are units of the neural system. The neuroglial cells protect and support the neurons.

- Neurons transmit sensations as electric impulses

## CHAPTER -4 ORGAN AND ORGAN SYSTEMS IN ANIMALS

**Answer the following:**

### **1. What characteristics are used to identify the earthworms?**

In gardens, earthworms can be traced by their fecal deposits known as worm castings on the soil surface. The earthworms can be identified using the following characteristics:

- Long and cylindrical narrow body.
- Bilateral symmetry
- It is light brown in colour with purple tinge at the anterior end.
- The division of body into many segments or metameres.
- The dorsal surface of the body is marked by a dark mid dorsal line.
- In mature worms, segments 14-17 may be found swollen with a glandular thickening of the skin called the clitellum.

### **2. What are earthworm casts?**

The undigested particles of food along with earth passed out through the anus of the earthworm are called worm casting.

### **3. How do earthworms breathe?**

In earthworms, respiration takes place through the body wall by the moist skin diffusion, oxygen diffuses through the skin into the blood while carbon dioxide from the blood diffuses out.

### **4. Why do you call cockroach a pest?**

Cockroaches destroy food and contaminates it with their offensive odour. They are carriers of a number of bacterial diseases. The cockroach allergen can cause asthma to sensitive people.

### **5. Comment on the functions of alary muscles?**

Alary muscles are the triangular muscles that are responsible for blood circulation in the cockroach. Each segment has one pair and a pumped anteriorly to sinuses again.

### **6. Name the visual units of the compound eyes of cockroach.**

Ommatidia

### **7. How does the male frog attracts the female for mating?**

Male frog has a pair of vocal sacs and a nuptial pad on the ventral side of the first digit of each forelimb. Vocal sacs assist in amplifying the croaking sound of frog. It makes a characteristic sound and attracts the female.

### **8. Write the types of respiration seen in frog.**

Frog respire on land and in the water by two different methods. In water, skin acts as aquatic respiratory organ (cutaneous respiration). Dissolved oxygen in the water gets exchanged through the skin by diffusion. On land, the buccal cavity, skin and

lungs act as the respiratory organs. In buccal respiration on land, the mouth remains permanently closed while the nostrils remain open.

The floor of the buccal cavity is alternately raised and lowered, so air is drawn into and expelled out of the buccal cavity repeatedly through the open nostrils. Respiration by lungs is called pulmonary respiration. The lungs are a pair of elongated, pink coloured sac-like structures present in the upper part of the trunk region (thorax). Air enters through the nostrils into the buccal cavity and then to the lungs. During aestivation and hibernation gaseous exchange takes place through skin.

**9. Differentiate between peristomium and prostomium in earthworm.**

Peristomium:

The first segment of the body of earthworm is called peristomium.

Prostomium:

A small flap overhanging the mouth is called prostomium or upper lip.

**10. Give the location of clitellum and spermathecal openings in *Lampito mauritii*.**

In mature earthworms, 14 – 17th segments are swollen with a glandular thickening of the skin called the clitellum. Spermathecal openings are three pairs of small ventrolateral apertures lying intersegmentally between the grooves of the segment 6 / 7, 7 / 8 and 8 / 9.

**11. Differentiate between tergum and a sternum**

Tergum:

Tergum is the covering each segment of cockroach on the dorsal side.

Sternum:

The sternum is the covering of each segment of cockroach on the ventral side.

**12. Head of cockroach is called hypognathous. Why?**

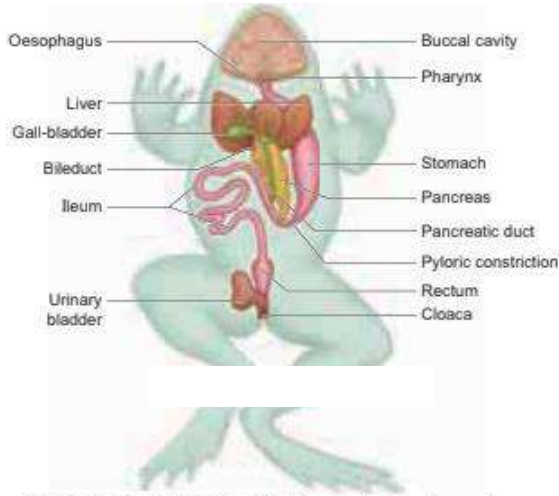
The mouth parts of cockroach are directed downwards. The head is small, triangular lies at right angle to the longitudinal body axis. Hence it is called hypognathous.

**13. What are the components of blood in frog?**

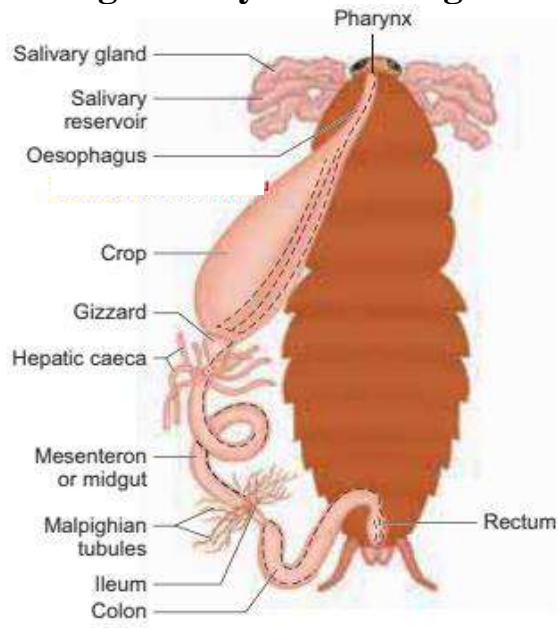
The blood consists of plasma [60%] and blood cells [40%], red blood cells, white blood cells, and platelets. RBCs are loaded with red pigment, nucleated and oval in shape. Leucocytes are nucleated, and circular in shape.



**14. Draw a neat labeled diagram of the digestive system of frog.**



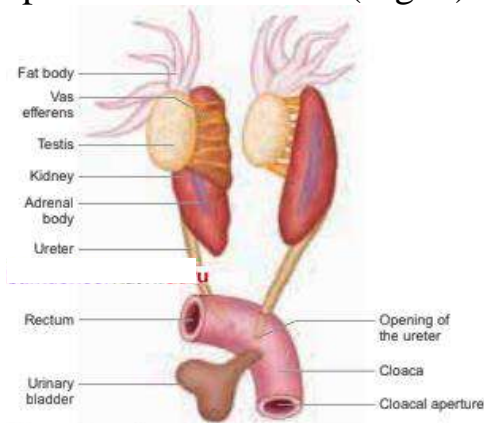
Digestive System of *Rana hexadactyla*



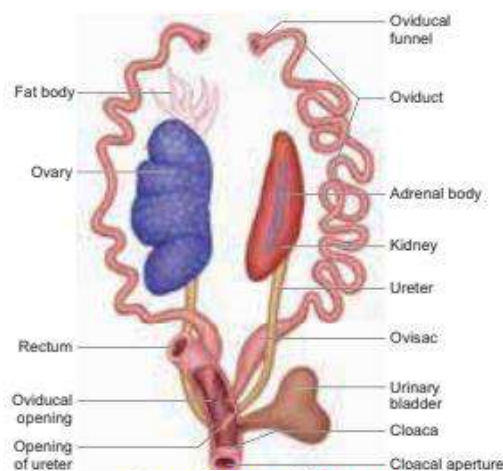
*Periplaneta americana*: Digestive system

**15. Explain the reproductive system of frog.**

The male frog has a pair of testes which are attached to the kidney and the dorsal body wall by folds of peritonium called mesorchium. Vasa efferentia arise from each testis. They enter the kidneys on both side and open into the bladder canal. Finally, it communicates with the urinogenital duct that comes out of kidneys and opens into the cloaca (Fig. 1).



*Rana hexadactyla* - Male Reproductive System



*Rana hexadactyla* - Female Reproductive System

Female reproductive system (Fig. 2) consists of paired ovaries, attached to the kidneys, and dorsal body wall by folds of peritoneum called mesovarium. There is a pair of coiled oviducts lying on the sides of the kidney. Each oviduct opens into the body-cavity at the anterior end by a funnel like opening called ostia. Unlike the male

frog, the female frog has separate genital ducts distinct from ureters. Posteriorly the oviducts dilated to form ovisacs before they open into cloaca. Ovisacs store the eggs temporarily before they are sent out through the cloaca.

### **In-Text Questions Solved**

#### **1. How do the earthworms sense activity in their habitat without eyes, ears or a nose?**

The earthworm's receptors are stimulated by a group of slender columnar cells connected with nerves. The Photoreceptors (sense of light) are found on the dorsal surface of the body. Gustatory (sense of taste) and olfactory receptors (sense of smell) are found in the buccal cavity. Tactile receptors (sense of touch), chemoreceptors (detect chemical changes) and thermoreceptors (changes in temperature) are present in the prostomium and the body wall.

#### **2. Respiratory system of cockroach is formed of spiracles and tracheal interconnections. Why is it said to be more efficient than that of earthworm? Why inspiration of cockroach is said to be a passive process while it is an active process in man?**

The respiratory system of cockroach is well developed compared with other terrestrial insects. Branched tubes known as trachea open through 10 pairs of small holes called spiracles or stigmata

#### **3. Arthropod eyes are called compound eyes because they are made up of repeating units, the ommatidia, each of which functions as a separate visual receptor. What is the difference between compound eyes and simple eyes? Why is mosaic vision with less resolution seen in cockroaches?**

If an eye is made of many eyes, it is a compound eye. It has many visual receptors unlike a simple eye which has only one visual receptor. The photoreceptors of the cockroach consists of a pair of compound eyes at the dorsal surface of the head. Each eye is formed of about 2000 simple eyes called the ommatidia (singular: ommatidium), through which the cockroach can receive several images of an object. This kind of vision is known as mosaic vision with more sensitivity but less resolution.

#### **4. Why three chambered heart of frog is not as efficient as the four chambered heart of birds and mammals?**

A 4-chambered heart can pump blood more powerfully and efficiently. This helps in better oxygenation of the blood, better circulation and better purification of the blood.

### **III. Answer the following Questions**

#### **1. Classify earthworms based on their ecological strategies.**

Earthworms are classified as epigeics, anecics and endogeics based on their ecological strategies.

- Epigeics are the surface dwellers e.g., *Perionyx excavatus* and *Eudrilus eugeniae*.
- Anecics are found in the upper layers of the soil e.g., *Lampiro mauritii*, *Lumbricus terrestris*.
- Endogeics are found in deeper layers of the soil e.g., *Octochaetona thursoni*.

## 2. Explain the morphology of earthworm, *Lampito mauritii*.

- *Lampilo mauritii* has a long and cylindrical narrow body which is laterally symmetrical.
- it is light brown in colour with purplish length at the anterior end.
- The body is divided into 165 – 190 segments.
- The dorsal surface of the body is marked by a dark mid dorsal line along the longitudinal axis of the body.
- The ventral surface has genital opening.
- The mouth is found in the centre of the first segment called peristomium.  
Overhanging
- the mouth is a small flag called upper lip or prostomium.
- The last segment called pygidium has the anus.
- The segments 14-17 are swollen with a glandular thickening of the skin called the clitellum.
- The body of earthworm is divided into pre clitellar region (1 – 13), clitellar region (14 – 17) and post clitellar region (after 17).
- Chitinous body setae are present in all segments except the first, last and clitellar segments. They are locomoting in function.
- The dorsal pores are present from the 10th segment onwards. The coelomic fluid
- communicates to the exterior through these pores and keeps the body surface moist and free from harmful microorganism.
- Between the segment 6/7, 7/8 and 8/9, supernatural openings are present.
- The female genital aperture lies on the ventral side in the 14th segment and a pair of male genital apertures are situated determinately in the 18th segment.
- Nephridiopores are numerous and found throughout the body except a few anterior segments.

## 3. Explain the internal structure of the earthworm.

The body wall of the earthworm is very moist, thin, soft, skinny, elastic and consists of the cuticle, epidermis, muscles and coelomic epithelium. The epidermis consists of supporting cells, gland cells, basal cells and sensory cells.

#### **4. Write a note on coelom of earthworm.**

A spacious body cavity called the coelom is seen between the alimentary canal and the body wall. The coelom contains the coelomic fluid and serves as a hydrostatic skeleton, in which the coelomocytes are known to play a major role in regeneration, immunity and wound healing. The coelomic fluid of the earthworm is milky and alkaline, which consists of granulocytes or cicocytes, amoebocytes, mucocytes and leucocytes.

#### **5. Explain the digestive system of earthworm.**

The digestive system of the earthworm consists of the alimentary canal and the digestive glands. The alimentary canal runs as a straight tube throughout the length of the body from the mouth to anus. The mouth opens into the buccal cavity which occupies the 1 and 2 segments.

The buccal cavity leads into a thick muscular pharynx, which occupies the 3<sup>th</sup> and 4<sup>th</sup> segments and is surrounded by the pharyngeal glands. A small narrow tube, oesophagus lies in the 5<sup>th</sup> segment and continues into a muscular gizzard in the 6<sup>th</sup> segment. The gizzard helps in the grinding of soil particles and decaying leaves. Intestine starts from the 7<sup>th</sup> segment and continues till the last segment. The dorsal wall of the intestine is folded into the cavity as the typhlosole. This fold contains blood vessels and increases the absorptive area of the intestine. The inner epithelium consists of columnar cells and glandular cells. The alimentary canal opens to the exterior through the anus. The ingested organic rich soil passes through the digestive tract where digestive enzymes breakdown complex food into smaller absorbable units.

The simpler molecules are absorbed through the intestinal membrane and are utilized. The undigested particles along with earth are passed out through the anus, as worm castings or vermicasts. The pharyngeal or salivary gland cells and the glandular cells of the intestine are supposed to be the digestive glands which secrete digestive enzymes for digestion of food.

#### **6. What is typhlosole?**

- The dorsal wall of the intestine of earthworm is folded into the cavity as the typhlosole.
- This fold contains blood vessels and increases the absorptive area of the intestine.

#### **7. Explain the nervous system of earthworm.**

The banded mass of nervous tissue called supra-pharyngeal ganglia lies on the dorsal wall of the pharynx in the 3 segment. It is referred as the brain. In the 4<sup>th</sup> segment, the sub-pharyngeal ganglia is found. The brain and the sub-pharyngeal are connected by a pair of circum-pharyngeal connectives. The double ventral nerve

cord runs backward from the sub-pharyngeal ganglion. The brain and other nerves in the ring integrates sensory inputs and command muscular responses of the body.

### 8. Explain the receptors in earthworm.

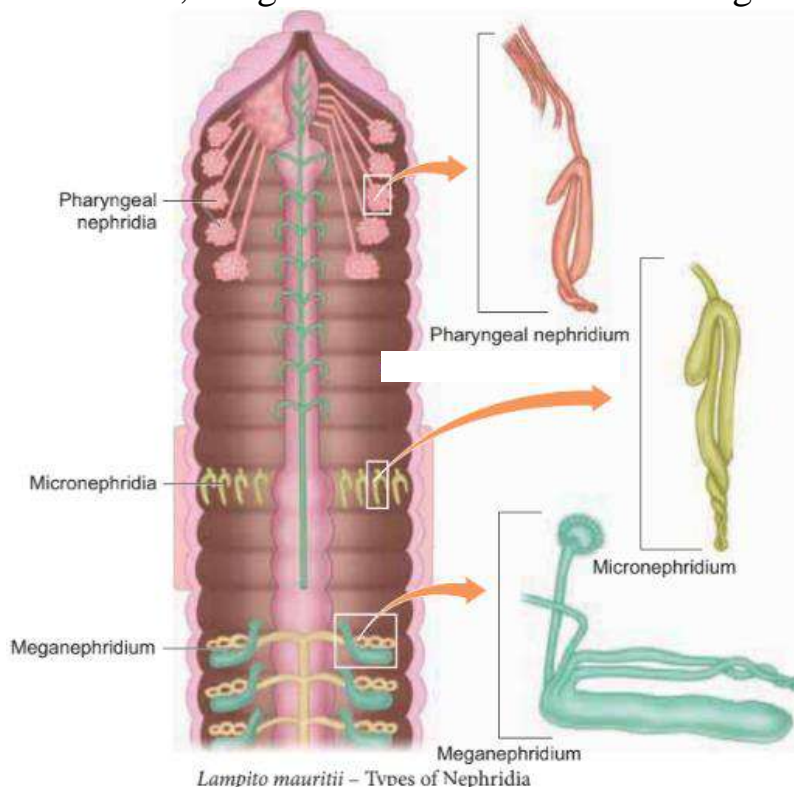
The receptors are simulated by a group of slender columnar cells connected with nerves. The photoreceptor are found on the dorsal surface of the body. Gustatory and olfactory receptors are found in the buccal cavity. Tactile receptors, chernoreceptors and thermoreceptors are present in the prostomium and the body wall.

### 9. Explain the excretory system of the earthworm.

Excretion is the process of elimination of metabolic waste products from the body. In earthworm, excretion is effected by segmentally arranged, minute coiled, paired tubules called nephridia.

There are three types of nephridia:

1. pharyngeal or tufted nephridia – present as paired tufts in the 5<sup>th</sup> segments.
2. Micronephridia or Integumentary nephridia attached to the lining of the body wall from the 14<sup>th</sup> segment to the last which open on the body surface.
3. Meganephridia or septal nephridia – present as pair on both sides of intersegmental septa of the 19<sup>th</sup> segment to the last and open into intestine (Figure). The mcganephridium has an internal funnel like opening called the nephrostome. which is fully ciliated. The nephrostorne is in the preceding segment and the rest of the tube is in the succeeding segment. This tube consists of three distinct divisions, the ciliated, the glandular and the muscular region.



The waste material collected through the ciliated funnel is pushed into the muscular part of nephridium by the ciliated region. The glandular part extracts the waste from the blood and finally the wastes exit out through the nephridiopore. Besides nephridia, special cells on the coelomic wall of the intestine, called chloragogen cells are present. They extract the nitrogenous waste from the blood of the intestinal wall, into the body cavity to be sent out through the nephridia.

**10. Explain the male reproductive system of the earthworm.**

In the male reproductive system, two pairs of testes are present in the 10<sup>th</sup> and 11<sup>th</sup> segments. The testes give rise to the germ cells or spermatogonia, which develop into spermatozoa in the two pairs of seminal vesicles. Two pairs of seminal funnels called ciliary rosettes are situated in the same segments as the testes. The ciliated funnels of the same side are connected to a long tube called vasa deferentia. The vasa deferentia run up to the 18<sup>th</sup> segment where they open to the exterior through the male genital aperture. The male genital aperture contains two pairs of penial setae for copulation. A pair of prostate glands lies in the 18 – 9<sup>th</sup> segments. The secretion of the prostate gland serves to cement the spermatozoa into bundles known as spermatophores.

**11. Explain the female reproductive system of earthworm.**

The female reproductive system consists of a pair of ovaries lying in the 3<sup>rd</sup> segment. Each ovary has finger-like projections which contain ova in linear series. Ovarian funnels are present beneath the ovaries which continue into the oviducts.

They join together and open on the ventral side as a single median female genital pore in the 14<sup>th</sup> segment. Spermathecae or seminal receptacles are three pairs lying in segments 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> opening to the exterior on the ventral side between 6<sup>th</sup> & 7<sup>th</sup>, 7<sup>th</sup> & 8<sup>th</sup> and 8<sup>th</sup> & 9<sup>th</sup> segments. They receive spermatozoa from the partner and store during copulation.

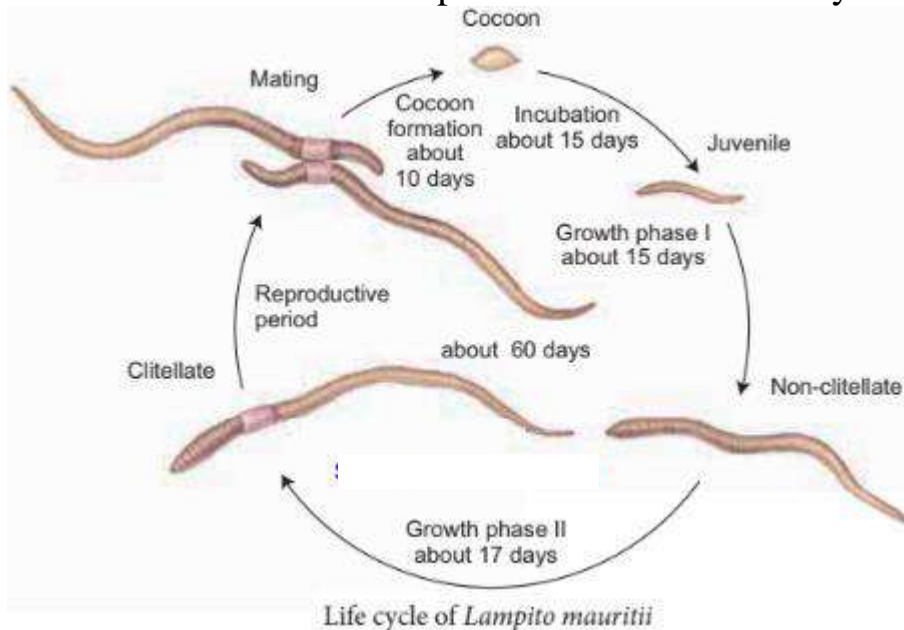
**12. In earthworm, self fertilization does not take place though it has both male and female reproductive system. Why?**

The male and female sex organs mature at different times. Sperm develops earlier than the production of ova (protandrous). Hence, self fertilization does not take place in earthworm.

**13. Write a short note on the life cycle of earthworm.**

*Lampito mauritii* begins its life cycle, from the fertilized eggs. The eggs are held in a protective cocoon. These cocoons have an incubation period of about 14 – 18 days after which they hatch to release juveniles (Figure). The juveniles undergo changes

into non clitellate forms in phase I after about 15 days.



which then develops a clitellum, called the clitellate at the end of the growth phase II taking 15 – 17 days to complete. During the reproductive stage, earthworms copulate, and later shed their cocoons in the soil after about 10 days. The life cycle of *Lampito mauritii* takes about 60 days to complete.

#### 14. What are earthworm known as friends of farmers?

They make burrows in the soil and make it porous which helps in respiration and penetration of developing plant roots. They help in recycling of dead and decayed plant material by feeding on them. Hence they are called as friends of farmers.

#### 15. Write a short note on vermitech and

1. Vermiculture
2. Vermicomposting
3. Vermiwash
4. Wormery

1. Vermiculture :

Artificial rearing or cultivation of earthworms involves new technology for the betterment of human beings. This process is known as vermiculture.

2. Vermicomposting :

The process of producing compost using earthworms is called vermicomposting.

3. Vermiwash :

Vermiwash is a liquid manure or plant tonic obtained from earthworm. It is used as a foliar spray and helps to induce plant growth. It is a collection of excretory products and mucus secretion of earthworms along with micronutrients from the soil organic molecules.



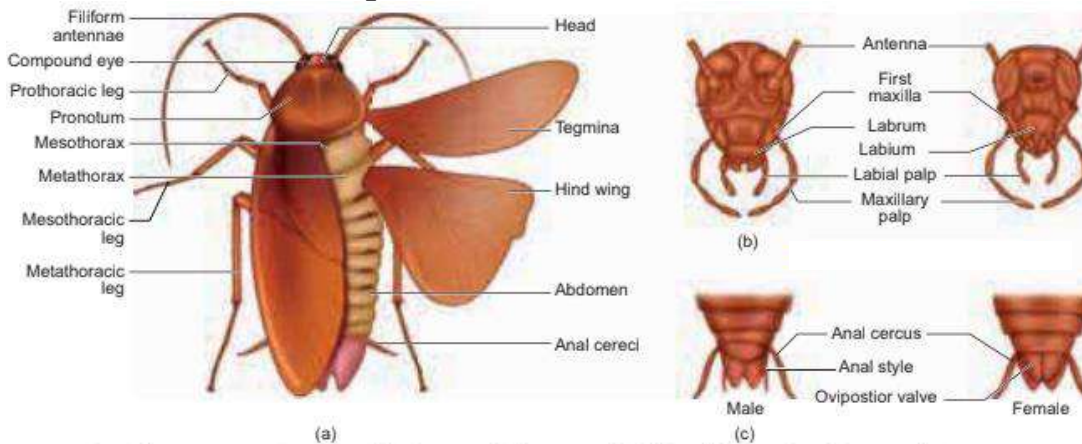
4. Wormery or wormbin :

Earthworm can be used for recycling of waste food, leaf, litter and biomass to prepare a good fertilizer in a container known as wormery or wormbin. It makes superior compost than conventional composting methods. Vermiculture, vericomposting, vermiwash and wormery are inter-related and independent process, collectively referred as vermitech.

**16. Explain the morphology of cockroach.**

The body of cockroach is compressed dorso – ventrally, bilaterally symmetrical and segmented. The body is divisible into head, thorax and abdomen. The entire body is covered by a hard, brown, chitinous exoskeleton. In each segment.

exoskeleton has hardened plates called sclerites which are joined by a delicate and elastic articular membrane or arthroial membrane. The sclerites on the dorsal side are called tergites, and those on the ventral side are called stemites and those on the lateral sides are called pleurites.



*Periplaneta americana*: (a) External features (b) Head dorsal and ventral view (c) Male and Female ventral view of posterior segment of abdomen

**Head :**

Head is small, triangular lies at right angle to the longitudinal axis. The mouth parts are directed downwards so it is hypognathous. The head has a pair of large, sessile and reniform compound eyes, a pair of antennae and appendages around the mouth part.

Antennae have sensory organs. The cockroach has a biting and chewing type (mandibulate or orthopterus type) of mouth parts. It includes a labrum, a pair of mandibles, a pair of maxillae, a labium and a hypopharynx or lingua.

**Thorax :**

The thorax consists of three segments, prothorax, mesothorax and metathorax. The head is connected with thorax by a short neck or cervicum. Each thoracic segment has three pairs of walking legs. Each leg consists of five segments, coxa, trochanter, femur, tibia and tarsus.



The tarsus has five movable joints or podomeres or tarsomeres. A pair of forewings arises from the mesothorax called elytra or tegmina. It protects the hind wings when at rest. The second pair membranous wings arises from the metathorax and are used in flight.

Abdomen :

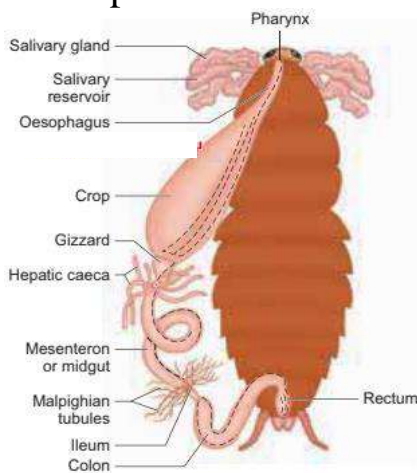
The abdomen has 10<sup>th</sup> segments. Each segment has a dorsal tergum, ventral sternum and between them a narrow membranous pleuron. In female the 7<sup>th</sup>, segment is boat shaped and together with the 8<sup>th</sup> and 9<sup>th</sup> sterna forms a brood pouch or genital pouch. Its anterior parts contain female gonopore, spermathecal pores, collateral glands and the posterior parts constitutes the oothecal chamber in which the cocoons are formed.

in males, the genital pouch lies at the hind end of the abdomen bound dorsally by 9<sup>th</sup> and 10<sup>th</sup> terga and ventrally by the 9<sup>th</sup> sternum. It contains dorsal anus and ventral male genital pore. In both sexes, genital apertures are surrounded by sclerites called goniapophysis.

Male has a pair of short and slender anal styles in the 9<sup>th</sup> sternum which are absent in female. In both sexes, the 10<sup>th</sup> segment has a pair of jointed filamentous structures called anal cerci which is a sense organ that is receptive to vibrations in the air and land. The 7<sup>th</sup> sternum of male has a pair of large and oval apical lobes or gynovalvular plates which form a keel like structure which distinguishes the male from female.

### 17. Explain the digestive system of cockroach.

The digestive system of cockroach consists of the alimentary canal and digestive glands. The alimentary canal is present in the body cavity and is divided into three regions: foregut, midgut and hindgut (Figure). The foregut includes pre-oral cavity, mouth, pharynx and oesophagus. This in turn opens into a sac like structure called the crop which is used for storing food.



*Periplaneta americana*: Digestive system

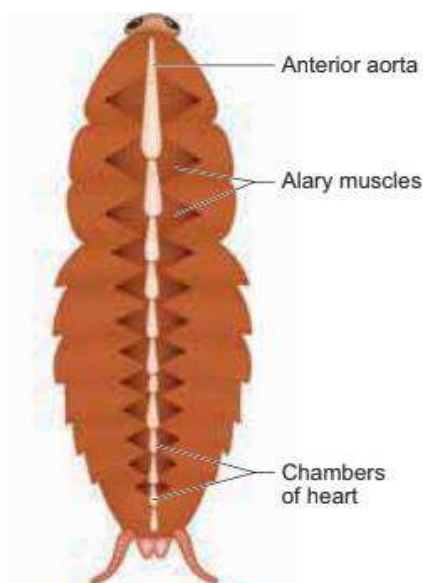
The crop is followed by the gizzard or proventriculus which has an outer layer of thick circular muscles and thick inner cuticle forming six highly chitinous plates called 'teeth'. gizzard helps in the grinding of the food particles. The midgut is a short and narrow tube behind the gizzard and is glandular in nature. At the junctional region of the gizzard are eight finger-like tubular blind processes called the hepatic caecae or enteric caecae.

The hindgut is marked by the presence of 100 – 150 yellow coloured thin filamentous Malpighian tubules which are helpful in removal of the excretory products from the haemolymph. The hindgut is broader than the midgut and is differentiated into ileum, colon, and rectum.

The rectum opens out through the anus. Digestive glands of cockroach consist of the salivary glands, the glandular cells and hepatic caecae. A pair of salivary glands is found on either side of the crop in the thorax. The glandular cells of the midgut and hepatic or gastric caecae produce digestive juices.

**18. Explain the circulatory system of cockroach.**

Periplaneta has an open type of circulatory system (Figure). Blood vessels are poorly developed and open into the haemocoel in which the blood or haemolymph flows freely. Visceral organs located in the haemocoel are bathed in blood. The haemolymph is colourless and consists of plasma and haemocytes which are 'phagocytic' in nature. Heart is an elongated tube with muscular wall lying mid dorsally beneath the thorax.

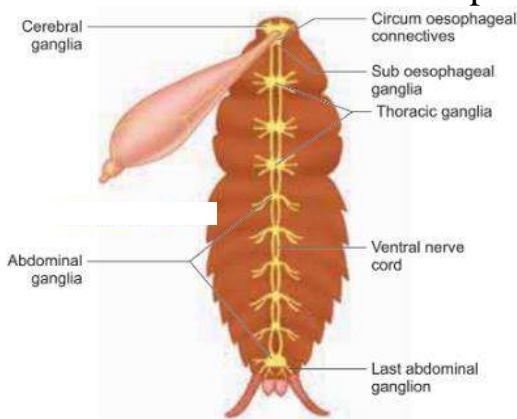


*Periplaneta americana*:  
Circulatory system

The heart consists of 13 chambers with ostia on either side. The blood from the sinuses enters the heart through the ostia and is pumped anteriorly to sinuses again. The triangular muscles that are responsible for blood circulation in the cockroach are called alary muscles (13 pairs). One pair of these muscles is found in each segment on either side of the heart. In cockroach, there is an accessory pulsatile vesicle at the base of each antenna which also pumps blood.

**19. Explain the nervous system of cockroach.**

The nervous system of cockroach consists of a nerve ring and a ganglionated double ventral nerve cord. sub-oesophageal ganglion. circum – oesophageal connectives and double ventral nerve cord (see figure). The nerve ring is present around the oesophagus in the head capsule and is formed by the supra-oesophageal ganglion called the ‘brain’. The brain is mainly a sensory and an endocrine centre and lies above the oesophagus. Sub – oesophageal ganglion is the motor centre that controls the movements of the mouth parts, legs and wings.



*Periplaneta americana*: Nervous system

it lies below the oesophagus and formed by the fusion of the paired ganglia of mandibular, maxillary and labial segments of the head. A pair of circum – oesophageal connectives is present around the oesophagus. connecting the supra oesophageal ganglia with the sub-oesophageal ganglion.

The double ventral nerve cord is solid, ganglionated and arises from the sub-oesophageal ganglion and extends up to the 7th abdominal segment. Three thoracic ganglia are one in each thoracic segment and six abdominal ganglia in the abdomen.

**20. Write about the sense organs of cockroach.**

In cockroach, the sense organs are antennae, compound eyes, labrum, maxillary alps, labial paips and anal cerci. The receptor for touch (thigmo receptors) is located in the antenna, maxillary palps and cerci. The receptor for smell (olfactory receptors) is found on the antennae. The receptor for taste (gustatory receptors) is

found on the pairs of maxilla and labium. Thermoreceptors are found on the first four tarsal segments on the legs.

The receptor chordotonal is found on the anal cerci which respond to air or earth borne vibrations. The photoreceptors of the cockroach Consists of a pair of compound eyes at the dorsal surface of the head. Each eye is formed of about 2000 simple eyes called the ommatidia (singular: ommatidium), through which the cockroach can receive several images of an object. This kind of vision is known as mosaic vision with more sensitivity but less resolution.

## 21. Differentiate male and female cockroaches.

S. No	Character	Male cockroach	Female cockroach
1.	Abdomen	Long and narrow	Short and broad
2.	Segments	In the abdomen, nine segments are visible	In the abdomen, seven segments are visible
3.	Anal styles	Present	Absent
4.	Terga	7 <sup>th</sup> tergum covers 8 <sup>th</sup> tergum	7 <sup>th</sup> tergum covers 8 <sup>th</sup> and 9 <sup>th</sup> terga
5.	Brood pouch	Absent	Present
6.	Antenna	Longer in length	Shorter in length
7.	Wings	Extends beyond the tip of abdomen	Extends up to the end of abdomen

## 22. Explain excretion in cockroach.

The Malpighian tubules are the main excretory organs of cockroach which help in eliminating the nitrogenous wastes from the body in the form of uric acid.

Cockroach excretes uric acid, so it is uricotelic. In addition, fat body, nephrocytes, cuticle, and urecose glands are also excretory in function.

The malpighian tubules are thin, long, filamentous, yellow coloured structures attached at the junction of midgut and hindgut. These are about 100-150 in number and are present in 6-9 bundles. Each tubule is lined by glandular and ciliated cells and the waste is excreted out through the hindgut.

The glandular cells of the malpighian tubules absorb water, salts, and nitrogenous wastes from the haemolymph and transfer them into the lumen of the tubules. The cells of the tubules reabsorb water and certain inorganic salts. By the contraction of the tubules nitrogenous waste is pushed into the ileum, where more water is

reabsorbed. It moves into the rectum and almost solid uric acid is excreted along with the fecal matter.

### **23. Explain the male reproductive system of cockroach.**

Cockroach is dioecious or unisexual. They have well developed reproductive organs. The male reproductive system consists of a pair of testes, vasa deferentia, an ejaculatory duct, utricular gland, phallic gland and the external genitalia. A pair of three lobed testes lies on the lateral side of the 4th and 6th abdominal segments. From each testis arises a thin vas deferens.

which opens into the ejaculatory duct through the seminal vesicles. The ejaculatory duct is an elongated duct which opens out by the male gonopore lying ventral to the anus.

A utricular or mushroom shaped gland is a large accessory reproductive gland, which opens into the anterior part of the ejaculatory duct. The seminal vesicles are present on the ventral surface of the ejaculatory duct, These sacs store the sperms in the form of bundles called spermatophores.

The duct of phallic or conglobate gland also opens near the gonopore, whose function is uncertain. Surrounding the male genital opening are few chitinous and asymmetrical structures called phallomeres or gonapophyses which help in copulation.

### **24. Explain the female reproductive system in cockroach.**

The female reproductive system of cockroach consists of a pair of ovaries, vagina, genital pouch, collateral glands, spermathecae and the external genitalia. A pair of ovaries lies laterally in the 2<sup>nd</sup> and 6<sup>th</sup> abdominal segment. Each ovary is formed of a group of eight ovarian tubules or ovarioles, containing a chain of developing ova. The lateral oviducts of each ovary unite into a broad median common oviduct known as vagina, which opens into the genital chamber.

The vertical opening of the vagina is the female genital pore. A pair of spermathecae is present in the 6<sup>th</sup> segment, which opens by a median aperture in the dorsal wall of the genital pouch. During copulation, the ova descend to the genital chamber, where they are fertilized by the sperms. A pair of white and branched collateral glands present behind the ovaries forms a hard egg case called Ootheca around the eggs. Genital pouch is formed by the 7, 8<sup>th</sup> and 9<sup>th</sup> abdominal sterna.

The genital pouch has two chambers, a genital chamber into which the vagina opens and an oothecal chamber where oothecae are formed. Three pairs of plate like chitinous structures called gonapophyses are present around the female genital aperture. These gonapophyses guide the ova into the ootheca as ovipositors.

### **25. Write a short note on ootheca.**

A pair of white and branched collateral glands present behind the ovaries forms a hard egg case called ootheca around the eggs. Ootheca is a dark reddish to blackish

brown capsule about 12 mm long which contains nearly 16 fertilized eggs and dropped or glued to a suitable surface, usually in crack or crevice of high relative humidity near a food source. On an average, each female cockroach produces nearly 15 – 40 oothecae in its life span of about one to two years.

## **26. Explain the morphological features of frog.**

The body of a frog is streamlined to help in swimming. It is dorso-ventrally flattened and is divisible into head and trunk. Body is covered by a smooth, slimy skin loosely attached to the body wall. The skin is dark green on the dorsal side and pale ventrally.

The head is almost triangular in shape and has an apex which forms the snout. The mouth is at the anterior end and can open widely. External nostrils are present on the dorsal surface of the snout, one on each side of the median line. Eyes are large and project above the general surface of the body.

They lie behind the external nostrils and are protected by a thin movable lower eyelid, thick immovable upper eyelid and a third transparent eyelid called nictitating membrane. This membrane protects the eye when the frog is under water.

A pair of tympanic membranes forms the ear drum behind the eyes on either side. Frogs have no external ears, neck and tail are absent. Trunk bears a pair of fore limbs and a pair of hind limbs. At the posterior end of the dorsal side, between the hind limbs is the cloacal aperture.

This is the common opening for the digestive, excretory and reproductive systems. Fore limbs are short, stumpy, and helps to bear the weight of the body. They are also helpful for the landing of the frog after leaping. Each forelimb consists of an upper arm.

fore arm and a hand. Hand bears four digits. Hind limbs are large, long and consist of thigh, shank and foot. Foot bears five long webbed toes and one small spot called the sixth toe. These are adaptations for leaping and swimming. When the animal is at rest, the hind limbs are kept folded in the form of letter 'Z' Sexual dimorphism is exhibited clearly during the breeding season.

The male frog has a pair of vocal sacs and a copulatory or nuptial pad on the ventral side of the first digit of each forelimb. Vocal sacs assist in amplifying the croaking sound of frog. Vocal sacs and nuptial pads are absent in the female frogs.



**27. Differentiate between a frog and toad.**

Characters	Frog	Toad
Family	Ranidae	Bufo
Body shape	Slender	More Bulky
Legs	Longer	Shorter
Webbed feet	present	Absent
Skin	Smooth and moist skin	Dry skin covered with wart like glands.
Teeth	Maxillary and vomerine teeth.	Teeth absent.
Egg formation	Lays eggs in clusters.	Lays eggs in strings.

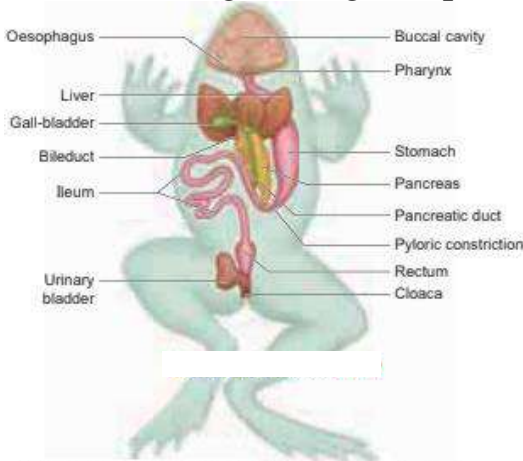
**28. Explain the digestive system of frog.**

The alimentary canal consists of the buccal cavity, pharynx, oesophagus, duodenum, ileum and the rectum which leads to the cloaca and opens outside by the cloacal aperture. The wide mouth opens into the buccal cavity. On the floor of the buccal cavity lies a large muscular sticky tongue.

The tongue is attached in front and free behind. The free edge is forked. When the frog sights an insect it flicks out its tongue and the insect gets glued to the sticky tongue. The tongue is immediately withdrawn and the mouth closes. A row of small and pointed maxillary teeth is found on the inner region of the upper jaw.

In addition vomerine teeth are also present as two groups, one on each side of the internal nostrils. The lower jaw is devoid of teeth. The mouth opens into the buccal cavity that leads to the oesophagus through the pharynx. Oesophagus is a short tube that opens into the stomach and continues as the intestine, rectum and finally opens outside by the cloaca. Liver secretes bile which is stored in the gall bladder.

Pancreas, a digestive gland produces pancreatic juice containing digestive enzymes.

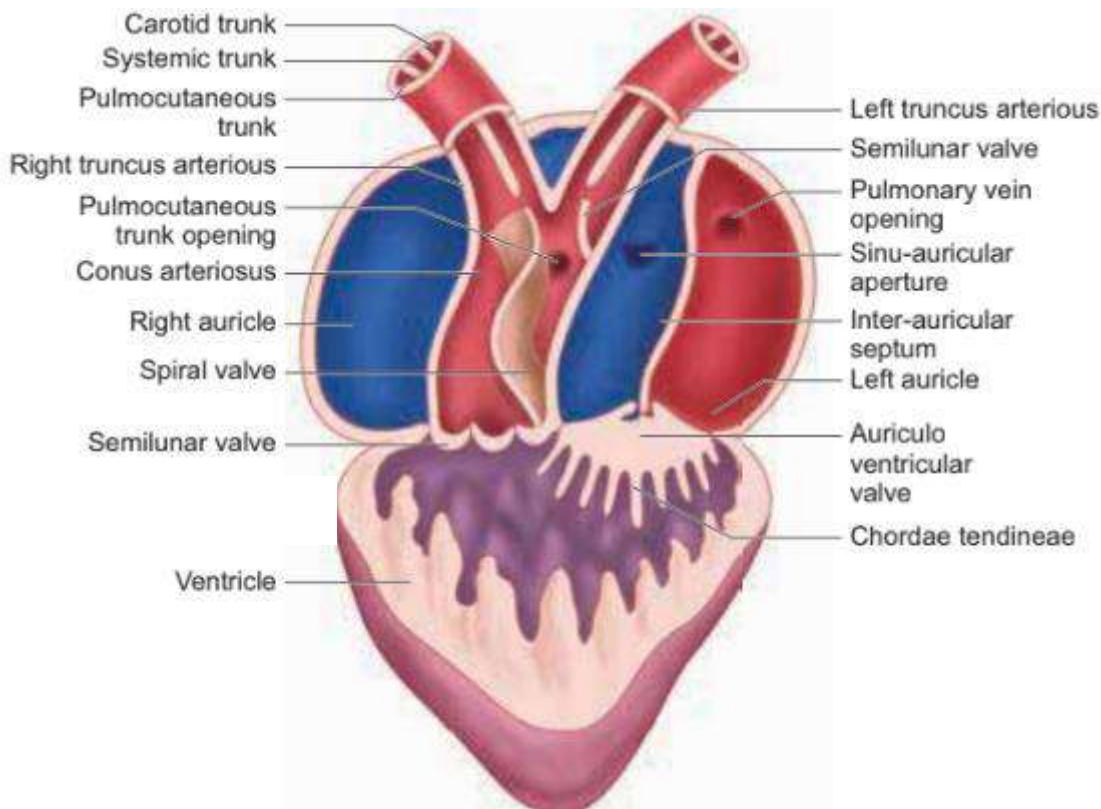


Digestive System of *Rana hexadactyla*

Food is captured by the bilobed tongue. Digestion of food takes place by the action of hydrochloric acid and gastric juices secreted from the walls of the stomach. Partially digested food called chyme is passed from the stomach to the first part of the intestine, the duodenum. The duodenum receives bile from the gall bladder and pancreatic juices from the pancreas through a common bile duct. Bile emulsifies fat and pancreatic juices digest carbohydrates, proteins and lipids. Final digestion takes place in the intestine. Digested food is absorbed by the numerous finger-like folds in the inner wall of intestine called villi and microvilli. The undigested solid waste moves into the rectum and passes out through the cloaca.

**29. Explain the circulatory system of frog.**

Blood vascular system consists of a heart with three chambers, blood vessels and blood. Heart is covered by a double-walled membrane called pericardium. There are two thin-walled anterior chambers called auricles (Atria) and a single thick-walled posterior chamber called ventricle. Sinus venosus is a large, thin-walled, triangular chamber, which is present on the dorsal side of the heart. Truncus arteriosus is a thick-walled and cylindrical structure which is obliquely placed on the ventral surface of the heart.



*Rana hexadactyla*: Internal Structure of Heart

It arises from the ventricle and divides into right and left aortic trunk, which is further divided into three aortic arches namely carotid, systemic and pulmo-cutaneous. The Carotid trunk supplies blood to the anterior region of the body. The



systemic trunk of each side is joined posteriorly to form the dorsal aorta. They supply blood to the posterior part of the body. Pulmo-cutaneous trunk supplies blood to the lungs and skin.

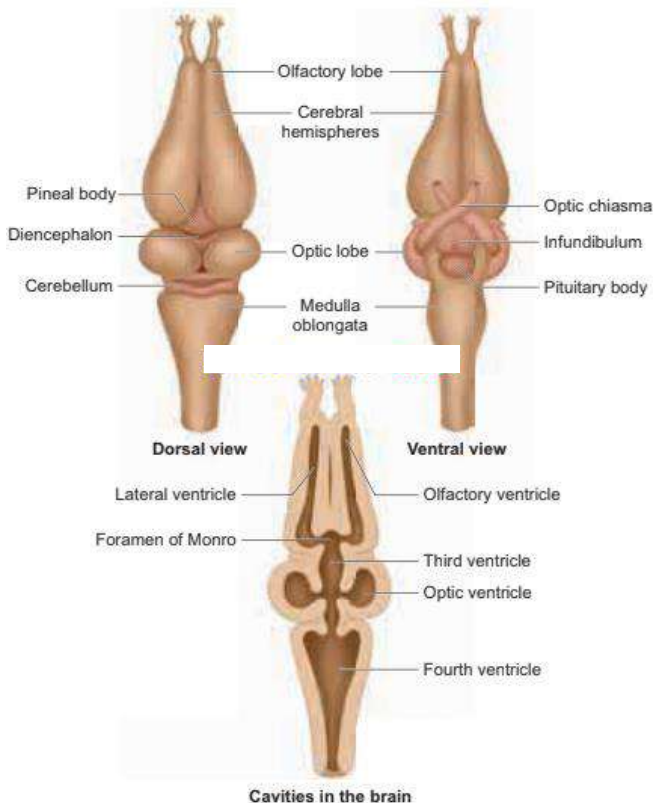
Sinus venosus receives the deoxygenated blood from the body parts by two anterior precaval veins and one post caval vein. It delivers the blood to the right auricle; at the same time left auricle receives oxygenated blood through the pulmonary vein. Renal portal and hepatic portal systems are seen in frog.

**30. Explain the nervous system of frog.**

The Nervous system is divided into the Central Nervous System [CNS], the Peripheral Nervous System [PNS], and the Autonomous Nervous System [ANS], Peripheral Nervous System consists of 10 pairs of cranial nerves and 10 pairs of spinal nerves. Autonomic Nervous System is divided into sympathetic and parasympathetic nervous system. They control involuntary functions of visceral organs.

**31. Explain the structure of brain of frog?**

Brain is situated in the cranial cavity and covered by two meninges called piamater and duramater. The brain is divided into forebrain, midbrain and hindbrain. Fore brain (Prosencephalon) is the anterior most and largest part consisting of a pair of olfactory lobes and cerebral hemisphere (as Telen-cephalon) and a diencephalon. Anterior part of the olfactory lobes is narrow and free but is fused posteriorly. The olfactory lobes contain a small olfactory ventricle.



*Rana hexadactyla* – Brain dorsal and ventral view

The mid brain (Mesencephalon) includes two large, oval optic lobes and has cavities called optic ventricles. The hind brain (Rhombencephalon) consists of the cerebellum and medulla oblongata. Cerebellum is a narrow, thin transverse band followed by medulla oblongata. The medulla oblongata passes out through the foramen magnum and continues as spinal cord, which is enclosed in the vertebral column.

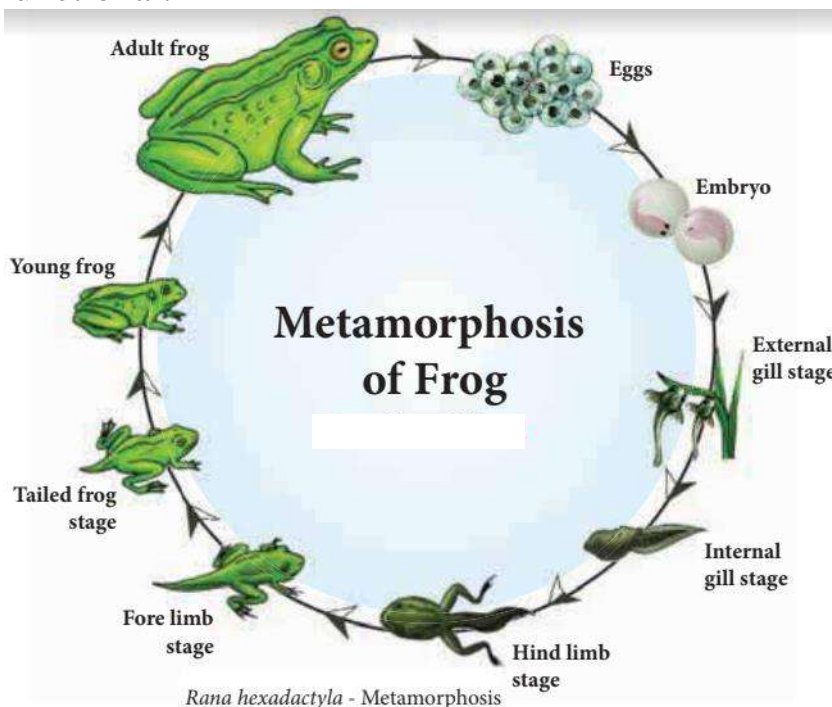
**32. Explain the excretory system of Frog.**

Elimination of nitrogenous waste and salt and water balance are performed by a well developed excretory system. It consists of a pair of kidneys, ureters, urinary bladder and cloaca. Kidneys are dark red, long, flat organs situated on either sides of the vertebral column in the body cavity.

Kidneys are Mesonephric. Several nephrons are found in each kidney. They separate nitrogenous waste from the blood and excrete urea, so frogs are called ureotelic organisms. A pair of ureters emerges from the kidneys and opens into the cloaca. A thin walled unpaired urinary bladder is present ventral to the rectum and opens into the cloaca.

**33. Write the short note on the development in frog.**

Within few days of fertilization, the eggs hatch into tadpoles. A newly hatched tadpole lives off the yolk stored in its body. It gradually grows larger and develops three pairs of gills. The tadpole grows and metamorphosis into an air-breathing carnivorous adult frog (Figure). Legs grow from the body, and the tail and gills disappear. The mouth broadens, developing teeth and jaws, and the lungs become functional.



**34. Write a note on the economic importance of frog.**

Economic importance of Frog:

Frog is an important animal in the food chain; it helps to maintain our ecosystem. So 'frogs should be protected'.

Frog are beneficial to man, since they feed on insects and helps in reducing insect pest population. Frogs are used in traditional medicine for controlling blood pressure and for its anti aging properties. In USA, Japan, China and North East of India, frogs are consumed as delicious food as they have high nutrition

**35. Frog respire through gills, lungs, skin and buccal cavity'. Justify.**

Frog is amphibious. It respire through lungs (pulmonary respiration) when it is on land. Buccal respiration is there in frog when it is on land. When it is in water, it respire through skin (cutaneous respiration). The larva of frog, tadpole respire through gills. During development, gills disappear and lungs develop and the tadpole metamorphoses into an adult frog. Hence, frog respire through gills, lungs, buccal cavity and skin in its life cycle.

## CHAPTER 5 DIGESTION AND ABSORPTION

### I. Short Answer Questions

#### 1. Why are villi present in the intestine and not in the stomach?

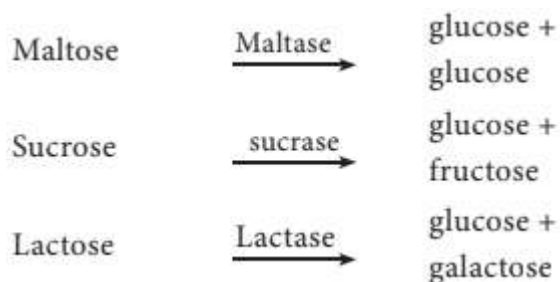
In small intestine digestion gets completed and the absorption of digested food materials like glucose, amino acids, fatty acids and glycerol takes place. The food materials are to be retained in the intestine by increasing the surface area. Hence villi are present in the intestine. Stomach is the temporary storing organ of food. In the stomach, HCl, pepsin, renin and lipase are secreted. These are concerned with digestion. Hence villi are not present in the stomach.

#### 2. Bile juice contains no digestive enzymes, yet It is important for digestion. Why?

Liver does not secrete digestive enzymes. It contains bile pigments bilirubin and biliverdin which are the break down products of haemoglobin of dead RBCs. bile salts, cholesterol and phospholipids. Bile helps in emulsification of fats. Bile salts reduce the surface tension of fat droplets and break them into small globules. Bile also activates lipase to digest lipids.

#### 3. List the chemical changes that starch molecule undergoes from the time it reaches the small intestine.

In the small intestine, starch digestion gets completed. The pancreatic juice contains pancreatic amylases which acts on polysaccharide and convert into disaccharides (maltose). These secretions of the Brunner's gland along with the secretions of the intestinal glands constitute the intestinal juice or succus entericus. It contains maltase, lactase and sucrase. These convert maltose, lactose and sucrose into monosaccharides, glucose and fructose.



In the small intestine, complex carbohydrates are converted into simple glucose, fructose and galactose. These are absorbed by active transport.

#### **4. How do proteins differ from fats in their energy value and their role in the body?**

The calorific value and physiological fuel value of one gram of protein are 5.65 Kcal and 4 Kcal respectively. Fat has a calorific value of 9.45 Kcal and the physiological fuel value of 9 Kcal per gram. Proteins are the source of amino acids required for growth and repair of body cells. They are stored in the body only to a certain extent. They replace the worn out protoplasm. They are important for the production of many enzymes, hormones and plasma. The catabolism of amino acids releases toxic nitrogenous wastes which are removed by the kidneys.

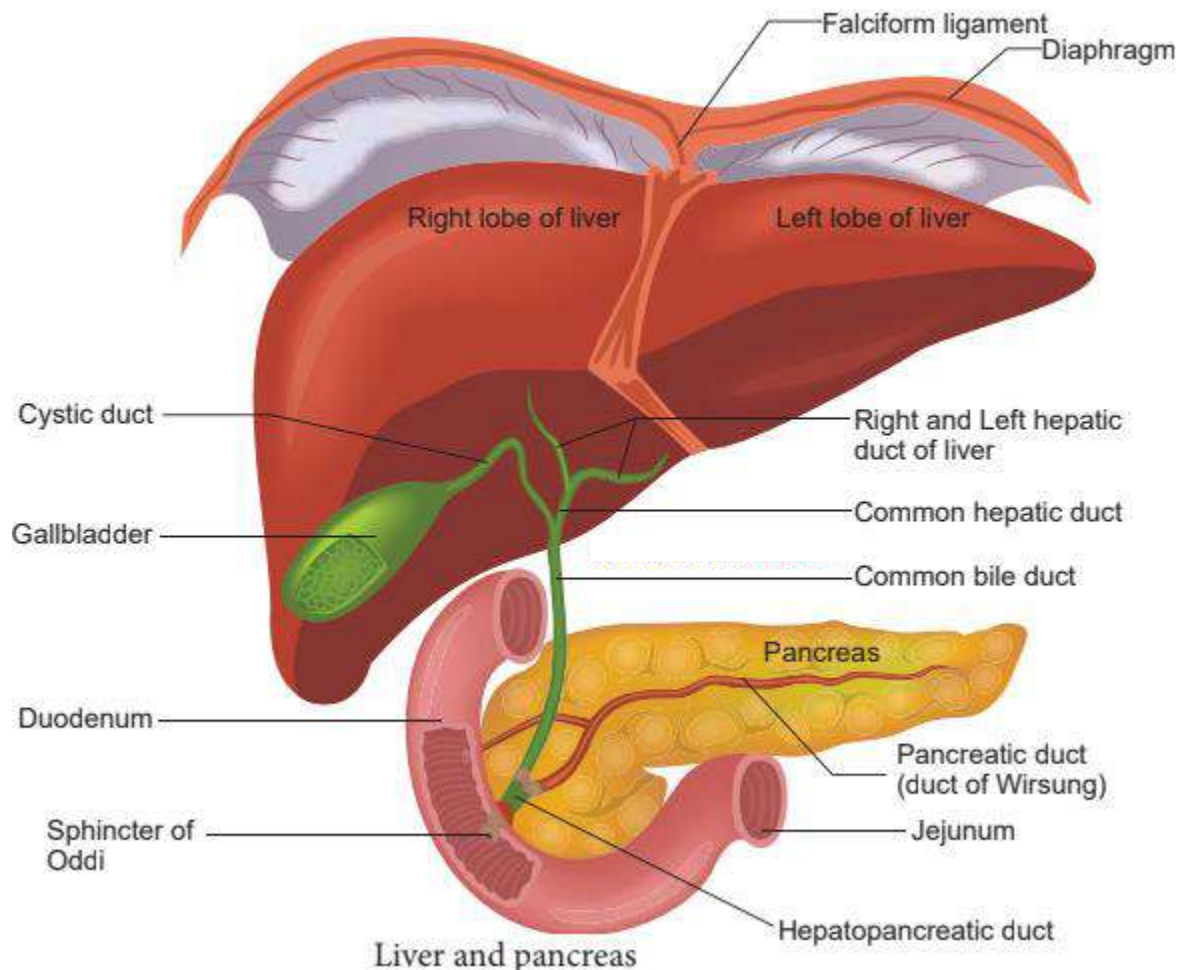
#### **5. Digestive secretions are secreted only when needed. Discuss.**

Digestive glands are exocrine glands which secrete biological catalysts called enzymes. These enzymes convert the complex, insoluble food materials like carbohydrates, proteins and lipids into simple, soluble food materials like glucose and fructose, amino acids and fatty acids and glycerol. These digestive secretions act only when food materials are available in the alimentary canal.

#### **6. Label the given diagram.**

- A – Right and left hepatic duct of liver.
- B – Common bile duct.
- C – Pancreatic duct (duct of Wirsung)
- D – Sphincter of oddi

E – Gall bladder.



### In-Text Questions Solved

**1. Though the bile juice of liver has no digestive enzyme but is very essential for proper digestion of food, especially of the fats. Discuss the following?**

**(a) What is composition of bile?**

**(b) How it helps in digestion of fats and other nutrients of food?**

**(c) How it helps in absorption of fats?**

The bile contains bile pigments (bilirubin and biliverdin) as the break down products of hemoglobin of dead RBCs, bile salts, cholesterol and phospholipids but has no enzymes. Bile helps in emulsification of fats. Bile salts reduce the surface tension of fat droplets and break them into small globules. Bile also activates lipases to digest lipids.

**2. What would happen if HCl is not secreted in the stomach?**

The gastric juice contains HCl and proenzymes. The proenzyme pepsinogen,

on exposure to HCl gets converted into the active enzyme pepsin which converts proteins into proteoses and peptones (peptides). The HCl provides an acidic medium (pH – 1.8) which is optimum for pepsin, kills bacteria and other harmful organisms and avoids putrefaction. So, if HCl is not secreted in stomach, digestion of protein and destruction of harmful micro organisms will be affected.

### **3. What features of the small intestine enables it to absorb digested food efficiently?**

Absorption is a process by which the end product of digestion passes through the intestinal mucosa into the blood and lymph. The villi in the lumen of ileum are the absorbing units, consisting of a lacteal duct in the middle surrounded by fine network of blood capillaries. The process of absorption involves active, passive and facilitated transpo

### **4. What happens to the protein molecules in food, from the time it is swallowed, to the time its products are built up in the cytoplasm of a muscle cell?**

Proteins and partially digested proteins in the chyme on reaching the intestine are acted upon by the proteolytic enzymes of pancreatic juice. Trypsin hydrolyses proteins into polypeptides and peptones, while chymotrypsin hydrolyses peptide bonds associated with specific amino acids. Proteins are source of amino acids required for growth and repair of body cells. They are stored in the body only to a certain extent; large quantities are excreted as nitrogenous waste.

## CHAPTER 6 RESPIRATION

### I. Short Answer Questions

#### 1. Resistance in the airways is typically low. Why? Give two reasons.

The airway resistance is low because:

- The diameter of most airways is relatively large.
- For smaller airways there are many in parallel, making their combined diameter large.
- Air has a low viscosity.

#### 2. How the body makes long-term adjustments when living in high altitude?

When a person lives in higher altitude, the body makes respiratory and hematopoietic . adjustment. Kidneys accelerate the production of the hormone erythropoietin which stimulate the bone marrow to produce more RBCs. This improves the binding of O<sub>2</sub> with haemoglobin.

#### 3. Why is pneumonia considered a dangerous disease?

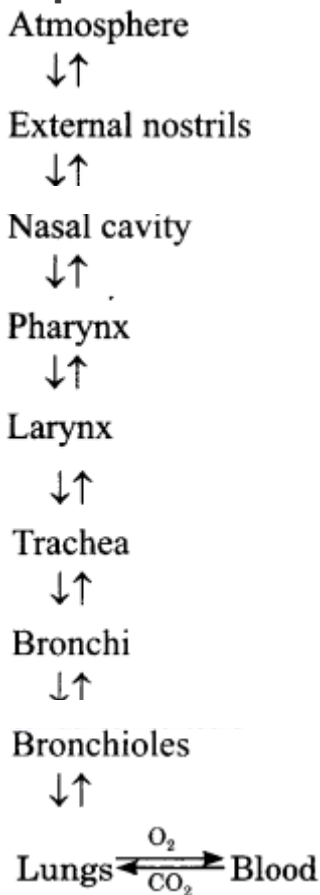
Inflammation of the lungs due to infection caused by bacteria or virus is called pneumonia. The symptoms are sputum production, nasal congestion, shortness of breath, sore throat etc. The alveoli get filled with fluid or pus, making is difficult to breathe (lung abscesses).

#### 4. Diffusion of gases occurs in the alveolar region only and not in any other part of the respiratory system. Discuss.

The alveolar region is highly vascular. Each alveolus is made up of highly permeable and thin layers of squamous epithelial cells. The barrier between the alveoli and the capillaries is thin and diffusion of gases takes place from higher partial pressure to lower partial pressure. Hence, gaseous exchange takes place in the alveolar region only but not in any other part of the respiratory system.



**5. Sketch a flow chart to show the path way of air flow during respiration.**



**6. Explain the conditions which creates problems in oxygen transport.**

When a person travels quickly from sea level to elevations above 8000 ft, where the atmospheric pressure and partial pressure of oxygen are lowered, the individual responds with symptoms of acute mountain sickness (AMS)- headache, shortness of breath, nausea and dizziness due to poor binding of O<sub>2</sub> with haemoglobin. When the person moves on a long-term basis to mountains from sea level his body begins to make respiratory and haematopoietic adjustments.

To overcome this situation kidneys accelerate production of the hormone erythropoietin, which stimulates the bone marrow to produce more RBCs. When a person descends deep into the sea, the pressure in the surrounding water increases which causes the lungs to decrease in volume.

This decrease in volume increases the partial pressure of the gases within the lungs. This effect can be beneficial, because it tends to drive additional oxygen into the circulation, but this benefit also has a risk, the increased pressure can also drive nitrogen gas into the circulation.

This increase in blood nitrogen content can lead to a condition called nitrogen narcosis. When the diver ascends to the surface too quickly a condition called 'bends' or decompression sickness occurs and nitrogen comes out of solution while still in the blood forming bubbles. Small bubbles in the blood are not harmful, but large bubbles can lodge in small capillaries, blocking blood flow or can press on nerve endings.

Decompression sickness is associated with pain in joints and muscles and neurological problems including stroke. The risk of nitrogen narcosis and bends is common in scuba divers. During carbon-dioxide poisoning, the demand for oxygen increases. As the O<sub>2</sub> level in the blood decreases it leads to suffocation and the skin turns bluish black.

## CHAPTER 7 BODY FLUIDS AND CIRCULATION

### I. Short Answer Questions

#### 1. Distinguish between arteries and veins?

<b>Arteries</b>	<b>Veins</b>
1. Arteries are the blood vessels that carry blood away from the heart.	1. Veins are the blood vessels that carry blood to the heart.
2. Arteries carry oxygenated blood except pulmonary artery.	2. Veins carry deoxygenated blood except pulmonary veins.
3. Arteries usually lie deep inside the body.	3. Veins are usually located superficially.
4. These are thick walled.	4. These are thin walled.
5. These do not have valves.	5. These have semilunar valves.
6. Blood pressure is high.	6. Blood pressure is low.

**2. Distinguish between open and closed circulation?**

Open circulation	Closed circulation
1. Open circulation, haemolymph is pumped by the heart which flows through blood vessels into the haemocoel.	1. In closed circulation, blood is pumped by the heart and flows through blood vessels
2. It is seen in arthropods and most molluscs.	2. It is seen in annelids, cephalopods and vertebrates

**3. Distinguish between mitral valve and semi lunar valve?**

Mitral valve	Semilunar valves
1. The valve present between the left atrium left ventricle is called mitral valve.	1. The valves present at the openings of right and left ventricles into the pulmonary artery and aorta are semilunar valves.
2. It is made of two flaps.	2. These are of three half moon shaped cusps.

**4. Right ventricular wall is thinner than the left ventricular wall. Why?**

The right ventricle pumps deoxygenated blood, to the lungs through pulmonary artery. The left ventricle pumps the oxygenated blood to all parts of the body through the aorta. Hence, left ventricle has to exert more pressure. Hence right ventricular wall is thinner but the left ventricular walls is thicker.

**5. What might be the effect on a person whose diet has less iron content?**

A person whose diet has less iron content will become anaemic. The haemoglobin content of the blood will be less. The volume of oxygen carried

by RBCs gets reduced. He/she may experience tiredness, weakness, fatigue etc. In order to overcome this deficiency one has to take iron rich diet.

### **6. Describe the mechanism by which the human heart beat is initiated and controlled?**

The rhythmic contraction and expansion of heart is called heart beat. The contraction of the heart is called systole and the relaxation of the heart is called diastole. The human heart is myogenic. The pacemaker cells are located in the right sinoatrial (SA) node.

On the left side of the right atrium, there is a node called auriculo ventricular node (AV). Two special cardiac muscle fibres which originate from the AV node are called the bundle of His. It runs down into the interventricular septum and the fibres spread into the ventricle as the Purkinje fibres.

The pacemaker cells produce excitation through depolarization of their cell membrane. Early depolarization is slow and takes place by sodium influx and reduction in potassium efflux. Minimum potential is required to activate voltage gated calcium ( $\text{Ca}^+$ ) channels that cause rapid depolarization which results in action potential. The pace maker cells repolarise slowly via  $\text{K}^+$  efflux.

### **7. What is lymph? Write its function?**

About 90% of fluid that leaks from capillaries eventually seeps back into the capillaries and the remaining 10% is collected and returned to blood system by means of a series of tubules known as lymph vessels or lymphatics.

The fluid inside the lymphatics is called lymph. The lymphatic system consists of a complex network of thin walled ducts (lymphatic vessels), filtering bodies (lymph nodes) and a large number of lymphocytic cell concentrations in various lymphoid organs.

The lymphatic vessels have smooth walls that run parallel to the blood vessels, in the skin, along the respiratory and digestive tracts. These vessels serve as return ducts for the fluids that are continually diffusing out of the blood capillaries into the body tissues.

Lymph fluid must pass through the lymph nodes before it is returned to the blood. The lymph nodes that filter the fluid from the lymphatic vessels of the skin are highly concentrated in the neck, inguinal, axillaries, respiratory and digestive tracts.

The lymph fluid flowing out of the lymph nodes flows into large collecting duct which finally drains into larger veins that run beneath the collar bone, the

subclavian vein and is emptied into the blood stream. The narrow passages in the lymph nodes are the sinusoids that are lined with macrophages.

The lymph nodes successfully prevent the invading microorganisms from reaching the blood stream. Cells found in the lymphatics are the lymphocytes. Lymphocytes collected in the lymphatic fluid are carried via the arterial blood and are recycled back to the lymph. Fats are absorbed through lymph in the lacteals present in the villi of the intestinal wall.

**8. What are the heart sounds? When and how are these sounds produced?**

Rhythmic contraction and expansion of heart is called heart beat. The contraction of the heart is called systole and the relaxation of the heart is called diastole. The heart normally beats 70-72 times per minute in a human adult. During each cardiac cycle two sounds are produced that can be heard through a stethoscope.

The first heart sound (lub) is associated with the closure of the tricuspid and bicuspid valves whereas Second heart sound (dub) is associated with the closure of the semilunar valves. These sounds are of clinical diagnostic significance. An increased heart rate is called tachycardia and decreased heart rate is called bradycardia.

**9. Select the correct biological term. Lymphocytes, red cells, leucocytes, plasma, erythrocytes, white cells, haemoglobin, phagocyte, platelets, blood clot?**

**Question (a)**

**Disc shaped cells which are concave on both sides?**

Red blood cells

**Question (b)**

**Most of these have a large, bilobed nucleus?**

Leucocytes

**Question (c)**

**Enable red cells to transport blood?**

Haemoglobin

**Question (d)**

**The liquid part of the blood?**

plasma

**Question (e)**

**Most of them move and change shape like an amoeba?**

phagocyte

**Question (f)**

**Consists of water and important dissolved substances?**

plasma

**Question (g)**

**Destroyed in the liver and spleen after circulating in the blood for four months?**

RBCs

**Question (h)**

**The substances which gives red colour to their cells?**

haemoglobin

**Question(i)**

**Another name for red blood cells?**

Erythrocytes

**Question (j)**

**Blood that has been changed to a jelly?**

Blood clot

**Question (k)**

**A word that me cell eater?**

Phagocyte

**Question (l)**

**Cells without nucleus?**

Red blood cells

**Question (m)**

**White cells made in the lymphatic tissue?**

Lymphocytes

**Question (n)**

**Blocks wound and prevent excessive bleeding?**

Platelets

**Question (o)**

**Fragment of cells which are made in the bone marrow?**

Erythrocytes

**Question (p)**

**Another name for white blood cells?**

Leucocytes

**Question (q)**

**Slowly releases oxygen to blood cells?**

Red cells

**Question (r)**

**Their function is to help blood clot in wounds?**

Platelets

**10. Select the correct biological term?**

Cardiac muscle, atria, tricuspid valve, systole, auricles, arteries, diastole, ventricles, bicuspid valve, pulmonary artery, cardiac cycle, semi lunar valve, veins, pulmonary vein, capillaries, vena cava, aorta?

**Question (a)**

**The main artery of the blood?**

Aorta

**Question (b)**

**Valves between the left atrium and ventricle?**

Bicuspid valve

**Question (c)**

**Technical name for relaxation of the heart?**

Diastole

**Question (d)**

**Another name for atria?**

Arteries

**Question (e)**

**The main vein?**

Vena cava

**Question (f)**

**Vessels which carry blood away from the heart?**

Arteries

**Question (g)**

**Two names for the upper chambers of the heart?**

Atria



**Question (h)**

**Thick walled chambers of the heart?**

Atria

**Question (i)**

**Carries blood from the heart to the lungs?**

Pulmonary Artery

**Question (j)**

**Takes about 0.8 sec to complete?**

Cardiac cycle

**Question (k)**

**Valves situated at the point where blood flows out of the heart?**

Semilunar valves

**Question (l)**

**Vessels which carry blood towards the heart?**

Veins

**Question (m)**

**Carries blood from the lungs to the heart?**

Pulmonary veins

**Question (n)**

**The two lower chambers of the heart?**

Ventricles

**Question (o)**

**Prevent blood from re-entering the ventricles after entering the aorta?**

Semilunar valves

**Question (p)**

**Technical name for one heart beat?**

Cardiac cycle

**Question (q)**

**Valves between right atrium and ventricles?**

Tricuspid valve

**Question (r)**

**Technical name for contraction of the heart?**

Systole

**Question (s)**

**Very narrow blood vessels?**

Capillaries

**11. Name and label the given diagram to show A, B, C, D, E, F, and G?**

**(A) Aorta**

**(B) Pulmonary trunk**

**(C) Left pulmonary veins**

**(D) Blocking the action of vasoconstrictor lowers the blood pressure. Give reasons.**

**(E) What is the role of ACH inhibitor in reducing blood pressure?**

**(F) What conditions one might expect if the blood pressure is not controlled?**

Answer:

(A) Aortic arch

(B) Left pulmonary artery

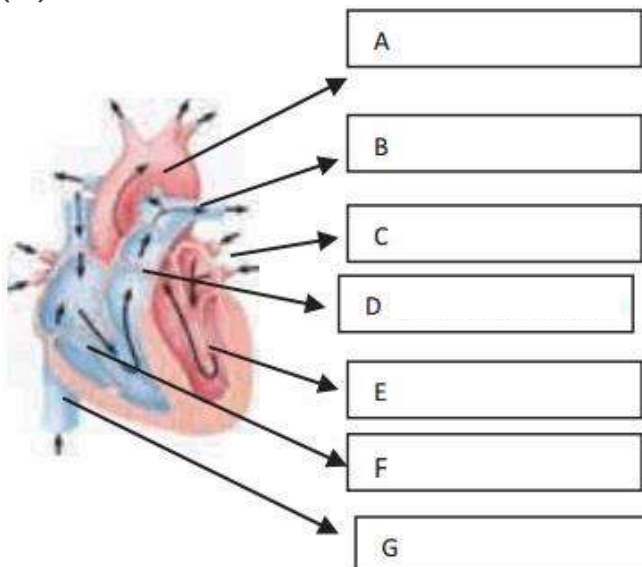
(C) Left pulmonary veins

(D) Pulmonary trunk

(E) Left ventricle

(F) Right ventricle

(G) Inferior vena cava



## CHAPTER 8 EXCRETION

### I. Answer the following:

**1. Arrange the following structures in the order that a drop of water entering the nephron would encounter them?**

1. (a) Afferent arteriole
2. (b) Bowman's capsule
3. (c) Collecting duct
4. (d) Distal tubule
5. (e) Glomerulus
6. (f) Loop of Henle
7. (g) Proximal tubule
8. (h) Renal pelvis

1. (a) Afferent arteriole
2. (b) Bowman's capsule
3. (e) Glomerulus
4. (g) Proximal tubule
5. (j) Loop of Henle
6. (d) Distal tubule
7. (c) Collecting duct
8. (h) Renal pelvis

**2. Name the three filtration barriers that solutes must come across as they move from plasma to the lumen of Bowman's capsule. What components of the blood are usually excluded by these layers?**

1. Glomerulus net filtration pressure – 55 mm Hg
2. Colloidal osmotic pressure – 30 mm Hg
3. Capsular Hydrostatic pressure -15 mm Hg

Protein aminoacid glucose urea, uric acid creatinine, etc are excluded by these layers.

**3. What forces promote glomerular filtration? What forces oppose them? What is meant by net filtration pressure?**

Glomerular hydrostatic pressure (55 mm Hg) is the force that promotes filtration. The colloidal osmotic pressure (30 mm Hg) and the capsular hydrostatic pressure (15 mm Hg) are the two opposing forces.

The difference between the force promoting and opposing filtration is the net filtration pressure. It is responsible for filtration. Net filtration pressure =

Glomerular hydrostatic pressure – (Colloidal osmotic pressure + Capsular hydrostatic pressure).

**4. Identify the following structures and explain their significance in renal physiology?**

- 1. Juxtaglomerular apparatus**
- 2. Podocytes**
- 3. Sphincters in the bladder**
- 4. Renal cortex**

1. Juxtaglomerular apparatus:

Juxtaglomerular apparatus is a specialized tissue in the afferent arteriole of the nephron that consists of macula densa and granular cells. The macula densa cells sense distal tubular flow and affect afferent arteriole diameter. The granular cells secrete an enzyme called renin. It plays an important role in reabsorption of water,  $\text{Na}^+$  and excretion of  $\text{K}^+$ .

2. Podocytes:

The visceral layer of the Bowman's capsule is made up of epithelial cells called podocytes. The podocytes end in foot processes which cling to the basement membrane of the glomerulus. The openings between the foot processes are called filtration slits. It is important for glomerular filtration.

3. Sphincters in the bladders:

Sphincter muscles in the bladder controls the flow of urine from the bladder. When urinary bladder is filled with urine, it stretches and stimulates the central nervous system through the sensory neurons of the parasympathetic nervous system and brings about contraction of the bladder.

Simultaneously, somatic motor neurons induce the sphincters to close. Smooth muscles contracts resulting in the opening of the internal sphincters passively and relaxing the external sphincter. When the stimulatory and inhibitory controls exceed the threshold, the sphincter opens and the urine is expelled out.

4. Renal cortex:

The outer portion of the kidney is the renal cortex. It contains renal corpuscles and the proximal and distal tubules. It is thin and fibrous.

**5. In which segment of the nephron most of the re-absorption of substances takes place?**

In proximal convoluted tubule cells, Glucose, lactate, amino acids,  $\text{Na}^+$  and water, are reabsorbed. In the descending limb of Henle's loop, water is reabsorbed. In the ascending limb,  $\text{Na}^+$ ,  $\text{Cl}$  and  $\text{K}^+$  are reabsorbed. In the distal convoluted tubule, water is reabsorbed.

**6. When a molecule or ion is reabsorbed from the lumen of the nephron, where does it go? If a solute is filtered and not reabsorbed from the tubule, where**

**does it go?**

If a solute is filtered and not reabsorbed from the tubule, where does it go?

- The reabsorbed molecule of the lumen of the nephron goes to interstitial fluid and then goes to the blood.
- The filtered molecule when it is not reabsorbed by the tubules it will be excreted out through urine.

**7. Match each of the following substances with its mode of transportation in proximal tubular reabsorption?**

- (a)  $\text{Na}^+$  – 1. indirect active transport
- (b) Glucose – 2. endocytosis
- (c) Urea – 3. paracellular movement
- (d) Plasma – 4. facilitated diffusion
- (e) Water – 5. primary active transport

- (a) 5
- (b) 1
- (c) 4
- (d) 2
- (e) 3

**8. Which segment is the site of secretion and regulated reabsorption of ions and pH homeostasis?**

Distal convoluted tubule.

**9. What solute is normally present in the body to estimate GFR in humans?**

Creatinine.

**10. Which part of the autonomic nervous system is involved in the micturition process?**

Para sympathetic nervous system.

**11. Match the following terms.**

- (a) a- adrenoceptor – 1. afferent arteriole
- (b) Autoregulation – 2. basal lamina
- (c) Bowman's capsule – 3. capillary blood pressure
- (d) Capsule fluid – 4. colloid osmotic pressure
- (e) Glomerulus – 5. GFR
- (f) Podocyte – 6. JG cells
- (g) Vasoconstriction – 7. plasma proteins Norepinephrine

- (a) 7
- (b) 6
- (c) 5

- (d) 3
- (e) 1
- (f) 2
- (g) 4

**12. If the afferent arteriole of the nephron constricts, what happens to the GFR in that nephron? If the efferent arteriole constricts what happens to the GFR in that nephron? Assume that no autoregulation takes place?**

If the afferent arteriole of the nephron constricts, GFR is reduced. If the efferent arteriole constricts, GFR is increased.

**13. How is the process of micturition altered by toilet training?**

The process of release of urine from the bladder is called micturition or urination. It is controlled by central nervous system and smooth muscles of sphincter. In young children, micturition cannot be controlled. By toilet training, one can temporarily postpone the signal reaching from the central nervous system to the motor neurons carrying stimuli to the urinary bladder.

**14. Identify the biological term Homeostasis, excretion, glomerulus, urea, glomerular filtration, ureters, urine, Bowman's capsule, urinary system, reabsorption, micturition, osmosis, glomerular capillaries via efferent arteriole, proteins?**

1. A liquid which gathers in the bladder?
2. Produced when blood is filtered in a Bowman's capsule?
3. The temporary storage of urine?
4. A ball of inter-twined capillaries?
5. A process that changes glomerular filtrate into urine?
6. Removal of unwanted substances from the body?
7. Does each contain a glomerulus?
8. Carry urine from the kidneys to the bladder?
9. Contains urea and many useful substances?
10. Blood is filtered through its walls into the Bowman's capsule?
11. Scientific term for urination?
12. Regulation of water and dissolved substances in blood and tissue fluid?
13. Carry urine from the kidneys to the bladder?
14. Consists of the kidneys, ureters and bladder?
15. Removal of useful substances from glomerular filtrate?
16. The process by which water is transported in the proximal convoluted tubule?
17. Where has the blood in the capillaries surrounding the proximal convoluted tubule come from?
18. What solute does blood contain that is not present in the glomerular filtrate?

Answer:

1. Urine
2. Glomerular filtrate
3. Urinary bladder
4. Glomerulus
5. Reabsorption
6. Excretion
7. Bowman's capsule
8. Ureters
9. Glomerular filtrate
10. Glomerulus
11. Micturition
12. Homeostatic
13. Ureters
14. Urinary system
15. Reabsorption
16. Osmosis
17. Glomerular capillaries via the efferent arteriole
18. Proteins

**15. With regards to toxicity and the need for dilution in water, how' different are ureotelic and uricotelic excretions? Give examples of animals that use these types of excretion?**

Ureotelic animals excrete urea with minimum loss of water, e.g., Mammals and terrestrial amphibians. Uricotelic animals excrete uric acid with the least loss of water, e.g., Birds and reptiles.

**16. Differentiate protonephridia from metanephridia?**

<b>Protonephridia</b>	<b>Metanephridia</b>
1. Primitive kidneys are protonephridia	1. Tubular excretory structures are
2. These are found in flatworms.	2. These are found in annelids and mollusks

**17. What is the nitrogenous waste produced by amphibian larvae and by adult animals?**

Amphibian larvae produce ammonia and the adult produces urea.

**18. How is urea formed in the human body?**

More toxic ammonia produced as a result of breakdown of amino acids is converted into less toxic urea in the liver by a cyclic process called Ornithine cycle.

**19. Differentiate cortical from medullary nephrons?**

Cortical nephrons	Medullary nephrons
1. These are found in the cortex.	1. These are found in the medulla.
2. These have short Henle's loop.	2. These have long Henle's loop.

**20. What vessels carry blood to the kidneys? Is this blood arterial or venous?**

The renal artery carries oxygenated (arterial) blood to the kidney.

**21. Which vessels drain filtered blood from the kidneys?**

Renal veins carry deoxygenated blood from the kidney.

**22. What is tubular secretion? Name the substances secreted through the renal tubules?**

The movement of substances such as  $H^+$ ,  $K^+$ ,  $NH_4^+$ , creatinine, and organic acids from the peritubular capillaries into the tubular fluid, the filtrate is called Tubular secretion.

**23. How are the kidneys involved in controlling blood volume? How is the volume of blood in the body related to arterial pressure?**

Renin-Angiotensin stimulates  $Na^+$  reabsorption from the glomerular filtrate. This stimulates Adrenal cortex to secrete aldosterone that causes reabsorption of  $Na^+$ ,  $K^+$  excretion and absorption of water.

This reduces the loss of water into the urine. This maintains the volume of blood. An increase in blood volume increases central venous pressure. This increases right atrial pressure, right ventricular end-diastolic pressure, and volume. This increases ventricular stroke volume and cardiac output and arterial blood pressure.



**24. Name the three main hormones that are involved in the regulation of renal function?**

Antidiuretic hormone, aldosterone and atrial natriuretic peptide factor.

**25. What is the function of the antidiuretic hormone? Where is it produced and what stimuli increase or decrease its secretion?**

Antidiuretic hormone increases reabsorption of water in the kidney tubules. It is produced in the posterior lobe of the pituitary gland. When there is excess loss of fluid from the body or increase in the blood pressure, ADH is secreted more. When there is no loss of fluid from the body, it is secreted less.

**26. What is the effect of aldosterone on kidneys and where is it produced?**

Aldosterone is produced by the Adrenal cortex. It increases reabsorption of sodium and water by distal convoluted tubule and increased secretion of potassium. Hence, it maintains blood volume, blood pressure and urine output.

**27. What evolutionary hypothesis could explain the heart's role in secreting a hormone that regulates renal function? What hormone is this?**

The cardiac atrial cells secrete atrial natriuretic peptide or factor. It travels to the kidney and increases blood flow to the glomerulus. It acts as a vasodilator on the afferent arteriole and vasoconstrictor on the efferent arteriole. It decreases aldosterone release from the adrenal cortex and decreases the release of renin Angiotensin-II. Health of the heart depends on the normal blood pressure and hence evolution might have preserved atrial natriuretic factor which acts upon the renal function.

**28. Explain the structure of Nephron?**

Each kidney has nearly one million tubular structures called nephrons. Each nephron consists of a filtering corpuscle called renal corpuscle or malpighian body and a renal tubule. The renal tubule opens into a longer tubule called the collecting duct. The renal corpuscle has a double-walled cup-shaped structure called the Bowman's capsule. It encloses a ball of capillaries called the glomerulus.

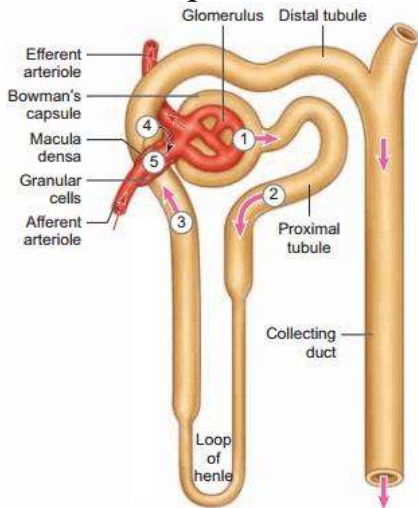
The Bowman's capsule and the Glomerulus together constitute the renal corpuscle. The endothelium of the glomerulus has many pores called fenestrae.

The external parietal layer of the Bowman's capsule is made up of simple squamous epithelium. The visceral layer is made of epithelial cells called podocytes. The podocytes end in foot processes which cling to the basement membrane of the glomerulus. The openings between the foot processes are called filtration slits.

The renal tubule continues further to form the proximal convoluted tubule, Henle's loop, and the distal convoluted tubule. The Henle loop has a thin descending limb and a thick ascending limb.

The distal convoluted tubule of many nephrons opens into a collecting duct. The proximal and the distal convoluted tubule are situated in the cortical region whereas

Henle's loop is situated in the medullary region of the kidney.



### 29. Explain the mechanism of urine formation in humans?

The nitrogenous waste formed as a result of the breakdown of amino acids is converted to urea in the liver by the Ornithine cycle or urea cycle. Urine formation involves three main processes:

1. Glomerular filtration
2. Tubular reabsorption
3. Tubular secretion

#### 1. Glomerular Filtration:

Blood enters the kidney from the renal artery, into the glomerulus. The glomerular membrane has a large surface area and is more permeable to water and small molecules present in the blood plasma.

Blood enters the glomerulus faster with greater force through the afferent arteriole and leaves the glomerulus through the efferent arterioles, much slower. This is because of the wider afferent arteriole and glomerular hydrostatic pressure which is around 55 mm Hg.

This is the chief force that pushes water and solutes out of the blood and across the filtration membrane. The pressure is much higher than in other capillary beds. The colloidal osmotic pressure (30 mm Hg) and the capsular hydrostatic pressure (15 mm Hg) are the opposing forces.

The net filtration pressure of 10 mm Hg is responsible for the renal filtration.

Net filtration pressure = Glomerular hydrostatic pressure – (Colloidal osmotic pressure + Capsular hydrostatic pressure) = 55 mm Hg – (30 mm Hg + 15 mm Hg) = 10 mm Hg.

The effective glomerular pressure of 10 mm Hg results in ultrafiltration. The fluid that leaves the glomerular capillaries and enters the Bowman's capsule is called the glomerular filtrate.

It is similar to blood plasma except that there are no plasma proteins. Kidneys produce about 180L of glomerular filtrate in 24 hours. It has water, glucose, amino acids and minerals along with urea and other nitrogenous waste.

## 2. Tubular Reabsorption:

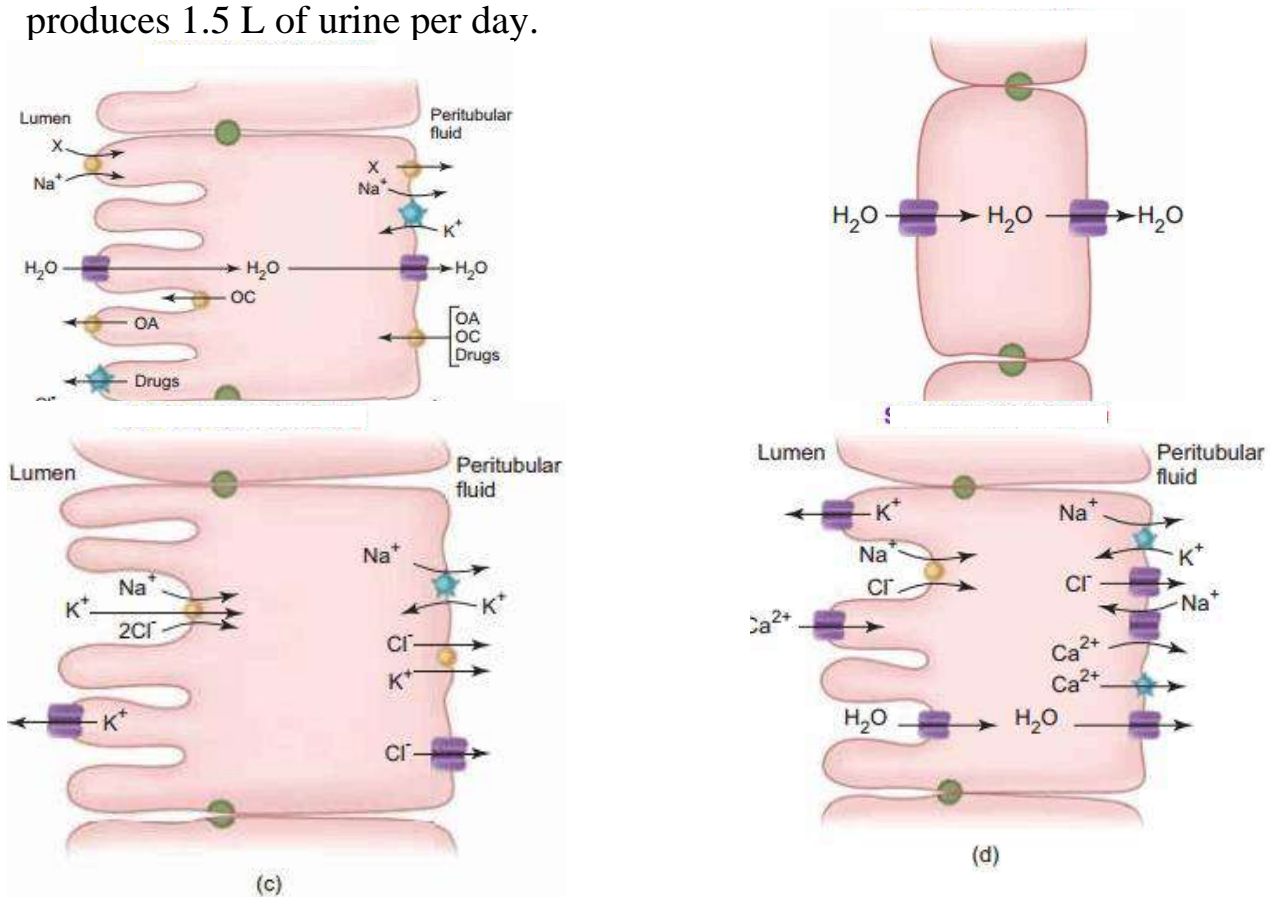
The substances of glomerular filtrate are reabsorbed by the renal tubules as they are needed by the body. This process is called selective reabsorption.

In the Proximal Convoluted Tubule, glucose, lactate, amino acids,  $\text{Na}^+$  and water are reabsorbed. Sodium is reabsorbed by active transport through the sodium-potassium pump. The descending limb of Henle's loop is permeable to water due to the presence of aquaporins, but impermeable to salts.

Water is lost in this region and hence  $\text{Na}^+$  and  $\text{Cl}^-$  get concentrated in the filtrate. In the ascending limb of Henle's loop,  $\text{Na}^+$ ,  $\text{Cl}^-$  and  $\text{K}^+$  are reabsorbed. This region is impermeable to water. The distal convoluted tubule reabsorbs water and secretes potassium into the tubule.  $\text{Na}^+$ ,  $\text{Cl}^-$  and water remain in the filtrate. In the collecting duct, water and  $\text{Na}^+$  are reabsorbed and  $\text{K}^+$  is secreted.

## 3. Tubular secretion:

In this process, substances such as  $\text{H}^+$ ,  $\text{K}^+$ ,  $\text{NH}_4^+$ , creatinine and organic acids move into the filtrate from the peritubular capillaries into the tubular fluid. Human produces 1.5 L of urine per day.



## CHAPTER 9 LOCOMOTION AND MOVEMENT

### I. Answer the following:

#### 1. Name the different types of movement?

Amoeboid movement

1. Ciliary movement
2. Flagellar movement
3. Muscular movement

#### 2. Name the filaments present in the sarcomere?

Thick and thin filaments are the two types of filaments present inside the sarcomere.

#### 3. Name the contractile proteins present in the skeletal muscle?

Actin and myosin are contractile proteins present in the skeletal muscle.

#### 4. When describing a skeletal muscle, what does "striated" mean?

Each skeletal muscle fibre has a repeated series of dark and light bands. The dark A-bands and light I-bands give a striated appearance to the muscle.

#### 5. How does an isotonic contraction take place?

In isotonic contraction the length of the muscle changes but the tension remains constant. The force produced is unchanged, e.g., lifting dumbbells and weight lifting.

#### 6. How does an isometric contraction take place?

In isometric contraction the length of the muscle does not change but the tension of the muscle changes. The force produced is changed, e.g., pushing against a wall, holding a heavy bag.

#### 7. Name the bones of the skull?

The skull is composed of two sets of bones – cranial and facial bones. It consists of 22 bones of which 8 are cranial bones and 14 are facial bones.

#### 8. Which is the only jointless bone in human body?

Hyoid

#### 9. List the three main parts of the axial skeleton?

The skull, the vertebral column and the ribcage are the three main parts of the axial skeleton.

#### 10. How is tetany caused?

Tetany is caused when rapid muscle spasms occur in the muscles due to deficiency of parathyroid hormone resulting in reduced calcium levels in the body.

#### 11. How does rigor mortis happen?

After the death of an individual, the membrane of muscle cells become more permeable to calcium ions. This happens due to partial contraction of skeletal muscles. The contracted muscles are unable to relax. This condition is known as rigor mortis.

## CHAPTER 10 NEURAL CONTROL AND COORDINATION

### I. Answer the following:

#### 1. Why is the blind spot called so?

Slightly below the posterior pole of the eye, the optic nerve and the retinal blood vessels enter the eye. This region is devoid of rods and cones. Hence, this region is called blind spot.

#### 2. Sam's optometrist tells him that his intraocular pressure is high.

#### What is this condition called and which fluid does it involve?

The aqueous humour present in between iris and lens and the cornea and iris is produced and drained at the same rate, maintaining a constant intra ocular pressure of about 16 mm Hg. Any block in the canal of schlemm increases the intra ocular pressure of aqueous humour. This condition is called 'Glaucoma'. Due to pressure, optic nerve and the retina are compressed. This leads to blindness.

#### 3. Why are we getting running nose while crying?

When we cry, the tears come out of the tear glands under the eyelids and drain through the tear duct that empty into the nose. It mixes with mucus there and the nose runs.

#### 4. The action potential occurs in response to a threshold stimulus; but not at subthreshold stimuli. What is the name of the principle involved?

All or none principle.

#### 5. Pleasant smell of food urges Ravi to rush into the kitchen. Name the parts of the brain involved in the identification of food and emotional responses to odour?

Olfactory nerve carries the sense of smell to the sensory strip present in the cerebrum. The sensory areas are present in the parietal lobe of the cerebrum. The stimuli of smell reaches the mammillary bodies present in the hypothalamus. This produces olfactory reflexes and emotional responses to odour.

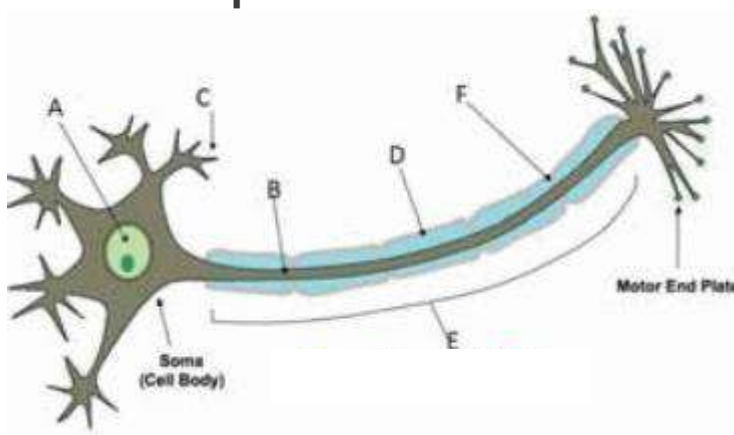
#### 6. Cornea transplant in humans is almost never rejected. State the reason?

Cornea does not have blood vessels. Hence there is no possibility of rejection when cornea is transplanted from one person to another person.

**7. At the end of repolarization, the nerve membrane gets hyperpolarized. Why?**

At the end of repolarization, the membrane potential inside the axolemma becomes negative due to the efflux of  $K^+$  ions. When it becomes more negative than the resting potential  $-70\text{ mV}$  to about  $-90\text{mV}$ , it becomes hyperpolarised.

**8. Label the parts of the neuron?**



1. Nucleolus
2. Node of Ranvier
3. Dendrite
4. Myelin sheath
5. Axon
6. Nucleus

**9. The choroid plexus secretes cerebrospinal fluid. List the function of it?**

Cerebro spinal fluid provides buoyancy to the central nervous system.

1. It acts as a shock absorber for the brain and spinal cord.
2. It nourishes the brain cells by transporting food and oxygen.
3. It carries harmful metabolic wastes from the brain to the blood.
4. It maintains a constant pressure inside the cranial vessels.

**10. What is the ANS controlling centre? Name the parts that are supplied by the ANS?**

Hypothalamus is the ANS controlling centre. The Autonomic neural system innervates smooth muscles, glands and cardiac muscle.

**11. Why the limbic system is called the emotional brain? Name the parts of it?**

The limbic system is a set of components located on both side of the thalamus present in the inner part of the cerebral hemisphere. It includes the olfactory bulbs, cingulate gyrus, mammillary body, amygdala, hippocampus and hypothalamus. The limbic system plays a primary role in the regulation of pleasure, pain, anger, fear, sexual feeling, affection and memory. Hence it is called emotional brain.

**12. Classify receptors based on type of stimuli?**

Receptors	Stimulus	Effector organs
Mechano receptors	Pressure and vibration	Mechano receptors are present in the cochlea of the inner ear and the semi circular canal and utricle
Chemoreceptors	Chemicals	Taste buds in the tongue and nasal epithelium
Thermoreceptors	Temperature	Skin
Photoreceptors	Light	Rod and cone cells of the retina in the eye

**13. Name the first five cranial nerves, their nature and their functions?**

	<b>Cranial nerves</b>	<b>Nature of nerve</b>	<b>Function</b>
1.	Olfactory nerve	Sensory	Sense of smell
2.	Optic nerves	Sensory	Sense of sight
3.	Oculomotor nerves	Motor	Movement of the eye
4.	Trochlear nerve	Motor	Rotation of the eye ball
5.	Trigeminal nerve	Sensory and motor (mixed)	Functioning of facial parts

**14. The sense of taste is considered to be the most pleasurable of all senses? Describe the structure of the receptor involved with a diagram?**

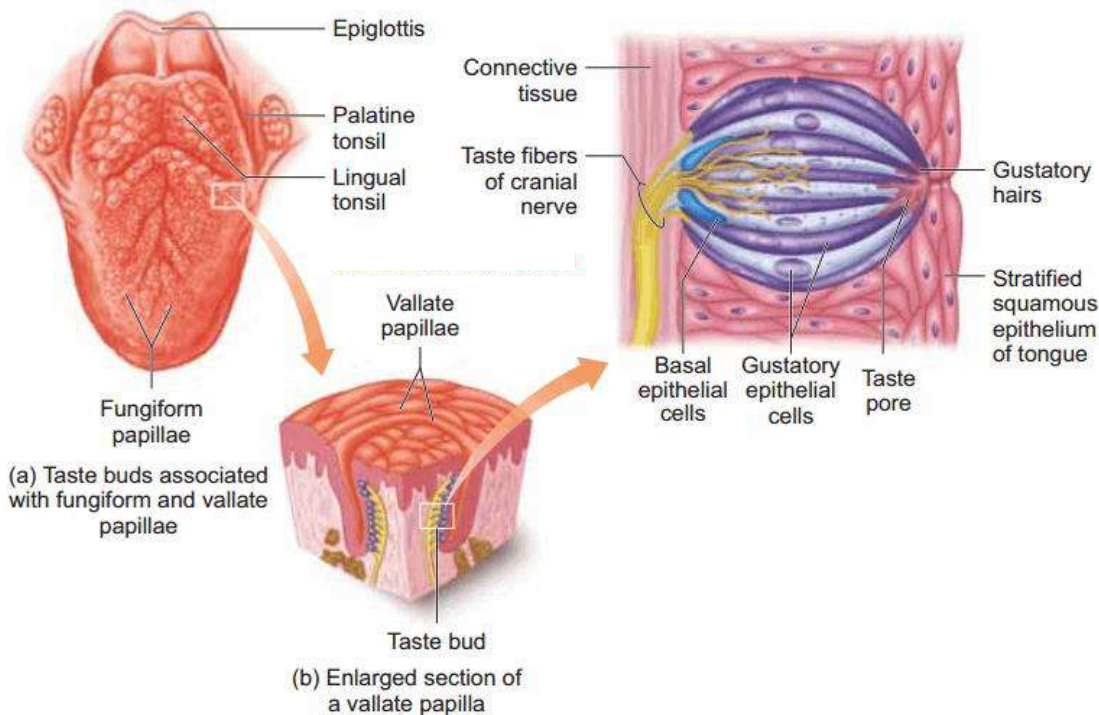
Gustatory receptor: The sense of taste is considered to be the most pleasurable of all senses. The tongue is provided with many small projections called papillae which give the tongue an abrasive feel. Taste buds are located mainly on the papillae which are scattered over the entire tongue surface. Most taste buds are seen on the tongue few are scattered on the soft palate, inner surface of the cheeks, pharynx and epiglottis of the larynx. Taste buds are flask-shaped and consist of 50 – 100 epithelial cells of two major types. Gustatory epithelial cells (taste cells) and Basal epithelial cells (Repairing cells). Long microvilli called gustatory hairs project from the tip of the gustatory cells and extends through a taste pore to the surface of the epithelium where they are bathed by saliva.

Gustatory hairs are the sensitive portion of the gustatory cells and they have sensory dendrites which send the signal to the brain. The basal cells that act



as stem cells, divide and differentiate into new gustatory cells.

**Taste buds**



**15. Describe the structures of olfactory receptors?**

The smell receptors are excited by air borne chemicals that dissolve in fluids. The yellow coloured patches of olfactory epithelium form the olfactory organs that are located on the roof of the nasal cavity.

The olfactory epithelium is covered by a thin coat of mucus layer below and olfactory glands bounded connective tissues, above. It contains three types of cells: supporting cells, Basal cells and millions of pin shaped olfactory receptor cells (which are unusual bipolar cells).

The olfactory glands and the supporting cells secrete the mucus. The unmyelinated axons of the olfactory receptor cells are gathered to form the filaments of olfactory nerve [cranial nerve-I] which synapse with cells of olfactory bulb.

## CHAPTER 11 CHEMICAL COORDINATION AND INTEGRATION

### I. Answer the following:

#### 1. Hormones are known as chemical messenger? Justify?

Hormones are released into the blood stream and circulated as chemical signals. These act specifically on certain organs or tissues called target organs or tissues. These speed up or slow down or alter the activity of target tissues or organs. Hence they are known as chemical messengers.

#### 2. Write the role of oestrogen in ovulation?

Oestrogen is the ovarian hormone secreted during the proliferation phase of menstrual cycle from the 6th day to 14th day of the cycle. On 14th day of the cycle, under the influence of uterine hormone, ovum is released from the graffian follicles. This process is known as ovulation.

#### 3. Comment on Acini of thyroid gland?

Thyroid gland is a bilobed endocrine gland. Each lobe is made up of many lobules. The lobules consist of follicles called acini. Each acinus is lined with glandular, cuboidal or squamous epithelial cells. The lumen of acinus is filled with colloid, a thick glycoprotein mixture consisting of thyroglobulin molecules.

#### 4. Write the causes for diabetes mellitus and diabetes insipids?

Diabetes mellitus is caused due to reduced secretion of insulin. As a result, blood glucose level is elevated. Diabetes insipidus is caused due to under secretion of ADH or vasopressin. As a result, reabsorption of water gets affected and hence large amount of urine is produced.

#### 5. Specify the symptoms of acromegaly?

Acromegaly is caused due to excessive secretion of growth hormone in adults. The symptoms of acromegaly are overgrowth of hand bones, feet bones, jaw bones malfunctioning of gonads. enlargement of viscera, tongue, lungs, heart, liver, spleen and endocrine glands like thyroid, or adrenal glands.

## 6. Write the symptoms of cretinism?

Cretinism is caused due to hypothyroidism in infants. A cretin child shows the following symptoms:-

1. Retarded skeletal growth.
2. Absence of sexual maturity
3. Retarded mental ability
4. Thick and short limbs
5. Thick wrinkled skin
6. Bloated face
7. Protruded enlarged tongue
8. Low BMR, slow pulse rate, subnormal body temperature and elevated blood cholesterol levels

## 7. Briefly explain the structure of thyroid gland?

The thyroid gland is butterfly shaped, bilobed situated below the larynx on each side of the upper trachea. The two lobes are connected by a median tissue mass called isthmus. Each lobe is made up of many lobules. The lobules consist of follicles called acini. Each acinus is lined with glandular, cuboidal or squamous epithelial cells.

The lumen of acini is filled with colloid, a thick glycoprotein mixture consisting of thyroglobulin molecules. The thyroid gland secretes Tri-iodothyronine (T<sub>3</sub>) and tetra-iodothyronine (T<sub>4</sub>) or thyroxine hormones. These are concerned with metabolism.

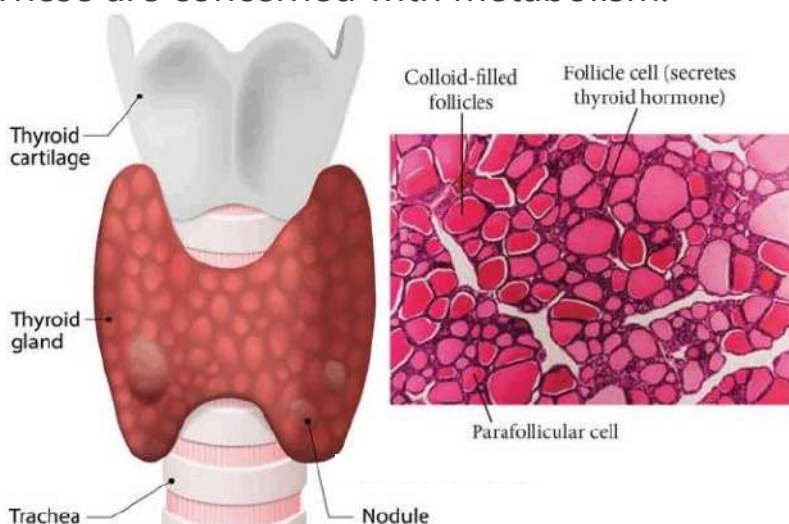


Figure.11.3 Structures of thyroid gland

**8. Name the layers of adrenal cortex and mention their secretions?**

A pair of adrenal glands are located at the anterior end of the kidneys. Hence, they are called suprarenal glands. The outer region is called cortex and the inner region is medulla. The adrenal cortex has three distinct zones,

- 1. Zona Glomerulosa
- 2. Zona fasciculata
- 3. Zona reticularis

1. Zona Glomerulosa:

- It is the outer thin layer. It constitutes about 15% of the cortex.
- It secretes mineralocorticoids.

2. Zona fasciculata:

- It is the middle wide layer constituting about 15% of adrenal cortex.
- It secretes glucocorticoids such as cortisol, corticosterone and trace amounts of adrenal androgen and oestrogen.

3. Zona reticularis:

- It is the inner zone of adrenal cortex.
- It constitutes about 10% of adrenal cortex.
- It secretes the adrenal androgen, trace amount of oestrogen and glucocorticoids.

**9. Differentiate hyperglycemia from hypoglycemia?**

<b>Hyperglycemia</b>	<b>Hypoglycemia</b>
1. Elevation in the blood sugar level is called hyperglycemia	1. Decrease in the blood sugar level is called hypoglycemia.
2. This happens due to reduced secretion of insulin.	2. This happens due to increased secretion of insulin.

**10. Write the functions of CCK?**

Cholecystokinin Cholecystokinin is secreted by duodenum in response to the

presence of fat and acid in the diet. It acts on the gall bladder to release bile into duodenum and stimulates the secretion of pancreatic enzymes and its discharge.

**11. Growth hormone is important for normal growth. Justify the statement?**

Growth hormone promotes growth of all the tissues and metabolic process of the body. It influences the metabolism of carbohydrate, proteins and lipids. It increases the rate of protein biosynthesis in the cells.

It stimulates chondrogenesis (cartilage formation), osteogenesis (bone formation) and helps in the retention of minerals like nitrogen, potassium, phosphorus, sodium etc in the body. It increases the release of fatty acid from adipose tissue and decreases the rate of glucose utilization for energy by the cells. The hyposecretion of growth hormones causes dwarfism in children.

**12. Pineal gland is an endocrine gland, write its role?**

The pineal gland or epiphysis cerebri or conarium is located behind the third ventricle of brain. It is formed of paranchymal cells and interstitial cells. It secretes the hormone, melatonin.

It plays a central role in the regulation of circadian rhythm of our body and maintains normal sleep wake cycle. It also regulates the timing of sexual maturation of gonads. It also influences metabolism, pigmentation, menstrual cycle and defence mechanism of our body.

**13. Comment on the functions of adrenalin?**

Adrenalin increases liver glycogen breakdown into glucose and increases the release of fatty acids from fat cells. During emergency, it increases heart beat rate and blood pressure. It stimulates the smooth muscles of cutaneous and visceral arteries to decrease blood flow. It increases blood flow to the skeletal muscles and nervous tissue.

**14. Predict the effects of removal of pancreas from the human body?**

Pancreas is both exocrine and endocrine gland. It is located just below the stomach as a leaf like structure. It secretes digestive enzymes and hormones like insulin and glucagon.

The digestive enzymes digest carbohydrates, proteins and fats. Insulin and glucose regulate blood sugar level. If pancreas is removed from the body, digestion and maintenance of blood sugar level gets affected.

**15. Enumerate the role of kidney as an endocrine gland?**

Kidney has endocrine tissues which act as partial endocrine gland. It secretes renin, erythropoietin and calcitriol. Renin is secreted by juxta glomerular cells. It increases blood pressure when angiotensin is formed in blood.

Erythropoietin is also secreted by the juxta glomerular cells of the kidney and stimulates erythropoiesis in bone marrow. Calcitriol is secreted by proximal tubes of nephrons. It is an active form of vitamin D<sub>3</sub> which promotes calcium and phosphorus absorption from intestine and accelerates bone formation.

**16. Write a detailed account of gastro intestinal tract hormones?**

Group of specialized endocrine cells present in gastro-intestinal tract secretes hormones such as gastrin, cholecystokinin (CCK), secretin and gastric inhibitory peptides (GIP). Gastrin acts on the gastric glands and stimulates the secretion of HCl and pepsinogen.

Cholecystokinin (CCK) is secreted by duodenum in response to the presence of fat and acid in the diet. It acts on the gall bladder to release bile into duodenum and stimulates the secretion of pancreatic enzymes and its discharge. Secretin acts on acini cells of pancreas to secrete bicarbonate ions and water to neutralize the acidity. Gastric inhibitory peptide (GIP) inhibits gastric secretion and motility.

## CHAPTER 12 TRENDS IN ECONOMIC ZOOLOGY

### I. Answer the following:

**1. Animal husbandry is the science of rearing, feeding and caring, breeding and disease control of animals. It ensures supply of proper nutrition to our growing population through activities like increased production and improvement of animal products like milk, eggs, meat, honey, etc.**

**(a) Poultry production depends upon the photoperiod. Discuss.**

**(b) Polyculture of fishes is of great importance.**

(a) Light is an important aspect in the poultry production. Light stimulates the secretion of FSH and LH. The wavelength between 400 and 700 nm is required. The decrease in the photoperiod will affect the egg production.

(b) A few selected fishes belonging to different species are stocked together in proper proportion in a pond. This mixed farming is termed as composite fish farming or polyculture. It is of great importance because

1. All available riches are fully utilized
2. Compatible species do not harm each other
3. There is no competition among different species

**2. Assertion: The best quality of pearl is known as lingha pearl and obtained from marine oysters.**

**Reason: Nacre is secreted continuously by the epithelial layer of the mantle and deposited around the foreign particle.**

**(a) Assertion is true, Reason is false**

**(b) Assertion and Reason are false**

**(c) Assertion is false But Reason is true**

**(d) Assertion and Reason are true**

**Answer**

(c) Assertion is false But Reason is true

**3. Choose the correctly matched pair.**

- |                       |   |                     |
|-----------------------|---|---------------------|
| (a) Egg layers        | – | Brahma              |
| (b) Broiler types     | – | Leghorn             |
| (c) Dual purpose      | – | White Plymouth rock |
| (d) Ornamental breeds | – | Silkie              |

**Answer:**

(d) Ornamental breeds – Silkie

**4. Write the advantages of vermicomposting?**

1. Vermicomposting provides excellent organic manure for sustainable agro-practices.
2. Marketing of vermicompost can provide a supplementary income.
3. Vermicompost is rich in essential plant nutrients.
4. It improves soil structure, texture, aeration, and water holding capacity and prevents soil erosion.
5. It is rich in nutrients and an eco-friendly amendment to soil for farming and terrace gardening,
6. It enhances seed germination and ensures good plant growth.

**5. Name the three castes in a honey bee colony?**

The Queen, Drones and Workers.

**6. Name the following?**

**1. The largest bee in the colony:**

**2. The kind of flight which the new virgin queen takes along with the drones out of the hive:**

1. The queen.
2. Nuptial flight.

**7. What are the main duties of a worker bee?**

Each worker has to perform different types of work in her life time.

During the first half of her life, she becomes a nurse bee attending to indoor duties such as secretion of royal jelly, prepares bee- bread to feed the larvae, feeds the queen, takes care of the queen and drones, secretes bees wax, builds combs, cleans and fans the bee hive. Then she becomes a soldier and guards the bee hive. In the second half her life lasting for three weeks, she searches and gathers the pollen, nectar,, propolis and water.





### **8. What happens to the drones after mating flight?**

They die after copulation.

### **9. Give the economic importance of Silkworm?**

1. Rearing of silkworm on a commercial scale is called sericulture.
2. It is an agro-based industry comprising of
  1. – Cultivation of food plants for the silkworms.
  2. – Rearing of silkworms.
  3. – Reeling and spinning of silk.
3. Silk fibres are utilized in preparing silk clothes.
4. Silk is used in industries and for military purposes.
5. Silk is used in the manufacture of fishing fibres, parachutes, cartridge bags, insulation coils for telephone, wireless receivers, tyres of racing cars, filter fibres, in medical dressings and as suture materials.

### **10. What are the Nutritive values of fishes?**

Economic importance of fish:-

Fishes form a rich source of protein food and provide a good staple food to tide over the nutritional needs of man. Fish species such as sardines, mackerel, tuna, herrings have high amino acids concentration particularly histidine which is responsible for the meaty flavor of the flesh. It is rich in fat such as omega 3 fatty acids. Minerals such as calcium, magnesium, phosphorus, potassium, iron, manganese, iodine and copper.

Some of the fish by-products are: Fish oil is the most important fish by-product. It is derived from fish liver and from the fish body.

Fish liver oil is derived from the liver which is rich in vitamin A and D, whereas fish body oil has high content of iodine, not suitable for human consumption, but is used in the manufacture of laundry soaps, paints and

cosmetics. Fish meal is prepared from fish waste after extracting oil from the fish.

The dried wastes are used to prepare food for pig, poultry and cattle. The wastes obtained during the preparation of fish meal are widely used as manure.

Isinglass is a high-grade collagen produced from dried air bladder or swim bladder of certain fishes viz. catfish and carps. The processed bladder which is dissolved in hot water forms a gelatin having adhesive property. It is primarily used for clarification of wine, beer and vinegar.

**11. Give the economic importance of prawn fishery?**

The flesh of prawn is palatable and rich in glycogen, protein with low fat content.

**12. Give the economic importance of lac insect?**

Economic importance of Lac:-

1. Lac is largely used as a sealing wax and adhesive for optical instruments. It is used in electric industry, as it is a good insulator.
2. It is used in preparations of shoe and leather polishes and as a protective coating of wood.
3. It is used in laminating paper board, photographs, engraved materials and plastic moulded articles.
4. Used as a filling material for gold ornaments.

**13. List any three common uses of shellac?**

1. Shellac with denatured alcohol is used to remove dust on the walls.
2. Coating of metals with shellac prevents rusting.
3. Shellac coating on citrus fruits increases their shelf life.

**14. Name any two trees on which lac insect grows?**

Acacia catechu, Acacia nilotica.

**15. What is seed lac?**

Lac cut from the host plant is called 'stick lac'. The lac present on the twig is scraped and collected. After grinding, the unnecessary materials like dusts and fine particles are removed. The resultant lac is called 'seed lac'.

**16. Define cross breeding?**

Breeding between a superior male of one breed with a superior female of another breed is known as cross breeding.

### **17. What are the advantages of artificial insemination?**

Advantages of artificial insemination:

1. It increases the rate of conception
2. It avoids genital diseases
3. Semen can be collected from injured bulls which have desirable traits
4. Superior animals located apart can be bred successfully

### **18. Discuss the various techniques adopted in cattle breeding?**

There are two methods of animal breeding, namely inbreeding and outbreeding.

#### 1. Inbreeding:

Breeding between animals of the same breed for 4-6 generations is called inbreeding.

#### 2. Outbreeding:

The breeding between unrelated animals is called outbreeding. It is done in three ways;

- Out crossing: It is the breeding between unrelated animals of the same breed but having no common ancestry. The offspring of such a cross is called outcross.
- Cross breeding: Breeding between a superior male of one breed with a superior female of another breed. The cross bred progeny has superior traits (hybrid vigour or heterosis).
- Interspecific hybridization: In this method of breeding mating is between male and female of two different species.

### **19. Mention the advantages of MOET?**

Multiple Ovulation Embryo Transfer Technology (MOET) is a method of propagation of animals with desirable traits. This technology is used to produce high milk yielding females and high quality meat yielding bulls in a short time.

### **20. Write the peculiar characters of duck?**

Peculiarity of ducks:

The ducks body is fully covered with oily feathers. They have a layer of fat under their skin which prevents it from getting wet. They lay eggs at night or in the morning. The ducks feed on rice bran, kitchen wastes, waste fish and snails.