CBSE
Class XI Biology
Sample Paper – 6

Time: 3 hrs **Total marks: 70**

General instructions:

1. All questions are compulsory.
2. The question paper consists of four sections A, B, C and D.
3. Internal choice is given in all the sections. A student has to attempt only one of the alternatives in such questions.
4. Section A contains 5 questions of 1 mark each.
5. Section B has 7 questions of 2 marks each.
6. Section C is of 12 questions of 3 marks each.
7. Section D has 3 questions of 5 marks each.
8. Wherever necessary, the diagrams drawn should be neat and properly labelled.

SECTION A

1. When is the coelom said to be a true coelom? [1]

OR

What kind of body cavity do the arthropods and nematodes have?

2. What are oothecae? [1]

3. Why is cellulose considered a homopolymer? [1]

4. Name the connecting link between glycolysis and the Krebs cycle. [1]

OR

Name the enzymes which catalyse the incomplete oxidation of glucose in yeast.

5. What is the name given to the bulb-like structures at axon terminals? [1]

SECTION B

6. Name two heterosporous ferns. Why are they called so? [2]

7. What is the site of fat digestion in humans? Name the enzyme which digests fats. Mention the end-product of fat digestion. [2]

8. Why is the axoplasm of a resting axon negatively charged? [2]

9. Amoeba multiplies by mitotic cell division. Is this phenomenon growth or reproduction? [2]

10. Differentiate between chromatin and chromosomes. [2]

OR

Mention two functions of the following:

i. Polysaccharides
ii. Amino acids

11. State any two points of differences between adipose tissue and blood tissue. [2]

12. Draw a well-labelled diagram of a mitochondrion. [2]

OR

List the functions of the cytoskeleton.

SECTION C

13. Name the type of fertilisation which is unique to angiosperms. Describe it. [3]

OR

Explain the modes of reproduction in Ulothrix.

14. Name and explain the portal systems found in frogs. [3]

15. Cork cambium forms tissues which form the cork. Do you agree with this statement? Explain. [3]

16. How is a pinnately compound leaf different from a palmately compound leaf? [3]

17. What is a cell wall? Mention the functions of a plant cell wall. [3]

18. Draw a labelled diagram of chloroplast. [3]

OR

Multicellular organisms have division of labour. Explain.

19. Name the stage of the cell cycle at which one of the following events occur: [3]

i. Chromosomes are moved to the spindle equator.
ii. Centromere splits and chromatids separate.
iii. Pairing between homologous chromosomes takes place.

20. What is a photosystem? Which is the pigment which acts as a reaction centre? [3]

21. What is cretinism? Give any two causes of it. [3]

OR

Represent diagrammatically the action of the hormone oestrogen.

22. Describe three disorders of the skeleton and joints. [3]

23. What are the factors affecting the rate of diffusion? [3]

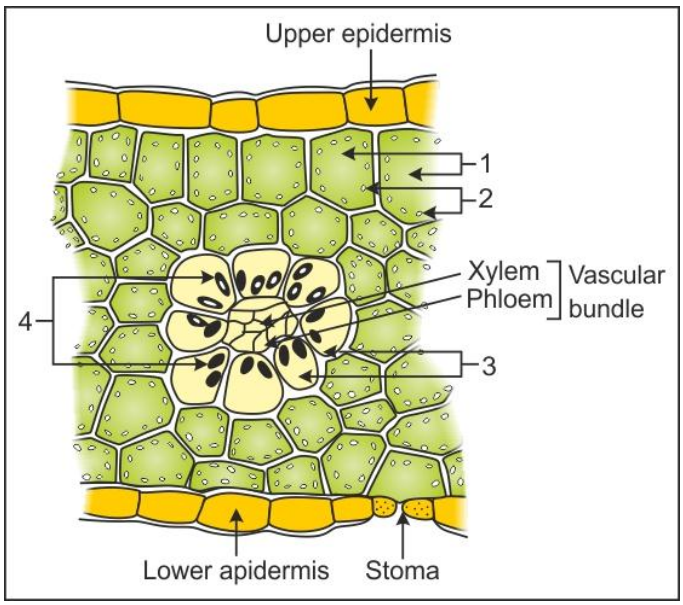
24. What is imbibition pressure? What is the usefulness of imbibition pressure to seed germination? [3]

OR

Explain the three physical properties of water which help in the ascent of sap in plants.

SECTION D

25. A portion of the cross-section of a leaf is shown in the diagram. Answer the following: [5]

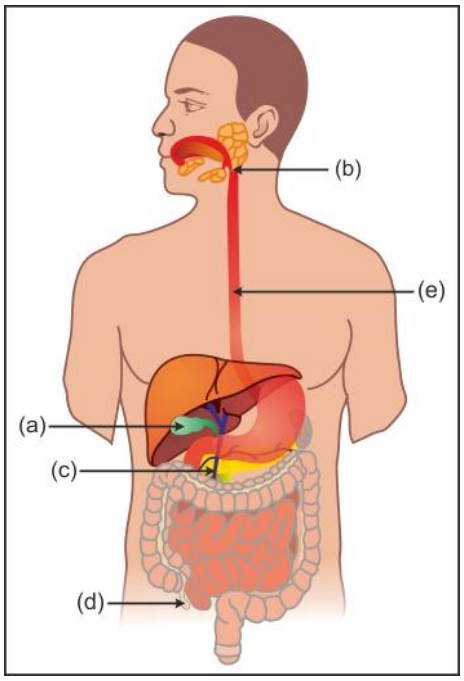


i. Label 1 to 4.
ii. What kind of anatomy is shown in the diagram?
iii. Write the structure and function of 2 and 4.

OR

List five main groups of natural plant growth regulators. Write a note on the discovery, physiological functions and agricultural/horticultural applications of any one of them.

26. In the given diagram of the alimentary canal of man, label five parts mentioned as (a) to (e) and give their functions. [5]



OR

Draw a neat and labelled diagram of the human ear and explain its structure.

27. Give a brief account of the counter-current mechanism. [5]

OR

(a) Describe the role of haemoglobin in the transport of respiratory gases.

(b) What is the function of carbonic anhydrase? Where is it operative?

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Sample Paper – 6 Solution

SECTION A

1. A coelom which is completely lined with mesoderm is a true coelom.

OR

Arthropods have blood-filled haemocoel, and nematodes have fluid-filled pseudocoel.

2. Oothecae are the capsules which enclose fertilised eggs.

3. Cellulose is made of only one type of monomer (glucose); hence, it is called a homopolymer.

4. Acetyl CoA

OR

- Pyruvic acid decarboxylase
- Alcohol dehydrogenase

5. Synaptic knob

SECTION B

6. Ferns which produce two kinds of spores—microspores and megaspores—are called heterosporous ferns.
Examples: Selaginella, Salvinia

7. Intestinal lumen and intestinal epithelial cells.
The enzyme which digests fats is lipase.
End-products of fat digestion are fatty acids and glycerol.

8. The resting membrane is impermeable to the negatively charged proteins of the axoplasm. An active sodium pump transports three sodium ions to the outside, but two potassium ions come inside.

9. Increase in the number of cells is referred to as growth. However, in unicellular organisms, increase in the number of cells occurs only though reproduction. Therefore, in unicellular organisms, reproduction results in an increase in the number of cells which in turn leads to growth.

10. Differences between chromatin and chromosomes:

Chromatin	Chromosomes
i. It is active in controlling metabolism and other activities of the cell. ii. Chromatin is observable in the interphase nucleus. iii. Chromatin is in the form of fine fibrils which run throughout the nucleus. iv. Replication occurs in the chromatin phase.	i. Chromosomes are meant for the distribution of genetic information to the daughter cells. ii. Chromosomes are observable during the M-phase or at nuclear division. iii. Chromosomes are in the form of short thick threads or rods. iv. Replication cannot occur in the chromosome phase.

OR

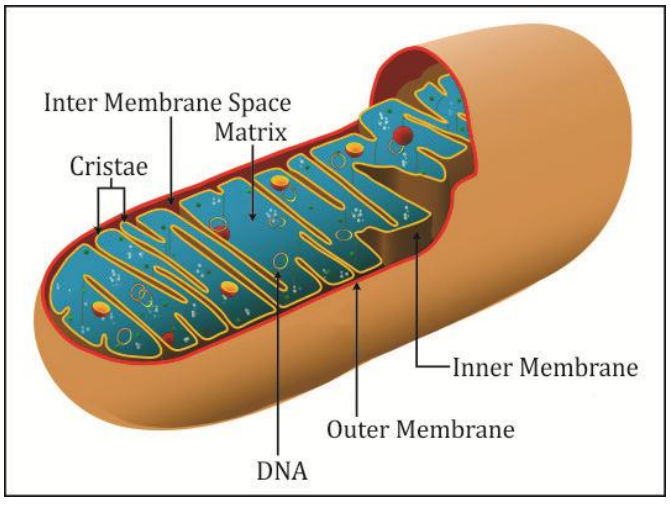
i. Functions of polysaccharides:
   (a) Starch and glycogen are the storage foods in most of the living organisms.
   (b) Chitin is the structural carbohydrate of fungal walls and exoskeleton of arthropods.

ii. Functions of amino acids:
   (a) Amino acids are building blocks of proteins and enzymes.
   (b) The amino acid glycine provides nitrogen and carbon atoms for the synthesis of protoporphyrin and haeme.

11. Differences between adipose tissue and blood tissue:

Adipose tissue	Blood tissue
• It is a loose connective tissue.	• It is a fluid connective tissue.
• The matrix has fibres.	• The matrix does not have fibres.
• It helps in storage and metabolism of fats.	• It helps in circulation of various substances and respiratory gases.

12. Structure of mitochondrion:



OR

Functions of the cytoskeleton:

- It provides mechanical support and motility to the cell.
- It maintains the shape of the cell.

SECTION C

13. Double fertilisation is unique to angiosperms.

In this phenomenon, two male gametes are discharged by a pollen tube into the embryo sac of an ovule. One male gamete fuses with the female gamete to form a zygote. This fusion is called syngamy. A second male gamete fuses with the secondary nucleus to form the primary endosperm nucleus. This is called double fertilisation.

OR

In *Ulothrix*, reproduction may occur by the following methods:

- Vegetative reproduction by fragmentation or by formation of different types of spores.
- Asexual reproduction by flagellated zoospores.
- Sexual reproduction by the isogamous, anisogamous or oogamous fusion of gametes.

14. Frogs have two well-developed portal systems—hepatic portal system and renal portal system.

The hepatic portal system is the connection between the liver and the intestine through veins, while the renal portal system is the connection between the kidneys and the lower parts of the body such as limbs, via veins, to remove nitrogenous wastes.

15. It is true that the cork cambium forms tissues which form the cork. The cork cambium produces new cells on both outer surface and inner surface. The cells formed on the outer side differentiate into cork, also called phellem. These cells become impervious to water due to deposition of suberin and become thick-walled.

16. Differences between pinnately compound leaf and palmately compound leaf:

Pinnately Compound Leaf	Palmately Compound Leaf
i. Several leaflets are present on a common axis.	i. The number of leaflets is attached at a common point.
ii. The shape of the leaflets appears feather-like.	ii. The shape of the leaflets appears like the palm.
iii. The leaflet-bearing axis is the continuation of the petiole or modified mid-rib. It is prominent. Example: Neem leaves	iii. The leaflet-bearing axis is very short and represents the tip of the petiole. It is not prominent. Example: Cotton leaves

17. The cell wall is a non-living rigid structure which forms an outer covering for the plasma membrane of fungi, plants and some protists.

Functions of the cell wall:

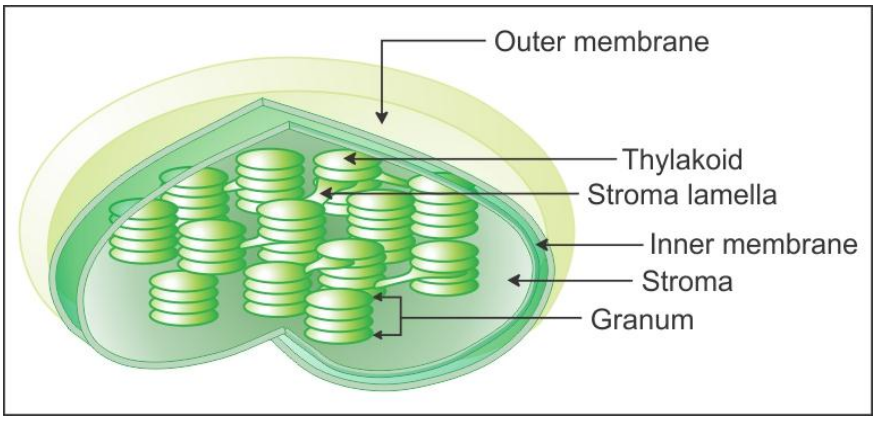
(a) Protects the protoplasm against mechanical injury and infection

(b) Provides rigidity and shape to the cell

(c) Helps in cell-to-cell interactions

(d) Acts as a barrier to unwanted molecules

18.



OR

Division of labour is the differentiation of certain parts of the cell to carry out different functions for increased efficiency and higher survival. In unicellular organisms, a single cell performs all the metabolic activities. In multicellular organisms, distinct organs and organ systems are meant to carry out distinct metabolic activities. In the human body, there is a separate system to carry out functions such as digestion, respiration, excretion and locomotion. Even in a particular system, there are different organs for different functions. For example, in the digestive system, the teeth and mouth are responsible for mastication. The stomach is responsible for killing the bacteria in the food. The small intestine is responsible for digestion and absorption.

Thus, multicellular organisms have division of labour.

19.

i. Metaphase

ii. Anaphase

iii. Zygotene stage of prophase-I during meiosis

20. A photosystem is a group of pigments which are involved in photosynthesis. These pigment systems have a reaction centre to which light energy absorbed by the accessory pigments is passed. There are two photosystems—I and II.

A chlorophyll a molecule acts as the reaction centre. It is called P700 in PS I and P680 in PS II.

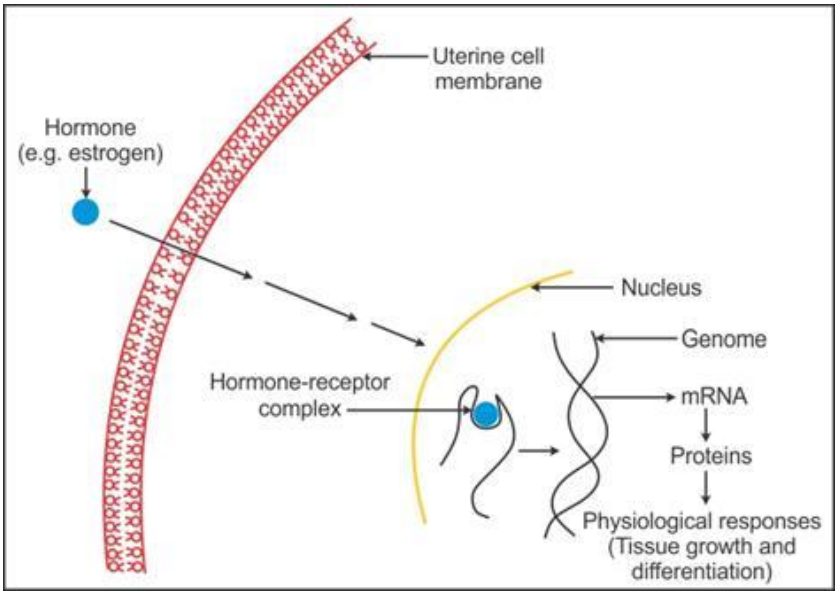
21. Cretinism is a disorder caused by the deficiency of thyroid hormone (hypothyroidism) in infants.

Causes:

i. Failure of the thyroid gland to secrete thyroxine
ii. Hyposecretion of thyrotropin-releasing hormone (TRH)

OR

Action of the hormone oestrogen:



22.

i. Arthritis. It is caused by the inflammation of the joints. It is a common disease in old age which includes pain and stiffness in the joints.
ii. Sprain. It refers to an injury to a joint capsule which involves stretching or tearing of tendons or ligaments. This condition may often remain for a week or may take more time. Thus, it may become chronic.
iii. Osteoporosis. It results from excessive resorption of calcium and phosphorus from the bones and leads to more chances of fractures. The major causes of this disorder are imbalances of hormones (such as calcitonin of thyroid, parathormone of parathyroids and sex hormones) and deficiency of vitamin D.

23. Factors affecting the rate of diffusion:

i. Temperature: The rate of diffusion increases with the increase in temperature because the kinetic energy of diffusing particles also increases with increasing temperature.
ii. Density of diffusing substance: The rate of diffusion is inversely proportional to the square root of the density of the diffusing substance.
iii. Medium in which diffusion occurs: The rate of diffusion decreases in a concentrated medium. Example: A gas diffuses more rapidly through vacuum than air.

24. Imbibition pressure is the pressure developed in an adsorbent due to the entry of water molecules.

Usefulness of imbibition pressure to seed germination:

- It is responsible for the rupture of the seed coat during germination.
- It is responsible for the seedlings to emerge above the soil and establish themselves.

OR

Properties of water which help in the movement of ascent of sap:

- Mutual attraction between water molecules. This property is called cohesion.
- Attraction of water molecules to polar surfaces such as the surface of tracheary elements. This attraction is also called adhesion.
- Water molecules are attracted to each other more in the liquid phase than in the gas phase. This property is called the surface tension of water.

These properties help to form a continuous passage of water molecules in the xylem which moves upwards due to the transpiration pull.

SECTION D

25.

i. 1. Mesophyll cells 2. Mesophyll chloroplasts
   3. Cells of bundle sheath 4. Bundle sheath chloroplasts
ii. Kranz anatomy. This kind of anatomy occurs in the leaves of C_4 plants in which the bundle-sheath cells are arranged in a wreath-like manner.
iii. Structure and function of mesophyll chloroplasts: Mesophyll chloroplasts are granal and contain thylakoids which are stacked to form grana. These chloroplasts perform the light reaction with the evolution of molecular 0_2. The CO_2 is fixed by phosphoenol pyruvic acid to form 4-carbon oxaloacetic acid.

   Structure and function of bundle sheath chloroplasts: These chloroplasts are agranal, i.e. grana are absent, and the thylakoids are present only as stroma lamellae. Bundle sheath chloroplasts perform the C_3 cycle in which CO_2 is fixed by RuBP catalysed by the enzyme RuBisCO (RuBisCO is present only in bundle sheath chloroplasts). CO_2 is made available by decarboxylation of 4 carbon organic acid (malic acid).

OR

Following are five plant growth regulators:

i. Auxins
ii. Gibberellins
iii. Cytokinins
iv. Ethylene
v. Abscisic acid

Discovery of auxins:

Charles Darwin and his son Francis Darwin observed that the coleoptiles of canary grass responded to unilateral illumination by growing towards the light source. Covering the tip with a black cap resulted in the loss of sensitivity of the plant towards light. Replacement of the tip again caused bending towards the source of light. Hence, it was concluded that the tip of the coleoptile is the site of production of a substance which caused the bending of coleoptiles.

Similar observations were made by Boysen-Jensen in oat coleoptiles. He decapitated the seedling, smeared a bit of gelatine on the cut end, replaced the tip on the gelatine and found that the coleoptile bends towards the source of light.

The final proof was provided by Went in 1928 that some material substance is involved in unilateral growth and that this substance is provided by the apex.

Physiological functions:

i. Auxins stimulate respiration by increasing the availability of respiratory substrate.
ii. They control plant cell growth.
iii. They cause the phenomenon of apical dominance.
iv. They control division in the vascular cambium and xylem differentiation.
v. They induce parthenocarpy and prevent abscission of leaves and fruits.

Horticultural applications:

i. Application of auxins activates rooting in stem cuttings.
ii. High concentrations of auxins such as 2,4-D are used as weedicide to kill broadleaf, dicotyledonous weeds.
iii. Low concentrations of auxins help to bring parthenocarpy in tomatoes.
iv. In pineapple and litchi, auxins such as 2,4-D and NAA have been found to promote flowering.

26.

(a) Gall bladder
(b) Epiglottis
(c) Pyloric sphincter
(d) Vermiform appendix
(e) Oesophagus

Functions:

(a) Gall bladder: It is a thin-walled sac which stores bile juice secreted by the liver. Bile juice helps in the emulsification of fats.
(b) Epiglottis: It prevents the entry of food into the wind pipe during swallowing in mammals.
(c) Pyloric sphincter: It allows the passage of partly digested food from the stomach to the duodenum.
(d) Vermiform appendix: Its function in man is unknown as it is a vestigial organ.
(e) Oesophagus: It serves for the passage of food by peristaltic movements from the pharynx into the stomach.

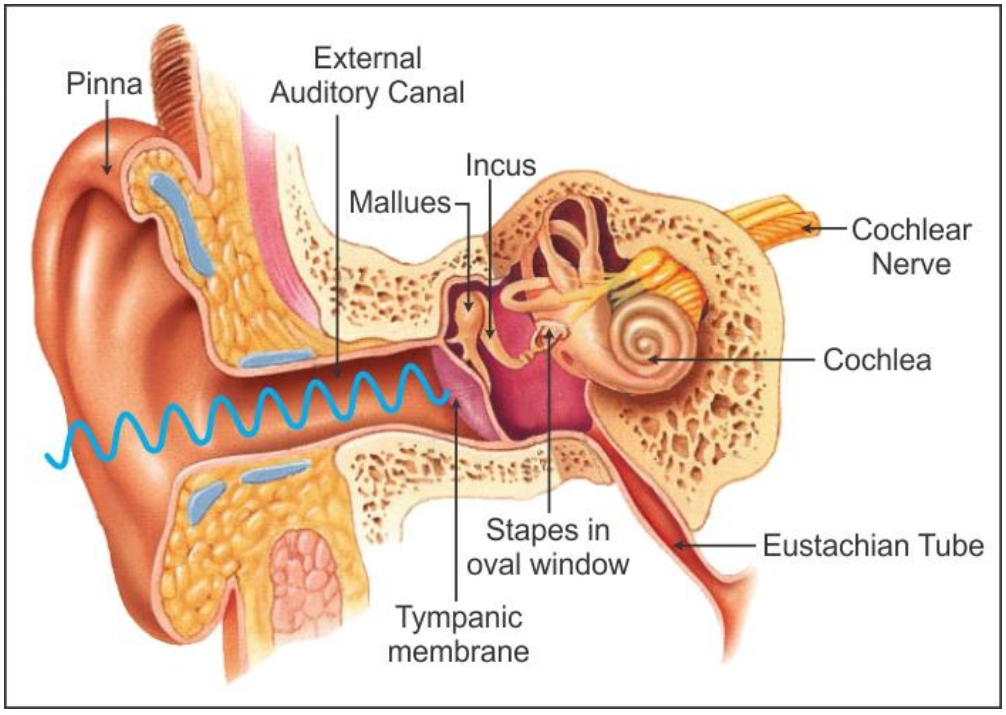
Structure of ear: The human ear is divided into three parts—external ear, middle ear and internal ear.

i. External ear: It consists of the pinna, external auditory canal and tympanic membrane.
   (a) Pinna: The pinna is an oval, somewhat funnel-shaped, flap-like structure made of elastic cartilage and muscles. Its outer stiff ridge is called the helix. The lower flexible lobe is called lobule, and its cavity is known as concha. It collects the sound waves and directs them into the external auditory canal.
   (b) External auditory canal: It is an S-shaped tubular passage supported by cartilage in its exterior part and by bone in its inner part. It follows an oblique course so as to prevent hard objects from hitting the tympanum directly. The outer region of the canal bears hair which keeps out the dust particles, and the inner region has wax glands or ceruminous glands.
   (c) Tympanic membrane: It is a thin, oval, tightly stretched membrane closing the external auditory canal internally. It is composed of connective tissue with fibres radiating from the central region called umbo.

ii. Middle ear: It consists of an irregular, air-filled space called the tympanic cavity. It communicates with the nasopharynx by a passage called the Eustachian tube. It serves to equalise the air pressure in the tympanic cavity with the external air pressure. There are three small bones called ear ossicles—the malleus (hammer-shaped), the incus (anvil-shaped) and the stapes (stirrup-shaped). The malleus is attached to the tympanic membrane on one side and to the incus on the other side. The incus is connected with the stapes, which is attached to the oval membrane covering the fenestra ovalis (oval window) of the inner ear. The middle ear is connected with the inner ear through two small openings closed by the membranes. These openings are fenestra ovalis (oval window) and fenestra rotunda (round window).

iii. Internal ear: The internal ear is a delicate, irregular organ called membranous labyrinth. It is surrounded by a bony labyrinth. The membranous labyrinth is separated from the bony labyrinth by a narrow perilymphatic space which contains a watery fluid called perilymph. The membranous labyrinth consists of three parts—vestibule, semicircular ducts and cochlear duct.
   (a) Vestibule: The vestibule is the central sac-like part of the membranous labyrinth. It consists of two chambers—the utricle, which communicates with the semicircular ducts, and the saccule, which leads into the cochlear duct.
   (b) Semicircular ducts: There are three semicircular ducts—superior, posterior and lateral, arranged in three mutually perpendicular planes. Each duct opens into the utricle by both ends. The superior and posterior ducts join to form a common duct, the crus commune, which opens into the utricle.

(c) Cochlear duct: It is a spirally coiled tube which resembles the snail's shell. Part of the bony labyrinth which encloses the cochlear duct is called the cochlear canal. The cochlear duct and the cochlear canal together are called cochlea. The cochlea has three longitudinal chambers—middle, upper and lower chambers. The middle chamber is called the scala media. It is an outgrowth from the saccule. The upper and lower chambers of the cochlea are termed the scala vestibuli and scala tympani. Both scala vestibuli and scala tympani are filled with perilymph. Scala media is filled with endolymph. Both scala vestibuli and scala tympani are connected with each other at the apex of the cochlea by a small canal called helicotrema. The basilar membrane bears on it an organ of hearing called the organ of Corti which consists of receptor cells.



27.

- The flow of filtrate in the two limbs of the loop of Henle is in the opposite direction and the flow of blood in the two limbs of vasa recta is also in the opposite direction, and hence, a counter-current mechanism is formed.
- Two factors responsible for increasing the osmolarity towards the medullary interstitium:
  - Proximity between the loop of Henle and vasa recta
  - Counter current systems in them
- The osmolarity in the cortex is about 300 $mOsmolL^{-1}$ and that in the medulla is about 1200 $mOsmolL^{-1}$.
- This gradient is maintained by sodium chloride and urea.
- This interstitial gradient of NaCl is maintained by the loop of Henle.
- Urea is added to the interstitial fluid of the medulla by its diffusion from the collecting duct; it re-enters the ascending limb by diffusion.
- The counter-current mechanism thus helps to maintain a concentration gradient between the medullary interstitium and the urinary tubule.
- As the filtrate moves in the collecting duct past the interstitial fluid, water moves out of the tubule by osmosis and the urine become concentrated.

OR

(a) <u>Role of haemoglobin in the transport of respiratory gases:</u>

- Oxygen is transported as oxyhaemoglobin in the erythrocytes.
- Oxygen binds to the Fe^{2+} ions of haem and is carried as oxyhaemoglobin.
- Each molecule of haemoglobin can transport a maximum of four molecules of oxygen.
- 97% of the O_2 is transported as oxyhaemoglobin.
- Carbon dioxide is transported as carbaminohaemoglobin.
- CO_2 combines with the amine radical of globin part of the haemoglobin to form carbaminohaemoglobin.
- About 23% of the CO_2 is transported in this form.

(b) Carbonic anhydrase catalyses the formation of carbonic acid from carbon dioxide and water.

$$CO_2 + H_2O \rightleftharpoons H_2CO_3$$

$$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$$

This enzyme is functional in our erythrocytes.