

**CBSE**  
**Class XI Biology**  
**Sample Paper – 9**

**Time: 3 hrs**

**Total marks: 70**

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**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.
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**SECTION A**

1. Name an alga which is used in laboratory culture media. [1]
2. Why is a leaf of silk cotton called palmately compound? [1]
3. Which stage of cell division will you select to study the morphology of chromosomes and why? [1]

**OR**

Which is the longest phase of the cell cycle?

4. What does the variegated leaf experiment of photosynthesis prove? [1]
5. What is serum? [1]

**OR**

Name the enzyme which facilitates the conversion of fibrinogen to fibrin.

**SECTION B**

6. What is meant by haemocoel? Name the phylum which shows this feature. [2]
7. Differentiate between saturated and unsaturated fats. [2]

**OR**

What are nucleic acids? Name the two types of nucleic acids.



8. Differentiate between tidal volume and residual volume. [2]

9. [2]

(a) What is hypertension?

(b) Name two vital organs affected by high blood pressure or hypertension.

10. Differentiate between syngamy and triple fusion. [2]

11. List any four functions of bones. [2]

**OR**

Which pairs of ribs are called false ribs? Why?

12. Why is the mitochondrion called the powerhouse of the cell? [2]

### SECTION C

13. Describe the three common steps in the sexual reproduction of fungi. [3]

**OR**

A virus is considered a living organism and an obligate parasite when inside a host cell. However, a virus is not classified along with bacteria or fungi. What are the characters of a virus which are similar to non-living objects?

14. Enumerate three points to show the interaction of cockroach with mankind. [3]

15. Describe any three modified forms of tap root for storage with one example of each. [3]

16. [3]

(a) What are spermathecal pores? Mention their location and function in earthworm.

(b) How many times do nymphs moult to reach the adult form of cockroach?

17. What is the significance of mitosis? [3]

18. [3]

(a) Differentiate between the primary and secondary wall.

(b) What is the significance of a vacuole in a plant cell?

19. [3]

(a) What is chromatin? Describe its chemical composition.

(b) What does 'S' refer to in a 70S and 80S ribosome?

**OR**

Represent diagrammatically the internal structure of a cilium/flagellum.

20. [3]  
(a) What are the chemical changes in a pyruvic acid molecule before it enters the mitochondria?  
(b) What is the function of phosphofructokinase in glycolysis?  
(c) Photorespiration is a wasteful process. Give two reasons.

21. [3]  
(a) What is imbibition pressure?  
(b) What is the usefulness of imbibition pressure to seed germination?  
(c) How is nitrate assimilated by plants?

**OR**

- (a) What is complex III in ETS of mitochondria? Describe its function.  
(b) Draw a diagram of the light harvesting complex.

22. Give the location and function of the following in the human eye: [3]  
(a) Cornea  
(b) Iris

23. Draw a well-labelled diagram of the human respiratory system. [3]

**OR**

Name the structures which constitute the thoracic chamber. What is the significance of the closed thoracic chamber?

24. Give the schematic representation of the pathway for anaerobic respiration. [3]

#### SECTION D

25. What are the steps involved in the formation of a root nodule? [5]

**OR**

What are the conditions necessary for fixation of atmospheric nitrogen by *Rhizobium*?  
What is its role in N<sub>2</sub> fixation?

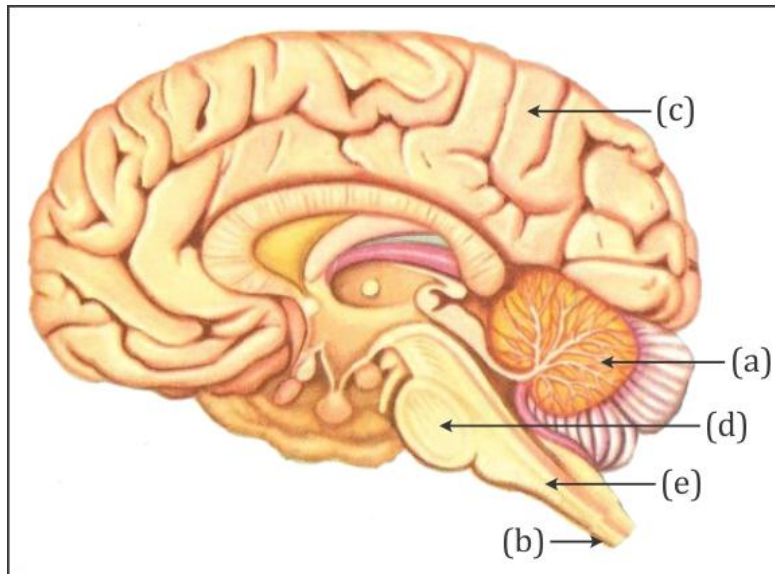
26. Discuss the main steps in the digestion of proteins as food passes through the alimentary canal of human beings. [5]

**OR**

What is meant by double circulation? State its significance.

27. Study the given figure carefully and answer the following questions:

[5]



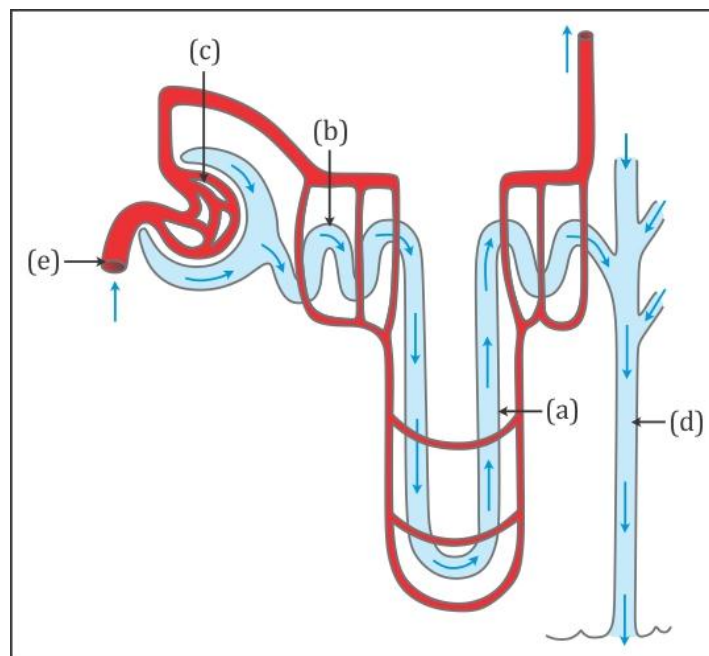
(a) Label the parts marked (a), (b), (c), (d) and (e).

(b) Give one major function of each.

**OR**

(a) Study the given figure carefully and label the parts (a), (b), (c), (d) and (e).

(b) Give one major function of each of these.



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**Sample Paper – 9 Solution**

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**SECTION A**

1. *Gelidium* - Agar
2. A leaf of silk cotton is palmately compound because the petiole bears leaflets at the tip of the petiole like the fingers of the palm.
3. Metaphase is the best stage to study the morphology of chromosomes because the chromosomes are the shortest and thickest at this stage.

**OR**

Interphase is the longest phase of the cell cycle.

4. It proves that chlorophyll is necessary for photosynthesis.
5. Plasma without the clotting factors is called serum.

**OR**

Thrombin facilitates the conversion of fibrinogen to fibrin.

**SECTION B**

6. Haemocoel is a body cavity or pseudocoel filled with blood. It is found in Arthropods and Molluscs.
- 7.

| <b>Saturated Fats</b>   | <b>Unsaturated Fats</b>   |
|---|---|
| i. They do not possess any double bonds in their fatty acids. | i. They contain one or more double bonds in their fatty acids.  |
| ii. All carbon atoms are fully saturated.                     | ii. Carbon atoms are unsaturated in the region of double bonds. |
| iii. They are solid at ordinary temperature.                  | iii. They are liquid at ordinary temperature.                   |
| iv. Animal fats are mostly saturated fats.                    | iv. Plant fats are generally unsaturated fats.                  |

**OR**



Nucleic acids are long chain macromolecules which are formed by end to end polymerisation of a large number of repeated units called nucleotides.

The two types of nucleic acids are deoxyribonucleic acid (DNA) and ribonucleic acid (RNA).

8.

| <b>Tidal volume</b>   | <b>Residual volume</b>  |
|---|---|
| i. It is the volume of air inspired or expired with each normal breath. | i. It is the volume of air which remains still in the lungs after the most forceful expiration. |
| ii. This is about 500 ml in an adult person.                            | ii. It is about 100 ml to 1200 ml of air.   |

9.

(a) If repeated checks of blood pressure of an individual are 140/90 mmHg or higher, it is called hypertension.

(b) Brain and kidneys

10. Differences between syngamy and triple fusion:

| <b>Syngamy</b>   | <b>Triple fusion</b>  |
|--|---|
| <ul style="list-style-type: none"> <li>It is the process of fusion of a male gamete with the female gamete.</li> </ul> | <ul style="list-style-type: none"> <li>It is the process of fusion of two polar nuclei (into a secondary nucleus) and a male gamete in the embryo sac.</li> </ul> |
| <ul style="list-style-type: none"> <li>It results in the formation of a diploid zygote.</li> </ul>                     | <ul style="list-style-type: none"> <li>It results in a triploid primary endosperm nucleus (PEN).</li> </ul>   |

11. Functions of bones:

- They provide place for attachment of muscles and help in movement and locomotion.
- Bone marrow present in the bones acts as the site for the manufacture of blood cells.
- Bones provide protection and support to the soft tissues and organs.
- The long bones of the limbs have weight-bearing function.
- They act as the depot of calcium and phosphorus.

**OR**

The 8<sup>th</sup>, 9<sup>th</sup> and 10<sup>th</sup> pairs of ribs are called false ribs.

These three pairs of ribs do not articulate directly with the sternum. Instead they are joined to the 7<sup>th</sup> pair by the hyaline cartilage.

12. Mitochondria are called the powerhouse of the cell because they act as sites of aerobic respiration. They produce cellular energy in the form of ATP which helps to carry out several life processes.

## SECTION C

13. Sexual reproduction in fungi involves:

- i. Plasmogamy: Fusion of the protoplasm of the two fusing gametes/cells is called plasmogamy.
- ii. Karyogamy: It involves mixing of two nuclei of the fusing gametes/cells. It follows plasmogamy.
- iii. Meiosis: The diploid nucleus formed by karyogamy undergoes meiosis to produce haploid spores.

OR

Characteristics of virus similar to non-living objects:

- Viruses do not have any specific cellular structure.
- They do not have their own metabolism.
- They show absence of growth.
- Irritability is absent.
- They can be crystallised.

14.

- i. Cockroaches cause damage to household materials such as clothes, purses, shoes etc. They also eat and destroy human food such as bread, fruits, cheese etc.
- ii. They carry harmful germs of diseases such as diarrhoea, cholera, typhoid, tuberculosis etc.
- iii. Many animals such as amphibians (e.g. frogs, toads), lizards and birds eat cockroaches. Thus, they are part of the food chain.

15. Modifications of the tap root for storage:

- i. Conical: The base of the root is broad and gradually tapers towards the apex. Example: Carrot
- ii. Fusiform: The fusiform fleshy root is like a spindle, i.e. thickest in the middle and narrow towards both base and apex. Example: Radish
- iii. Napiform: The fleshy root is very thick at the base and is almost spherical. It suddenly thins out towards the apex. Example: Turnip

16.

- i. Spermathecal pores are four pairs of small openings situated ventro-laterally in the intersegmental grooves of the segments 5/6, 6/7, 7/8 and 8/9 on each side. Each opening leads into a spermatheca, in which the sperms of the other earthworm are stored.
- ii. Thirteen times



**17. Significance of mitosis:**

- i. Mitosis is essential for growth and development of a multicellular organism.
- ii. An efficient cell has a high nucleocytoplasmic ratio. An increase in size lowers the ratio. It is brought back to the efficient level through division.
- iii. Mitosis involves replication and equitable distribution of all the chromosomes so that all the cells of a multicellular organism have the same number and type of chromosomes.

**18.**

i.

| Primary Wall  | Secondary Wall  |
|---|---|
| <ul style="list-style-type: none"><li>i. The primary wall is laid inner to the middle lamella.</li><li>ii. It is formed in growing cells.</li><li>iii. It occurs in all plant cells.</li><li>iv. It is comparatively thin (0.1–3 μm).</li></ul> | <ul style="list-style-type: none"><li>i. The secondary wall is laid inner to the primary wall.</li><li>ii. It is formed when the cell has stopped growing.</li><li>iii. It is found in some cells.</li><li>iv. It is quite thick (3–10 μm).</li></ul> |

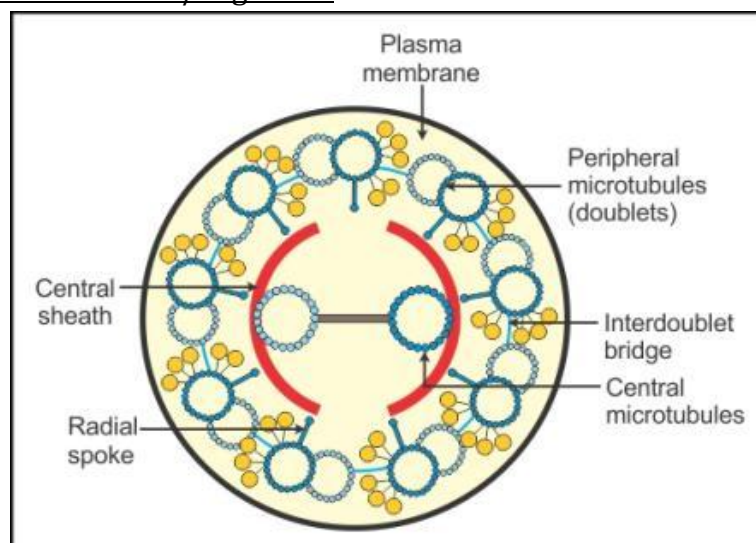
ii. It contains cell sap and helps to maintain the osmotic pressure of the cell.

**19.**

- i. The highly extended and indistinct network of nucleoprotein fibres present in the nucleoplasm is called chromatin.  
The chromatin contains DNA and some basic proteins called histones, some non-histone proteins and RNA.
- ii. S refers to sedimentation (or Svedberg) coefficient.

**OR**

Internal structure of a cilium/flagellum:





20.

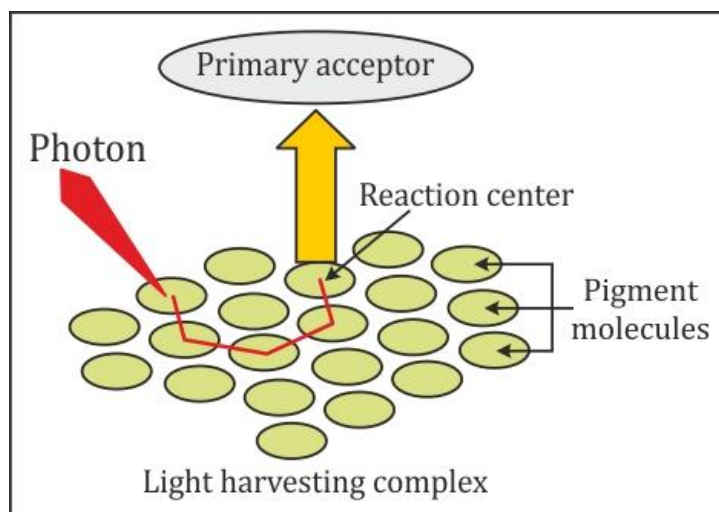
- i. Pyruvic acid undergoes oxidative decarboxylation in which it first loses one carbon dioxide molecule and then undergoes oxidation in the presence of enzyme pyruvic dehydrogenase to form acetyl CoA.
- ii. Phosphofructokinase catalyses the phosphorylation of fructose 6-phosphate by ATP to form fructose 1, 6-biphosphate.
- iii. It is a wasteful process because
  - (a) There is no synthesis of sugars or other energy-rich compounds such as ATP.
  - (b) It consumes ATP and liberates photosynthetically fixed carbon dioxide.

21.

- i. The pressure developed in the adsorbent or imbibant due to diffusion of water in it is known as imbibition pressure.
- ii. This pressure makes the seedlings to emerge from the soil during seed germination.
- iii. The nitrate formed by the process of nitrification is absorbed by plants and transported to the leaves where it is reduced to form ammonia. The reduced ammonia finally forms the amino group of amino acids.

**OR**

- i. Complex III consists of cytochrome bc complex. It passes the electrons from ubiquinol to cytochrome c, which in turn, passes it to complex IV.
- ii.

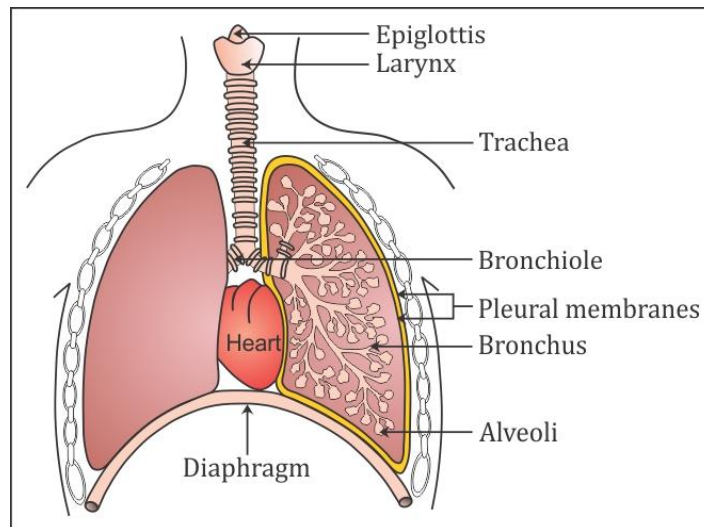


22.

- i. The cornea is the transparent portion which forms the anterior one-sixth of the eyeball. The cornea admits and helps to focus light waves as they enter the eye.
- ii. It extends from the ciliary body across the eyeball in front of the lens and has an opening in the centre called the pupil. It contains two types of smooth radial muscles which control the amount of light entering the eye.



23.



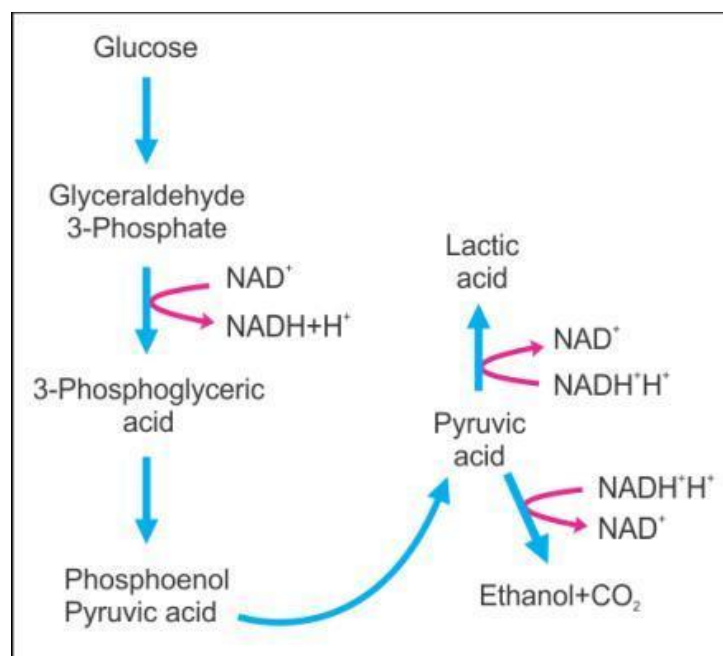
OR

Structures which constitute the thoracic chamber:

- Vertebral column on the dorsal side
- Sternum on the ventral side
- Ribs laterally
- Diaphragm on the lower side

The change in the volume of the thoracic chamber helps to know the change in the volume of the lungs.

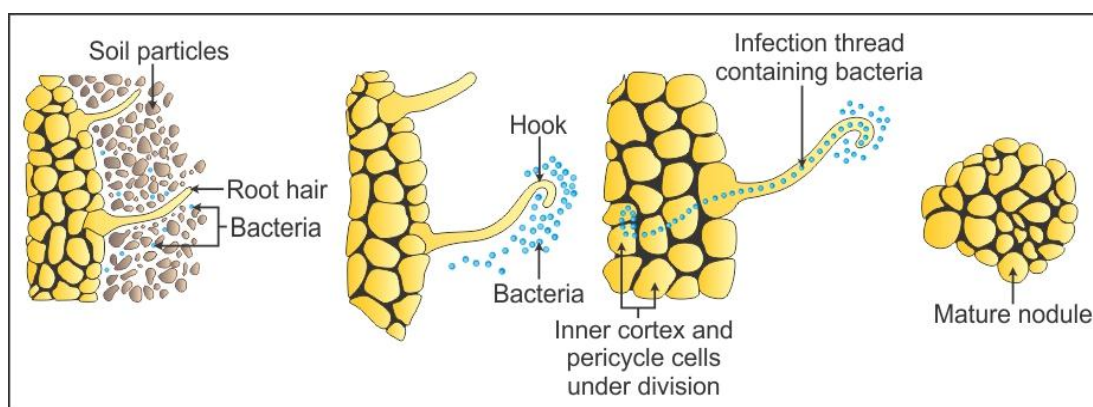
**24. Pathway of anaerobic respiration:**



## SECTION D

### 25. Steps in the development of root nodules:

- The roots of legumes secrete flavonoids and betaines which attract *Rhizobium* bacteria.
- The bacteria collect over the root hair and release Nod factors which cause curling of root hair.
- The enzymes from the bacteria degrade the parts of the root hair cell wall which produces a thread-like structure called the infection thread.
- The bacteria multiply and invade the infection thread and finally reach up to the inner cortex where they enter the cells and divide to form a knob-like protuberance called the root nodule.



OR

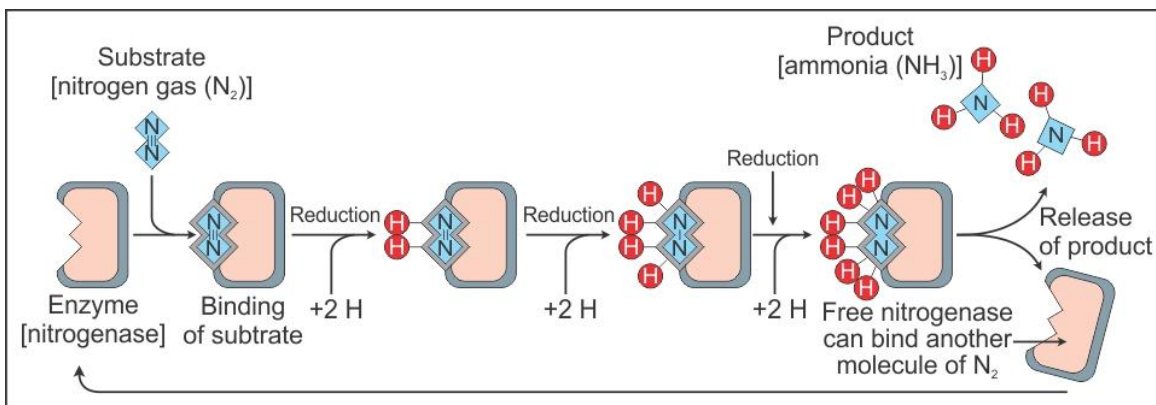
The following conditions are necessary for fixation of atmospheric nitrogen by *Rhizobium*:

- Reducing environment
- Presence of enzyme nitrogenase
- Source of energy as ATP
- Source of reducing power, NAD(P)H<sub>2</sub> or FMNH<sub>2</sub>
- Ferredoxin as electron donor
- Keto acids for picking up the amino group
- Reduced availability of nitrate in the substrate

#### Role of *Rhizobium* in N<sub>2</sub> fixation:

*Rhizobium* fixes nitrogen from the atmosphere into a plant usable form, ammonium, using the enzyme nitrogenase. In return, the plant supplies the bacteria with carbohydrates, proteins and sufficient oxygen so as not to interfere with the fixation process. Leghaemoglobin, a plant protein, helps to provide oxygen for respiration while keeping the free oxygen concentration low enough not to inhibit the nitrogenase activity.



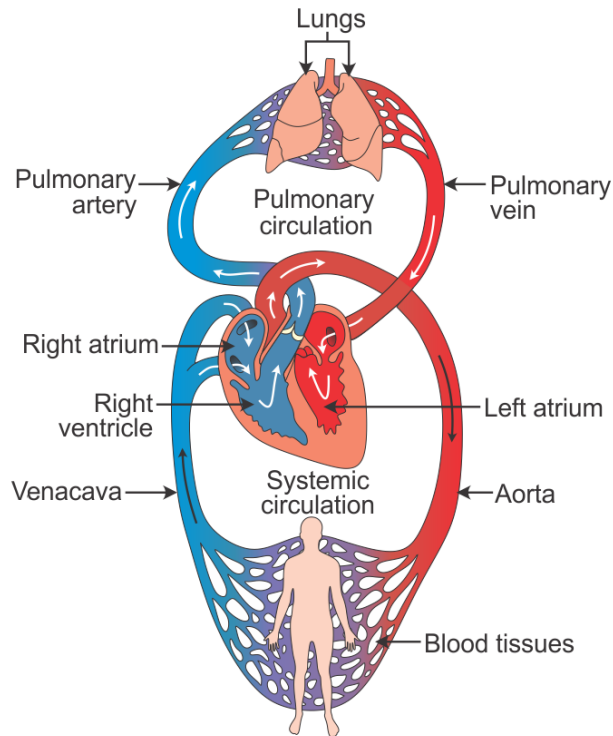


## 26. Steps in the digestion of proteins:

- In the stomach, protein digestion is carried out by enzymes pepsinogen and prorennin, secreted in the gastric juice.
  - These proenzymes are activated by the hydrochloric acid present in the gastric juice.
  - Pepsin acts on proteins and converts them to proteoses and peptones.
  - Rennin hydrolyses milk proteins.
- In the duodenum, protein digestion is carried out by enzymes of the pancreatic juice and succus entericus.
  - Pancreatic juice contains trypsin, chymotrypsin and carboxypeptidases.
  - Trypsin acts on proteins, proteoses and peptones and converts them to shorter peptides and dipeptides.
  - Chymotrypsin hydrolyses the milk proteins.
  - Carboxylpeptidases act on the terminal peptide bond and release the last amino acid and progressively shorten the peptide chain.
- Intestinal juice contains enterokinase, aminopeptidases and dipeptidases.
  - Enterokinase activates trypsinogen into the active form, trypsin.
  - Aminopeptidases act on the terminal peptide bond and release the last amino acid and thus progressively shorten the peptide chain.
  - Dipeptidases act on the dipeptides and break them into individual amino acids.

**OR**

- Double circulation is the process in which there are two separate circulatory pathways, i.e. the heart receives and pumps the oxygenated blood and deoxygenated blood separately without mixing.
- The left atrium receives oxygenated blood, which passes into the left ventricle, which pumps it to all the parts of the body.
- The right atrium receives deoxygenated blood from all the parts of the body, which passes into the right ventricle which pumps it to the lungs for oxygenation.



Significance of double circulation:

- There is no mixing of oxygenated and deoxygenated blood.
- Pulmonary circulation assists in oxygenation of blood.
- Systemic circulation helps to pump blood to different parts of the body.

27.

i.

- Cerebellum
- Spinal cord
- Cerebrum
- Pons varolii
- Medulla oblongata

ii. Functions of parts:

- It maintains posture, equilibrium and muscle tone.
- It acts as a centre for spinal reflexes.
- It perceives the sensory impulses coming from the sense organs.
- It controls some aspects of respiration.
- It has a cardiac centre to control the rate of heartbeat and a respiratory centre to control breathing movements.

**OR**

- i.
  - (a) Thin ascending limb of loop of Henle
  - (b) Proximal convoluted tubule
  - (c) Glomerulus
  - (d) Collecting duct
  - (e) Afferent arteriole
- ii. Functions of parts from (a) to (e):
  - (a) Reabsorption of electrolytes
  - (b) Selective reabsorption of useful substances
  - (c) Ultrafiltration of blood
  - (d) Reabsorption of water to form hypertonic urine
  - (e) To carry blood to the glomerulus for ultrafiltration