CBSE
Class XI Biology
Sample Paper – 4 Solution

SECTION A

1.

i. Marshy areas
ii. Gut of ruminant mammals

2. It stores food materials, resins, latex and mucilage.

OR

In the absence of a nucleus, functions of a sieve tube are maintained by the nucleus of companion cells.

3. Pili and fimbriae

4. Most plant nutrient elements are derived from rock minerals; hence, they are called mineral nutrients.

5. Schwann cell

OR

(a) Sensory neurons
(b) Motor neurons

SECTION B

6.

i. Poisonous snakes: *Naja* (cobra), *Bangarus* (krait) and *Vipera* (viper)
ii. They are included in Class Reptilia due to their crawling mode of locomotion.

7.

i. In Amoeba, the contractile vacuole is involved in excretion and osmoregulation.
ii. In protists, food vacuoles contain digestive enzymes with the help of which nutrients are digested.

OR

Nucleic acids are long-chain macromolecules formed by 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. All minerals cannot be passively absorbed by the roots from the soil for two reasons:

i. Minerals exist in the soil as ions which cannot directly cross the cell membranes.

ii. The concentration of minerals in the soil is usually lower than the concentration of minerals in the root.

9.

Absorption Spectrum	Action Spectrum
It is a graph plotted with the amount of light absorbed as a function of wavelength.	It is a graph plotted with the amount of photosynthesis (in terms of CO_2 fixed or O_2 liberated) as a function of wavelength.

10. Metagenesis is the phenomenon of the alteration of generations. For example, in cnidarians, polyps produce medusa asexually and medusa produce polyps sexually.

11. Difference between phellogen and phelloderm:

Phellogen	Phelloderm
• It is a meristematic tissue and produces new cells.	• It stores food materials.

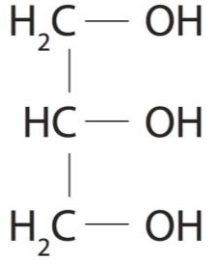
OR

Study of plant anatomy is useful to us in the following ways:

- To solve taxonomic problems
- To identify the adulteration of spices, tea and tobacco by analysing the microstructure
- To differentiate inferior quality wood from superior quality wood
- To extract compounds for use as medicine

12. Trihydroxy propane is commonly called glycerol.

Structural formula:



SECTION C

13.

(a) An animal which has two layers of cells in its early embryonic stage is called a diploblastic animal.

(b) An animal which has three layers of cells in its early embryonic stage is called a triploblastic animal.

(c) There is always scope for change and improvement; this leads to innovations.

14. The gizzard follows the crop of the alimentary canal.

It is a thick-walled somewhat rounded structure. Its walls are muscular and greatly folded. Its wall consists of strong circular muscles. The gizzard has six teeth which help in grinding food particles.

OR

Three types of cell junctions:

- Tight junctions
- Gap junctions
- Adhering junctions

Functions of junctions:

- Tight junctions: To prevent the leaking of substances across a tissue
- Gap junctions: To facilitate cells to communicate with each other by connecting their cytoplasm
- Adhering junctions: To perform cementing of the adjacent cells to keep them together

15.

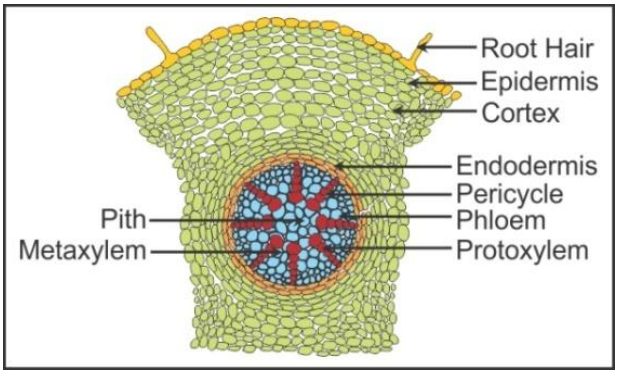
(a) It is called rachis.

(b) The rachis represents the midrib.

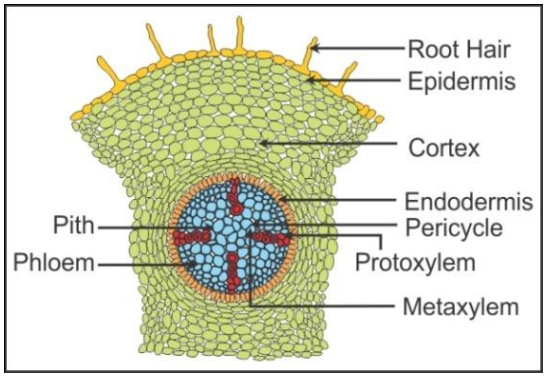
(c) A bud is present in the axil of a leaf, while a leaflet does not have a bud in its axil.

16. Anatomical difference between monocot root and dicot root:

i. Monocot root:



ii. Dicot root:



OR

(a) The pericycle is located just inner to the endodermis.
(b) The protoxylem elements are towards the outer surface, while the metaxylem elements are found towards the centre or pith.
(c) Parenchyma cells constitute the cortex.

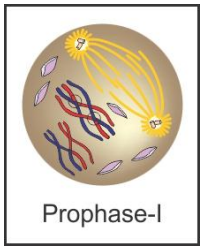
17. The cell wall is a non-living rigid structure which forms an outer covering for the plasma membrane of fungi, plants and some protists.

Functions of the cell wall:

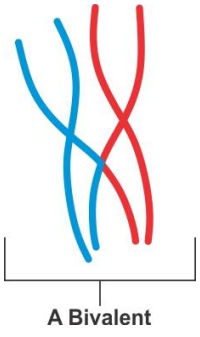
(a) Protects the protoplasm against mechanical injury and infection
(b) Provides rigidity and shape to the cell
(c) Helps in cell-to-cell interactions
(d) Acts as a barrier to unwanted molecules

18.

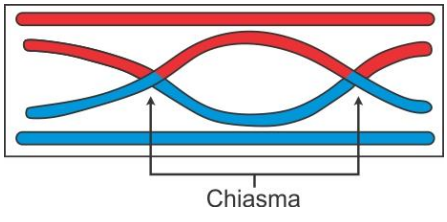
(a) Synapsis: During zygotene of prophase I of meiosis, homologous chromosomes pair together. This pairing is called synapsis.



(b) Bivalent: The complex formed by a pair of synapsed homologous chromosomes during zygotene of prophase I of meiosis is called a bivalent.



(c) Chiasmata: During diplotene, the paired chromosomes make an X-shaped structure. This is called chiasmata. These are the sites where crossing over between two non-sister chromatids occurs.



19. Differences between plant cytokinesis and animal cytokinesis:

Plant Cytokinesis	Animal Cytokinesis
(i) It occurs by cell plate formation.	(i) It occurs by cleavage.
(ii) The cell plate appears at the centre and extends outwards.	(ii) Cleavage begins at the periphery and proceeds inwards.
(iii) Fusion of vesicles begins cell plate formation.	(iii) Cleavage is started by contraction of the peripheral ring of microfilaments.

20. Ubiquinone receives the electrons after its oxidation by NADH dehydrogenase (Complex I). It also receives reducing equivalents through $FADH_2$ which is generated during oxidation of succinate through the activity of succinate dehydrogenase (Complex II). This leads to reduction of ubiquinone to ubiquinol.

Ubiquinone is located in the inner mitochondrial membrane.

OR

- RuBisCO is present in the bundle sheath cells of C_4 plants.
- The mesophyll cells of C_4 plants have a mechanism to concentrate the CO_2 in the bundle sheath cells.
- Since the concentration of CO_2 in the bundle sheath is higher, RuBisCO functions as a carboxylase.

21. The phenomenon involved is imbibition.

Absorption of water by the solid particles of an adsorbent without forming a solution is called imbibition.

The two conditions necessary are

i. Water potential gradient between the adsorbent and the liquid/water imbibed.
ii. Affinity between the adsorbent and the imbibed liquid.

22. HCl converts pepsinogen (proenzyme) and prorennin (proenzyme) to pepsin and rennin. It provides the acidic pH (pH 1.8) which is optimal for pepsin. Rennin is a proteolytic enzyme found in the gastric juice of infants which helps in the digestion of milk proteins. So, without HCl, infants would not be able to digest milk proteins.

HCl is also necessary to kill harmful bacteria which may be present in food. In the absence of HCl, harmful bacteria will not be killed and may cause diseases.

23. The major plasma proteins are fibrinogens, globulins and albumins.

Importance of plasma proteins:

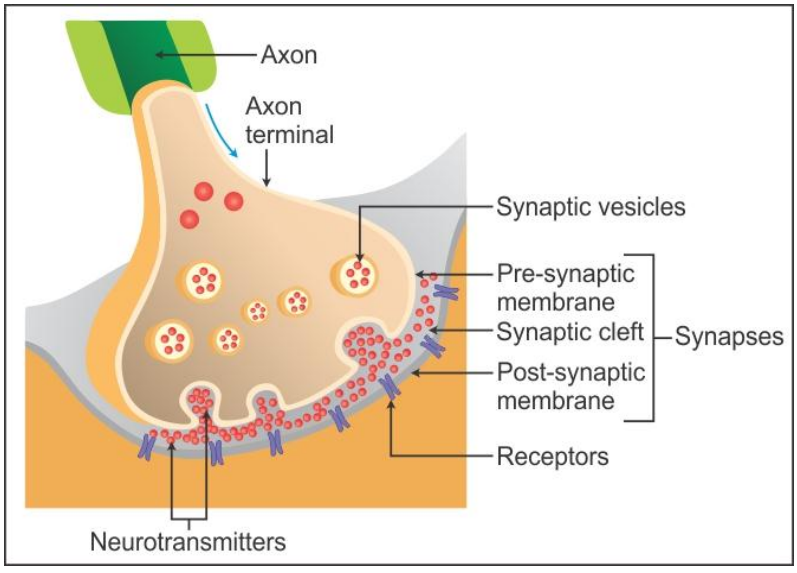
i. Fibrinogens help in the clotting or coagulation of blood.
ii. Globulins, also called immunoglobulins, are involved in defence mechanisms of the body.
iii. Albumins and globulins retain water and thus help in maintaining the osmotic balance.
iv. Plasma proteins help in the uniform distribution of heat all over the body.

OR

Transmission of a nerve impulse across chemical synapse: The nerve impulse is conducted across the synapse always from the axon to the dendron with the help of chemicals called neurotransmitters. The transmission of a nerve impulse involves two processes—neurosecretion and chemoreception.

i. Neurosecretion: When a nerve impulse reaches the end knob of the axon, a large number of sodium and calcium channels open due to which ions diffuse rapidly inside and become more concentrated in the synaptic cleft. Inside the synaptic knob, calcium ions bind the proteinous release sites on the inner surface of the presynaptic membrane and stimulate the synaptic vesicles to secrete neurotransmitter chemicals.

ii. Chemoreception: It is characterised by the reception of neurotransmitters at some special proteinous molecular sites, the chemoreceptors, on the postsynaptic membrane. This chemoreception causes depolarisation of the membrane by opening the Na+ ion channels and initiates a new action potential on the next neuron.



24. Significance of step-wise release of energy in respiration:

- The step-wise release of energy facilitates the utilisation of a relatively higher proportion of that energy in the synthesis of ATP.
- This provides a mechanism to control the rate of the pathway and the energy output according to the need of the cell because activities of enzymes for the different steps can be enhanced or inhibited by specific compounds.
- The same pathway may be utilised for forming intermediates used in the synthesis of other biomolecules.

SECTION D

25. Xylem vessels are tubular structures extending from the roots to the top of the plant. Water is filled inside the xylem capillaries and forms a continuous water column due to its cohesion and adhesion properties. A pull called the transpiration pull is generated due to transpiration. Loss of water from the mesophyll cells causes a decrease in the water potential. Water moves from cell to cell along the water potential gradient. This exerts the pull, and the water filled in the xylem comes to a state of tension. This tension which is generated at the top of the unbroken water column is transmitted downwards from the stem and finally reaches the roots. This tension or pull results in the upward movement of water.

Factors affecting transpiration:

i. Temperature: The rate of transpiration increases with the increase in atmospheric temperature because the temperature increases the rate of water evaporation from the cell surface, opens the stomata and decreases the relative humidity of the atmosphere.
ii. Relative humidity: Relative humidity is the percentage of water vapour present in the air at a given time and temperature relative to the amount required to be present to make the air saturated at that temperature. The rate of transpiration is inversely proportional to the relative humidity.
iii. Light: In most plants, the stomata open in the presence of light and close in darkness. The rate of transpiration increases in the presence of light and decreases in darkness.
iv. Wind: Transpiration is lower in still air because the water vapour accumulates around the transpiring organs. The movement of air increases the rate of transpiration by removing the saturated air around the leaves.

Importance of transpiration:

i. Ascent of sap: Ascent of sap mostly occurs due to the transpiration pull exerted by the transpiration of water.
ii. Turgidity: Transpiration maintains the shape and structure of plant parts by keeping the cells turgid.
iii. Removal of excess water: Plants absorb far more amount of water than actually required by them. Thus, transpiration removes excess of water.
iv. Distribution of mineral salts: Mineral salts are mostly distributed by the rise of sap.

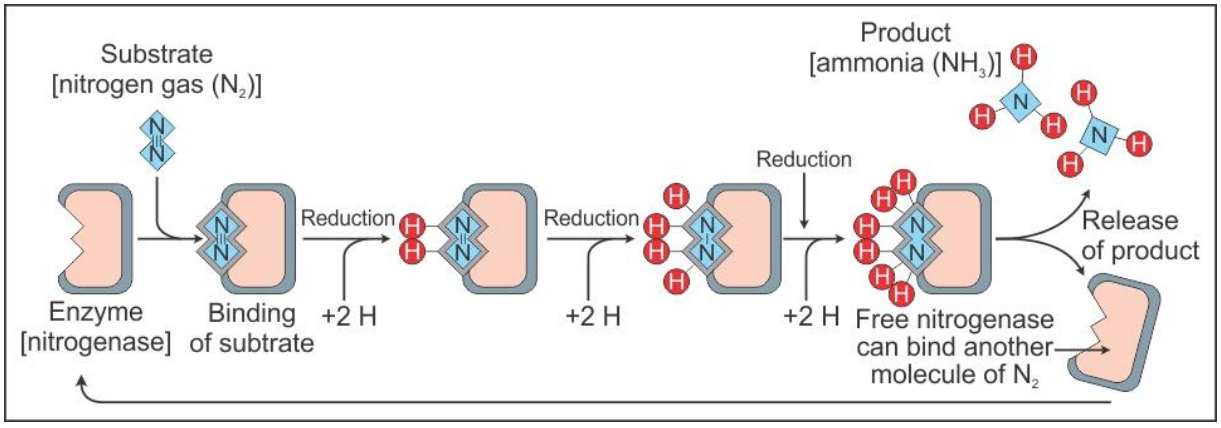
OR

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

i. Reducing environment
ii. Presence of enzyme nitrogenase
iii. Source of energy as ATP
iv. Source of reducing power, $NAD(P)H_2$ or $FMNH_2$
v. Ferredoxin as electron donor
vi. Keto acids for picking up the amino group
vii. Reduced availability of nitrate in the substrate

Role of Rhizobium in N_2 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 nitrogenase activity.

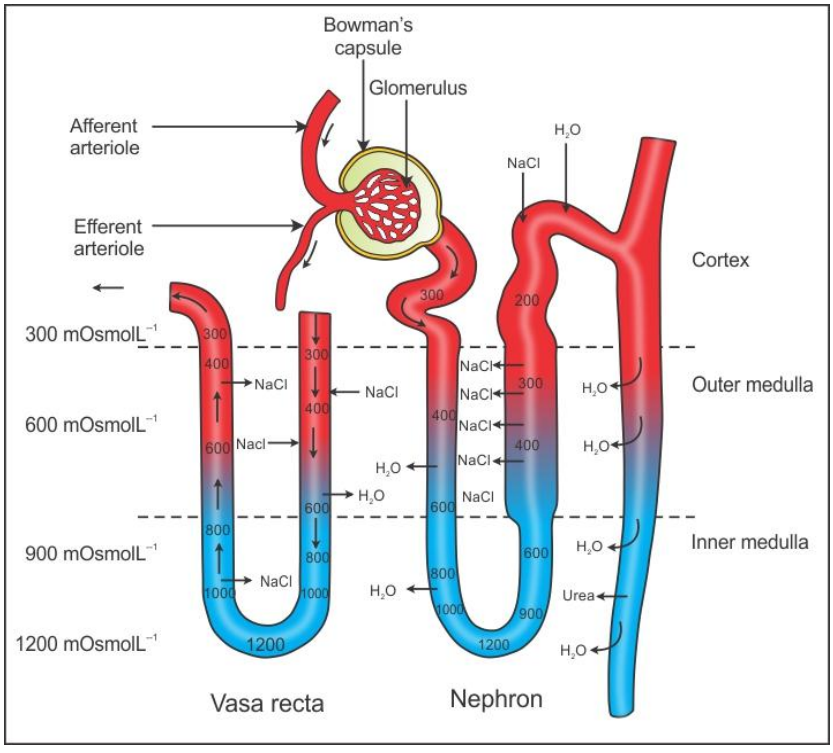


26. The loop of Henle and vasa recta play an important role in counter current mechanism. Glomerular fluid in the loop of Henle and blood in the vasa recta flow in opposite directions and thus form a counter current mechanism which helps in concentrating urine.

i. Loop of Henle: The glomerular filtrate passes through the ascending limb of the loop of Henle. NaCl is transported by the ascending limb of the loop of Henle. The increased concentration of the solutes, Na^+ and Cl^- in the interstitial fluid draws out water by osmosis from the descending limb and collecting duct. Water enters the vasa recta and is carried away. This maintains the high concentration of solutes in the interstitial fluid around the loop of Henle and the collecting duct. This helps turn the isotonic glomerular filtrate into hypertonic urine.

ii. Vasa recta: The walls of vasa recta are permeable to ions, water and urea. As the blood flows in the descending capillary of the vasa recta towards the renal medulla, water is drawn out from the blood plasma by osmosis. Sodium and chloride ions and urea enter the plasma by diffusion. As the blood flows in the ascending capillary towards the renal cortex, water re-enters the plasma and Na^+, Cl^- and urea leave it due to a decrease in concentration of the interstitial fluid.

The counter current exchange in the vasa recta prevents the loss of sodium and chloride ions from the renal medulla and helps maintain the concentration gradient in the renal medulla. Hence, the counter current mechanism concentrates the urine by maintaining a high salt concentration and the production of hypertonic urine conserves the water in the body.



OR

i.
(a) Alveolar sac
(b) Secondary bronchus
(c) Alveoli
(d) Bronchioles
(e) Trachea

ii. 3 in the right lung and 2 in the left lung

iii. 11 cm long and 2.5 cm wide

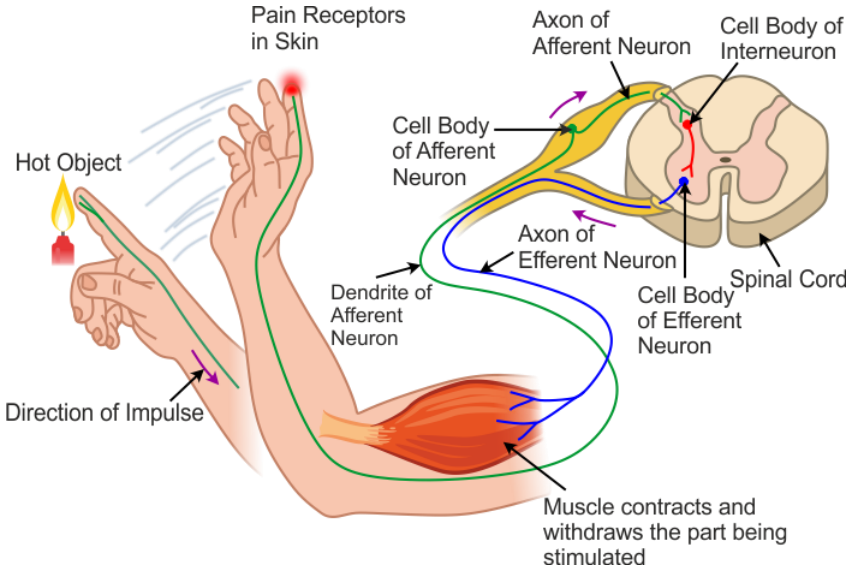
iv. It closes the glottis during swallowing to check the entry of food into the food pipe.

v. Thoracic cavity

27. The path followed by a stimulus while eliciting a response in a reflex action is called a reflex arc.

Components and functions of a reflex arc in a reflex action:

- The sensory receptor receives a stimulus and sets up a sensory impulse.
- The afferent neuron brings the sensory impulse from the receptor to the central nervous system.
- The association neuron transfers the impulse from the afferent neuron to the efferent neuron. The efferent neuron carries the motor impulse from the central nervous system to the specific effector.
- The effector is the organ/gland which functions according to the impulse received.



OR

Peptide hormones secreted by the gastrointestinal tract and their functions:

Hormones	**Functions**
Gastrin	Controls the secretion of gastric juice by the gastric glands
Secretin	Acts on the exocrine region of the pancreas and stimulates the secretion of water and bicarbonate ions
Cholecystokinin (CCK)	Acts on the pancreas to secrete pancreatic enzymes. Acts on the gall bladder to release bile juice into the duodenum
Gastric inhibitory peptide (GIP)	Inhibits gastric secretion and motility

Examples of hyperglycaemic hormone:

- Glucagon
- Cortisol