

NAAHAR PUBLIC SCHOOL(CBSE) SENIOR SECONDARY,
 AYYUR AGARAM, VILLUPURAM
A.Y. 2022-2023, ANNUAL EXAMINATION,

CLASS: XI – A1
 Sub: BIOLOGY(044)
 Tr. Initial: MHR / ATCHAYA

Duration: 3 hours
 Max. Marks: 70
 Date: 03.03.2023

General Instructions:
 SECTION-A carries 20 marks.
 (Multiple choice questions : 10 marks, Diagram based 5 marks, Case based- 5 marks)
 SECTION-B carries 15 marks.
 (Very Short Questions : 8 marks, Assertion & Reasoning Questions : 7 marks)
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 SECTION-C carries 35

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such questions. When necessary neat and properly labeled diagram should be drawn.

SECTION A

1	Match the columns I and II select the correct option. <table border="1" style="width: 100%; border-collapse: collapse; margin: 10px 0;"><tr><td style="width: 5%;"></td><td style="width: 20%; text-align: center;">Column I</td><td style="width: 5%;"></td><td style="width: 20%; text-align: center;">Column II</td></tr><tr><td style="text-align: center;">1.</td><td>Lycopodium</td><td style="text-align: center;">p.</td><td>Alga</td></tr><tr><td style="text-align: center;">2.</td><td>Sequoia</td><td style="text-align: center;">q.</td><td>Moss</td></tr><tr><td style="text-align: center;">3.</td><td>Polytrichum</td><td style="text-align: center;">r.</td><td>Pteriophyte</td></tr><tr><td style="text-align: center;">4.</td><td>Dictyota</td><td style="text-align: center;">s.</td><td>Gymnosperm</td></tr></table> A. 1 = r, 2 = s, 3 = p, 4 = q B. 1 = s, 2 = r, 3 = q, 4 = p C. 1 = r, 2 = s, 3 = q, 4 = p D. 1 = q, 2 = t, 3 = p, 4 = q Ans: Lycopodium belongs to the division pteridophyta. Sequoia, also known as Californian redwood is a gymnosperm and the tallest known tree on Earth. Polytrichum is a bryophyte (moss) while Dictyota is a brown algae belonging to Phaeophyceae.		Column I		Column II	1.	Lycopodium	p.	Alga	2.	Sequoia	q.	Moss	3.	Polytrichum	r.	Pteriophyte	4.	Dictyota	s.	Gymnosperm	1
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4.	Dictyota	s.	Gymnosperm																			
2	Which one of these is not a characteristic feature of sponges? A. Cellular level of organization C. Body supported externally by cuticle D. Intracellular digestion Ans: In sponges, the body is supported by spicules made of calcium or silica or proteinaceous spongin fibres, but not cuticle.	1																				
3	Mesocarp, endosperm and thalamus are edible, respectively in: A. Apple, mango and coconut B. Coconut, apple and mango C. Coconut, mango and apple D. Mango, coconut and apple Ans: In mango and coconut, the fruit is known as a drupe. In mango, the middle fleshy edible mesocarp is edible. In coconut the part we eat is the endosperm. Apple is a false fruit, where the edible part is the fleshy thalamus.	1																				
4	In an annual ring, the light coloured part is known as A. Early wood B. Late wood C. Heart wood D. Sap wood Ans: The light colored part of the annual rings is the early wood that is formed during the spring. During this time, the physiological activity will be at its peak and therefore the wood is thicker and less denser, which makes it light in color.	1																				
5	Which of the following statements about a prokaryotic cell is incorrect? A. It has no Golgi apparatus B. It is generally smaller than a eukaryotic cell C. It has an impermeable membrane that encloses the DNA D. Electron transport chain takes place at the cell membrane Ans: Prokaryotic cells do not have a nucleus and any other membrane-bound organelles. The function of mitochondria is performed by the proteins embedded in the plasma membrane. Most of the prokaryotic cells are smaller in size than the eukaryotic cells.	1																				
6	When there is an increase in the condensation of chromatin during the process of cell division – A. Heterochromatin increases B. Euchromatin increases	1																				

	C.Differentiation of euchromatin & heterochromatin decreases D.Differentiation of euchromatin & heterochromatin increases	
7	In Hatch and slack pathway, the primary carbon dioxide acceptor is A. PhosphoenolpyruvateB. Phosphoglyceric acid C. Oxaloacetic acidD. Rubisco	1
8	Oxidative phosphorylation usually refers to _____ A.Anaerobic production of ATPB.Citric acid cycle production of ATP C.Alcoholic fermentationD.None of the above	1
9	Which of the following statements is true about Trachea in a respiratory system? A.It functions as passages of air to each alveolusB.It functions for sound production C.It Acts as passage of air to bronchiD.It Lowers the surface tension	1
10	_____ is a condition where plaque builds up on the inside of arteries. A.ArthrocentesisB.Arthralgia C.ArthritisD.Atherosclerosis	1
11	i) Identify the given picture. ii) Find and explain the processes where they are involved.	2
12	i) Identify and explain the process taking place in A & B.	3
13	The detailed structure of the membrane was studied only after the advent of the electron microscope in the 1950s. Meanwhile, chemical studies on the cell membrane, especially in human red blood cells (RBCs), enabled the scientists to deduce the possible structure of the plasma membrane. These studies showed that the cell membrane is composed of lipids, proteins and carbohydrates. - Which component of the plasma membrane is arranged as a bilayer? - Nucleic acid b) Lipid - Protein - Carbohydrate - The lipid component of the membrane mainly consists of _____. a) Phosphoglycerides - Amino - acids - Glycoproteins - What percentage of the membrane of human erythrocytes consists of proteins? 40 70 c) 52	5

	d) 66 2. Depending on the ease of extraction, membrane proteins can be of _____ types. a) Three b) Two c) Four d) Five 2. Assertion: The plasma membrane is selectively permeable to some molecules present on either side of it. Reason: Neutral solutes may move across the membrane by the process of simple diffusion. a) Both assertion and reason are true, and reason is the correct explanation of the assertion. b) Both assertion and reason are true, and reason is not the correct explanation of the assertion. c) Assertion is true but reason is false. d) Both assertion and reason are false.									
	SECTION – B									
14	State the differences between flora, fauna, and vegetation. Ans. <table><tr><td>Flora</td><td>Fauna</td><td>Vegetation</td></tr><tr><td>Flora refers to the total number of plants found in a particular area at a particular time.</td><td>Fauna refers to the total number of animals found in a specific region at a particular time.</td><td>It is a broad term used for the plants and animals of a region. It does not refer to any particular taxa or botanical characteristics.</td></tr></table>	Flora	Fauna	Vegetation	Flora refers to the total number of plants found in a particular area at a particular time.	Fauna refers to the total number of animals found in a specific region at a particular time.	It is a broad term used for the plants and animals of a region. It does not refer to any particular taxa or botanical characteristics.	1		
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15	Explain the myth of ‘fairy rings’ created by the mushrooms after heavy rains in the forest. Ans. The mycelium of the mushroom absorbs nutrients from the soil. The nutrients in the centre get exhausted and grow in diameter thereby forming a circle. These rings are the fruiting bodies of the fungus and are known as ‘fairy ring’.	1								
16	Differentiate between the hypogeal germination and epigeal germination. Ans. <table><tr><td>Hypogeal Germination</td><td>Epigeal Germination</td></tr><tr><td>Rapid growth and elongation of epicotyl.</td><td>Rapid growth and elongation of the hypocotyl.</td></tr><tr><td>The seed cotyledons are inside the soil.</td><td>The seed cotyledons are above the soil.</td></tr><tr><td>Cotyledons are not green and non-photosynthetic.</td><td>Cotyledons are green and photosynthetic.</td></tr></table>	Hypogeal Germination	Epigeal Germination	Rapid growth and elongation of epicotyl.	Rapid growth and elongation of the hypocotyl.	The seed cotyledons are inside the soil.	The seed cotyledons are above the soil.	Cotyledons are not green and non-photosynthetic.	Cotyledons are green and photosynthetic.	1
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17	Explain the cellular components of blood. Ans. Erythrocytes (RBCs), leucocytes (WBCs), and thrombocytes (platelets) are the key cellular components of blood and constitute 45% of the blood. The remaining 55% of the fluid is called plasma. In mammals, the erythrocytes are the biconcave-coloured cells, devoid of the nucleus, and thus, this creates space for carrying and transporting respiratory gases. The leukocytes, also known as white blood cells, are nucleated cells. These are primarily divided into granulocytes (neutrophils, eosinophils, and basophils) and agranulocytes (lymphocytes and monocytes). Leukocytes mainly help destroy foreign particles, as they possess a phagocytic nature. The megakaryocytes of the bone produce thrombocytes, the cell fragments, and help in clotting the blood.	1								
18	Can rubber be classified as a primary metabolite or a secondary metabolite? Write a short note on the rubber. Ans. It is a secondary metabolite and is extracted from the rubber tree (Hevea brasiliensis). Latex in the rubber tree is produced by the highly specialized cells in phloem called laticifers. Rubber is a terpenoid and because of its high tensile strength, plasticity, and elasticity, it is used across industries. It is a polymeric substance and is a good conductor of electricity.	1								
19	How are co-factors different from prosthetic groups? Ans: Prosthetic groups are organic compounds whereas cofactors can be organic or inorganic (metal ions). Prosthetics are distinguished from cofactors as they are tightly bound to the apoenzyme.	1								
20	State the difference between Expiratory and Inspiratory reserve volume. Ans:	1								

	Inspiratory reserve volume The additional volume of air that can be inspired by a person forcible inspiration which can range between – 2500ml – 3000ml	Expiratory reserve volume The additional volume of air that can be expired forcibly through a forcible expiration ranges between 1000ml-1100ml	
21	The walls of ventricles are much thicker than atria. Explain. Ans: The walls of ventricles are much thicker than atria because they pump blood more strongly than the atria.		1
	Question No. 22 to 28 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. (c) If Assertion is true but Reason is false. (d) If both Assertion and Reason are false.		
22	Assertion: Euglena is studied as an animal as well as a plant. Reason: Euglena is more an animal than a plant. Ans: (b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion. Euglena is a typical example of mastigophora. It is phytoflagellate as it possesses both chloroplast and flagella. It is autotrophic in sunlight, but becomes heterotrophic in dark. Because of its twofold nutritional abilities, it is usually studied as a plant as well as an animal. But it is more an animal than plant because of (a) The absence of cellulose cell wall overlying the plasma membrane. (b) Presence of centriole.		1
23	Assertion: Rhodophyta is red in colour of due to abundant formation of r-phycoerythrin. Reason: r-phycoerythrin is able to absorb blue green wavelength of light and reflect red colour. Ans: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. The red colour of Rhodophyta is due to abundan of the pigment r-phycoerythrin. Phycoerythrin absorbs blue green wavelengths of light and reflects red light where a imparts red colour to algae.		1
24	Assertion: Frogs undergo aestivation & hibernation Reason: Frogs take shelter in deep burrows to protect themselves from extreme heat & cold. Ans: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. Frogs are poikilotherms (cold-blooded). In order to protect themselves from extreme temperatures, they undergo aestivation and hibernation. Aestivation is also called summer sleep and hibernation is called winter sleep. They take shelter in burrows during aestivation and hibernation.		1
25	Assertion: The number of cells in a multicellular organism is inversely proportional to the size of body. Reason: All the cells in the biological world are of same size. Ans: (d) If both Assertion and Reason are false. Number of cells in a multicellular organism are directly proportional to the size of the body. On the other hand, it is a fact that cell vary greatly in their size. Mycoplasma cells are the smallest, ranging from 0.1 to 0.3µm, whereas human cells, generally range from 20 to 30µm. Nerve cells are the longest.		1
26	Assertion: Mitosis maintains the genetic similarity of somatic cells. Reason: Chromosomes do not undergo crossing over. Ans: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. Mitosis keeps all the somatic cells of an organism genetically similar, resembling the fertilized egg. 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. This helps in proper co-ordination among different cells.		1
27	Assertion: Leaf colouration is due to the presence of four pigments – Chlorophyll a, chlorophyll b, xanthophylls and carotenoids. Reason: Chlorophyll b is the chief pigment associated with photosynthesis. Ans: (c) If Assertion is true but Reason is false		1

	Chlorophyll a is found in all photosynthetic plants except bacteria. Hence, it is called as universal photosynthetic pigment. It is also called primary photosynthetic pigment because it performs primary reaction of photosynthesis which involves conversion of light into chemical energy. Other photosynthetic pigments like chlorophyll b, carotenes and xanthophylls are called accessory pigments.	
28	Assertion : Insects develop a complex system of air tubes called trachea for respiratory purpose. Reason : Exchange through body surface is not possible in insects. Ans: (a) If both Assertion and Reason are true and Reason is the correct explanation of Assertion. As the integument of insect is thick and impermeable to minimise loss of body water, they can not carry out gas exchange through their body surface. To overcome this difficulty they have developed a complex system of air tubes called trachea to reach the air directly near the tissue cells. Each trachea communicates with the exterior through openings in the body wall.	1
SECTION - C		
29	Describe the similarities in the sexual reproduction of moss and fern. Ans: The similarities in sexual reproduction of moss and fern are: (i) Oogamous mode of sexual reproduction involves fertilization of non-motile female gametes or eggs through motile male gamete/sperm. (ii) In both, the male sex organ consists of a jacket of sterile cells enclosing a spermatogenous tissue. (iii) Sperms are flagellate. (iv) Female sex organs (archegonia) are flask-shaped and have a tubular neck with a swollen basal venter. (v) External source of water is required for the swimming of sperms in order to reach the open archegonia. (OR) “All vertebrates are chordates but all chordates are not vertebrates” justify the statement. Ans: All vertebrates are chordates because they possess three basic chordate features: (i) All chordates possess a dorsal solid notochord throughout life or in the larval stage. (ii) All chordates possess a dorsal hollow nerve cord. (iii) All chordates have pharyngeal gill slits in some stages of the life cycle. All chordates are not vertebrates. Vertebrates have vertebral columns but protochordate and agnatha have notochord that is not replaced by the vertebral column.	2
30	What is a stomatal apparatus? Explain briefly. . Ans: Stomata are structures that are present in the epidermis of leaves. They regulate the process of transpiration and gaseous exchange. Each stoma present is composed of two bean-shaped cells called guard cells. They enclose a stomatal pore These guard cells are dumbbell-shaped, where the outer wall is thin and the inner wall is thick. These structures possess chloroplasts which regulate the closing and opening of the stomata. The epidermal cells present near the guard cells become specialised in their structure, shape, and size. They are commonly referred to as subsidiary cells. The guard cells, the stomatal aperture and girdling subsidiary cells are collectively known as the stomatal apparatus.	2
31	A cell having 32 chromosomes undergoes mitotic division. During metaphase, what will the chromosome number (N) of the cell? During anaphase, what will the DNA content of the cell be? Ans: Mitosis occurs in somatic cells of entities. The number of chromosomes is the same in both parent and daughter cell and remains unchanged even at anaphase or metaphors. The content of DNA, however, is doubled at the interphase or synthetic phase. The division takes place at the anaphase but the number of chromosomes remains unchanged.	2
32	In a C3 plant, a light dependent cyclic process is occurring that requires oxygen. Instead of producing, it consumes energy. a) Name the process b) Is it necessary for survival c) Write the end products of this process d) Where does it take place? Ans: a) Photorespiration b) Not necessary for the survival of a C3 plant. c) The end product – H₂O₂ d) Three cell organelles are involved – chloroplast, peroxisome, mitochondria (OR) List a hormone that: a) Is in nature, gaseous. b) Is in charge of phototropism.	2

	c) Influences femaleness in cucumber flowers. d) Is utilized to kill weeds(dicots). e) In long-day plants, induces flowering. Ans: a) Ethylene(C₂H₄) b) Auxin. c) Ethylene(C₂H₄). d) Auxin. e) Gibberellin.	
33	Write a note on the mechanism of breathing Ans: a) Inspiration – It is induced by the diaphragm contraction that raises the volume of the thoracic chamber in the anteroposterior axis. The inter-costal muscles contracts causing external protrusion of the sternum and ribs resulting in an increment in the volume of the thoracic chamber in the dorsoventral axis. This increase in the thoracic volume results in a similar increase in pulmonary volume causing reduced intrapulmonary pressure to lesser than the atmospheric pressure which results in inspiration. b) Expiration – The inter-costal muscles reverse the sternum and diaphragm to their original positions with the diaphragm relaxing, which decreases the thoracic volume and hence the pulmonary volume. Expulsion of air occurs as the intra-pulmonary pressure increases to a level somewhat above the atmospheric pressure causing expiration.	2
34	Give an account of the asexual reproduction by spores in algae. A.1. Asexual reproduction in algae involves the formation of several kinds of spores. • Zoospores- Motile, naked spores with two, four or many flagella. For eg., Chlamydomonas possess biflagellate zoospores, Ulothrix possess quadriflagellate zoospores and Oedogonium possess multiflagellate zoospores. • Aplanospores- These spores are non-motile. They may be formed either singly or by the division of protoplast to form several aplanospores. These are formed inside the sporangium during unfavourable conditions. Eg., Microspora. • Tetraspores- Tetraspores are produced by diploid plants of some algae. These are a special type of haploid aplanospores formed within tetrasporangium. • Akinetes- These are thick-walled spore-like structures with abundant food reserves. They can survive under unfavourable conditions. • Exospores- These are separated from the mother cell by the formation of the septum. They are formed near the end of the mother cell. Eg., Chamaesiphon • Endospores- The mother protoplast divides and forms the endospores. They are also known as conidia or gonidia. These are formed to survive under unfavourable conditions. Eg., Dermocarpa (OR) What are the different phases of growth in plants? Give characteristics of each. Ans: Growth is the most fundamental characteristic of all living organisms. It is an irreversible and permanent metabolic process. Plants have a unique ability to continue throughout their life cycle. This entire process is carried out by the specialized cells called meristems. Phases of growth in plants There are three phases of growth in plants. Meristematic (Formative phase) – This phase consists of continually dividing cells called meristematic cells at the root apex and shooting apex. The cells in this region have large nuclei and rich protoplasm. The cell walls of these cells are primary, thin cellulose with abundant plasmodesmata connections. Elongation (Cell enlargement phase) – The cells of elongation are present just after the meristematic region. The cells of this region have increased vacuolation, cell enlargement, and new cell wall deposition. Cell enlargement may be linear or in all directions. Maturation phase – These cells are present just below the phase me of elongation, but away from the apex where the phase of maturation is found. The cells in this region reach their maximal size with cell wall thickening and new protoplasm formation. They form various simple and complex tissues of plants to perform different functions.	3
35	Describe the Rh incompatibility in humans, give schematic representation. Ans: Rh antigen is seen on the RBC surface of majority humans, these are called Rh-positive individuals and when the antigen is absent they are Rh-negative individuals. Both these individuals are phenotypically normal individuals. However, in these individuals, a problem emerges during pregnancy or transfusion of blood. The first blood transfusion from Rh-positive blood to the RI-T individual leads to no harm as the Rh-negative person acquires antibodies or Rh factors in their blood. During the second transfusion of blood, from Rh-positive blood to the Rh-negative individual, the antibodies already formed attack to destruct the RBC of the donor. In pregnancy, if the father's blood is Rh-positive and the mother's blood is Rh-negative, the blood of the fetus will be Rh-positive, which leads to serious	3

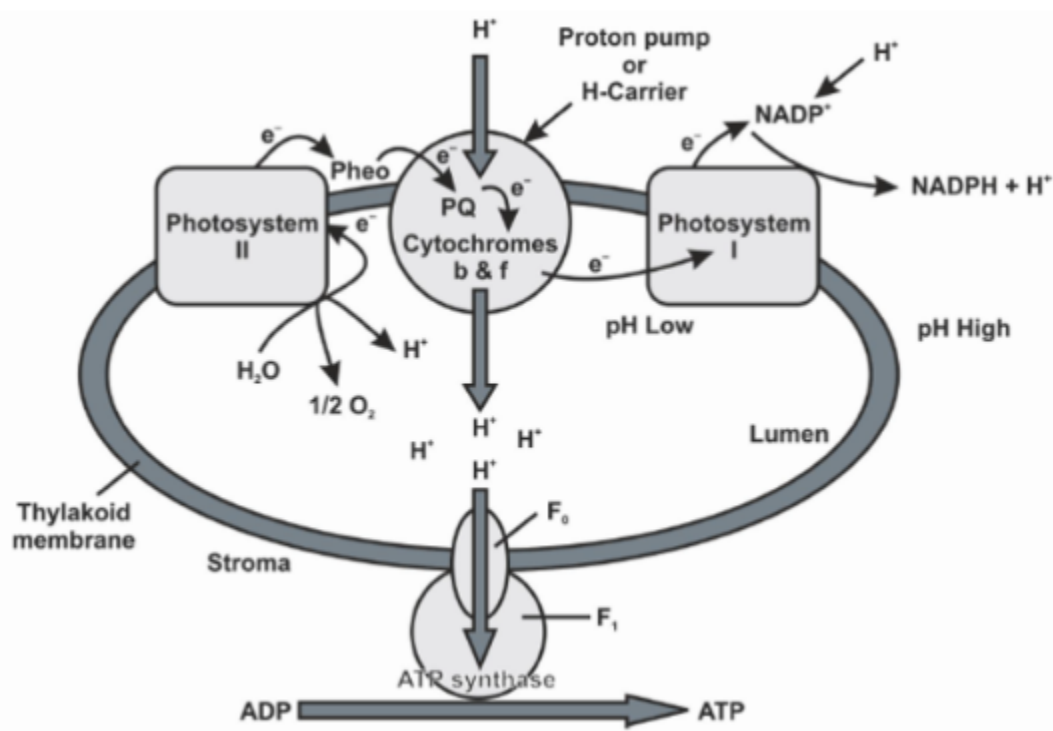
issues. The Rh antigens of the fetus are not exposed to the Rh-positive blood of the mother during the first pregnancy, as they are separated from the placenta. But in the succeeding Rh-positive fetus, the anti-Rh factors from the mother destruct the RBCs of the fetus as the blood mixes which causes hemolytic disease in the newborn(HDN) known as erythroblastosis fetalis. This can be prevented through the administration of anti-Rh antibodies to the mother after the delivery of the first child

(OR)

Briefly explain the chemiosmotic hypothesis?

Ans: The mechanism of ATP synthesis in chloroplasts was explained by the chemiosmotic hypothesis. ATP generation in photosynthesis is tied to the formation of a proton gradient across a membrane. These are thylakoids membranes. The proton accumulation is toward the membrane's interior (in the lumen).

The mechanisms that happen during electron activation and transit to establish the steps that lead to the formation of a proton gradient. The establishment of a proton gradient is linked to the synthesis of ATP.



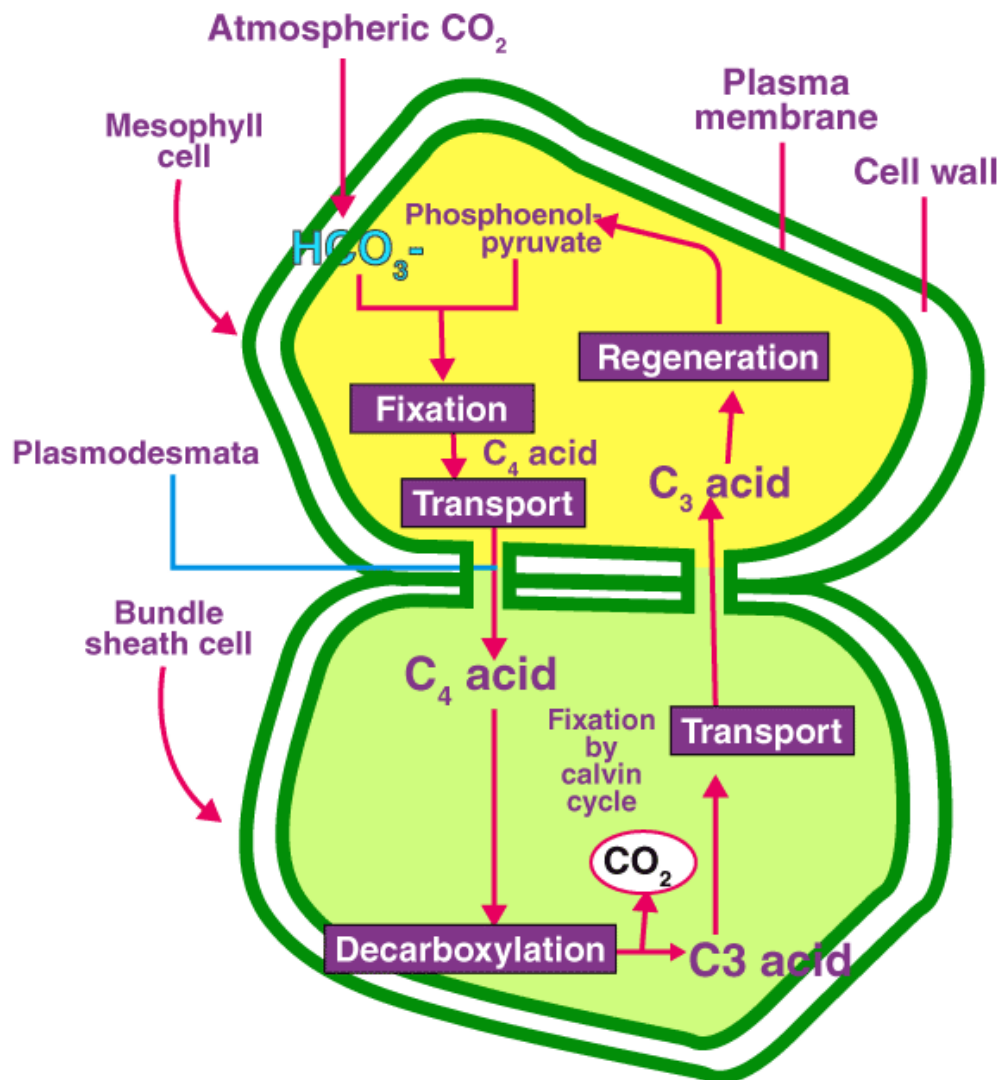
36 Explain Glycolysis with flowchart. State where it occurs and its end products. In both aerobic and anaerobic respiration, determine the fate of these products.

Ans: It takes place in the cytoplasm of the cell and is seen in all living entities. In this, glucose goes through partial oxidation for the formation of pyruvic acid(2 molecules). It is obtained from the sucrose in plants which is the resulting product of photosynthesis. Invertase converts sucrose into fructose and glucose which enter into the glycolytic pathway. These are phosphorylated to produce glucose-6-phosphate which isomerizes to generate fructose-6-phosphate. A sequence of 10 reactions regulated by different enzymes occurs in glycolysis to yield pyruvate from glucose. The chief product of glycolysis is pyruvic acid. The cellular need decides pyruvate’s metabolic fate. The three modes in which various cells manage pyruvic acid produced by glycolysis are – lactic acid fermentation, aerobic respiration, and alcoholic fermentation. Under anaerobic conditions in unicellular eukaryotes and prokaryotes, fermentation takes place. Krebs’ cycle or aerobic respiration is observed in entities for the complete oxidation of glucose into carbon dioxide and water which requires the supply of oxygen.

37 (a) Explain how our heart muscles get a continuous supply of atmospheric oxygen.

Ans: The O2 is absorbed into the lungs during inspiration. Alveolar air, which has a PO2 of 100 m Hg, is formed when O2 reacts with the air already present in the alveoli. Because the PO2 of blood in arteries is 40 mmHg, oxygen enters blood vessels differently than it does in alveoli, and oxyhaemoglobin is generated when oxygen loosely interacts with the Fe++ ions of haemoglobin.

	The pulmonary vein transports oxygenated blood from the lungs to the left auricle, and the aorta transports blood to the left ventricle. The coronary artery is the branch that supplies blood to the heart muscles. Because the PO₂ in heart muscles is lower than the blood in coronary artery branches, oxyhaemoglobin dissociates and releases O₂ to cardiac muscles. (b) Define oxygen dissociation curve? Why it has a sigmoidal pattern? Ans: The graph produced by the connection between O₂ tension and its absorption by haemoglobin is known as the oxygen dissociation curve (O₂ equilibrium curve). Hb is 98 per cent saturated at about 100 mm Hg O₂ tension (complete formation of haemoglobin). The saturation of Hb gradually reduces as it declines. Oxyhaemoglobin dissociates and O₂ is accessible to the tissues when O₂ tension is around 40mm Hg. The O₂ binds to Hb on the lung surface and then dissociates in the tissues.	
38	Explain the events in the cardiac cycle. Describe ‘double circulation’. Ans: The cardiac cycle makes for one heartbeat i.e., one complete cycle of relaxation and contraction occurring in the cardiac muscles, where one heartbeat constitutes for contraction(systole) and relaxation(diastole) of atria and ventricles. The events are: ● Atrial systole – Due to the wave of contraction, the atria contracts, that is triggered by the sino-atrial node. As the bicuspid and the tricuspid valve are open, the blood is forced into the ventricles. ● Beginning of the ventricular systole – The wave of contraction triggered by the AV node causes the contraction of ventricles that leads to the bicuspid and tricuspid valve to close and hence generates the first heartbeat sound – “lub” ● Complete Ventricular Systole – After the ventricles contract, blood flows into the pulmonary trunk and aorta due to the opening of the semilunar valves. ● Beginning of the ventricular diastole – The ventricles relax while the semilunar valves remain closed, which causes the second heart sound – dub. ● Complete ventricular diastole – A fall in pressure of ventricles causes the opening of the bicuspid and the tricuspid valve and hence blood flows from the atria to the ventricles. Blood does not flow in the backward direction due to the contraction of the heart as the pressure inside the relaxed ventricles is lesser in comparison to the atria and the veins.	3
39	Give diagrammatic representation of Hatch and slack pathway.Mention its significance.	5



(OR)

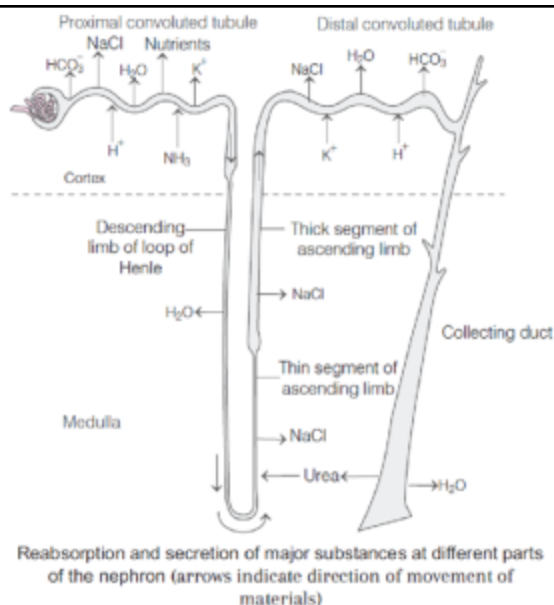
What are the main processes of urine formation? Draw a labelled diagram showing the events take place at different parts of the nephron.

Ans: The process of urine formation is known as uropoiesis. The process involves three steps:

- **Glomerular filtration:** The filtration of blood is carried out by the glomerulus. This is why this step is known as glomerular filtration. The blood rushes into the glomerular capillaries with high pressure and gets filtered across the thin walls of the capillaries. The glomerular filtrate is plasma minus proteins and consists of glucose, amino acids, water, urea, uric acid, hippuric acid, salts, vitamins, creatinine, bicarbonates, phosphates, etc.
- **Selective reabsorption:** This step involves the formation of urine with the filtrate. The process is called reabsorption. In PCT, the maximum reabsorption from glomerular filtrate takes place. Glucose and amino acids are absorbed 100 % by active transportation and do not appear in the urine in normal conditions. Active transportation requires energy in the form of ATP and is against the concentration gradient. Urea and uric acid are not completely reabsorbed and appear in urine under normal conditions. Creatinine and sulphates are not at all absorbed in this step. The absorption of chloride is passive. The counter-current mechanism makes the fluid more concentrated in Henle's Loop. The absorption of sodium occurs in ascending loop only. The water absorption in DCT and collecting tubule and collecting duct is ADH dependent.

The water absorption is 60 – 70 % in PCT, 15 % in Henle's loop and 4-5 % in DCT.

- **Tubular secretion:** It is an essential step in urine formation. Certain chemicals in the blood which are not removed from the glomerular capillaries are removed in this step. There is the maintenance of ionic and acid-base balance by the removal of ions and other molecules which are toxic at elevated levels. The maximum tubular secretion is added from PCT and DCT linings. It includes the addition of creatinine, ammonia, hydrogen ions, potassium ions and uric acid into the glomerular filtrate.



40 (a) Describe the lock & key hypothesis of enzyme action?

Ans: Fischer's lock and key hypothesis of enzyme activity state that if the proper key fits in the right lock, the lock can be opened; otherwise, the lock cannot be unlocked. To interpret the preceding in the context of enzyme function, it is assumed that molecules have precise geometric forms. Proteins can operate as enzymes because their form creates a space configuration into which other molecules can fit. The compounds that are acted on by enzymes are referred to as enzyme substrates.

Only substrate molecules with the proper geometric shape can fit into the active site of the enzymes, according to the aforementioned premise. However, under certain conditions, other molecules that are similar to the substrate might potentially bind with the active site of the enzyme. In such instances, molecules may compete with the substrate, causing the process to slow or cease. This is known as competitive inhibition.

(b) How do enzymes bring about a high rate of chemical conversions?

Ans: Enzymes are known as biological system catalysts because they speed up chemical reactions or their rates. Enzymes bind to the substrate, and the resulting 'enzyme-substrate complex has lower activation energy, implying that the 'amount of energy required to activate the chemical process is smaller, and thus the process is faster. The lower the activation energy, the faster the chemical reactions.

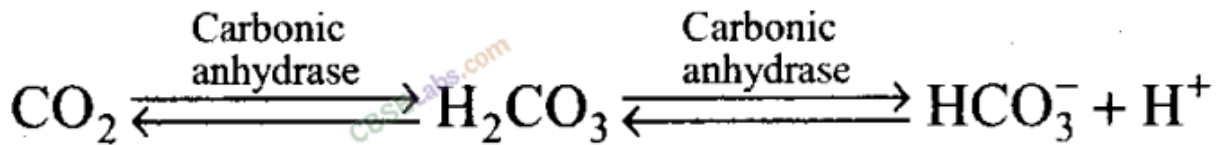
(OR)

Explain the transport of O_2 and CO_2 between alveoli and tissue with a diagram.

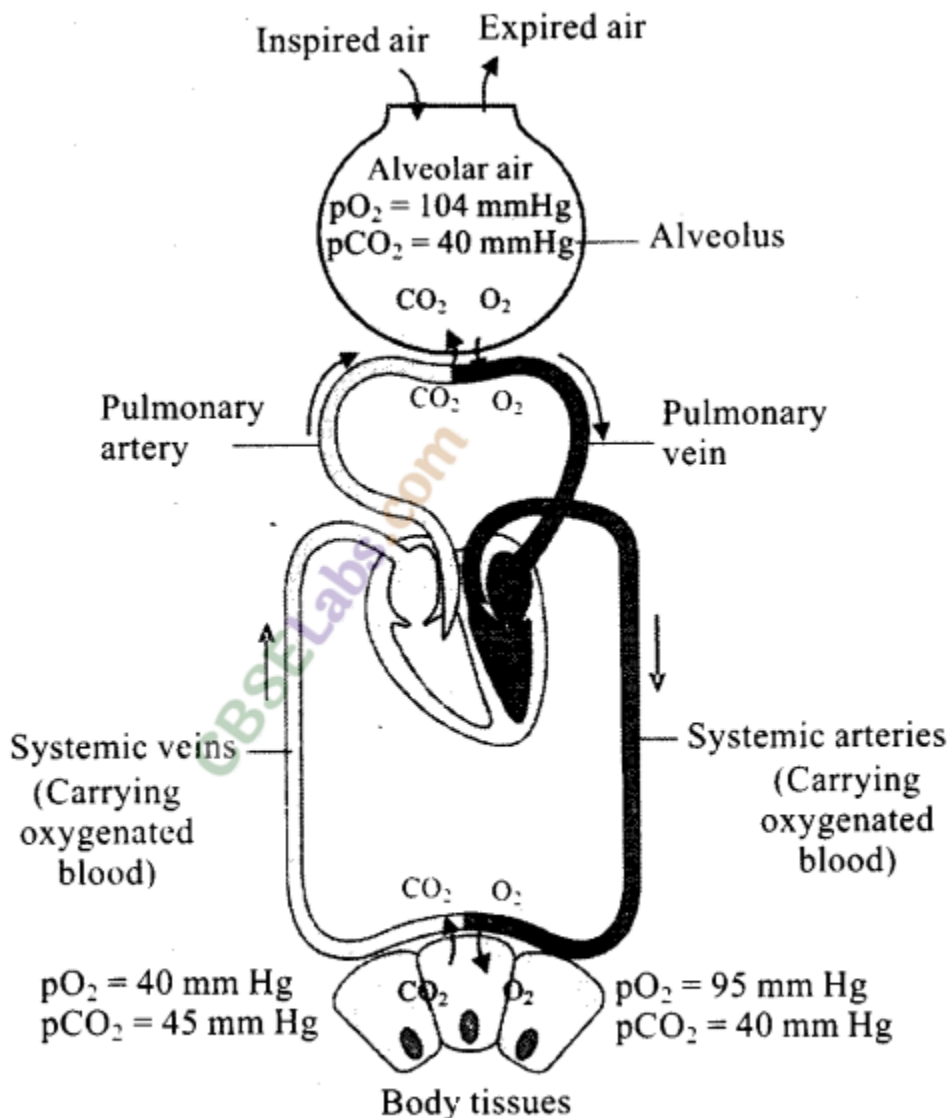
Ans:

- **Transport of gases:** Blood is the medium of transport for O_2 and CO_2 . About 97% of O_2 is transported by RBCs in the blood. The remaining 3% of O_2 is carried in a dissolved state through the plasma. Nearly 20-25% of CO_2 is transported by RBCs whereas 70% of it is carried as bicarbonate. About 7% of CO_2 is carried in a dissolved state through plasma.
- **Transport of oxygen:** Haemoglobin is a red coloured iron containing pigment present in the RBCs. O_2 can bind with haemoglobin in a reversible manner to form oxyhaemoglobin. Each haemoglobin molecule can carry a maximum of four molecules of O_2 . Binding of oxygen with haemoglobin is primarily related to partial pressure of O_2 . Partial pressure of CO_2 , hydrogen ion concentration and temperature are the other factors which can interfere with this binding. A sigmoid curve is obtained when percentage saturation of haemoglobin with O_2 is plotted against the pO_2 . This curve is called the Oxygen dissociation curve and is highly useful in studying the effect of factors like pCO_2 , H^+ concentration, etc., on binding of O_2 with haemoglobin. In the alveoli, where there is high pO_2 , low pCO_2 , lesser H^+ concentration and lower temperature, the factors are all favourable for the formation of oxyhaemoglobin, whereas in the tissues, where low pO_2 , high pCO_2 , high H^+ concentration and higher temperature exist, the conditions are favourable for dissociation of oxygen from the oxyhaemoglobin. This clearly indicates that O_2 gets bound to haemoglobin in the lung surface and gets dissociated at the tissues. Every 100 mL of oxygenated blood can deliver around 5 mL of O_2 to the tissues under normal physiological conditions.
- **Transport of carbon dioxide:** CO_2 is carried by haemoglobin as carbamino-haemoglobin (about 20-25%). This binding is related to the partial pressure of CO_2 . pO_2 is a major factor which could affect this binding. When pCO_2 is high and pO_2 is low as in the

tissues, more binding of carbon dioxide occurs whereas, when the $p\text{CO}_2$ is low and $p\text{O}_2$ is high as in the alveoli, dissociation of CO_2 from carbamino-haemoglobin takes place, i.e., CO_2 which is bound to haemoglobin from the tissues is delivered at the alveoli. RBCs contain a very high concentration of the enzyme, carbonic anhydrase and minute quantities of the same is present in the plasma too. This enzyme facilitates the following reaction in both directions



At the tissue site where partial pressure of CO_2 is high due to catabolism, CO_2 diffuses into blood (RBCs and plasma) and forms HCO_2^- and H^+ . At the alveolar site where $p\text{CO}_2$ is low, the reaction proceeds in the opposite direction leading to the formation of CO_2 and H_2O . Thus, CO_2 trapped as bicarbonate at the tissue level and transported to the alveoli is released out as CO_2 . Every 100 mL of deoxygenated blood delivers approximately 4 mL of CO_2 to the alveoli.



Exchange of gases at the alveolus and the body tissues with blood and transport of oxygen and carbon dioxide