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### UACE Biology 2020 paper 1

#### Answer all questions

- Which one of the following parts of a cell replenishes the cell membrane?
  - Rough endoplasmic reticulum
  - Smooth endoplasmic reticulum
  - Nucleus
  - Golgi apparatus
- The sequence of bases that will be produced as a result of transcription of a DNA molecule CGACCCAG is
  - GCTGGGTC
  - GCUGGGUG
  - UUACCCAG
  - CGACCGGAC
- Which one of the following statement is correct about non-essential amino acids in animal cell? They
  - Less than the essential amino acids
  - Of less nutritive value
  - Synthesized by the body
  - Taken up in the diet.
- A characteristic that makes ferns better adapted for life on land than mosses is
  - Having a dominant gametophyte
  - Producing large quantities of spores
  - Possessing vascular tissue
  - Having relatively large frond
- Which one of the following features can be used to differentiate nematodes from Platyhelminthes? Body
  - Body shape
  - Symmetry
  - Segmentation
  - layers
- Why don't small insects use their body surface for gaseous exchange? They
  - Waxy cuticle
  - Spiracles with valves
  - High surface area to volume ratio
  - Shortened bodies
- The challenge created by parallel flow of water and blood in the gill of a dogfish can be improved by

- A. Fast flow of water in gills relative to that of blood.
  - B. Increased movement of the fish through water
  - C. Vertical septum deflecting water to pass over the gills
  - D. Keeping the mouth and spiracles always open
8. Which one of the following is **not** a result of increase in metabolic rate during exercise?
- A. Increase in carbon dioxide concentration in the skeletal muscle
  - B. Dilation of the arterioles in the skeletal muscles
  - C. Increased in the temperature of skeletal muscles
  - D. Decrease in the respiratory quotient of skeletal muscle.
9. Which one of the following is the final electron acceptor in non-cyclic photophosphorylation?
- A. Cytochrome
  - B. Ferredoxin
  - C. NADP
  - D. Oxygen
10. Which one of the following is incorrect about C4 plant? They
- A. Fix carbon dioxide using the enzyme PEP carboxylase
  - B. Fix carbon dioxide using RuBP carboxylase
  - C. Efficiently fix carbon dioxide at very high temperatures
  - D. Use less energy than c3 plants
11. Dioecious plant species are rare in spite of having the advantages of cross pollination because
- A. The male and female plants are usually far apart
  - B. Others and stigma mature at different times
  - C. Half of the individuals plants do not produce seeds
  - D. Only few agents of dispersal are involved
12. Which one of the following may result from under secretion of cholecystokinin? Poor digestion of
- A. Fats in the duodenum
  - B. Proteins in the stomach
  - C. Lactose in the ileum
  - D. sucrose
13. How do marine fish overcome excessive loss of water
- A. Having a large volume of glomerular filtrate
  - B. Absorption of salts by chloride secretory cells
  - C. Having small and few glomeruli
  - D. Excreting ammonia as nitrogenous waste
14. Which one of the following statements explains why insulin must **not** be taken orally by a diabetic patient?
- A. It easily breaks down when mixed with saliva
  - B. It can easily be digested in the gut
  - C. The alkalinity in the mouth may destroy it
  - D. Saliva inactivates insulin
15. Which one of the following stages of impulse transmission would be most affected by conditions of low respiration rates in the body?
- A. Depolarization
  - B. Hyperpolarization
  - C. Propagation
  - D. Repolarization
16. Collenchyma cells differ from sclerenchyma cells in that collenchyma

- A. Have unevenly thick walls
  - B. Have great tensile strength
  - C. Have simple pits
  - D. Are made of dead material
17. Which one of the following processes requires carrier proteins?
- A. Exocytosis
  - B. Phagocytosis
  - C. Facilitated diffusion
  - D. Pinocytosis
18. Which one of the following is true for both enzymes and inorganic catalysts? They
- A. highly specific in the reactions they catalyse
  - B. affected by changes in pH
  - C. affected by changes in temperature
  - D. unchanged at the end of a reaction
19. Which one of the following characteristics is common to both algae and cyanobacteria?
- A. Both contain chlorophyll
  - B. Both have rigid cell walls
  - C. Their ribosomes are of the same size
  - D. They lack membrane bound organelles
20. Which one of the following happens when pressure in the ventricles reaches its maximum?
- A. Both semilunar and atrio-ventricular valves close
  - B. Semilunar valve open and atrio-ventricular valves close
  - C. Semilunar valves close and atrio-ventricular valve open
  - D. Both semilunar and atrio-ventricular valves open
21. Which one of the following promotes gaseous exchange in an earthworm?
- A. Having fully visible segment
  - B. Enclosing the body with elastic cuticle
  - C. Possession of a cylindrical body
  - D. High level of metabolic activity
22. The importance of photolysis in light stage of photosynthesis is that it releases
- A. electrons to stabilize chlorophyll in photosystem II
  - B. electrons to stabilize chlorophyll in photosystem I
  - C. hydroxyl ions which maintain pH
  - D. oxygen molecule used in respiration
23. What is the respiratory quotient (RQ) of a substrate, if its breakdown equation is
- $$C_{51}H_{98}O_6 + 145O_2 \rightarrow 102CO_2 + 98H_2O?$$
- A. 0.7
  - B. 0.9
  - C. 1.7
  - D. 1.0
24. In what form do terrestrial insect excrete nitrogenous wastes?
- A. Urea
  - B. Ammonia
  - C. Uric acid
  - D. Potassium urate
25. Which one of the following is true about a contracted myofibril compared to a relaxed one?
- A. H zone is narrow and A band is unchanged
  - B. Both A and I bands are narrow

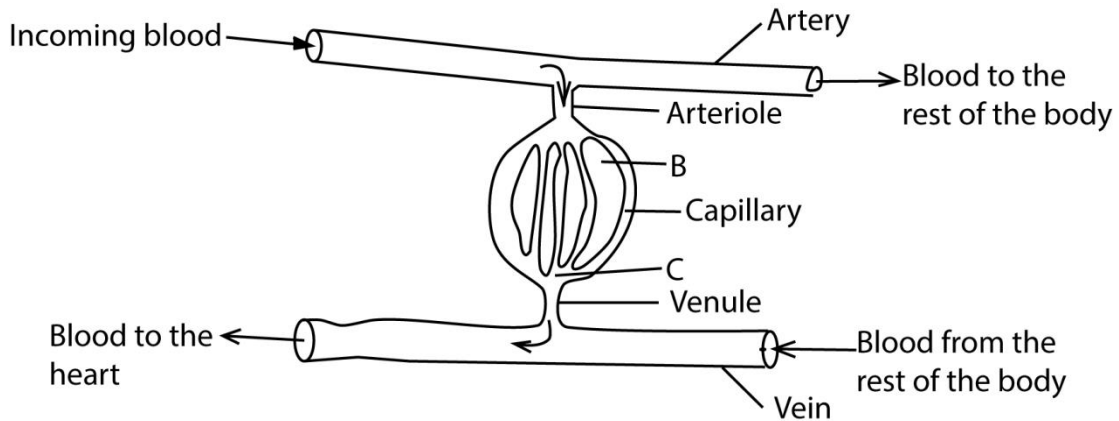
- C. I band is unchanged and A Band is narrow
  - D. Both H and A bands are narrow
26. The differentiation of sclerenchyma cells normally occurs when cell enlargement is virtually complete because
- A. Sclerenchyma change into collenchyma cells
  - B. During enlargement, cells develop additional thickening of walls
  - C. The cells lose a lot of water due to elongation of surrounding tissue
  - D. The cells soon die after gaining thick layers of lignin.
27. Which one of the following is **not** an advantage of the long absolute refractory period of cardiac muscles? It
- A. allows the muscles to beat forcefully
  - B. initiates excitation of the pace marker
  - C. prevents the heart from developing state of sustained contraction
  - D. enable the muscle to beat continuously, without fatigue
28. Which one of the following is **not** an adaptation of cells lining the proximal tubules for reabsorption?
- A. Possession of numerous mitochondria
  - B. Closeness to blood capillaries
  - C. Having numerous pinocytotic vesicles
  - D. Large fluid filled spaces separate the cells
29. Which one of the following types of behaviour is exhibited when males of the same species perform ritualised threatening
- A. Courtship
  - B. Altruism
  - C. Territoriality
  - D. Imprinting
30. Which one of the following would stimulate neurosecretory cells connected to the posterior lobe of pituitary glands?
- A. Rise in the osmotic pressure of blood
  - B. Development of a follicle into corpus luteum
  - C. Reduced rate of metabolism in children
  - D. Decreased amount of thyroxin hormone in blood
31. Which one of the following does **not** contribute to the increased sensitivity of the rods in dim light?
- A. Rods are closely packed are closely parked
  - B. Single sensory cell are excitable by a very small amount of light
  - C. Many rod converge to one nerve fibre
  - D. Rods synthesize the photochemical pigment rapidly
32. Diapause and hibernation are similar in that both are
- A. Triggered of the low light intensity
  - B. Response to humidity changes
  - C. Artificially induced by removal of part of the brain
  - D. Characterised by low body metabolism
33. Spatial summation in chemical transmission of nerve impulses occur when
- A. a single synaptic knob is repeatedly stimulated
  - B. more than one receptor are simultaneously stimulated
  - C. a single receptor is repeatedly stimulated
  - D. more than one synaptic knobs are simultaneously stimulated

34. Which one of the following processes in the mammalian female is associated with the presence of the corpus luteum?
- A. Thickening of the endometrium
  - B. Development of the graafian follicle
  - C. Fusion of sperm with the ovum
  - D. Release of ovum from the ovary
35. Which one of the following is true about oogenesis?
- A. Secondary oocyte divides to form one ovum and one polar body
  - B. Primary oocyte divides to form two secondary oocytes
  - C. Secondary oocyte divides to form two polar bodies
  - D. Three polar bodies are formed at meiosis I
36. When an allele affects more than one characteristic in an individual organism, it said to be
- A. Epistatic
  - B. Polygenic
  - C. Pleiotropic
  - D. polyploidy
37. What is the frequency of albino carriers in a large population where one out of ten thousand people (1:10,000) is an albino?
- A. 0.01
  - B. 0.02
  - C. 0.64
  - D. 0.99
38. Which one of the following organelles forms a new cell wall between daughter cells during plant cell division?
- A. Golgi apparatus
  - B. Lysosome
  - C. Micro bodies
  - D. centrosome
39. What causes the initial absorption of water by a germinating seed?
- A. Mass flow through micropyle into the seed food store
  - B. Active absorption involving expenditure of energy
  - C. Active chemical substances in the seed food store
  - D. Imbibition pressure due to colloidal particles in the seed.
40. In allosteric inhibition , the inhibitor reduces the rate of enzyme activity by
- A. Blocking the enzyme from reaching the substrate
  - B. Permanently combining with the substrate molecule
  - C. Changing the shape of the active site
  - D. Causing the enzyme to precipitate

SECTION B

Answer all questions in the spaces provided

41. Figure 1 shows blood flow through a tissue of a mammal. Study the figure and answer the questions that follow



- (a) (i) Name fluid B (01mark)  
 (ii) Explain how fluid B is formed (04marks)
- (b) Explain what takes place at the venous end of the capillaries at C. (03marks)
- (c) State two components of blood that do not become part of fluid B (02marks)
42. (a) How are gene frequencies affected by the following  
 (i) Migration (03marks)  
 (ii) Non-random mating (03marks)
- (b) Diabetes mellitus, a disorder in human is inherited as a recessive allele at a single locus. If the frequency of this allele is 0.07, calculate the frequency of the  
 (i) normal allele in a population (02marks)  
 (ii) diabetic individual in the population (01mark)  
 (iii) heterozygous individual in the population (01mark)
43. (a) Give the importance of saprophytes in nature. (01mark)  
 (b) Explain how the following affect the nitrogen content in the soil  
 (i) Poor drainage (02marks)  
 (ii) drought (03 marks)
- (d) Outline the effects of acid rain in an ecosystem. (03marks)
44. Figure 2 shows the effect of light intensity on the rate of photosynthesis of an aquatic plant, measured in two different carbon dioxide concentrations. Use it to answer the questions that follow

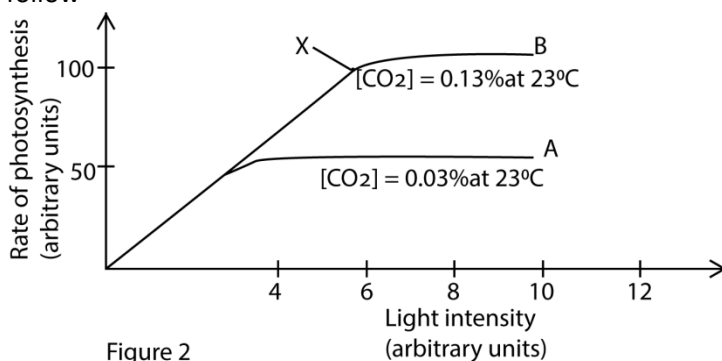


Figure 2

- (a) Describe the changes in the rate of photosynthesis in curve A and B (04 marks)
- curve A
  - curve B
- (b) Explain the causes of the differences in the curve A and B(02marks)
- (c) Give two possible reasons for the change of shape of curve B at point X. (02marks)
- (d) Explain why light intensity has an effect on the rate of photosynthesis (02marks)
45. (a) explain the meaning of the following terms as related to the functioning of mammalian nervous system:
- Resting membrane potential (02marks)
  - Motor end-plate (02marks)
  - Salutatory conduction in myelinated axon (02marks)
- (b) (i) How is anionic balance within a resting nerve maintained? (03marks)
- (ii) What is the name of the supporting cell that produces the myelin sheath?

46. Figure 3 shows the concentration of solutes in the fluid within different parts of the nephron of human kidney. Use it to answer questions that follow.

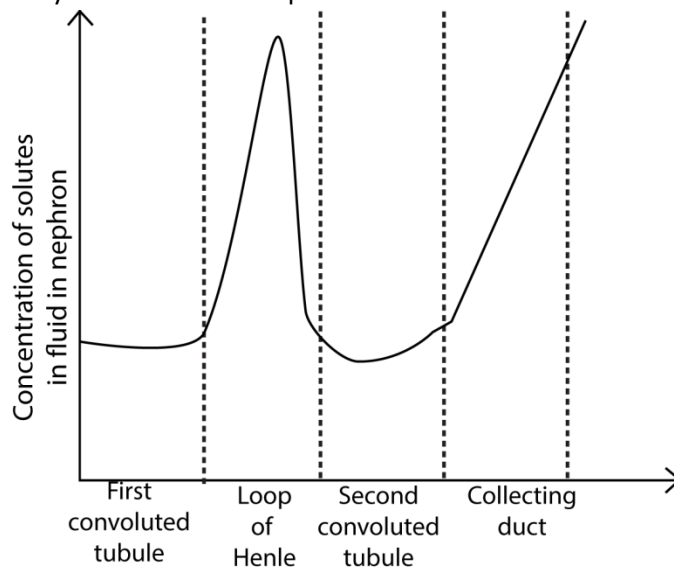


Fig.3

- (a) Explain the changes in concentration of the fluid as it passes along the;
- Loop of Henle (04 marks)
  - Collecting duct. (02 marks)
- (b) Suggest the significance of the changes in solute concentration explain in (a). (02 marks)
- (c) Briefly explain what may cause a person to pass out large quantities of dilute urine. (02marks)

### Suggested answers

1D 4C 7A 10B 13C 16A 19D 22A 25B 28D 31D 34C 37 B 40A  
 2B 5A 8A 11C 14B 17C 20B 23 A 26D 29C 32D 35A 38A  
 3C 6C 9C 12A 15D 18D 21D 24C 27B 30A 33D 36C 39D

Coments

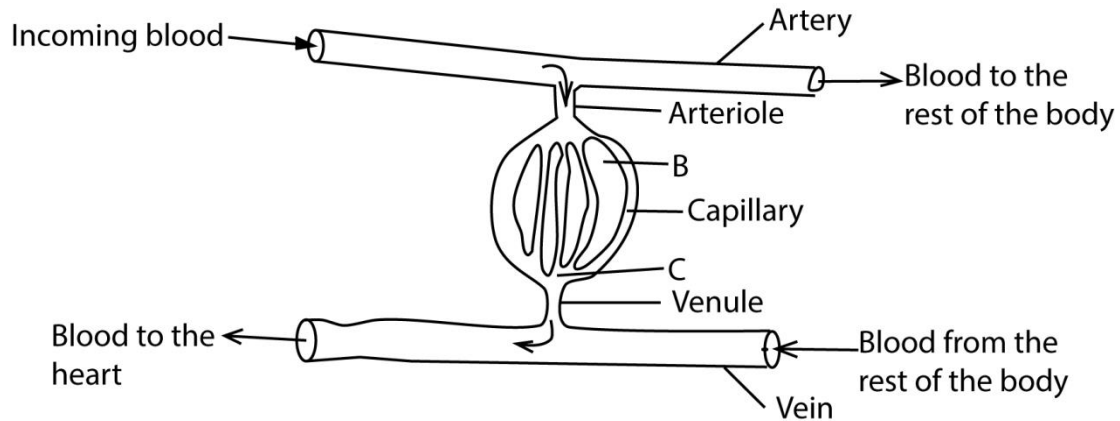
8. Increase in metabolic rate leads to production of lactic acid instead of carbon dioxide.
12. Cholecystokinin hormone stimulates release of bile into the duodenum from gallbladder.
15. Repolarization is an active process that requires energy
19. Lack of membrane bound organelles is the most distinguishing feature of prokaryotes.
20. Semilunar valve opens to allow blood into aorta while atrio-ventricular valves close to prevent back flow of blood into the atria
21. High level of metabolic activity builds a diffusion gradient
23.  $RQ = \frac{CO_2 \text{ given out}}{O_2 \text{ used}} = \frac{102}{142} = 0.7$
25. When a muscle contracts, the **sarcomeres shorten in length** due to the thick and thin filaments sliding over each other, resulting in greater overlap between the filaments and a shortening of the H-zone and the I band.
27. Cardiac muscle cells undergo twitch-type contractions with long refractory periods followed by brief relaxation periods. The relaxation is essential so the heart can fill with blood for the next cycle. The refractory period is very long to **prevent the possibility of tetany**, a condition in which muscle remains involuntarily contracted.
28. Large fluid filled spaces separate the cells do not exist in the anatomy of the proximal convoluted tubule cell lining
30. Rise in the osmotic pressure of blood stimulates the posterior lobe of pituitary to secrete ADH.
31. Rods take longer to adapt fully to changes in light. Their photopigments regenerate more slowly, and they don't reach maximum sensitivity until about two hours.
33. Spatial summation means that the **effects of impulses received at different places on the neuron add up** so that the neuron may fire when such impulses are received simultaneously, even if each impulse on its own would not be sufficient to cause firing.
34. When sperm fuse with the ovum, corpus luteum develops to produce progesterone that sustains pregnancy in the initial stages
37. Using  $p^2 + 2pq + q^2 = 1$
- $$q^2 = \frac{1}{10000}$$
- $$q = \sqrt{\frac{1}{10000}} = 0.01$$
- But  $p + q = 1 \Rightarrow p = 1 - 0.01 = 0.99$
- The frequency of the albino =  $2pq = 2 \times 0.01 \times 0.99 = 0.0198$
40. Allosteric inhibitors **modify the active site of the enzyme so that substrate binding is reduced or prevented**



SECTION B

Answer all questions in the spaces provided

41. Figure 1 shows blood flow through a tissue of a mammal. Study the figure and answer the questions that follow



(a) (i) Name fluid B (01mark)

Lymph

(ii) Explain how fluid B is formed (04marks)

- As blood flows through capillaries, plasma oozes through tiny holes in capillary walls.
- This plasma, now called lymph, moves into tissues and spaces around cells, delivering oxygen, proteins, and nutrients.
- Lymph also sweeps up debris like damaged cells, bacteria, and viruses.
- Lymphatic vessels collect lymph from tissue spaces and drain it into larger lymphatic vessels.
- These vessels carry lymph toward lymph nodes and lymphoid organs

(b) Explain what takes place at the venous end of the capillaries at C. (03marks)

When plasma oozes out of blood proteins are retained these causes high osmotic pressure in blood leading drawing of water by osmosis in the blood vessels at C

(c) State two components of blood that do not become part of fluid B (02marks)

- Red blood cells
- Proteins

42. (a) How are gene frequencies affected by the following

(i) Migration (03marks)

- Introduces more copies of genes in the population increasing the proportion of certain gene the population
- Introduces new genes in the population that have risen by mutation of these new have a selective advantage, then their proportion in the population increase
- Leads to loss of genes from the population reducing their proportions and may lead to total loss of genes from a small population if the one/few individuals that possess a certain gene vacates. This reduces the proportion of the lost genes to zero.

(ii) Non-random mating (03marks)

It does not affect gene frequencies as long as the population is large and there is no migration to and out of the population.

(b) Diabetes mellitus, a disorder in human is inherited as a recessive allele at a single locus. If the frequency of this allele is 0.07, calculate the frequency of the

(i) normal allele in a population (02marks)

$$q = 0.07$$

$$\text{since } p + q = 1$$

$$p = 1 - 0.07 = 0.93$$

Therefore, the frequency of normal allele = 0.93

(ii) diabetical individual in the population (01mark)

$$\text{Diabetic individual} = q^2 = 0.07^2 = 0.0049 \text{ or } 1 \text{ to } 204$$

(iii) heterozygous individual in the population (01mark)

$$\text{The frequency of heterozygous} = pq = 0.07 \times 0.93 = 0.0651 \text{ or } 1:15$$

43. (a) Give the importance of saprophytes in nature. (01mark)

Recycle nutrients in ecosystem

(b) Explain how the following affect the nitrogen content in the soil

(i) Poor drainage (02marks)

Reduces nitrogen content of the soil due denitrification and leaching

(ii) drought (03 marks)

Drought nitrogen content in the soil because

- Increased microbial break down of organic matter resulting in increase of soil temperature
- Increased nitrogen fixation because of available oxygen
- Reduced root uptake due reduced available soil water to dissolve nitrates and nitrogen compounds. It is also due reduced development of roots to reach the nitrates.

(c) Outline the effects of acid rain in an ecosystem. (03marks)

- Cause skin lesions
- Lower soil pH
- Increase aluminium availability in the soil

44. Figure 2 shows the effect of light intensity on the rate of photosynthesis of an aquatic plant, measured in two different carbon dioxide concentrations. Use it to answer the questions that follow

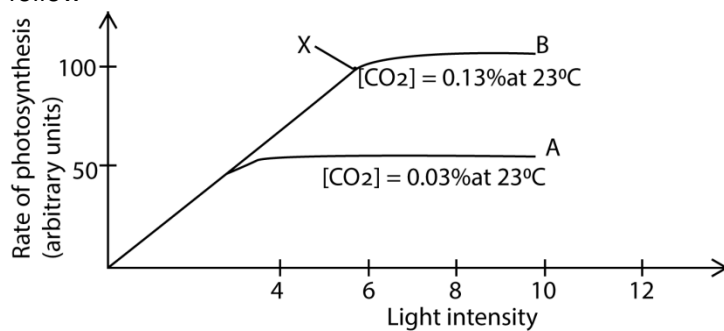


Figure 2

(arbitrary units)

(a) Describe the changes in the rate of photosynthesis in curve A and B (04 marks)

(iii) curve A

The rate of photosynthesis increases linearly from zero with increase with light intensity up to about 50 arbitrary units and the levels of at 4 arbitrary units of light.

(iv) curve B

(v) The rate of photosynthesis increases linearly from zero with increase with light intensity up to about 100 arbitrary units and the levels of at 6 arbitrary units of light.

(b) Explain the causes of the differences in the curve A and B(02marks)

Increase in carbon dioxide concentration increases the rate of photosynthesis because carbon dioxide is required for synthesis of carbohydrates.

(c) Give two possible reasons for the change of shape of curve B at point X. (02marks)

- Probably light is not enough
- Probably carbon dioxide limits photosynthesis
- Probable the enzyme active sites are saturated

(d) Explain why light intensity has an effect on the rate of photosynthesis (02marks)

- light energy is converted to chemical energy in the form of sugars during photosynthesis.
- Presence of light promotes opening of stomata leading to uptake of carbon dioxide
- Light contain heat that provide optimum temperature for photosynthetic enzymes

45. (a) Explain the meaning of the following terms as related to the functioning of mammalian nervous system:

(i) Resting membrane potential (02marks)

The resting membrane potential of a cell is defined as the electrical potential difference across the plasma membrane when the cell is in a non-excited state. It is about -70mV which means that the inside of the neuron is 70mV less than the outside.

(ii) Motor end-plate (02marks)

It is a specialized postsynaptic region of a muscle cell.

(iii) Salutory conduction in myelinated axon (02marks)

It is the propagation of action potentials along myelinated axons from one node of Ranvier to the next node, increasing the conduction velocity of action potentials.

(b) (i) How is an ionic balance within a resting nerve maintained? (03marks)

The Na/K ATP-ase maintains the sodium and potassium concentrations across the nerve by actively transporting these ions against their concentration gradients. Three sodium ions exit the cell in return for two potassium ions.

(ii) What is the name of the supporting cell that produces the myelin sheath?

Schwann cells

46. Figure 3 shows the concentration of solutes in the fluid within different parts of the nephron of human kidney. Use it to answer questions that follow.

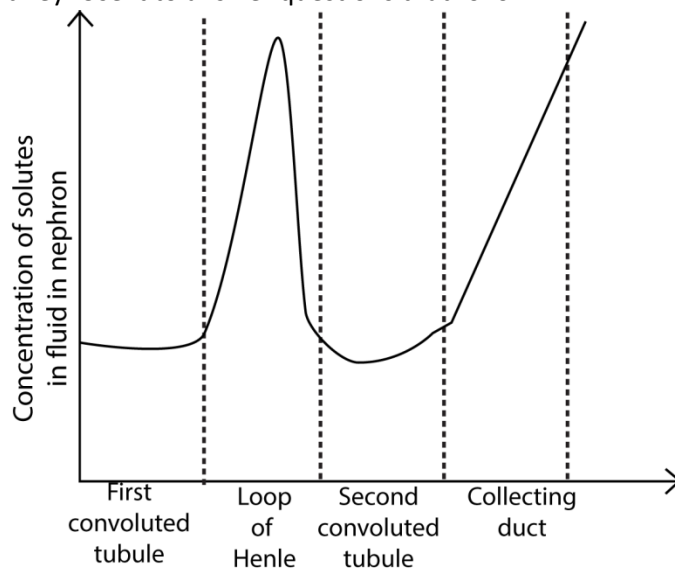


Fig.3

(a) Explain the changes in concentration of the fluid as it passes along the;

(i) Loop of Henle (04 marks)

Concentration of solute in fluid in the loop of Henle increases to the maximum at the tip of the loop of Henle due to osmotic loss of water down the descending limb into hyper concentrated region of the kidney and active removal of solute ions from fluid along the ascending limb of loop of Henle.

(ii) Collecting duct. (02 marks)

The concentration of solute increases along the conducting duct due to osmotic reabsorption of water from the fluid as the duct passes through the hyper concentrated region of the kidney.

(b) Suggest the significance of the changes in solute concentration explain in (a). (02 marks)

It reduces water loss in urine leading to water conservation in the animal

(c) Briefly explain what may cause a person to pass out large quantities of dilute urine.

(02marks)

- Diabetes mellitus
- Deficiency of ADH
- When a person drinks a lot of water/fluids
- Low temperature when there reduced loss of water through sweating
- Urinary tract infections

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