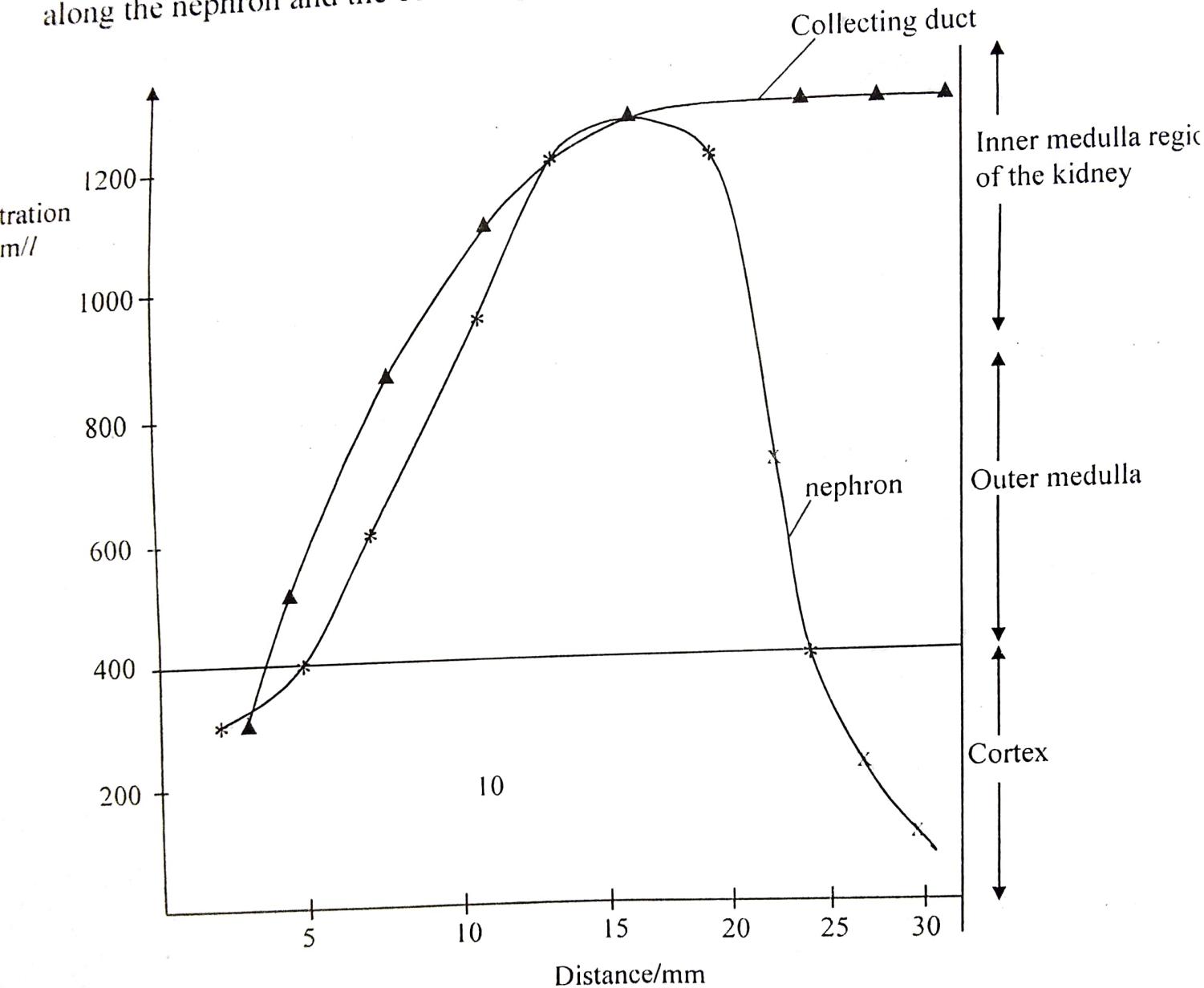


SECTION A (40 MARKS)

COMPULSORY QUESTION

Excretion of urea and other waste products is done by the nephron. The nephron transverses along the different regions of the kidney along which different substances like urea, water and salts i.e. (Na^+ , Cl^- and K^+) are either added or removed depending on a variety of factors.

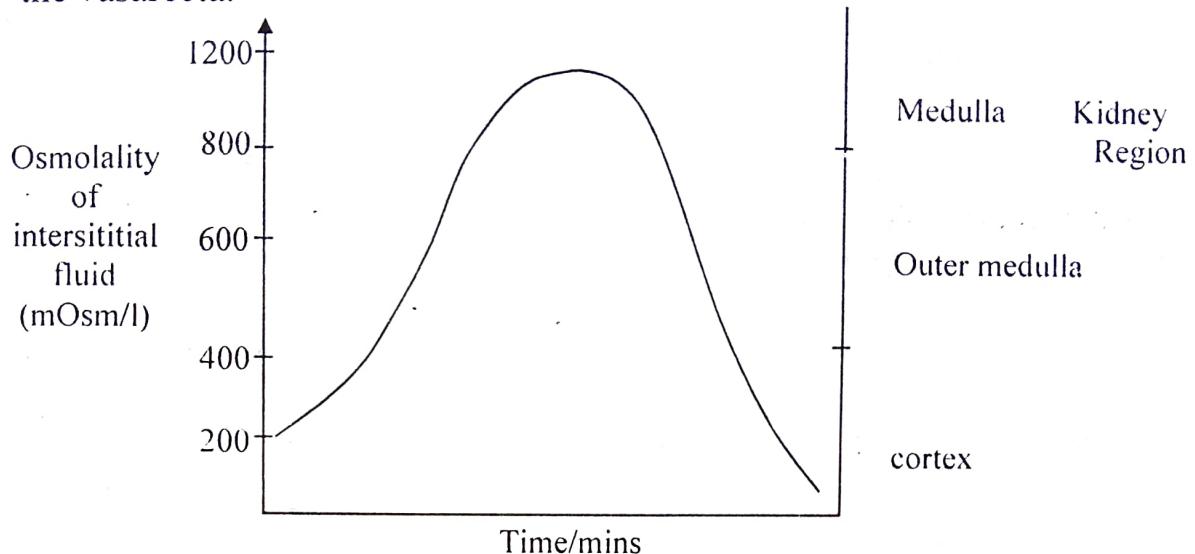
Fig 1. below: shows the variation of concentration within the glomerular filtrate along the nephron and the collecting duct. Study it carefully.



Questions

- c) The vasarecta a blood vessel surrounding the nephron has both ascending and descending loops transversing the kidney. The Osmolality of the interstitial fluid flowing per litre within the vasarecta was measured at intervals.

Fig. 2 below, shows the Osmolality of interstitial fluid (mOsm/c) within the vasarecta.



- (i) With reference to the curve for collecting duct fig. 1 and curve in fig. 2, state the similarities between the concentration in fluids flowing within the Vasa recta and the collecting duct. (3 marks)
- (ii) Explain the observed similarities. (3 marks)
- (iii) Mention any other function performed by the kidney apart from those discussed above. (2 marks)

SECTION B (60 MARKS)

Answer three questions from this section.

2. a) Write down the similarities and differences between angiosperms and gymnosperms. (8 marks)
- b) i) Describe the life cycle of a virulent bacteriophage. (6 marks)
 ii) List the importance of bacteria. (6 marks)
3. a) Describe the structure and function of the following tissues.
 i) Areolar tissue. (8 marks)
 ii) Striated muscle tissue. (3 marks)
- b) How does the structure of proteins permit the wide variety of the functions of proteins? (4 marks)

4. a) What is meant by a receptor? (3 marks)
- b) Describe the general features common to all receptors. (5 marks)
- c) Using the mammalian ear as an example show how a receptor organ functions. (12 marks)
5. a) Describe the formation of vascular tissues in a herbaceous dicotyledonous stem. (12 marks)
- b) i) What is linkage? (2 marks)
- ii) A population of human beings will contain many more colour blind individuals than haemophiliacs although the genes are transmitted in the same way. Explain. (6 marks)
6. a) Discuss the different ways in which man has influenced natural habitats to suit his style of living. (12 marks)
- b) What is the long term effect of the following?
- i) Pesticide application. (4 marks)
- ii) Global warming. (4 marks)

END

Qn 1. a) (i) Cortex: $2-2.5\text{mm}$

- From 0 to 5mm , the concentration increase slightly from 300mOsm/l to 400mOsm/l in the cortex.

gradually/slowly

From 5mm to 12.5mm , the concentration of the glomerular increase rapidly from 400mOsm/l to 1200mOsm/l in the outer medulla.

From 12.5mm to 20mm , the concentration of the glomerular remains/ almost constant at a peak of 1200mOsm/l in the inner medulla.

From 20mm to 24mm , the glomerular filtrate concentration decreases rapidly in the outer medulla, from 1200mOsm/l to 400mOsm/l .

From 24mm to 30mm , the glomerular filtrate concentration decreases gradually from 400mOsm/l to 100mOsm/l within the cortex.

Also consider: 20 to 22 mm for inner medulla
 22 to 24 mm for outer medulla

10 marks

(ii) Collecting duct;

The initially at 3mm the concentration is low at 300mOsm/l with the cortex.

From 3mm to 4mm , the concentration increases rapidly within the cortex.

Between 3mm to 15mm the fluid concentration increase rapidly from 300mOsm/l to 1200mOsm/l , the rapid increase in concentration occurs in the outer medulla.

From 7.5mm to 11mm the concentration within the inner medulla increases rapidly.

Between 15mm to 30mm the fluid in the collecting duct reaches its highest at 1200mOsm/l and remains constant which occurs within the inner medulla.

From 16mm to 31mm , the concentration remains almost constant

total = 7 mark

b) Explanation:

The concentration increases slightly due to the loss of water, from the glomerular filtrate at this region the nephron is ~~permeable~~ to water but salts.

Concentration increase rapidly because the surrounding fluid is more concentrated than the glomerular filtrate hence there is exercise loss of water from the filtrate increasing the concentration of the filtrate; ~~this region of the nephron is more permeable to water~~

In the inner medulla, the surrounding fluid is very concentrated thus there is much loss of water from the glomerular filtrate; the nephron is also impermeable to salts.

From 20mm to 24mm the glomerular filtrate concentration decrease rapidly because in the region the nephron is impermeable to flow of water but permeable to the flow of salts, thus the loss of salts lowers the concentration of the glomerular filtrate.

The more lost from the glomerular filtrate the lower the concentration of the filtrate in the outer medulla and the cortex.

1/2 mark

Total = 10 marks

In the cortex and outer medulla, the surrounding fluid is more concentrated. So there is a rapid loss of water from the collecting duct to the surrounding fluid.

In the inner medulla, the concentration of the fluid within the collecting duct is almost the same as that in the surrounding fluid; there is less loss of water from the C-T.

The concentration remains constant because the two fluids' concentration are the same/ equal; so (ii) Collecting duct there's little or no loss of water from the C-T. 6marks

In the cortex, the surrounding fluid is less concentrated so there is little loss of water from the fluid as the duct more thus the outer medulla, the surrounding fluid concentrated increase so more water flows out of the collecting duct increasing the concentration. In the inner medulla the surrounding fluid is much concentrated causing much loss of water by osmosis of the surrounding tissue.

(c) (i) Similarities between concentrations in fluids in vasorecta and collecting duct.

- In the cortex both concentration are low.
- In the inner medulla, concentrations is highest. 1 maximum Any 3
- In both, concentration of fluids increase up to a maximum and then decrease. @ Imark
- In both the conc. of the fluids increase rapidly at first within outer medulla

(ii) Explanation for the observed similarities.

The vasorecta ensures that the concentration gradient in the different regions of the kidney is maintained by not removing/ taking away any salt from any of the region which facilitate continuous exchange of materials between the nephron, collecting duct and the kidney tissues.

@ Imark

Total - 3marks

(iii) Other functions performed by the kidney

- Protein synthesis e.g. aquaporins
- Selective secretion.
- Regulating blood volume. 1 pressure
- Regulation of blood pH
- Secretion of hormones e.g. renin

Any 1mark

Total = 40marks

2. a)

Similarities

- Embryo sac enclosed in the ovule
- Sporophyte is dominant and gametophyte reduced
- Separate male and female spores
- Pollen tube present
- Fertilized embryo sac develops into a seed. 1 sexual reproduction
- Xylem and phloem present

Any 4

@ Imark

Differences double fertilisation

- Angiosperm
- Ovule protected in ovary
- Stigma and style present
- Cones absent.
- Fruits formed after fertilization
- Companion cells present in phloem
- Xylem has tracheids and vessels

seeds not naked

fruit present

single fertilisation

Gymnosperm

- ovule unprotected
- absent.
- Cones present.
- no fruits formed
- no companion cells.
- only tracheids in xylem, no vessels.

if student used flowers present, mark but reject any other point concerned to flowers

seeds naked

fruit absent

b)

(i) The virus becomes attached onto the surface of the bacteria via tail fibres pushed

- The viral DNA is provided into the bacterium.
- Viral DNA incorporates itself into bacterial DNA strand.
- Bacterial DNA replication ceases
- Viral DNA component synthesis begins.
- Host enzyme and synthetic systems are used to produce viral proteins coats
- Viral DNA cause host systems to produce lysis enzymes to break down host cell wall, releasing new viruses.

- (ii) Importance of bacteria
- Decomposition and recycling of plant and animal remains
 - Symbiotic relationships e.g. *in gut, for N₂ examples* Monk independently
 - Food production e.g. cheese, yoghurt, tea. *but if acidic*
 - Manufacture of leather, linen, soap powder.
 - Antibiotic production
 - Research and study
 - Cause diseases

Any 6

1 mark

3. a) Structure and function

- Fibroblast - Secretes *Protein matrix* *e.g. collagen & elastic fibres*
- (i) Areolar tissue.
 - Harvezian canal contains blood vessels for nourishment and nerve fibres for co-ordination
- Macrophages - *Phagocytising all foreign bodies*
- Mast cells - *Secretes anticoagulant*
- Fat cells - store fat
- Collagen fibres - *Provide Strength*
- elastic fibres - *allow stretching*
- *hard Marks for drawing*
- *if Structures well labelled*
- *Structure 1 mark*
- *function 1/2 mark*
- Canalculus contains osteocytes
- Endosteum for strength and support.
- Volkman canal links haversian canal to circumferential lamellae
- Periosteum, a dense connective tissue for strength and support
- Interstitials lamella for strength and support.
- Lacum contains osteocytes
- Schafer fibre, a collagen fibre holding periosteum to underlying bone.
- Outer circumferential lamellae
- Haversian system containing harvezian canal.

- (ii) Striated Muscle.

- Elongate fibres - allow considerable contraction
- Parallel fibres - Give maximum contractile effect
- Fibre ends tapered and interwoven - provide strength.
- Large number of mitochondria - provide ATP.
- Actin and myosin arrangement in sarcomere - allows contraction by filament slight over each other.
- Rich supply of blood vessels - provide adequate supply of oxygen and glucose.
- Myoglobin present - a store of oxygen.
- Motor end plates - allows stimulation of muscle.
- Fibre arranged in motor units - it allows variable degree of contraction.
- *Multinucleated to increase effective muscle fibre length, e.g. 20, 30 & 40*

1/2 mark
1/2 mark
1/2 mark
1/2 mark
1/2 mark
1/2 mark

Max = 8 marks

Variety in structure
amino acids and
bonds
different
sequence
Variety of function of proteins is due to variety of structure, which is also due to the infinite arrangement of amino acids in a protein chain and the different means of folding in the protein chain; e.g. disulfide, ionic, salt linkage;

tissue/organ defect

4. a) A receptor is a group of cells (one cell) that transforms various forms of energy into action potentials, informs the CNS of external and internal changes.

- b) Features of a receptor

- transforms energy into action potential *Transduction*
- specialized in structure and function.
- Creates generator potential.
- Has a threshold value of stimulation.
- Becomes adapted.
- Sensitive to low intensity stimulation.
- *Precision*

all or nothing law

Any 5

1 mark

- c) Sound energy hits the tympanic membrane after being collected by pinna.
 - Tympanic membrane vibrates.
 - Ear ossicles (malleus, incus, stapes) amplify vibrations ~~at~~ ^{to} the oval window.
 - Vibrations transmitted across organ of Corti in the inner ear.
 - Different sound frequencies take different routes.
 - Endolymph in the organ of Corti vibrates i.e. cochlear canal, vestibular and tympanic canal
 - Sensory cells between basilar and tectorial membranes are stimulated.
 - Action potentials generated in the sensory hair cells ~~are passed~~ into the cochlea nerve which forms the auditory nerve.
 - Impulses taken to the brain via auditory canal for interpretation ^{1 mark}

5. a) Formation of vascular tissues.

- Meristematic cells form actively dividing tissue which gives ^{rise} to the cells required for growth, the apical meristem is located at the stem tip and other dividing cells form a broken cylinder called the cambium situated inside the stem. Max = 12 marks

The cells are small, regularly shaped, have dense cytoplasm and with thin elastic walls.

To form the xylem, newly formed cells elongate and vacuolate. They lose their cytoplasm, their end walls breakdown and lignin is deposited in the side walls either through annual ^{reticulate} or whole ^{thickening}

To form the phloem, sieve plates are formed by partial breakdown of the contents are retained, companion cells are formed alongside the sieve tubes. horizontal cell walls

Max 12 marks

b) (i) Linkage is the association of two or more alleles so that they tend to be passed from generation to generation as an inseparable unit and fail to separate during independent assortment. (2 marks)

(ii) The different frequencies of the alleles in the proceeding generation are as a result of greater selection against the haemophiliac allele than the colour blind allele. The haemophiliac allele is potentially lethal; thus individual haemophiliac have less chance of surviving to sexual maturity and less chance of passing it to their offspring.

Some haemophiliacs carriers of disease choose not to have children incase their offspring are affected.

Colour blindness may however be passed on by carrier and colour blind females and the condition is not as lethal as haemophilia.

6. a) Man's influence on the habitat

- Population fluctuate in stable environment by because of poaching, introduction of alien species, interfere ^{with} nature causing populations to crash or use.
- Increase in human population resulting into encroachment in swamps and forests
- Deforestation. ^{Logging}
- Over grazing.
- Mechanization of agriculture
- Pollution.
- Constructions.
- Introduction of wild life animals. game parks | reserves
- Mining
- Quarrying

4 1/2 mark
6 marks

Any 12 well discussed
examples

- b) (i) effect of long term use of pesticide.
- Overall decrease in yields
 - Increase in number of pests. /pest resurgence
 - Increase in different kinds of pests.
 - Ineffectiveness of the pesticides

Biomagnification effects

- (ii) long term effect of global warming.

- Melting of snow ice caps.
- Avalanches of the floods.
- Increase in sea level.
- Unstable soil structure resulting into landslides.
- Increase in local temperatures. / resulting into drought
- Increase in diseases.

- spp migration

- change in rainfall pattern

- world fires

- lowers inland water bodies level / due to high temp

- Desertification

END

Any 4

@ 1 mark

changes in seasons