



## 6.0 BIOLOGY (231)

### 6.1 GENERAL CANDIDATES' PERFORMANCE

The performance of candidates in the year 2006 KCSE examination is given in *table 9* below. This was the first time the Biology examination was offered under the revised curriculum.

**Table 9: Candidates Overall Performance in Biology in the Year 2006**

Paper	Candidature	Maximum Mark	Mean Score	Standard Deviation
1		80	19.83	13.35
2		80	23.2	13.06
3		40	11.63	7.00
<b>Overall</b>	<b>217,675</b>	<b>200</b>	<b>54.89</b>	<b>31.00</b>

The questions that were performed poorly by the candidates are discussed below:

### 6.2 PAPER 1 (231/1)

#### Question 1(a)

*State the function of cristae in mitochondria.*

Candidates were required to know the structure of mitochondria and their function.

#### Weaknesses

The candidates made general reference to enzymes without referring to respiration hence giving incomplete answers.

#### Expected Response

To increase surface area for attachment of respiratory enzymes / site of ATP formation / site for energy production / site for respiration.

#### Question 3

(a) *Name two tissues in plants which are thickened with lignin.*

(b) *How is support attained in herbaceous plants?*

Candidates were required to name the various tissues found in plants and identify two that are thickened with lignin.

#### Weaknesses

Most candidates named all the plant tissues and ended up misspelling some in the process.

#### Expected Responses

(a) Sclerenchyma;  
Xylem vessels.

(b) Cells take in water and become turgid.

#### Question 4

- (a) *Name the fluid that is produced by sebaceous glands.*  
(b) *What is the role of sweat on the human skin?*

Candidates were required to know the glands found in the human skin, the secretions produced by the glands and the role they play in the body.

#### Weaknesses

Most of the terms given by candidates were misspelt and bore the misconception that the skin is the same as the body. Candidates were not conclusive in associating functions with adaptations and were not able to give complete short answers.

#### Expected Responses

- (a) Sebum.  
(b) Kills micro organisms, cools the body and gets rid of wastes (excretion).

#### Question 5

*State two ways in which floating leaves of aquatic plants are adapted to gaseous exchange.*

Candidates were expected to know the characteristics of leaves found in aquatic plants and how they are adapted to gaseous exchange.

#### Weaknesses

Candidates did not know that stomata are found on the upper surface of a leaf. They did not relate structure to function and displayed poor knowledge of adaptive features of hydrophytes.

#### Expected Response

Stomata are found only on the upper epidermis to allow for efficient gaseous exchange. Presence of aerenchyma tissue / large air spaces of cuticle enhances gaseous exchange.

#### Question 6

- (a) *State three characteristics of Monera that are not found in other kingdoms.*  
(b) *Name the class to which a termite belongs.*

Candidates had to know the characteristics that are unique to Monera.

#### Weaknesses

Knowledge on "*Monera*" was not well expressed and there were wrong spelling of technical terms indicating lack of practical work to supplement theory.

### Expected Responses

- (a) The genetic/ nuclear/ nucleus material is not surrounded by a membrane, smaller in size, lack most organelles.
- (b) Insector, Ribosomes, Nucleous, Lysosmer, Golgi bodies.

### Question 7

- (a) Name **one** defect of the circulatory system in humans.
- (b) State **three** functions of blood other than transport.

Knowledge of the circulatory system and its defects in humans was required.

### Weaknesses

Candidates were unable to distinguish between disease and defects. Misuse of protect, prevent, regulate and control “germs” was noted. Wrong spelling of terms was also evident.

### Expected Responses

- (a) Thrombosis/ varicose veins/ arteriosclerosis/ coronary thrombosis/ antheroma/ antherosclerosclerosis.
- (b) Regulation of body temperature, regulation of Ph (of fluids), defence against disease causing organisms/ pathogens/infection prevent bleeding.

### Question 9

- (a) State **two** processes which occur during anaphase of mitosis.
- (b) What is the significance of meiosis?

Knowledge and understanding of the process of *mitosis* and *meiosis* was required.

### Weaknesses

Candidates failed to distinguish between chromosomes and chromatods, sister chromatods and homologans chromosomes and significance of meiosis was poorly brought out.

### Expected Responses

- (a) Sister chromatics separate: sister chromatics move to opposite poles.
- (b) Gamete formation, source of variation.

### Question 10

State the importance of tactic response among some members of kingdom Protista.

Candidates had to know the members of the kingdom of Protista and have understanding of tactic responses.

### Weaknesses

Candidates failed to understand the meaning of tactic responses and examples of Protista were lacking.

### Expected Response

Move towards favourable environment.

### Question 11

State the role of insulin in the human body.

The role of insulin in the human body was required.

### Weaknesses

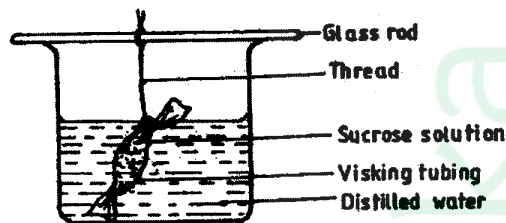
Candidates displayed misconceptions about insulin and failed to give the correct concept with some saying it stimulates liver cells.

### Expected Response

Stimulates the conversion of excess glucose to glycogen (for storage), enhances oxidative breakdown of glucose: some (excess) glucose converted to fats and stored.

### Question 12

An experiment was set up as shown in the diagram below.



The set up was left for 30 minutes.

- State the expected results.
- Explain your answer in (a) above.

Candidates were required to explain observations in an experimental design.

### Weaknesses

Responses provided by candidates indicated that the experiment had not been carried out leading to theoretical responses. The candidates were unable to distinguish between **hypertonic**, **hypotonic**, **flaccid** and **haemolysis**.

### Expected Responses

- The visking tubing will become turgid; increase in volume/swell/enlarge/become big.
- Water moves from the beaker into the visking tubing: by osmosis: through a semi permeable visking tubing; sucrose - hypertonic solution, water - hypotonic solution.

### Question 13

- (a) *In what form is energy stored in muscles?*
- (b) *State the economic importance of anaerobic respiration in plants.*

Knowledge of energy in the body and anaerobic respiration was required.

#### Weaknesses

In part (a) of the question there was poor knowledge about use of ATP. Wrong spelling of *Adenosine Triphosphate* was common.

#### Expected Responses

- (a) Adenosine Triphosphate
- (b) Brewing of alcohol, sewage treatment, dairy production, baking of bread, biogas production, compost manure formation.

### Question 15

*Explain continental drift as an evidence of evolution.*

To answer this question correctly, candidates had to have knowledge about evolution and continental drift in particular.

#### Weaknesses

Candidates' responses portrayed insufficient knowledge about continental drift.

#### Expected Responses

Current continents existed as one large land mass. The present continents drifted leading to isolation of organisms; Organisms in each continent evolved along different lines, hence emergence of new species.

### Question 17

- (a) *Distinguish between the terms homodont and heterodont.*
- (b) *What is the function of carnassial teeth?*
- (c) *A certain animal has no incisors, no canines, 6 premolars and 6 molars in its upper jaw. In the lower jaw there are 6 incisors, 2 canines, 6 premolars and 6 molars. Write its dental formula.*

Candidates were required to distinguish between *homodont* and *heterodont*, know the function of carnassial teeth and the dental formula of an animal described in the question.

#### Weaknesses

Lack of interest in arithmetic was evident and there were misconceptions about homodont indicating lack of effective teaching.

#### Expected Responses

- (a) Homodont is having same kind/type of teeth while heterodont is having different kinds of teeth.

(b) Cutting and crushing / chopping

(c)  $i \frac{0}{3}$   $c \frac{0}{1}$   $pm \frac{3}{3}$   $m \frac{3}{3}$

### Question 18

- (a) State **two** functions of bile juice in the digestion of food.  
(b) How does substrate concentration affect the rate of enzyme action?

Candidates were required to state the function of bile in digestion of food and knowledge of enzyme controlled reactions.

### Weaknesses

There was confusion between “*emulsification*” and “*digestion*”. Candidates were unable to explain enzyme controlled reactions.

### Expected Responses

Emulsification of fats/ breaking into small droplets increases the surface area for digestion.

### Question 19(a)

Explain how the following prevent self-pollination:

- (i) *protoandry*  
(ii) *self-sterility*.

Candidates were required to have knowledge of pollination and also distinguish between different types of pollination.

### Weaknesses

A poor interpretation of “*Protoandry*” and “*Self-sterility*” was evident. There was also a confusion of these terms with other terms such as “*Heterostyly*”.

### Expected Responses

- (i) Protandry; the male reproductive organ / stamen mature earlier than the female carpel/stigma reproductive organs.  
(ii) Pollen grains are stuck to stigma of the flower/ plant.

### Question 20

- a) What name is given to response to contact with surface exhibited by tendrils and climbing stems in plants ?  
(b) State **three** biological importance of tropisms to plants

Knowledge about tropisms was required.

### Weaknesses

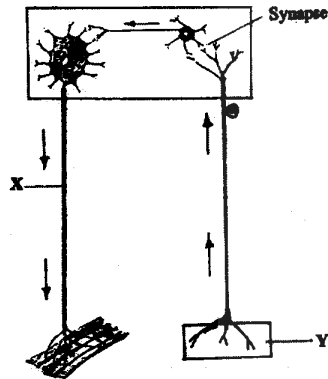
Wrong spelling of *Thigmotropism*; the relationship between plant parts and what they do did not come out well.

### Expected Responses

- (a) Haptotropism / Thigmotropism.
- (b) Expose leaves/ shoots in positions for maximum absorption of sunlight for photosynthesis; enables roots of plants to seek water, enables plants to obtain mechanical support especially those that lack woody stems, enables roots to grow deep into the soil for anchorage, and enables pollen tube to grow to embryo sac to facilitate fertilisation.

### Question 21

The diagram below represents a reflex arc in human.



- (a) Name the parts labelled X and Y.
- (b) Name the substance that is responsible for the transmission of an impulse across the synapse.

Candidates were required to study a diagram and name some parts.

### Weaknesses

Spelling mistakes were noted and poor knowledge of the nervous system was obvious.

### Expected Responses

- X - Motor neurone/axon of the motor neurone.
- Y - Sense organ/receptor.

### Question 22

- (a) State the function of the ciliary muscles in the human eye.
- (b) State two functional differences between the rods and cones in the human eye.

Candidates were asked about structures in the human eye and their functions.

### Weaknesses

Knowledge on the structures in the human eye was poorly presented and candidates were unable to relate structure to function and make corresponding comparisons.

### Expected Responses

- (a) They alter the shape of the lens/ they (contract and relax) to alter the shape of the lens.
- (b) Rods perceive light of low intensity and are not sensitive to colour, therefore low visual acuity, while cones perceive light intensity and are sensitive to colour therefore high visual acuity.

### Question 23

State the function of each of the following parts of human ear.

- (a) Ear ossicles.
- (b) Cochlea.
- (c) Semi-circular canals.
- (d) Eustachian tube.

This question tested candidates on their understanding of parts of human ear and their functions.

### Weaknesses

Lack of knowledge about the parts. It was evident that the concepts had been poorly taught. Candidates were unable to distinguish between waves and vibrations.

### Expected Responses

- (a) Transmit/amplify/magnify sound vibrations.
- (b) Converts sound vibrations into nerve impulses.
- (c) Posture/balance.
- (d) Balance pressure in middle ear to that of the outside/outer ear.

### Question 24

State *four* ways in which respiratory surfaces are suited to their function.

Knowledge about respiratory surfaces in general was required.

### Weaknesses

Most candidates stated functions but did not relate the structures to function.

### Expected Responses

- Thin walls for faster diffusion of gases (thus reduces diffusion distance).
- Moist for dissolving gases.
- Large surface for maximum diffusion/gaseous exchange.
- Highly vascularised to facilitate diffusion/enhance diffusion gradient.

### Question 25

- a) A dog weighing 15.2 kg requires 216 kJ while a mouse weighing 50 g requires 2736 kJ per day. Explain
- b) What is the end-product of respiration in animals when there is insufficient oxygen supply?



Candidates had to study the figures given of energy requirements of animals of different sizes and account for the difference. They also were required to know the end-product of respiration when there is insufficient oxygen supply.

### Weaknesses

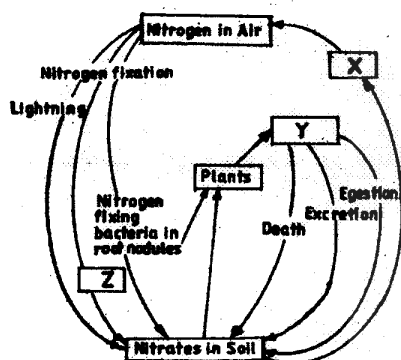
Candidates were not able to relate surface area with ratio to heat loss. There were misspelt terms and some candidates used symbols and formulae.

### Expected Responses

- (a) A mouse has a larger surface area to volume ratio than a dog; hence losses more energy per unit body weight/mouse loses heat faster than a dog.
- (b) Lactic energy/Adenosine Triphosphate

### Question 26

The chart below represents a simplified nitrogen cycle.



What is represented by X, Y and Z?

Candidates were required to study an incomplete chart of nitrogen cycle and fill in some missing information.

### Weaknesses

Candidates were unable to interpret the chart indicating lack of knowledge of cycles.

### Expected Responses

- X - Denitrifying bacteria
- Y - Animals / Herbivores
- Z - Nitrogen fixing bacteria

### Question 27

Name the end-products of the light stage in photosynthesis.

Knowledge about photosynthesis, light stage in particular was required.

### Weaknesses

Candidates used symbols in place of names.

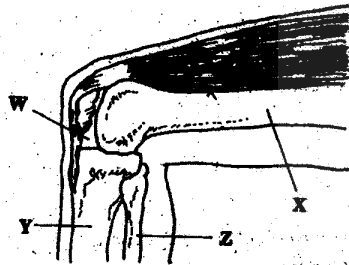
### Expected Responses

Hydrogen; and oxygen / oxygen gas

### 6.3 PAPER 2 (231/2)

#### Question 1

The diagram below represents bones at a joint found in the hind limb of a mammal.



- (a) Name the bones labelled X, Y and Z.
- (b)
  - (i) Name the substance found in the place labelled W.
  - (ii) State the function of the substance named in (b) (i) above.
- (c) Name the structure that joins the bones together at the joint.
- (d) State the difference between ball and socket joint and the one illustrated in the diagram above.
- (e) Name the structure at the elbow that performs the same function as the patella.

This question required knowledge on bones found in a mammal, types of joints and differences between them.

### Weaknesses

Spelling mistakes, such as "*Fibia*" were common in the candidates' work.

### Expected Responses

- (a) X: Femur.  
Y: Fibula.  
Z: Tibia.
- (b)
  - (i) Synovial fluid.
  - (ii) Lubrication of the joint.
- (c) Ligament
- (d) Ball and socket joint allows movement in all planes while the illustrated allows movement in one plane only.
- (e) Olecranon process.

## Question 2

- (a) Name **two** disorders in humans caused by gene mutation.
- (b) Describe the following chromosomal mutations:  
(i) inversion  
(ii) translocation.
- (c) In mice the allele for black fur is dominant to the allele for brown fur. What percentage offspring would have brown fur from a cross between heterozygous black mice and brown mice? Show your working. Use letter **B** to represent the allele for black colour.

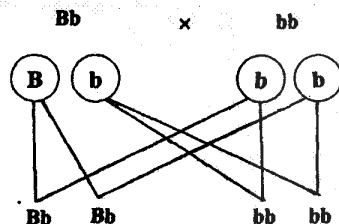
Understanding of disorders caused by gene mutations, chromosomal mutations and distinction between inversion and translocation were required.

### Weaknesses

Clear understanding of chromosome mutations was lacking. Language to express the required answers was also lacking.

### Expected Responses

- (a) Albinism; Sickle cell anaemia; Haemophilia; Colour blindness.
- (b) (i) Occurs when chromatid breaks at two places and when rejoining the middle piece rotates and joins in an inverted position.  
(ii) Occurs when a section of a chromatid breaks off and becomes attached to another chromatid of another Chromosome.
- (c)



$$\frac{2}{4} \times 100 = 50\%$$

## Question 3

- (a) Distinguish between pyramid of numbers and pyramid of biomass.
- (b) Give **three** reasons for loss of energy from one trophic level to another in a food chain.
- (c) Describe how the belt transect can be used in estimating the population of a shrub in a grassland

Candidates were required to distinguish between pyramid of numbers and pyramid of biomass, loss of energy from one trophic level to another and explain how the belt transect can be used to estimate population of a shrub in a grassland.

### Weaknesses

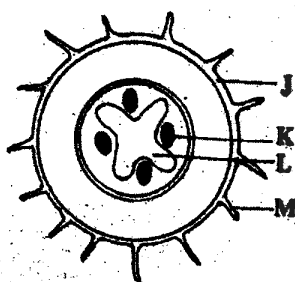
Some candidates did not know what a belt transect was. They confused belt transect with line transect and quadrant.

### Expected Responses

- (a) Pyramid of numbers is a diagrammatic representation of organisms at each trophic level in a food chain while biomass is a diagrammatic representation of dry weight of organisms at each trophic level in a food chain.
- (b) Insufficient utilisation of food resource/wastage; through respiration; through death; through excretion.
- (c) Run two ropes parallel to each a metre apart; counts of shrub are made between the two ropes at marked points/whole belt; calculate area of belt transect; calculate for whole area.

### Question 4

The diagram below represents a transverse section through a plant organ.



- (a) From which plant organ was the section obtained?
- (b) Give two reasons for your answer in (a) above.
- (c) Name the parts labelled J, K and L.
- (d) State two functions of the part labelled M.

Understanding of a cross-section of a root and naming the parts was required in this question.

### Weaknesses

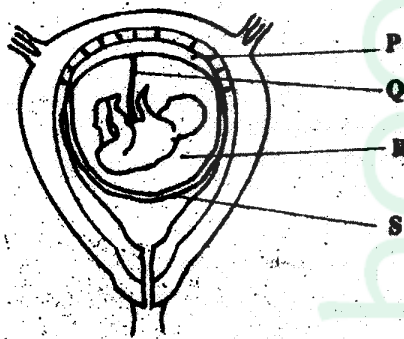
Some candidates could not distinguish between parts of the cross section.

### Expected Responses

- (a) Root.
- (b) Presence of root-hairs; presence of endodermis; xylem star-shaped and at centre with phloem at arms of the xylem.
- (c) J-Epidermis.  
K-Phloem.  
L-Xylem.
- (d) Absorption of water; absorption of mineral salts.

### Question 5

The diagram below represents a human foetus in a uterus.



- (a) Name the part labelled *S*.
- (b) (i) Name the types of blood vessels found in the structure labelled *Q*.
- (ii) State the difference in composition of blood found in the vessels named in (b) (i) above
- (c) Name two features that enable the structure labelled *P* carry out its function.
- (d) State the role of the part labelled *R*.

Knowledge of the surrounding of a foetus and its blood supply through the umbilical cord was necessary to answer this question.

#### Weaknesses

There was confusion between “*chorion*” and “*amnion*” and the constituents of blood supply.

#### Expected Responses

- (a) Amniotic membrane.
- (b) (i) Arteries; Veins; Capillaries.  
(ii) More food nutrients and oxygen in arteries; and less food nutrients and excretory products in the veins; nitrogenous wastes and carbon dioxide.
- (c) Highly vascularised; large surface area.
- (d) Cushion/absorbs shock.

### Question 6

An experiment was carried out to investigate the effect of hormones on growth of lateral buds of three pea plants.

The shoots were treated as follows:

Shoot A - Apical bud was removed.

Shoot B - Apical bud was removed and gibberellic acid placed on the cut shoot.

Shoot C - Apical bud was left intact.

The lengths of the branches developing from the lateral buds were determined at regular intervals.

The results obtained are shown in the table below.

Time in days	Length of branches in millimetres		
	Shoot A	Shoot B	Shoot C
0	3	3	3
2	10	12	3
4	28	48	8
6	50	90	14
8	80	120	20
10	118	152	26

a) Using the same axes, draw graphs to show the lengths of branches against time.

(b) (i) What was the length of the branch in shoot B on the 7th day?

(ii) What would be the expected length of the branch developing from shoot A on the 11th day?

(c) Account for the results obtained in the experiment.

(d) Why was shoot C included in the experiment?

(e) What is the importance of gibberellic acid in agriculture?

(f) State two physiological processes that are brought about by the application of gibberellic acid on plants.

A data based question where candidates had to draw graphs, extrapolate, account for results and know the application of gibberellic acid in agriculture.

### Weaknesses

Drawing of graphs was well done despite the challenge of drawing three graphs beginning from the same point. Accounting for the results was the most difficult part of the question. There was confusion between shoot, bud and branches and which part was responding. Practical application of gibberellic acid in Agriculture was a challenge.

### Expected Responses

- (b) (i)  $105 \pm 1$  mm.  
(ii) 134 - 140 mm.

(c) **Graph A**

The tip of the shoot which was removed contained Indole acetic acid (IAA) which causes apical dominance or Inhibits growth and develop more of lateral buds; hence, lateral buds sprouted and grew.

**Graph B**

The gibberellic which was added on the cut promotes formation of lateral branches on stem; hence the fast growth of shoot B.

**Graph C**

The shoot tip which remained intact contains IAA which inhibits growth and development of latest buds; hence no change in length of lateral buds.

- (d) Control.
- (e) Increase productivity.
- (f) Promote cell division; and cell elongation.

**Question 7**

*Describe how the human kidneys function.*

This question required candidates to have an understanding of the functioning of the human kidneys.

**Weaknesses**

There was confusion of what happens at the loop of the henle because absorption and reabsorption were interchanged or used interchangeably. Details of what happens at the nephron were lacking. There was confusion of what is ultra filtered. The urinary bladder was called gall bladder by some candidates. How pressure is caused was not clear in some cases. Many candidates referred to the lumen as thin / thick instead as wide/narrow and did not know which is afferent and which is efferent.

**Expected Responses**

The afferent arteriole which is a branch of renal artery supplies blood to glomerulus; the efferent arteriole has a wider diameter than the afferent arteriole; which takes blood away from glomerulus. The difference in the diameter of the afferent and efferent vessels causes high pressure; leading to ultra filtration of blood. The walls of the blood capillaries are one cell thick hence glucose, amino acids, vitamins, hormones, salts, creatine, urea and water filter into Bowman's capsule; to form glomerular filtrate; white blood cells, red blood cells, plasma proteins such as globulin and platelets are too large to pass through the capillary wall; hence remain in blood capillary; useful substances in the human body are selectively reabsorbed; back into the blood stream at the proximal convoluted tubule. The useful substances include amino acids, glucose, vitamins, hormones, sodium chloride and water; Many mitochondria found at the proximal convoluted tubule provide energy for reabsorption of these substances against a concentration gradient; The glomerular filtrate flows into the descending and then ascending of loop of henle. Water in the descending loop moves by osmosis into the blood capillaries. Sodium chloride is actively absorbed from the ascending into blood capillaries. The glomerular filtrate flows into distal convoluted tubule; water is reabsorbed by osmosis from distal convoluted tubule into blood capillaries; the glomerular filtrate flows into collecting tubule from where, more water is reabsorbed into blood stream. Antidiuretic hormone influences the amount of water reabsorbed depending on osmotic pressure of blood. The glomerular filtrate from several collecting tubules now referred to urine is emptied into collecting duct. The urine passes through pyramid, pelvis and ureter into bladder; where urine is stored for some time. The sphincter on urethra relaxes to allow urine to be released from the body.

**Question 8**

*Describe how water moves from the soil to the leaves in a tree.*

Candidates were required to describe how water moves from the soil to the leaves in a tree.

### Weaknesses

Reference to hypertonic was not made to cell sap but to roots. Osmotic pressure was confused with osmotic potential. Active transport across endodermis was not familiar to many candidates. Transport of water to the leaf was not well explained.

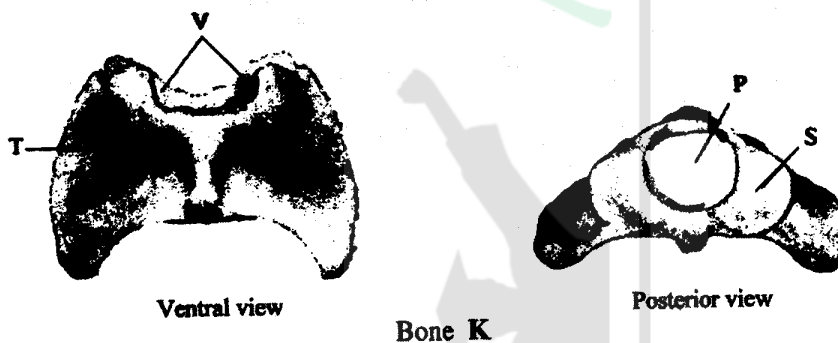
### Expected Responses

Water is drawn into the root hair cells of osmosis. Due to the presence of dissolved substances in the cell sap of root hairs, the concentration of cell sap is greater than that of the surrounding solution in the soil/concentration gradient. This exerts a higher osmotic pressure, thus drawing the water molecules across the cell wall and cell membrane into the root hair cells. More water drawn into the root hair cells dilutes the cell sap making it less concentrated than that in the adjacent cortex cell of the root. Due to osmotic gradient water moves from the adjacent cells to the next by osmosis; until it enters by xylem vessels located in the centre of the root; These xylem vessels of the root then conduct the water up into the xylem vessels of the stem into the leaves. There is a force in the roots which pushes water up the stem. This force is known as root pressure and can be considerably high in some plants. Energy is essential in this process; In the xylem vessels, water would rise by capillarity; to some extent because the vessels are narrower, and there is a higher attractive force between the water molecules and the cell walls. The cohesive and adhesive forces are important in the maintenance of a continuous and an uninterrupted water column in the xylem vessels up the tree to the leaves. Water vaporises from the spongy mesophyll cells their cell sap becomes concentrated than adjacent cells. This increases the osmotic pressure of the spongy mesophyll cells. As a result water flows into the cell from other surrounding cells which in turn take in water from xylem vessels within the leaf veins. This creates a pull/suction force that pulls a stream of water from xylem vessels in the stem and roots. The transpiration pull maintains continuous column of water from the roots to the leaves.

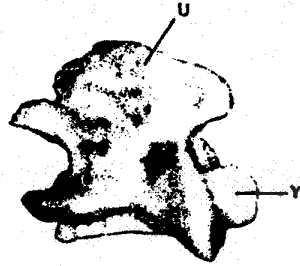
## 6.4 PAPER 3 (231/3)

### Question 1

*The photographs below are of bones obtained from the same region of a mammalian body. Photographs labelled K are different views of the same bone while M and N are views of different bones.*







Side view  
Bone M



Posterior view  
Bone N

- (a) Name the region from which the bones were obtained.
- (b) Identify the bones.  
K  
M  
N
- (c) State three characteristic features of the bone in photographs labelled K.
- (d) Name the structures that fit in the opening labelled P in the photographs of bone K.
- (e) State the functions of the parts labelled S and T in photographs of bone K.
- (f) Name the structures that articulate with the parts labelled V in the photographs of bone K.
- (g) Name the parts labelled U and Y in the photograph of bone M and R in the photograph of bone N.

Candidates were required to identify mammalian vertebrae obtained from the neck (cervical region) by observing photographs. They were also required to know the various parts of the bones and their functions.

#### Weaknesses

Candidates' responses had many spelling mistakes, poor identification of vertebra and portrayed incorrect language. Candidates lacked knowledge of functions of various parts of the vertebrae, singular and plural of biological terms e.g. vertebra and vertebrae.

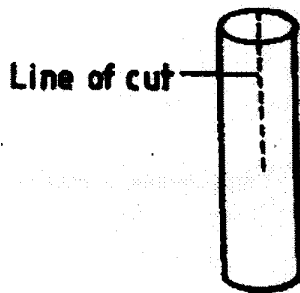
#### Expected Responses

- (a) Cervical region/neck region.
- (b) K - Atlas; M - Axis; N - Cervical vertebra.
- (c) Wide neural canal; absence of centrum; small neural spine.

- (d) Spinal cord; Odontoid process.
- (e) S - Facets for articulation; T - For passage of blood vessels.
- (f) Occipital condyle.
- (g) U - Post Zygapophysis; Y - Odontoid process; R - Centrum.

**Question 2**

You are provided with two pieces of plant material labelled specimen D. Using a scalpel cut a slit halfway through the middle of each piece as shown in the diagram below.



Place one piece in the solution labelled  $L_1$  and the other in solution labelled  $L_2$ . Allow the set up to stand for 30 minutes.

- (a) After 30 minutes remove the pieces and press each gently between the fingers.
  - (i) Record your observations.
    - $L_1$
    - $L_2$
  - (ii) Account for the observations in (a) (i) above.
- (b) Examine the pieces.
  - (i) Record other observations beside those made in (a) (i) above.
  - (ii) Account for the observations in (b) (i) above.

The question tested candidates' understanding of the terms hypertonic, hypotonic, aenation, turgid, plasmolysis.

**Weaknesses**

Candidates used the terms in a mixed up manner. There was lack of basic understanding of cell physiology and the language used by candidates in expressing their responses was poor.

### Expected Responses

- (a) (i) The stem from L<sub>1</sub> is firm/hard/stiff; the stem from L<sub>2</sub> is soft.
- (ii) Solution L<sub>1</sub> is hypotonic to the cell sap; water moved into the stem cells by osmosis; Cells of the stem become turgid; solution L<sub>2</sub> is hypertonic; water moves out of the cells by osmosis making the cells flaccid.
- (b) (i) Material in L<sub>1</sub> - the slit opens wider; and they bend backwards; Material in L<sub>2</sub> - the strips remain close together.
- (ii) In L<sub>1</sub> cells in the inner surface/cut surface enlarged more because they took in more water; (by osmosis) than the outer cells which have cuticle.

### Question 3

You are provided with three sets of seedlings labelled A, B and C. Examine them.

- (a) State the conditions under which each set was grown.
- Set A
- Set B
- Set C
- (b) State **four** differences between the seedlings in set A and B.
- (c) (i) Name the phenomenon exhibited by seedlings in set B
- (ii) Give a reason why plants exhibit the phenomenon named in (c)(i) above.
- (d) Name the response exhibited by the seedlings in set C.
- (e) Explain how the response named in (d) above occurred.

Candidates were tested on the understanding of growth conditions, identifying and comparing plants grown under different conditions, the phenomenon of etiolation as well as knowledge of tropisms.

### Weaknesses

Candidates were unable to make corresponding comparisons and used negative answers when giving differences. They lacked correct usage of biological expressions and came up with wrong expressions such as "*Auxins are not friendly to light*", "*Auxins run away from light*" etc. Wrong spelling of the word "*auxin*" was also noted and wrong terms e.g. "*dark stage*", "*light stage*" were common. Etiolation was not known to many. Candidates gave very poor descriptions of colour and accounts for growth curvatures based on auxin theory.

### Expected Responses

- (a) (i) Set A - Normal conditions/in light.
- (ii) Set B - In the dark.
- (iii) Set C - Subjected to unilateral light.

- |     |       |              |                     |
|-----|-------|--------------|---------------------|
| (b) |       | <b>SET A</b> | <b>SET B</b>        |
|     | (i)   | Green plants | Pale yellow plants. |
|     | (ii)  | Large leaves | Small leaves.       |
|     | (iii) | Short stems  | Long stem.          |
|     | (iv)  | Thick stems  | Thin stems.         |
- (c) (i) Etiolation.  
(ii) To reach light.
- (d) Positive phototropism.
- (e)
- Auxins migrate to the dark side.
  - Causing faster growth of cells on the dark side.
  - Resulting in the curvature of the shoot towards the source of light.

## 6.5 ADVICE TO TEACHERS

The following observations were made in candidates' responses across the three papers.

- 6.5.1 Wrong spelling of biological terms.
- 6.5.2 Poor expressions of statements, for example: "*Auxins run away*".
- 6.5.3 Some candidates' answers do not relate structure to function especially in questions on adaptations.
- 6.5.4 Candidates did not confine themselves to the number of responses required by the questions.
- 6.5.5 The topic of "*Evolution*" was not well taught as was the case in the old syllabus.
- 6.5.6 Questions testing experimental design were performed poorly by candidates indicating lack of a practical approach to teaching.
- 6.5.7 Candidates' responses to a large extent showed poorly taught and poorly remembered concepts.
- 6.5.8 Use of symbols and formulae in place of names is not acceptable in Biology.
- 6.5.9 Inability of candidates' to comprehend diagrams and charts.
- 6.5.10 Mixing up of concepts that are required in responses with those that are not required.
- 6.5.11 Incorrect use of biological terminologies.
- 6.5.12 The topic of "*Support and movement*" does not seem to be taught using actual specimen.
- 6.5.13 Practical application of population estimation in ecology is not exhaustively taught.
- 6.5.14 Details of process and explanations were lacking leading to superficial answers and loss of marks.