

## 6.0 BIOLOGY (231)

This was the fifth time the revised KCSE Biology syllabus was tested.



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### 6.1 CANDIDATES' GENERAL PERFORMANCE

The performance of the candidates in the three Biology papers is given in the table below. The performance of the candidates in the years 2008 and 2009 is also given for comparison.

**Table 12: Candidates' Overall Performance in Biology In the years 2008, 2009 and 2010.**

Year	Paper	Candidate re	Maximum score	Mean score	Standard Deviation
2008	1		80	22.24	14.42
	2		80	21.09	11.55
	3		40	17.30	6.76
	<b>Overall</b>	<b>274,215</b>	<b>200</b>	<b>60.64</b>	<b>29.12</b>
2009	1		80	20.14	12.31
	2		80	18.41	10.30
	3		40	15.86	8.43
	<b>Overall</b>	<b>299302</b>	<b>200</b>	<b>54.29</b>	<b>28.80</b>
2010	1		80	21.39	13.76
	2		80	18.67	10.82
	3		40	18.42	8.31
	<b>Overall</b>	<b>317135</b>	<b>200</b>	<b>58.39</b>	<b>30.44</b>

From the table it can be observed that:

6.1.1 There has been an increase in candidature for the past three years.

6.1.2 There was improvement in performance for the year 2010 compared to 2009 as indicated by the mean scores and standard deviations of the papers.

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

### 6.2 PAPER 1 (231/1)

#### Question 1

State the name given to the study of:

- (a) the cell;
- (b) microorganisms.

The candidates were required to state names given to the study of cell and microorganisms

#### Weaknesses

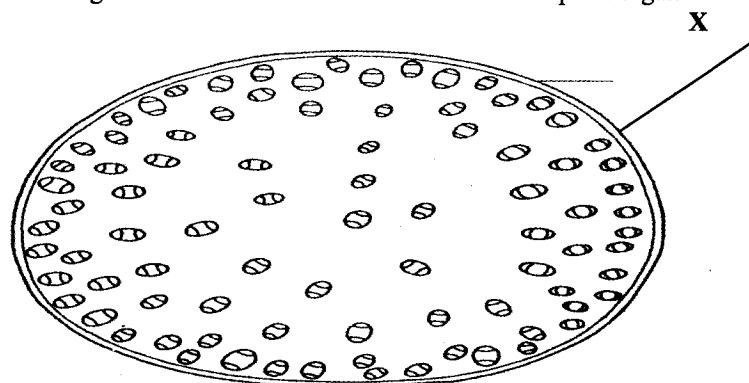
- (a) Some Students wrote serology / cerology instead of cytology
- (b) Some wrote microbiology

#### Expected responses

- (a) Cytology
- (b) Microbiology

### Question 2

The diagram below shows a transverse section of a plant organ



- (a) Name the plant organ from which the section was obtained.
- (b)
  - (i) Name the class to which the plant organ was obtained.
  - (ii) Give a reason for your answer in (b)(i) above.
- (c) Name the part labelled X.

Candidates were required to identify the transverse section of plant organ.

#### Weaknesses

Students wrote monocotyledon which refers to plant not class

Candidates were unable to differentiate between *monocotyledonae* and *dicotyledonae* and whether it was a stem or root section.

#### Expected response

- (a) Stem;
- (b)
  - (i) Monocotyledonae;
  - (ii) Vascular bundles scattered/not arranged in a ring/  
Absence of pith/Absence of vascular cambium;
- (c) Epidermis;

### Question 7

Distinguish between haemolysis and plasmolysis.

Candidates required to differentiate between haemolysis and plasmolysis

#### Weaknesses

Candidates confused between red blood cells and plant cells, hypertonic and hypotonic solutions, flaccid and cell shrinking

#### Expected response

- Haemolysis – process by which red blood cells take in water till they burst;
- Plasmolysis – loss of water from a plant cell until the membrane is detached from the cell wall/flaccid;

NB. First mark 4 correct identification of cells & correct movement of water.

Second mark 4 correct results of what is happening.

### Question 9

State two ways in which chloroplasts are adapted to their function.

Candidates were required to state adaptations of chloroplasts to their function

### **Weaknesses**

Most candidates only mentioned the position of chloroplasts on the leaf while others described many chloroplasts instead of only one

### **Expected response**

- They contain chlorophyll which traps/absorbs light (energy);
- They have grana which increase surface area for accommodation of large number of chlorophyll molecules;
- The stroma has enzymes for photosynthesis;

### **Question 18**

Give **two** reasons why animals have specialised organs for excretion as compared to plants.

Candidates were required to give reasons why animals have specialized organs for excretion

### **Weaknesses**

Some Candidates wrote incomplete comparisons either mentioning plants or animals only without comparing the two. Others wrote comparisons that did not match while others didn't know that only some wastes in animals are reused and not all.

### **Expected response**

- Animals form waste products more rapidly than plants/produce more metabolic wastes;
- Animal wastes are more toxic than those of plants;
- Animals don't re-use their wastes while plants re-use some of their wastes;

### **Question 24**

(a) State **two** ideas proposed by Lamarck in his theory of evolution.

(b) Why is Lamarck's theory not acceptable? (1 mark)

Candidates were required state ideas proposed by Lamarck in his evolution theory and why the theory is not accepted.

### **Weaknesses**

Some candidates wrote misuse instead of disuse, phenotypic characters instead of acquired characteristics. There was confusion between phenotypic and genotypic

### **Expected response**

- (a) Use and disuse;  
Acquired traits can be passed on to offspring;
- (b) Acquired characteristics cannot be inherited;  
There is no evidence to support Lamarck's theory;

### **Question 25**

State **three** factors that contribute to the deceleration phase in the population curve of an organism.

Candidates were required to state three factors contributing to deceleration phase in population curve.

### **Weaknesses**

Some candidates wrote competition as a factor while others wrote reduction in space to mean the same as overcrowding. There was confusion also between no food and insufficient food.

### Expected response

- Overcrowding;
- Accumulation of toxic wastes;
- Limited resources such as nutrients;

### Question 27

- (a) What is meant by the term non-disjunction?
- (b) Give an example of a genetic disorder caused by:  
(i) non-disjunction;  
(ii) gene mutation.

Candidates were required to state meaning of non-disjunction and give names of genetic disorders caused by gene mutation and non-disjunction

### Weaknesses

Candidates were not able to distinguish between albinism and albino, colour blind and colour blindness and hemophilia and haemophiliac. Most candidates did not understand the concept non-disjunction.

### Expected response

- (a) Failure of homologous chromosomes to segregate during meiosis/anaphase I; failure of sister chromatids to segregate during anaphase II;
- (b) (i) Down's syndrome/Turner's syndrome/Klinefelter's syndrome;  
Mongolism/Surners syndrome;  
(ii) Albinism/sickle cell anaemia/haemophilia/colour blindness;  
Achndroplasia/chndrodystrophic dwarfism;

### Question 29

The diagram below represents a female cone.



- (a) Name the subdivision of the plant from which the cone was obtained.
- (b) Other than the presence of cones, name **two** other external features that identify plants in the subdivision named in (a) above

Candidates were required to name subdivision of cone stating other external features that identify the plant in the subdivision.

### Weaknesses

There were wrong spellings of the subdivision name. Most candidates lacked knowledge on classification

### Expected response

- (a) Gymnospermae/Gymnospermatophyta/Gymnospermaphyta;
- (b) Needle-like leaves (with waxy cuticle);  
Naked seeds;  
Thick waxy cuticle; sunken stomata;

### Question 30

What is meant by the term apical dominance?

Candidates were required to define apical dominance

### Weaknesses

Some candidates confused apical dominance with seed dormancy. Some me did not understand that presence of auxins is what causes apical b bud to overshadow lateral buds.

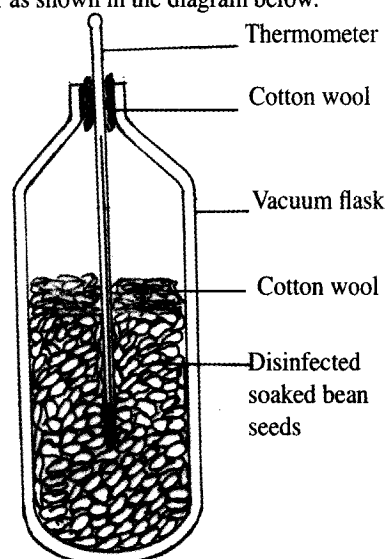
### Expected response

The inhibition of growth of lateral buds;  
by auxins; produced by the growing apical bud;

## 6.3 PAPER 2 (231/2)

### Question 1

In an experiment, disinfected soaked bean seeds were put in a vacuum flask which was then fitted with a thermometer as shown in the diagram below.



The temperature readings were taken every morning for three consecutive days.

- (a) Which process was being investigated? (1 mark)
- (b) (i) What were the expected results? (1 mark)
- (ii) Account for the answer in (b)(i) above. (2 marks)
- (c) Why were the seeds disinfected? (2 marks)
- (d) Why was a vacuum flask used in the set-up? (1 mark)
- (e) How would a control for this experiment be set? (1 mark)

Candidates were required to know experimental procedures to investigate to investigate what happens when seeds germinate.

**Weaknesses**

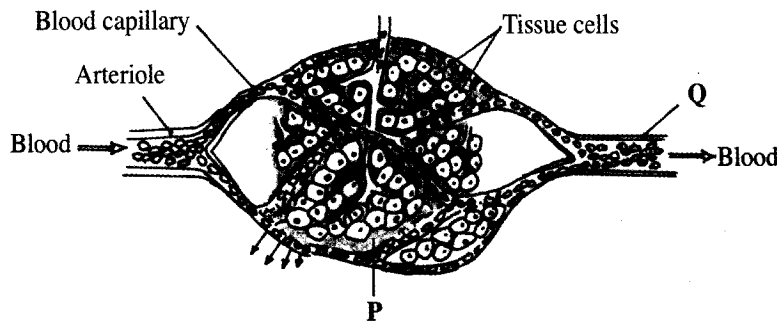
Some candidates did not differentiate between respiration and fermentation. Some did not understand the meaning of “disinfect” making them to answer wrongly part (c) of the question. Majority did not know what it meant by control experiment.

**Expected response**

- (a) Respiration;
- (b) (i) Increase/rise in thermometer reading/temperature;
- (ii) Carbohydrates/starch/glucose in germinating seeds is broken down/oxidised to get energy; some of the energy is released as heat; (which increases temperature reading).
- (c) To kill bacteria/fungi/microorganisms; that would cause decay/decomposition/respiration of the beans;
- (d) To conserve heat/prevent heat loss to surroundings;
- (e) Use similar set-up but with dead and disinfected beans seeds/ use dead disinfected bean seeds/use dry bean seeds;

**Question 2**

The diagram below shows blood circulation in a mammalian tissue.



- (a) Name the parts labelled **P** and **Q**.
  - P** ..... (1 mark)
  - Q** ..... (1 mark)
- (b) Name the substances that are:
  - (i) required for respiration that move out of capillaries; (1 mark)
  - (ii) removed from tissue cells as a result of respiration. (1 mark)
- (c) Explain how substances move from blood capillaries into the tissue cells. (3 marks)
- (d) Name **one** component of the blood that is not found in the part labelled **P**. (1 mark)

Candidates were required to know how cells get nutrient for respiration from blood in capillaries and the wastes of respiration that leave the cells.

#### Weaknesses4

Some candidates did not understand how substances are exchanged between tissues and blood in the capillaries. There were spelling mistakes on the word venule. On substances required for respiration that move out of capillaries, some candidates were just writing one substance instead of two making them to lose the mark.

#### Expected response

- (a) P Tissue fluid/intercellular/interstitial fluid/space;  
Q Venule;
- (b) (i) Glucose, oxygen;  
(ii) Carbon (iv) Oxide, water;
- (c) Blood entering arteriole has a high pressure; the pressure forces water and small solute molecules in blood to go through capillary wall forming tissue fluids; nutrients/oxygen move into the tissue cells by diffusion;
- (d) Red Blood cells/proteins/platelets;

#### Question 6

Candidates were required to know how to:

- Select appropriate scale from given data for graph drawing
- Plot and interpret graphs
- Relate size of an organism to heat loss or gain
- Calculate the rate of heat loss

#### Weaknesses

Some candidates did not know how to select a suitable scale for the graphs. Some were not able to calculate the rate of heat loss using the graphs. Techniques on graph plotting were not understood by some candidates.

#### Expected response

- (a) Graph  
Title  
Suitable Scale cover  $\frac{3}{4}$  page  
Axes  
Plotting  
Smooth curves  
Identification
- (b) (i) A:  $56 - 48.5 = 7.5^{\circ}\text{C}$   
 $7.5^{\circ}\text{C}$  ;  $=0.75^{\circ}\text{C Per Minute}; \pm 0.05$   
10 Minutes
- B:  $48 - 34 = 14^{\circ}\text{C}$   
 $14^{\circ}\text{C}$  ;  $=1.4^{\circ}\text{C Per Minute}; \pm 0.05$   
10 Minutes
- (ii) B has a larger surface area to volume ratio; making it to lose heat to the surrounding faster; (the converse is true)
- (iii) A rat has larger surface area to volume ratio compared to an elephant; making the rat to lose heat at a faster rate than an elephant;
- (c) (i) Insulation/insulate against heat loss; (to surrounding);  
(ii) Subcutaneous fat layer / adipose tissue;  
Fur / hair; (2 Marks)
- (d) Are active always; (even under very cold conditions)  
Are able to escape from predators/search for mates/food; (because they are active always)  
Can survive in a wide variety of habitats: (both cold and hot)

WTTE

#### Question 7

Describe the process of fertilization in flowering plants.

(20 marks)

Candidates were required to describe the process of fertilization in flowering plants.

### **Weaknesses**

Candidates were not able to describe the sequence of events from pollination to fertilization. They did not have proper understanding of the biological terms used to describe the process like triploid nucleus, diploid diploid zygote and double fertilization.

### **Expected response**

Pollen grains land onto the stigma; and adhere to it as a result of the stigma cells secreting a sticky substance; It absorbs nutrients; and germinates forming a pollen tube; The pollen tube grows down the style to the ovary; deriving nourishment from surrounding tissues; The pollen tube has tube nucleus at the tip; and generative nucleus immediately behind it; As the tube grows downwards into the ovary the generative nucleus divides mitotically; to give rise to two nuclei; which represent the male gametes; The pollen tube penetrates the ovule/embryo sac through the micropyle/chalazassa; After the pollen tube enters the embryo sac, the tube/vegetative nucleus breaks down; leaving a clear passage for the entry of the male nuclei; which enter the embryo sac; where one fuses with the egg cell nucleus; to form a diploid zygote; which develops into an embryo; The other male nucleus fuses with the two polar nuclei; to form a triploid nucleus /primary endosperm nucleus; Which becomes endosperm; This type of fertilization is called double fertilization;

### **Question 8**

Describe how a finned fish such as Tilapia moves in water.

(20 marks)

Candidates were required to describe how a finned fish like a Tilapia moves in water.

### **Weaknesses**

Candidates did not describe in detail all that is involved to bring about movement of fish in water including myotomes, fins and swim bladder. Most were sketch in their description.

### **Expected response**

Movement of fish in water is by swimming; It involves forward movement and control of the body position in water; Scales overlapping backwards/mucus/streamlined body shape reduces resistance/friction to enhance forward movement; Forward movement (propulsion) is caused by the tail; The tail is (almost half the length of the body of the fish) to enable it create enough force (to enable the fish to push forward); Propulsion is achieved when the tail pushes sideways against the water; Sideways movements is brought about by muscles arranged in segmented blocks/myotomes on both sides of vertebral column; The muscles contract alternately causing the vertebral column to swing sideways; When muscle blocks on the right relax and those on the left contract; the body bends to the left side; When the muscles of the left relax and those on the right contract; the body bends to the right; The fish uses its fins to control the position of its body in water; During forward movement paired fins/pectoral and pelvic fins lie flat on the body surface to reduce resistance/friction; To change direction the fish uses the paired fins; Paired fins are also used by fish to change its level in water/control/prevent pitching; The fish spreads out the pectoral and pelvic fins at 90° to the body; to enable it to brake; Fish can also use the swim bladder to change its level in water; When the bladder fills up with air the fish becomes lighter/more buoyant; making it to rise in water; When the air leaves the bladder the fish becomes heavier; making it to sink deeper in the water; water currents may cause the sideways swaying of the body of the fish/ yawing; Dorsal and ventral fins prevent rolling/yawing;



**6.4 PAPER 3 (231/3)**

**Question 1**

You are provided with a visking tubing, a solution labelled L, Iodine solution labelled solution E, Benedict's solution labelled solution F and a piece of thread.

Tie one end of the visking tubing tightly using the thread provided. With the help of a syringe, put 10 ml of the solution labelled L into the visking tubing. Tie the other end of the visking tubing tightly.

**Ensure that there is no leakage at both ends of the visking tubing.**

Wash the outside of the visking tubing with water. Place the visking tubing upright in a 100 ml beaker. Add distilled water into the beaker to reach the level of the liquid in the visking tubing. Allow the set up to stand for 30 minutes or more.

(a) Using 2ml in a test-tube in each case, test for the food substance in the liquid outside the visking tubing using (6 marks)

TEST	Procedure	Observations	Conclusion
(i) Iodine solution (Solution E)			
(ii) Benedict's solution (Solution F)			

(b) Using 2ml in a test-tube in each case, test for the food substance in the contents of the visking tubing using (2 marks)

TEST	Procedure	Observations	Conclusion
(i) Iodine solution (Solution E)			
(ii) Benedict's solution (Solution F)			

(c) Account for your results in (a) and (b) above. (3 marks)

Candidates were required to test for the presence of reducing sugar and non-reducing sugar in the solution given. The solution was to be placed in a visking tubing then after sometime test for the food that passes through the pores of the tubing to outside and that which is unable to pass.

**Weaknesses**

Candidates had spelling mistakes, tied visking tubing loosely hence wrong results. Some used wrong units e.g. 2m instead of 2ml. Others used wrong apparatus like white in question 1. Others were unable to differentiate between conclusion and accounting.

**Expected response**

(a)

	Procedure	Observations	Conclusion
Iodine test	Add (a few drops of) iodine (to liquid in the beaker);	No change in colour/Brown/yellow /orange colour of iodine retained;	Starch absent;
Benedict's test	(To 2 ml of the liquid from the beaker),(2 ml of) Benedict's solution is added. The mixture is heated/boiled/warmed in a water bath;	The solution acquires a brick red colour; Yellow/orange/brown/reddish brown. NB. Colour sequence must be correct	Reducing sugar is present;

(b)

	Procedure	Observations	Conclusion
Iodine test	Add (a few drops of) iodine (to contents of visking tubing);	Solution acquires a blue black colour/blue/black/bluish Black colour;	Starch present;
Benedict's test	(To 2 ml of the liquid from the beaker), (2 ml of) Benedict's solution is added. The mixture is heated/boiled/warmed in water bath;	The solution acquires a yellow/orange/brown/reddish brown colour;	Reducing sugar is present;

Observations and conclusion that is repeated to be awarded once in (a) and (b).

- (c) The visking tubing in semi-permeable/selectively permeable; allowing (the small) reducing sugar molecules to diffuse/move pass through; but (not the large molecule of) starch;

- NB.
- spelling of reagents must be correct.
  - Quantities of reagents and test materials if stated must bear correct units e.g. ml/cm<sup>3</sup>
  - Procedure for Iodine to be awarded once in(a) and (b) Procedures, observations and conclusion for Benedict's Test to be awarded once in (a)/or (b).
  - Award if student refers to Iodine as solution E, Benedict's solution as solution F and contents of visking tubing as L.
  - Deny all marks if student writes a wrong food substance in the Test column e.g. Non-reducing sugar.

**Question 2**

Candidates were required to identify chambers of the mammalian heart and the associated blood vessels.

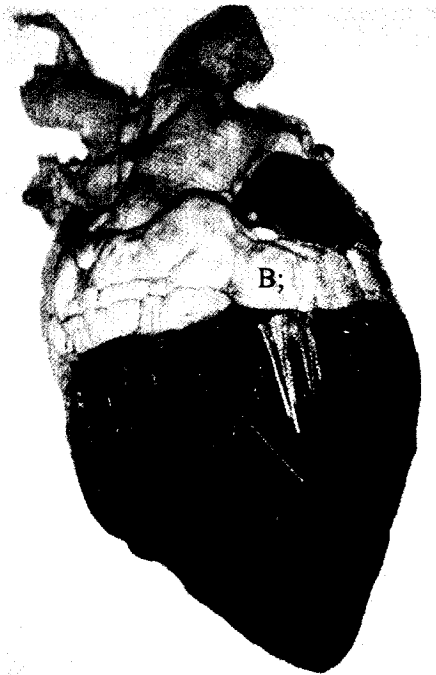
**Weaknesses**

Candidates were not able to identify the blood vessels on the photograph. They also gave wrong spellings of the names.

**Expected response**

(a) String	Chamber	Blood vessel
Blue	right ventricle;	pulmonary artery;
Green	left ventricle;	(branches of) aorta;
Cream 1	right auricle/atrium	vena cava;
Cream 2	left auricle/atrium;	pulmonary vein

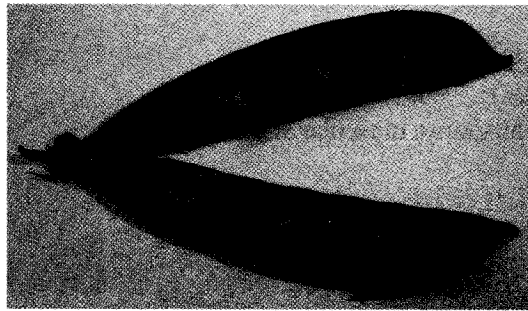
- (b) (Inter-ventricular) Septum;
- (c) 4 is thicker than 5, because the latter (forms the wall of the chamber that) pumps blood to the lungs and 4 (forms the wall of the chamber that) pumps blood to all the other parts of the body; Distance be compared i.e. longer if the parts are not named.
- (d) X Vein(s);  
Reason: It has thin walls/ less muscular walls;  
Y Artery(Arteries);  
Reason: It has thick walls/more muscular walls;
- (e)



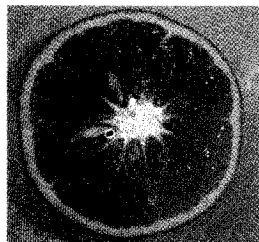
- NB: (i) Accept any point of the region marked.
- (ii) Labelling rules to be adhered to e.g. continuous line, no arrow head to structure.

**Question 3**

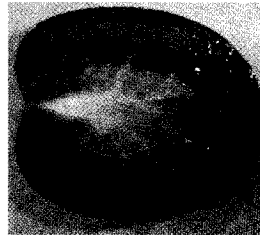
The photographs labelled **Q, R, S** and **T** are sections of some parts of plants.



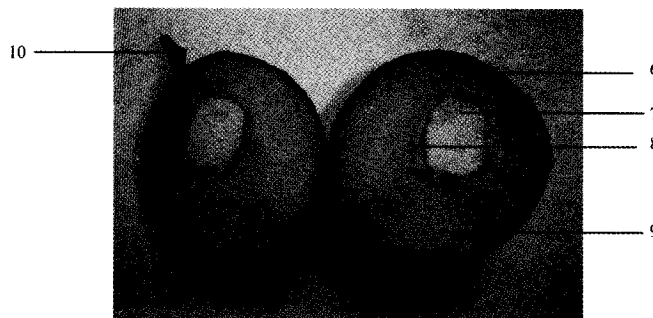
**PHOTOGRAPH Q**



**PHOTOGRAPH R**



**PHOTOGRAPH S**



**PHOTOGRAPH T**

(a) Name the type of placentation in the specimens shown in photographs **Q, R** and **S**. (3 marks)

**Q** .....

**R** .....

**S** .....

(b) Label a seed in photographs **R** and **S**. (2 marks)

(c) Name the parts labelled 6, 7, 8, 9 and 10 in photograph **T**. (5 marks)

6 .....

7 .....

8 .....

9 .....

10 .....

- (d) Giving a reason in each case, name the mode of dispersal of each of the specimens in photographs Q and T. (4 marks)

Q .....

Reason .....

T .....

Reason .....

Candidates were required to state type of placentation and mode of dispersal of some plant specimens represented by photographs.

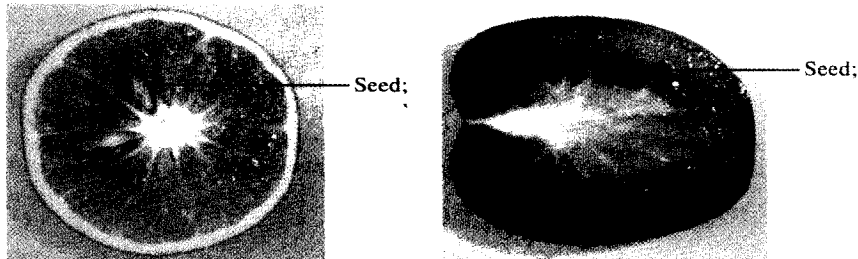
### Weaknesses

There were many spelling mistakes in this question. Candidates were also not able to follow rules of labeling diagrams. Candidates were also unable to interpret the question correctly.

### Expected response

- (a) Q Marginal;  
R Axial/axile/central;  
S Central;

(b)



- (c) 6 Epicarp/Exocarp;  
7 Seed; Acc cotyleone(s)  
8 Edocarp;  
9 Mesocarp;  
10 Remain of flower stalk/pedicel/fruit stalk;

- (d) Q Self (dispersal)/self explosive/explosion (mechanisms/explosive mechanism/self Dispersed);  
Reason Presence of sutures/lines of weakness/dehiscence (along which it splits);

T By animal(s)/animal dispersed;

Reason The fruit is fleshly succulent/brightly coloured/fleshy mesocarp (and animals eat and drop the seed on another place far away from the mother plant);

## 6.5 ADVICE TO TEACHERS

- 6.5.1 Experimental questions were performed poorly by candidates. Students should be exposed to more practicals while stressing on correct procedures and proper use of apparatus.
- 6.5.2 Exoose students to both real and photographs of specimens. Teachers should also teach students on how to set control experiments.
- 6.5.3 Schools should embrace e-learning to enable students access diversified information for easy understanding of science concepts.
- 6.5.4 Teachers should cover the syllabus adequately to enable students to have a clear grasp of the content. They should not rush to cover the e syllabus the last minutes denying candidates a chance to digest the contents properly.

- 6.5.5 Teachers should distinguish clearly the difference between co-dominance and incomplete dominance and other closely related biological terms.
- 6.5.6 Use of correct biological terms with correct spelling should be emphasized during teaching.
- 6.5.7 The correct way of drawing and labeling of diagrams should be given emphasis during teaching-learning process. Biology cannot be taught without using diagrams.
- 6.5.8 Techniques of answering questions on adaptations should be taught. Candidates should clearly relate structure to function to score.