

### 3.3 BIOLOGY (231)

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



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#### 3.3.1 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, 2009, 2010 and 2011 is also given for comparison.

**Table 10: Candidates' Overall Performance in Biology In the years 2008, 2009, 2010, 2011 and 2012**

Year	Paper	Candidature	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
	Overall	274,215	200	60.64	29.12
2009	1		80	20.14	12.31
	2		80	18.41	10.30
	3		40	15.86	8.43
	Overall	299,302		54.29	28.80
2010	1		80	21.39	13.76
	2		80	18.67	10.82
	3		40	18.42	8.31
	Overall	317,135	200	58.39	30.44
2011	1		80	22.74	12.41
	2		80	23.31	13.04
	3		40	18.84	8.10
	Overall	363,817	200	64.87	31.05
2012	1		80	19.77	12.84
	2		80	20.70	12.09
	3		40	11.97	6.59
	Overall	389,523	200	52.41	29.43

From the table it can be observed that:

- There has been an increase in candidature for the past four years.
- There was a drop in performance in the year 2012 compared to 2011 as indicated by the mean scores of the papers.
- The standard deviation values indicate that the papers adequately discriminated learners of different abilities.

#### ANALYSIS OF POORLY PERFORMED QUESTIONS

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

### 3.3.2 Biology Paper 1 (231/1)

#### Question 15

What name is given to a group of hormones that controls the development of secondary sexual characteristics?

#### Weaknesses

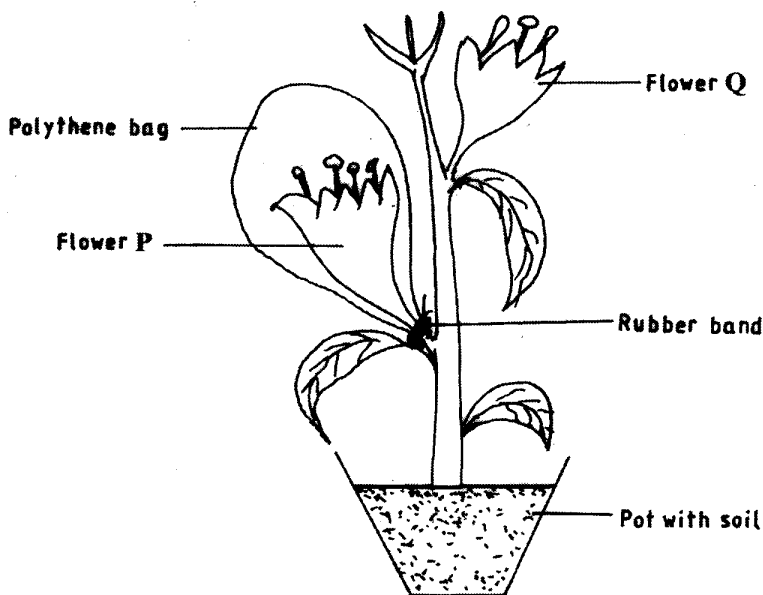
Most candidates were not able to give the correct response. They gave a variety of specific hormones in both sexes.

#### Expected response

Androgens;

#### Question 16

16 The diagram below represents an experimental set-up used by students to investigate a certain process.



Flower Q produced seeds while P did not. Account for the results.

(3 marks)

#### Weaknesses

Some candidates failed to link the inability to produce seeds with pollination and as a result they lost the marks for the entire question. Others were unable to synthesize that the plant is self sterile hence cross pollinated.

#### Expected response

The plant is self sterile hence cross pollinated; polythene bag prevented cross pollination; flower Q received pollen from other plants.

### **Question 18**

Why are plants able to accumulate most of their waste products for long?

#### **Weaknesses**

Most candidates gave recycling/re-use as a response; an indication that they may have interpreted the question incorrectly.

#### **Expected response**

Most of the waste products are harmless/non-toxic to the plant/  
The wastes are converted into harmless products;

### **Question 19**

List four symptoms of diabetes mellitus.

#### **Weaknesses**

Most candidates were unable to give the correct symptoms of diabetes mellitus. The candidates may not have understood the meaning of diabetes mellitus or the topic is not exhaustively covered during instruction.

#### **Expected responses**

Frequent urination/*polyuria*  
Excessive thirst/*polydipsia*  
Increased appetite/*polyphagia*  
Weight loss  
Excess glucose in blood  
Poor resistance to diseases  
Fatigue  
Blurred vision  
Glucose in urine

### **Question 22**

State the importance of divergent evolution to organisms.

#### **Weaknesses**

Most candidates went back to the meaning of divergent evolution in their response. The question required candidates to give the importance of divergent evolution to organisms. This could be an indication that instruction does not adequately emphasize application of this concept in life.

#### **Expected response**

Results in adaptations to exploit different ecological niches; leads to formation of new species;

### Question 26

26 (a) state the theories of evolution proposed by the following scientists:

Charles Darwin;

Jean-Baptiste de Larmack.

26 (b) state the evidence of evolution based on

(i) cell organelles;

(ii) fossils.

### Weaknesses

Most candidates were unable to answer the question correctly. This observation is consistent with that on question 22 on the same topic. This could be an indication that the topic is not adequately covered during instruction. Evolution is one of the last topics in this course. The performance on this topic may imply that it is covered in a hurry to complete the syllabus. The abstract nature of the content in this topic calls for more creativity and improvisation during instruction for the learners to sufficiently grasp and apply the concepts of evolution.

### Expected responses

26 (a) Charles Darwin:

Theory of natural selection;

Jean-Baptiste de Larmack:

Theory of inheritance of acquired characteristics;

26 (b)

(i) Similar organelles perform similar functions in different organisms suggesting that they originate from a common ancestry;

(ii) Fossils of different ages show common phylogenic relationships meaning that they evolved from a common ancestry;

### 3.3.3 Biology Paper 2 (231/2)

#### Question 1(a)

1 In a certain plant species which is normally green, a recessive gene for colour (n) causes the plants to be white in colour. Such plants die at an early age. In the heterozygous state, the plants are pale green in colour but grow to maturity.

(a) Give a reason for the early death of the plants with the homozygous recessive gene.

(2 marks)

### Weaknesses

Most candidates were unable to associate the white colour with lack of chlorophyll. They narrowed themselves to the genetics and could not think about the implication of the white colour. Candidates should pay attention to the details in the question.

**Expected response**

The plants lack chlorophyll/do not photosynthesize; they die as soon as the food reserves are depleted;

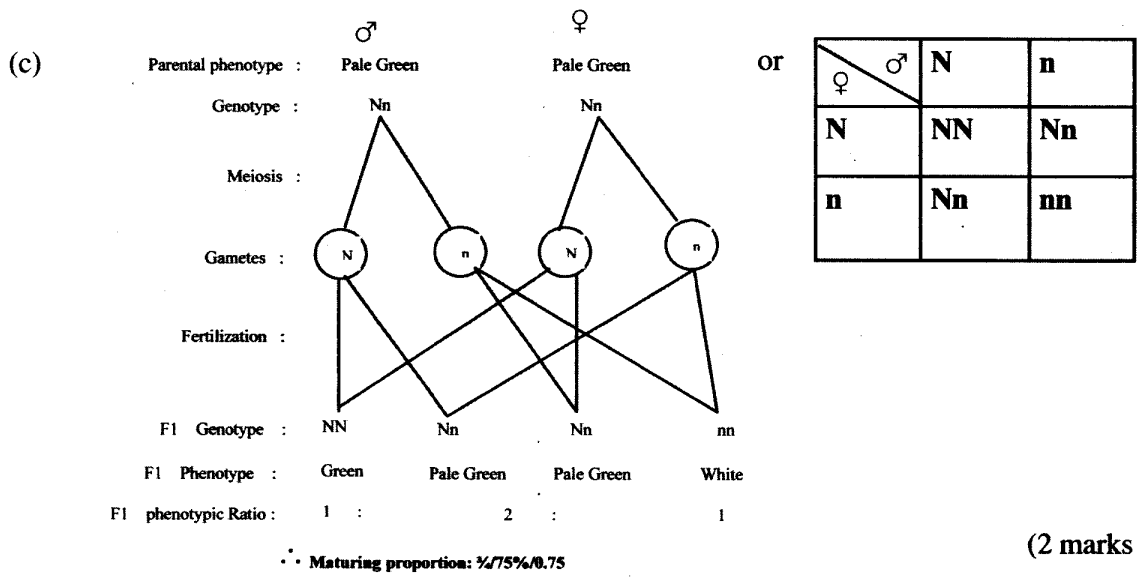
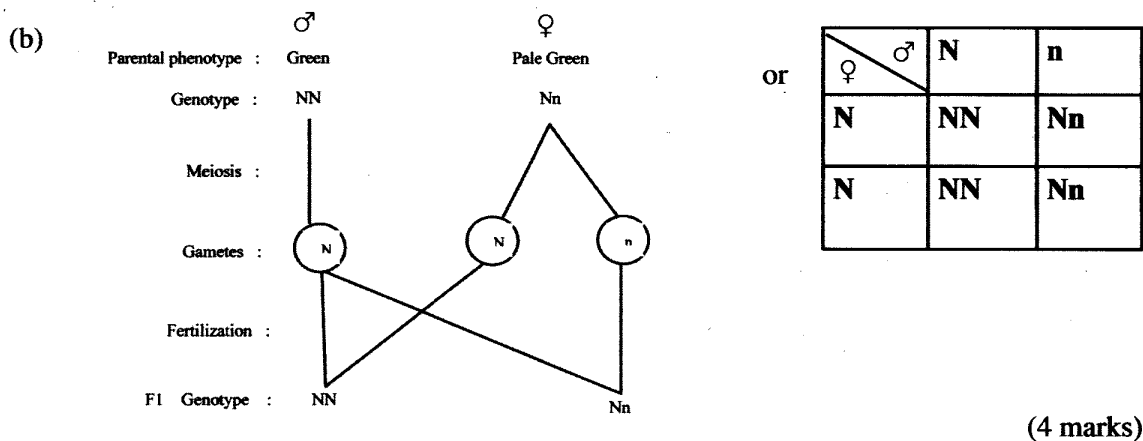
**Question 1 (c)**

If heterozygous plants were self-pollinated and the resulting seeds planted, work out the proportion of their offspring that would grow to maturity.

**Weaknesses**

Most candidates did not know how to express the resulting cross as a phenotypic ratio.

**Expected response**



**Question 2 (c)**

State three physiological mechanisms of controlling the human body temperature during a cold day.

### **Weaknesses**

Some candidates did not know the difference between physical, behavioural and physiological mechanisms. Other candidates only gave the structures involved.

### **Expected response**

Vasoconstriction;  
Hair rises;  
Increase in metabolic rates;  
Shivering;

### **Question 4 (b)**

State three ways in which support is brought about in a leaf.

### **Weaknesses**

Most candidates were not able to link the support in the leaf with the general support in plants.

### **Expected response**

The rigid mid rib holds the leaf from the stem;  
Profuse network venation keeps the leaf spread out;  
Turgidity in the spongy mesophyll keeps the leaf open;

### **Question 5**

- (a) Describe the process of inhalation.
- (b) Explain the mechanism of stomatal opening.

### **Weaknesses**

Most of the candidates were not able to give a correct account of each of the two processes.

### **Expected response**

- (a) The external intercostal muscles contract while internal intercostal muscles relax; the rib cage is pulled upwards and outwards; the diaphragm muscles contract and the diaphragm flattens; the volume of the thoracic cavity increases/the pressure in the thoracic cavity decreases; air rushes into the lungs; from the atmosphere through the nose  
(4 marks)
- (b) The osmotic pressure of guard cells increase when sugar is manufactured during photosynthesis/starch is converted to sugar in low acidity/potassium moves into guard cells during the day; water enters guard cells from the surrounding cells by osmosis; because the guard cells are bean shaped with thin outer walls and thick inner walls, the thin outer walls expand faster as the cell becomes turgid; thus the thick inner wall curves; causing the stomatal aperture to open.  
(4 marks)

### Question 8 (a)

Using a relevant example, describe how an allergic reaction occurs in a human being.

#### Weaknesses

Most candidates knew the manifestation of allergies in humans but could not give the biological concept behind them.

#### Expected response

- (a) An allergic reaction is a hypersensitive response; to an antigen by the body immune system; The body immune system responds by overproducing antibodies; against harmless antigens; The antigen-antibody reaction occurs on the surface of body cells, which burst open; and release histamines; Histamines cause inflammation/itching/swelling/pain, etc; which damage the body; Allergic people are hypersensitive to materials like dust/pollen grains/some foods/some drugs/some pollutants, etc;

### 3.3.4 Biology Paper 3 (231/3)

#### QUESTION 1 (c)



- (c) Account for the change in shape the seedling will undergo to straighten. (6 marks)

#### Weaknesses

Most candidates were unable to link the straightening of the seedling with the effect of auxins. Those who were able to associate it with auxins were unable to correctly explain how they bring about the straightening.

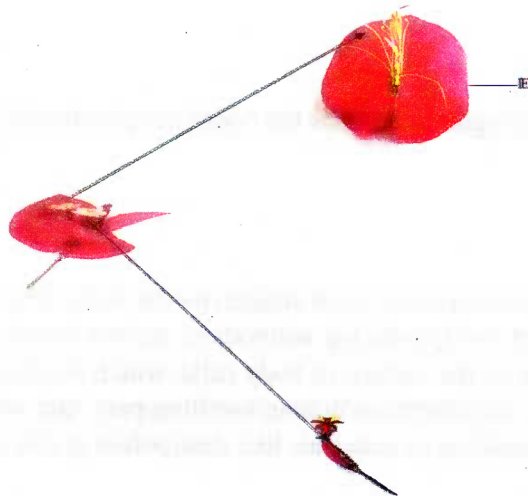
#### Expected response

- (c) Emergence of the hypocotyle exposes it to light;  
Light stimulates migration of auxins to the lower side of the hypocotyle;  
High concentration of auxins; on the lower side;  
Stimulates faster rate of growth than on the upper side;  
Faster elongation of the lower side straightens the seedlings;

(6 marks)

**Question 2 (b) (ii)**

(b) The photograph below shows different parts of a flower.



- (i) Name the class of the plant from which the photograph was taken. (1 mark)
- (ii) Using observable features on the photograph, give **three** reasons for your answer in (b) (i) above. (3 marks)

**Weaknesses**

Most candidates gave the correct class of the plant. However most of them could not give the correct reasons based on the photograph. This could be an indication of inability to apply knowledge and pay attention to details. The reasons are clearly observable from the photograph: broad bract/lamina; network venation; 5 sepals/petals;

**Expected response**

Broad bract/lamina;  
Network venation;  
5 sepals/petals;

**QUESTION 2 (b) (v)**

- (v) Name the part labelled **E** on the photograph. (1 mark)

**Weaknesses**

Most candidates were unable to identify the bracts. Candidates were expected to analyse the floral parts in order to arrive at a correct response.

**Expected response**

- (v) Bract; (1 mark)



**QUESTION 3 (b) (ii)**

You are provided with a potato, a 10 ml measuring cylinder, dilute hydrogen peroxide solution and substances **F** (pH 4), **G** (pH 7) and **H** (pH 9). Cut the potato and remove a piece measuring 1 cm<sup>3</sup> from it.

Cut the 1 cm<sup>3</sup> piece into tiny pieces and crush (macerate) them on a clean white tile using a glass rod.

Divide the macerated potato into **three** equal portions for use in the procedure that follows:

- I. Put 2 cm<sup>3</sup> of substance **F** (pH 4) into the 10 ml measuring cylinder.  
Add **one** portion of the macerated potato into the measuring cylinder.  
Read and record the volume of the mixture in the table provided below.  
Add one drop of washing-up solution.  
Add 1 cm<sup>3</sup> of dilute hydrogen peroxide solution to the mixture and immediately start a stop clock or watch. At the end of **two minutes**, read the mark to which the foam rises.  
Record the reading in the table provided.  
Clean and rinse the measuring cylinder with distilled water.
  
- II. Put 2 cm<sup>3</sup> of substance **G** (pH 7) into the measuring cylinder.  
Add the **second** portion of the macerated potato.  
Read and record the volume of the mixture in the table.  
Add one drop of washing-up solution.  
Add 1 cm<sup>3</sup> of dilute hydrogen peroxide solution to the mixture and immediately start a stop clock or watch. At the end of **two minutes**, read the mark to which the foam rises.  
Record the reading in the table.  
Clean and rinse the measuring cylinder with distilled water.
  
- III. Put 2 cm<sup>3</sup> of substance **H** (pH 9) into the measuring cylinder.  
Add the **third** portion of the macerated potato.  
Read and record the volume of the mixture in the table.  
Add one drop of washing-up solution.  
Add 1 cm<sup>3</sup> of dilute hydrogen peroxide solution to the mixture and immediately start a stop clock or watch. At the end of **two minutes**, read the mark to which the foam rises.  
Record the reading in the table.

	F (pH 4)	G (pH 7)	H (pH 9)
<b>Volume of solution + portion of potato</b>			
<b>Volume of solution + portion of potato + foam</b>			
<b>Volume of foam</b>			

(9 marks)

- (a) Using the data obtained in the table, calculate the volume of the foam produced in each of the pH 4, pH 7, and pH 9 substances. Record the volumes in the table.
- (b) Account for
- (i) the observation made when hydrogen peroxide was added to the potato mixture (3 marks)
  - (ii) the difference in the volume of foam produced in pH 4 and pH 9 substances. (2 marks)

### **Weaknesses**

Most candidates were unable to associate the difference in the volume of foam produced at pH 4 and pH 9 with the effect of pH on enzyme activity.

### **Expected response**

More foam is produced at pH 9; which is optimum for catalase enzyme activity;

### **GENERAL ADVICE TO TEACHERS**

Questions involving application of knowledge were poorly performed by candidates compared to those that required factual knowledge. This could be a likely indication that the instruction should go beyond mere transfer of factual information.

Questions involving biological processes were equally performed poorly. Some candidates had the points to build up the processes but could not put them down coherently. The points were not flowing as per the requirements of the biological procedure in question. This could be an indication that these candidates had simply memorized the points and therefore could not use them to build the biological process in the task.

Topics with abstract content such as evolution should be approached creatively to ensure that learners are active participants in the teaching learning process. Teachers should ensure that the learners understand and are able to apply the knowledge behind the biological concepts in such topics.

The syllabus should be covered adequately to enable students to have a clear grasp of the content. All the suggested activities should be covered practically for the candidates to internalize the scientific concepts behind them.

The technical words used in biology should be fully embraced and candidates adequately exposed to their use in their scientific communication. Use of correct biological terms with correct spelling should be emphasized during teaching.

The correct way of drawing and labeling of diagrams should be given emphasis during teaching-learning process. Biology cannot be taught without using diagrams. Techniques of answering questions on adaptations should be taught. Candidates should clearly relate the structure to the function in order to score.

Finally, all the biology topics in the syllabus are tested by the three papers. Teachers should therefore ensure that all the topics are adequately covered during teaching. All content areas should be equally emphasized during instruction. There should be no discrimination on the basis of past biology examination papers. The content area you think is never tested could be in the next test paper. Let us prepare our candidates adequately.