

NAME \_\_\_\_\_ INDEX NO. \_\_\_\_\_

CANDIDATE'S SIGNATURE \_\_\_\_\_

DATE \_\_\_\_\_

**231/1  
BIOLOGY  
PAPER 1  
(THEORY)  
JUNE/JULY 2011  
2 HOURS**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011  
Kenya Certificate of Secondary Education  
BIOLOGY  
PAPER 1  
THEORY  
2 HOURS**

**INSTRUCTIONS TO CANDIDATES**

- This paper consists of 9 printed pages
- Answer all questions in the spaces provided after each question
- Write clearly and legibly

Question	
1-22	80 marks
Total score	

**This paper consists of 9 printed pages**

**Turn Over**

1. (a) What is a cell (1mk)

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(b) Define the meaning of the following terms  
(i) Entomology (1mk)

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(ii) Genetics (2mks)

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2. (a) State the apparatus/equipment used in the laboratory to obtain the magnification of a specimen of a leaf (1mk)

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(b) Write the formula used to obtain the magnification of (a) above (1mk)

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3. List two major characteristics of members of the same species (2mks)

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4. State the functions of;  
(a) Rough Endoplasmic Reticulum (1mk)

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(b) Centrioles (1mk)

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5. The diagram below represents a specialized plant structure

(a) Name the cells labelled A and B (2mks)  
A \_\_\_\_\_

B. \_\_\_\_\_

(b) State the functions of structures C and D (2mk)  
C \_\_\_\_\_

D \_\_\_\_\_

6.

The diagram above represents a specialized animal cell

(a) (i) Name the cell (1mk)  
\_\_\_\_\_  
\_\_\_\_\_

(ii) Name the parts labelled A and D (2mks)  
A \_\_\_\_\_

D \_\_\_\_\_

(b) State the functions of the part labeled E. (1mk)

\_\_\_\_\_  
\_\_\_\_\_

7. The following are characteristics of a certain animal dentition; large curved and sharply pointed canines, small closely fitting incisors, narrow molars and premolars with cusps  
(i) Identify the likely mode of feeding in this animal (1mk)

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(ii) State three adaptations of the three types of teeth to the mode of feeding identified in (i) above (3mks)

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8. (a) Distinguish between the terms transpiration and Guttation (2mks)

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(b) State the structures through which each of the process named in (a) above occurs (2mks)

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9. (a) State two structural adaptations of capillaries to their functions (2mks)

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(b) In which ways are the xylem vessels adapted to their functions (2mks)

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10. (a) State the part of the brain that controls breathing movements in man (1mk)

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(b) Explain how the aquatic plants are adapted to gaseous exchange (4mks)

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11. State the organisms in which the following word reactions occur (2mks)

(a) (i) Glucose  $\longrightarrow$  Ethanol + carbon IV oxide + Energy

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(ii) Glucose  $\longrightarrow$  Lactic acid + Energy

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(b) What is meant by the term “oxygen debt” (3mks)

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12. (a) Distinguish between taxon and taxonomy (2mks)

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(b) Name two classes of the phylum Arthropoda that have cephalothorax (2mks)

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13. Name four mechanisms through which plants excrete (4mks)

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14. Study the food chain below



(a) Draw a pyramid of biomass for food chain above (4mks)

(b) Name the group of organisms not included in the food chain (1mk)

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15. State the stage in meiosis where the following take place

(a) Disappearing of nucleolus (1mk)

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(b) Formation of new spindle fibres (1mk)

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(c) Formation of separate cells each with haploid number of chromosomes (1mk)

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16. State the relationship between auxins and the response phototropism (4mks)

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17. Explain the following genetic terms  
(a) Turner's syndrome (2mks)

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(b) Deletion (2mks)

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(c) Name one sex-linked trait carried in the y chromosome (1mk)

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18. (a) What is meant by organic evolution (1mk)

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(b) State three limitations in use of fossil records in retracing the evolutionary history of all modern day organisms (3mks)

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19. Name the structures of the human body concerned with the following; (1mk)

(a) Maintenance of balance

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(b) Hearing (1mk)

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20. List three roles of the paired fins in fish (3mks)

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21. Differentiate between monoecious and dioecious plants (2mks)

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22. The figure below represents a human eye defect in humans

(i) Name the defect (1mk)

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(ii) State two causes of the defect (2mks)

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(iii) What kind of eye lenses can correct this defect

(1mk)

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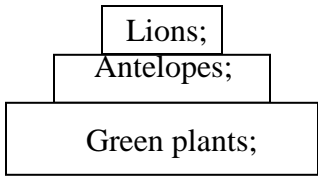
**231/1**  
**BIOLOGY**  
**PAPER 1**  
**(THEORY)**  
**JUNE/JULY 2011**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011**  
**Kenya Certificate of Secondary Education**  
**BIOLOGY**  
**PAPER 1**  
**THEORY**  
**MARKING SCHEME**

1. (a) A cell is the basic structural; and functional unit of a living organism/ thing; (1mk)  
(b) (i) Entomology: study of insects; (1mk)  
(ii) Genetics: study of inheritance; and variation. (2mks)
2. (a) Ruler/hand lens ; (1mk)  
(b)  $\text{Magn} = \frac{\text{length of diagram}}{\text{Length of real object}}$ ; (1mk)
3. - Interbreed freely;  
- Produce fertile/viable offspring; (2mks)
4. (a) Transport proteins;  
(b) Formation of cilia and flagella (2mks)
5. (a) A - Epidermal cell;  
B - Guard cell; (2mks)  
(b) C – chloroplast – traps/absorbs light energy required for photosynthesis;  
D – Nucleus – control all the activities of the cell; (2mks)
6. (a) (i) Sperm cell; (1mk)  
(ii) A – Acrosome; (2mks)  
B – Centriole; (1mk)  
(b) For propelling the sperm/mobility;
7. (i) Carnivorous; rej carnivore (s) (1mk)  
(ii) Incisors – chisel shaped and closely fitting to seize prey; /gripping and stripping  
flesh from bones (1mk)  
- Canines: long conical and curved to hold, kill and tear prey;  
- Premolars and molars: small except for special premolars in lower and upper jaw which are  
modified into Carnassial teeth which have smooth surfaces and sharp edges to slice  
through flesh and crush bones (1mk)

**This paper consists of 3 printed pages**

**Turn Over**

8. (a) Transpiration – water loss from plants in form of water vapour; (2mks)  
 Guttation – water loss from plants in form of water droplets;
- (b) Transpiration – stomata/cuticle/lenticel; (2mks)  
 Guttation – Hydathodes;
9. (a) Thin walls to reduce diffusion distance and facilitate the rate; (2mks)  
 - Thin lumen to increase efficiency of exchange of gases;
10. (a) Medulla oblongata;  
 (b) – have thin non-waxy cuticle to facilitate diffusion of gases;  
 - Have aerenchyma tissues for buoyancy and rapid diffusion of gases;  
 - Have stomata on the upper leaf surface only  
 - Leaves have large surface area to facilitate the diffusion of gases
- Any 4 = 4mks
11. (a) (i) Plants; (2mks)  
 (ii) Animals;  
 (b) – Oxygen required to get rid of the lactic acid that accumulates in the body tissues when oxygen demand exceeds supply;
12. (a) Taxon – Rank in the hierarchical classification of organism; (2mks)  
 Taxonomy – study of theory, practice and rules of classification of living and extinct organisms;  
 (b) - Crustacea; (2mks)  
 - Arachnida;
13. - Diffusion;  
 - Transpiration;  
 - Guttation/exudation;  
 - Abscission;  
 - Deposition; any 4 = 4mks
14. (a)  (a) 

Lions;
Antelopes;
Green plants;
- 1 mark for correct drawing; max 4 mks
- (b) Decomposers; (1mk)
15. (a) Prophase I  
 (b) Prophase II  
 (c) Telophase II (3mks)
16. - light causes lateral migration of auxins; in the shoot tip; high concentration of auxins causes high rate of cell division; on the dark side leading to a growth curvature towards source of light; (4mks)

17. (a) Individual lacks one sex chromosome; hence only 45 chromosomes; (XO or YO) (2mks)  
 (b) Deletion – occurs when some section of the chromosome breaks off; and fails to reconnect; to any of the chromatids. The section is completely lost; and genetic material they contain is also said to be deleted/ lost  
 Acc. Diagram max 2mks  
 (c) – Tufts of hairs on the pinna and nose;  
 - Baldness;  
 - Muscular dystrophy (Thick musculature); one 1mk
18. (a) Organic evolution: is the production of a new organism from simple ancient forms of life through gradual and small changes occurring over long period of time; (1mk)  
 (b) – Missing links due to decomposition of some parts/whole organism;  
 - Scavengers, unsuitable conditions for fossilization;  
 - Few fossils discovered; (3mks)
19. (a) – Semi circular canals;  
 (b) Cochlea; (2mks)
20. - Maintaining balance;  
 - Braking;  
 - changing direction;
21. Monoecious plant: is a plant with both male and female flowers borne on the same plant but in different parts; while Dioecious plant is a plant which bears either a male or female flower on different individual plants: (2mks)
22. (i) Short sightedness/myopia;  
 (ii) – Long / large eye ball;  
 - For thick lens;  
 - Weak ciliary muscles;  
 (iii) Concave/diverging lenses;

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DATE \_\_\_\_\_

**231/2**  
**BIOLOGY**  
**PAPER 2**  
**(THEORY)**  
**JUNE/JULY 2011**  
**2 HOURS**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011**  
**Kenya Certificate of Secondary Education**  
**BIOLOGY**  
**PAPER 2**  
**THEORY**  
**2 HOURS**

**INSTRUCTIONS TO CANDIDATES**

- This paper consists of two sections A and B. Attempt all the questions in section A. In section B, attempt question 6 and either question 7 or 8 in the spaces provided after question 8.

Section	Questions	Max. score	Candidates score
A	1	8	
	2	8	
	3	8	
	4	8	
	5	8	
B	6	20	
	7	20	
	8	20	
	Total marks	80	

**This paper consists of 10 printed pages**

**Turn Over**

**SECTION A (40 MARKS)**

**Attempt all the questions in this section**

1. The diagram below shows the exchange of gases in the alveolus. Study it and answer the questions that follow.

(a) Name the gases named A and B

A \_\_\_\_\_ (1mk)

B \_\_\_\_\_ (1mk)

(b) State the importance of the gas marked B in tissues

(1mk)

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(c) Name parts marked K and P

(2mks)

K \_\_\_\_\_

P \_\_\_\_\_

(d) State the adaptations of the alveolus to its function

(3mks)

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2. In human beings, a downward pointed frontal hairline (“windows peak”) is a heritable trait. A person with windows peak always has at least one parent who has this trait; where as persons with frontal hairline may occur in families in which one or even both parents have windows peak. Using W and w to symbolize genes for this trait.

(a) Determine the F1 generation if a homozygous windows peak male parent is married to a homozygous frontal hairlined female parent (4mks)

(b) State two causes of variations (1mk)

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© Name two sex linked genetic disorders affecting human females and males (2mks)

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(d) What is genome (1mk)

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3. (a) State the two principle functions of the kidney (2mks)  
(i)

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(ii)

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(b) The figure below shows a highly magnified cross-section of a proximal convoluted tubule of a mammalian kidney. Study it and answer the questions that follow

Wall of capillary Q Wall of tubule

(i) From the diagram, identify three structural features that adapt the proximal convoluted tubule to its function (3mks)

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(ii) Name the physiological process involved in the reabsorption of water and glucose from the proximal convoluted tubule to the blood stream (1mk)

Water

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Glucose

(1mk)

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(c) Which fluid substance flows in the part labelled Q (1mk)

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4. What is meant by the following?

(a) (i) Continental drift

(1mk)

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(b) Name parts marked X, Y and Z (3mks)

X \_\_\_\_\_

Y \_\_\_\_\_

Z \_\_\_\_\_

(c) Write a word equation of the chemical reactions that occur at

X \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Y \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

(d) State two factors influencing the reactions at X and Y above (2mks)

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

### SECTION B (40 MARKS)

**Answer question 6 (compulsory) in the spaces provided and either question 7 or 8 in the spaces provided after question 8.**

6. Form three students in Mua secondary school studied the population growth of two species of flour beetles. *T. confusum* and *T. casteanum*. The beetles were grown in a box with limited supply of maize flour. The box was kept in a warm place for 200 days. The beetles were counted at certain intervals and the results tabulated as shown below.

No of Days		0	10	50	60	80	100	120	140	180	200
No. of Beetles	<i>T. confusum</i>	20	20	30	80	130	150	162	160	160	160
	<i>T. Casteanum</i>	20	20	30	43	50	40	15	10	6	2

(a) Using the same axis draw the graphs of the number of beetles in the box against time (8mks)

(b) How many beetles were present on the 70<sup>th</sup> day?

T. Confusum

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T. Casteanum

(2mks)

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(c) Account for the shape of T. confusum curve between day

(i) 0 -10

(2mks)

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(ii) 60-80

(2mks)

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(iii) 120-140

(2mks)

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(d) (i) Suggest what happened to T. Casteanum between day 80 and 160

(2mks)

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(ii) What biological phenomenon is represented by observation made in d(i) above

(1mk)

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(e) State one factor that may determine the distribution of animals in a given area

(1mk)

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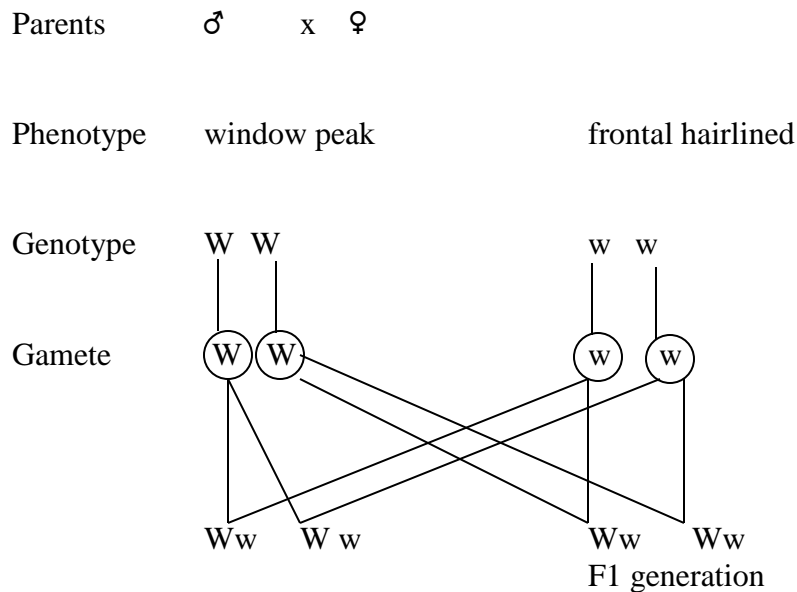


**231/2  
BIOLOGY  
PAPER 2  
(THEORY)  
JUNE/JULY 2011**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011  
Kenya Certificate of Secondary Education  
BIOLOGY  
PAPER 2  
THEORY  
MARKING SCHEME**

1. (a) A carbon dioxide (Rej CO<sub>2</sub>)  
B. oxygen (Rej O<sub>2</sub>) (2mks)
- (b) Oxygen – needed for tissue respiration to provide energy to tissues (1mk)
- (c) K – Plasma  
P – Wall of alveolus (2mks)
- (d) – Moist to dissolve gases which diffuse in solution form;  
- Thin alveolus wall for gases to diffuse across a short distance  
- Supplied with dense network of capillaries for the transportation of gases to and from exchange surface  
- Have big surface area to volume ratio to increase the rate of gaseous exchange  
Any three (3mks)

2. (a) Gene for windows peak is dominant over the gene for frontal hairlined



All windows peak

(4mks)

**This paper consists of 5 printed pages**

**Turn Over**

(b) Mutations

- Gene formation/independent assortment of homologous chromosomes and crossing over ;
- Fertilization; any  $2 \frac{1}{2} \times 2 = (1\text{mk})$

(c) Haemophilia

Colour blindness (2mks)

(d) It is the entire genotype of a cell individual; (1mk)

3. (a) (i) Excretion; (1mk)

(ii) Homeostasis; (1mk)

(b) (i) Has numerous microvilli; which increases the surface area for reabsorption;

- Has one cell thick epithelial lining; to reduce diffusion distance across which substances are reabsorbed into the blood stream;
- Highly vascularised to transport reabsorbed materials
- Proximal convoluted tubule being intimately associated with the thin wall of adjacent capillaries for rapid reabsorption of substances;

Any three (3mks)

(ii) Osmosis (1mk)

Active transport (1mk)

(c) Glomerular filtrate; (1mk)

4. (a) (i) Breaking of one land mass into different continents; (1mk)

(ii) Structures that have ceased to be functional and have been reduced in size; (1mk)

(iii) Convergent evolution – evolution where structures from different embryonic origin have evolved to perform same function; (1mk)

(b) In the bacteria population some become resistant; due to mutation. Those that do not have this characteristic are destroyed by penicillin; the mutants with the gene for resistance multiply; eventually all the bacteria become resistant; and are no longer affected by penicillin; (5mks)

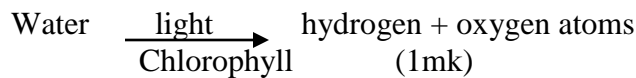
5. (a) Chloroplast; (1mk)

(b) X – granum;

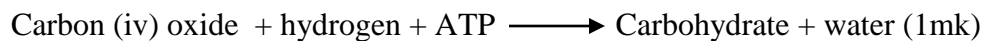
Y – Stroma;

Z – Starch grain; (3mks)

(c) At X



At Y



At X – Light intensity; (1mk)

At Y – Carbon (iv) oxide concentration; (1mk)

6. (a) Scale @ 1 – 2  
 Axis @  $\frac{1}{2}$  - 1  
 Curve @ 1 – 2  
 Point @ 1 – 2  
 Identity @  $\frac{1}{2}$  -  $\frac{1}{8}$

T. Confusum P1 C1 P1 C1 Number of beetles Time (Days) T. Casteanum  $\frac{1}{2}$   
 0 20 40 60 80 100 120 140 160 180 200 20 40 60 80 100 120 140 160 180



- (b) T. Confusum –  $140 \pm 1$ ; (1mk)  
 T. Casteanum –  $47 \pm 1$ ; 1mk
- (c) (i) 0 – 10  
 Population constant;  
 Organisms adjusting to the environment; (2mks)
- (ii) 60 – 80  
 Exponential phase/Rapid increase in population; many reproducing individuals enough space and food; (2mks)
- (iii) 120 – 140  
 Decelerating phase/Decrease in population growth rate;  
 Overcrowding/accumulation of wastes/limited space and food; (2mks)
- (d) (i) Competitive exclusion; being a weaker competitor for resources the T. Casteanum was outcompeted by T. Confusum which is a better competitor; (2mks)  
 (ii) Interspecific competition (competition); (1mk)
- (e) Food availability; space availability; predators/mates/water;  
 Any 1 (1mk)

7. (i) Auxins/indole Acetic acid
- Promote fruit formation/parthenocarpy;
  - Promote cell division;
  - Influences cell elongation/tropic responses;
  - Promote formation of abscission layers/bring about fruit fall/leaf fall;
  - Cause apical dominance/inhibit growth of lateral branches/buds;
  - Promote growth of adventitious roots;
- (ii) Cytokinins/kinetin/zeatin
- Promote root formation;
  - Stabilizes proteins and chlorophyll;
  - Promote flowering in some plant species;
  - Breaks seed dormancy in some plant species;
  - In low concentration it promotes leaf aging;
- (iii) Ethylene/ethane/
- Induces stem thickening;
  - Inhibit stem elongation;
  - Induces ripening of fruits;
  - Promotes germination of certain seeds;
  - Promotes development of abscission layer leading in fruit/leaf fall;
- (iv) Gibberellins/GBA
- Promotes parthenocarpy;
  - Initiate formation of IAA;
  - Promote ripening of fruits after fertilization;
  - Inhibit growth of adventitious roots;
  - Slow down leaf abscission;
  - Activates hydrolytic enzymes during seed germination;
  - Promote cell division/cell elongation in dwarf varieties;
- (v) Abscisc Acid/ABA
- Causes seed dormancy/bud dormancy;
  - Causes abscission of leaves/fruit fall;
  - Inhibit seed germination;
  - In high concentration it leads to closure of stomata;

(vi) Florigens

- Promote flowering

1 x 34 = 34 mks max 20mks

8. Cornified layer; - to protect the skin against mechanical damage; bacterial infection; water loss;  
Granular layer; - forms cornified layer;  
Malpighian layer; - form granular layer; contains melanin which protects skin against ultraviolet rays;  
Sebaceous glands; - produce to make skin supple; and water proof;  
Sebum is also antiseptic;  
Blood vessels; - for temperature regulation  
Sensory nerve endings/ and receptors – for detection of changes in external environment;  
Sweat glands – produce sweat which evaporates and cools the body; sweat also removes waste products from the skin;  
Hair; - regulates body temperature;  
Subcutaneous fat; for insulation against heat loss;  
Max 20 mks

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**231/3**  
**BIOLOGY**  
**PAPER 3**  
**(PRACTICAL)**  
**JUNE/JULY 2011**  
**1 ¾ HOURS**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011**  
**Kenya Certificate of Secondary Education**  
**BIOLOGY**  
**PAPER 3**  
**PRACTICAL**  
**1 ¾ HOURS**

**INSTRUCTIONS TO CANDIDATES**

- ❖ Answer ALL the questions in this question paper in the spaces provided
- ❖ You are required to spend the first 15 minutes of the 1 ¾ hours allowed for this paper reading the whole paper carefully before commencing your work
- ❖ Additional paper MUST NOT be inserted

**FOR EXAMINER'S USE ONLY**

Questions	Maximum. score	Candidates score
1	13	
2	13	
3	14	
Total score	40	

**This paper consists of 5 printed pages**

**Turn Over**

1. Study the photograph below and answer the questions that follow  
A B C D

(a) (i) Name the structure represented by the photograph (1mk)

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(ii) Name the parts labelled A, B, C and D (4mks)

A \_\_\_\_\_

B \_\_\_\_\_

C \_\_\_\_\_

D \_\_\_\_\_

(ii) Name the parts on the photograph where the following processes take place

(i) Ultrafiltration (1mk)

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(ii) Tubular reabsorption (1mk)

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(b) (i) State two adaptations of the part labelled C to its functions (2mks)

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(ii) List down two substances found in the structure labeled A (2mks)

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(c) Identify the part on the photograph where counter current flow occurs (1mk)

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(d) Explain the significance of a long loop of henle with respect to habitat of an organism (1mk)

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2. You are provide with a food solution mixture labelled Q. you are also provided with the following reagents. 1% copper (II) sulphate solution, 10% sodium hydroxide solution, 0.1% DCPIP solution and a filter paper. Carry out tests to determine the food substances present in Q (13mks)

Food substance being tested	Procedure	Observation	Conclusion

3. The photographs below are of two different plants. Study them carefully and answer the question that follow

(a) Label the parts N, O, P, U on the diagram. (4mks)

(b) (i) Into what division do the two specimens in the photograph belong? (1mk)

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(ii) State the class into which these specimen belong

Specimen K

(1mk)

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Specimen L

(1mk)

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(c) Giving reason, state the type of germination displayed by specimens

K \_\_\_\_\_ (1mk)

Reason:

(1mk)

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L \_\_\_\_\_ (1mk)

Reason:

(1mk)

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(d) List Three observable differences between specimens K and L in the photograph (3mks)

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**231/3**  
**BIOLOGY**  
**PAPER 3**  
**(PRACTICAL)**  
**JULY/AUGUST 2011**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011**

**Kenya Certificate of Secondary Education**

**BIOLOGY**  
**PAPER 3**  
**PRACTICAL**  
**MARKING SCHEME**

1. (a) (i) Nephron✓  
(ii) A – Glomerulus✓  
B – Loop of Henle✓  
C – Distal convoluted tubule✓  
D – Collecting tubule/duct✓  
(iii) I – Glomerulus✓  
II – Proximal convoluted tubule✓
- (b) (i) - Cells of the tubule have microvilli which increase surface area✓  
(ii) - The tubule is long and highly coiled to provide a large surface✓  
(iii) – Tubule is well supplied with blood capillaries  
Any 2
- (ii) – Glucose✓  
- Amino acids✓  
- Salts✓  
- Water✓  
- Urea✓ }  
Any 2
- (c) Loop of Henle ✓ 1mk
- (d) Long loop of Henle ensures maximum reabsorption ✓of water in animals that live in desert✓ and semi- arid area 1mk

**This paper consists of 2 printed pages**

**Turn Over**



2.

Food being tested	Procedure	Observation	Conclusion
Protein✓	To food substance Q in a test – tube add sodium hydroxide followed by an equal amount of copper II ✓sulphate solution	Purple colour is observed✓	Proteins present✓
Vitamin C ✓(ascorbic acid)	Place DCPIP in a clean test tube , add few drops of the food substance Q✓	DCPIP solution is decolourized✓	Presence of vitamin C/ascorbic acid✓
Lipids✓	Put a drop of food substance Q onto a filter paper.✓ Dry it over a flame✓	A translucent ✓spot appears on the paper	Presence of lipids✓

13mks

3. (a) Labelling

4mks

(b) (i) Angiospermae✓

1mk

(ii) K – Monocotyledonae✓

L = Dicotyledonae✓

2mks

(c) K – Hypogeal

Reason – Cotyledon is below the soil surface

2mks

L – Epigeal

Reason – Cotyledon is above the soil surface

2mks

(d)

K

L

(i) Has fibrous root system

Has tap root system

(ii) Has one cotyledon

Has two cotyledons any 3 3mks

(iii) Has parallel veination

Has net veination

(iv) has hypogeal germination

Shows epigeal germination

(v) Cotyledons remain below the ground

Cotyledons are brought above the soil

**231/3  
BIOLOGY  
PAPER 3  
(PRACTICAL)  
JULY/AUGUST 2011**

**FORM 4 MID – YEAR ASSESSMENT TEST 2011  
Kenya Certificate of Secondary Education  
BIOLOGY  
PAPER 3  
PRACTICAL**

**CONFIDENTIAL INSTRUCTION TO ALL SCHOOLS**

**Each candidate should have the following**

- 20Ml of solution Q
- 10% sodium hydroxide solution
- 1% copper II sulphate solution
- 0.1% DCPIP
- Filter paper
- 4 test tubes in a rack
- Source of heat
- 1 dropper

**Preparation**

Solution Q is a solution mixture of egg albumen, Olive oil and ascorbic acid in the ratio of 1:1:1 respectively.