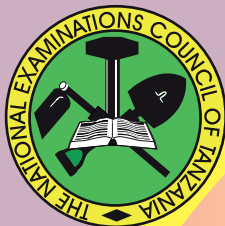


**THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA**



**EXAMINERS' REPORT ON THE PERFORMANCE  
OF CANDIDATES**

**ACSEE, 2014**

**133 BIOLOGY**

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## FOREWORD

The examiners' Report on the Performance of Candidates in Biology subject in the Advanced Certificate of Secondary Education Examination (ACSEE) 2014 was prepared in order to provide feedback to students, teachers, parents, policy makers and the public in general, on the performance of candidates.

The Advanced Certificate of Secondary Education Examination marks the end of two years of advanced secondary education. It is a summative evaluation, which among other things shows the effectiveness of the education system in general and the education delivery system in particular. Essentially, the candidates' response to the examination questions is a strong indicator of what the education system was able/unable to offer to the students in their two years of Advanced Secondary Education.

The analysis presented in this report is intended to contribute towards the understanding of some of the reasons behind the performance of the candidates in Biology subject. The report highlights some of the factors that made the candidates fail to score high marks in the questions. Such factors include; lack of the basic knowledge on biological concepts, failure to understand the demand of the question, failure of candidates to express themselves clearly in English language and poor writing skills. The feedback provided will enable the education administrators, school managers, teachers and students to identify proper measures to be taken in order to improve the candidates' performance in future examinations administered by the Council.

The National Examinations Council of Tanzania will highly appreciate comments and suggestions from teachers, students and the public in general, that can be used in improving future Examiners' Reports.

Finally, the Council would like to thank all the Examination Officers, examiners and all who participated in the preparation of this report.



Dr. Charles E. Msonde  
**EXECUTIVE SECRETARY**

## 1.0 INTRODUCTION

This report is focused on paper 1 and paper 2 Biology Advanced Certificate of Secondary Education Examination (ACSEE) 2014.

Questions in all papers intended to measure candidates' theoretical competences on the contents analyzed in the 2010 Biology syllabus and were set according to 2001 Examination format.

Paper 1 contained eleven (11) questions categorized into two sections namely section A and B. Section A had seven (7) compulsory short answer questions. Each question carried eight (8) marks except question three which carried seven (7) marks. On the other hand, section B consisted of four (4) essay type questions carrying fifteen (15) marks each. The candidates were required to attempt three questions in this section.

Paper 2 consisted of eight (8) essay type questions categorized into four sections namely section A, B, C and D. Candidates were required to answer five (5) questions in this paper by choosing at least one (1) question from each section. Each question carried 20 marks.

The analysis of the examination results shows that the general performance in Biology was good as out of 10,982 candidates who sat for the papers, 97.57% passed the examination at D grade or above. Further analysis reveals that candidate performance in ACSEE 2014, has improved by 10.52% when compared to 87.05% who passed the examination in ACSEE 2013.

The next section of the report analyses the performances of candidates in each question by highlighting candidates' performance in relation to the demand of the question and provides possible reasons for high or poor performance of the candidates in each question. In addition, samples of candidates' extracts are used to illustrate examples of candidates' good and poor responses in each question. It is expected that this report will provide a useful feedback to teachers, students and other education stakeholders to support them pinpoint areas where candidates have learning difficulties and also take proper measures for improving the teaching and learning of the subject.

## **2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE PER QUESTION IN PAPER 1 (133/1)**

The performance in a given question is poor, average or good if the percentage of the candidates who scored an average of 30% or more lies in the range 0 – 29, 30 – 49 or 50 – 100 respectively.

### **2.1 SECTION A**

This section consisted of seven (7) compulsory questions, each carrying 8 marks except question three (3) which carried 7 marks.

#### **2.1.1 Question 1: Transportation**

In part (a), the candidates were required to explain briefly the functions of the vascular system in plants and in part (b), the question required the candidates to explain the processes involved in transportation of water from the soil to the xylem.

A total of 10,980 of the candidates attempted this question of whom 55.7% scored 0 - 2 marks, 25.6% scored 3 – 3.5 and 18.7% scored 4 - 8 out of the 08 marks allocated to this question. These data indicate that the candidates' performance in this question was average.

The candidates who performed well in this question had adequate knowledge on the topic of transportation. These candidates managed to give correct responses on the functions of the vascular system in plants and to explain the processes involved in transportation of water from the soil to the xylem. Extract 1.1 shows a sample of candidate's good responses.

### Extract 1.1

- 1(a) Vascular system is the conducting tissue of plant which are involved in transport of material in the plant body. This includes xylem and phloem.
- Functions of vascular system in plant
- (i) Conduction of water and mineral salts from the soil to the aerial part of the plant body. Example, xylem conduct the water and dissolved mineral to the plant.
  - (ii) Translocation of manufactured food from the site of synthesis to the site of storage or used by other cells for various activities. Example, phloem conduct the manufactured food material from the leaves to the other part of the plant.
  - (iii) Help to support the plant because it contains microfibrils which are very tough hence ensure support to the plant body.
- 1(b) The process involved in transportation of water from the soil to the xylem.
- Water and dissolved mineral salts are transported absorbed from the soil through the root hair which has high surface area for absorption. Water moves through the root hair due to concentration gradient difference between the plant and the cells of the soil solution.
- The water moves through the epidermis to the cortex of the root and then moves through the system either apoplastic or symplastic movement or vacuolar movement to the xylem.

Extract 1.1 shows a sample of candidate's good responses. The candidate had good knowledge about the topic of transportation. He /she also managed to identify the demand of the question.

The candidates who performed poorly failed to understand the demand of the question. For example, in part (a) of the question some of the candidates explained the functions of vascular tissue in animals such as; 'transport enzymes, transport hormones, transport excretory products and transport of gaseous' instead of explaining the functions of the vascular system in plants. In part (b) some of the candidates explained the types of transport such as 'active and passive transport' some explained some forces necessary for water transport such as 'cohesive and adhesive forces' which were out of question demand. Extract 1.2 illustrates the sample of candidate's poor responses.

### Extract 1.2

1(a)	Vascular System in plant is the structural used for pass the difference materials from the out side to the inner part of the plant.
	Present of gap which is easily of materials pass from the out side of the cell to inner in side the cell.
1(a)	Present of Caspary Strip, which used for provide the <del>the</del> Minerals which can be found in the soil.
(b)	The process which can be involved the transportation of water from the soil to the xylem is Active transport, Also during the water can be moved from the soil to the xylem it can involved active transport which the energy must be need also materials can be occur against concentration gradient in the soil.
	Passive transport, Also the materials which can be moved from the soil or waters can be transported from the soil to the xylem through the materials occur along the concentration gradient in the plant xylem.
	Effusion, Also the effusion can be used used to transport the water from the soil to the xylem which mean that the materials can effused from soil to xylem.
1(b)	Adhesive force, Also the materials can be water transport from the soil to the xylem the materials can occur on the same substance.
	Cohesive force, Also the force used to regard the movement of water from the soil to the xylem because during the movement some of pressure can be need.
	Turgor pressure, Also the turgor pressure can be needed to applied in the soil for the purpose of moved up water from the soil to the xylem of vessel.

Extract 1.2 shows a sample of responses of a candidate who performed poorly in this question. The candidate failed to identify the question demand as he/she explained the forces necessary for water movement instead of explaining the process involved in transport of water. The candidate had also difficulties in using English language

### 2.1.2 Question 2: Nutrition

In part (a), the candidates were required to define photoautotrophs and chemo heterotrophs while in part (b), they were required to state the effect of lowering oxygen concentration on  $C_3$  photosynthesis and  $C_4$  photosynthesis while in part (c) the candidates were required to give the reason on why it is an advantage that bundle sheath chloroplasts lack grana and to state what would happen to the activities of intestinal enzymes if the pH in intestine remains at 2.

A total of 10,980 of the candidates attempted this question of whom 11.7% scored 0 - 2 marks, 16.4% scored 2.5 – 3.5 marks and 71.9% scored 4 - 8 marks out of the eight (8) allocated to this question.

The candidates who performed well in this question had enough knowledge on the topic of Nutrition; they were able to identify the question demand and had good mastery of English language. In addition, the candidate had well organized ideas on the advantage of bundle sheath and the effect of pH in intestine. Extract 2.1 shows a sample of candidate's good responses.



## Extract 2.1

- Q2.
- (a) (i) Photoautotrophs  
- There are the organisms which are able to use the light energy to synthesize their own food substances due to presence of Chlorophyll example green plants and grasses.
- (ii) Chemoheterotrophs  
- There are the organisms which are not able to synthesize their own food substances but use the chemical substances of the already synthesized food for their body activities. Example are the sulphur bacteria which use the chemical to synthesize their own food.
- Q2.
- (b) (i) The lowering of Oxygen concentration in the  $C_3$  plants will help them increasing the process of synthesizing food because  $C_3$  plants have affected by effect of  $O_2$  concentration due to photorespiration in which their cells are of RubisCO (carbon dioxide acceptor) have competitive effect with  $O_2$  hence the reduction of Oxygen to  $C_3$  plant will favour the photosynthesis process and reduce the photorespiration effect.
- (ii) The lowering of oxygen concentration has no effect on the  $C_4$  photosynthesis plant because their enzyme of carbon dioxide acceptor PEP carboxylase have no competitive effect of oxygen but no.
- 2(c) (i) The advantage of bundle sheath to leaf grass is that it reduces the competitive effect of carbon dioxide acceptor RubisCO whose enzyme have high affinity to oxygen and favour the photorespiration instead of photosynthesis.
- (ii) if the pH in the intestine will remain at 2 it will cause the denaturation of the enzymes.

Extract 2.1 shows a sample of candidate's good responses. The candidate had sufficient knowledge on the topic of Nutrition.

The candidates who performed poorly in this question lacked knowledge on the concepts and terminologies used in nutrition. For example, in part (a) of the question some of the candidates wrote 'potoautotrophs is the type of autotrophic movement....'. While other wrote 'chemoheterotrophs is the type of heterotrophic movement in response to chemicals'. In addition to that, most of the candidates failed to express themselves in English language. Some wrote unclear statements such as; 'The male sperm are moving towards the released chemicals by the female eggs' indicating that the candidate had inadequate knowledge on the concept of nutrition. Extract 2.2 shows a sample of the candidate's poor responses.

### Extract 2.2

2	a/ (i) Photoautotrophs, is the type of autotrophic movement in which the motile parts of the plants are moving in response to light.
	(ii) <del>to the</del> Chemoheterotrophs is the type of heterotrophic movement in response to the chemicals <del>eg</del> for example. the male sperm are moving towards the released chemicals by the female eggs.
2	b/ (i) In lowering of oxygen in $C_3$ photosynthetic <del>sis</del> have no effect because it is occur in high affinity of Carbondioxide.
	(ii) In lowering of oxygen in $C_4$ photosynthetic <del>sis</del> it <del>can</del> will leads leaves senescence.
2	c/ (i) It is advantages because instead of kreb's circle process to take place in bundle sheath chloroplasts it will take place in the cytoplasm which can be transported easily than in bundle sheath.
	(ii) Pepsin digestive juice will work efficiently.

Extract 2.2 shows a sample of responses from a candidate who lacked knowledge on the topic of nutrition as all his/her responses were wrong.

### 2.1.3 Question 3: Gaseous Exchange and Respiration

In part (a), candidates were required to define the term glycolysis whereas in part (b), they were required to state the ways in which fermentation processes are useful to human beings.

A total of 10,980 of the candidates attempted this question of whom 29.8% scored 0 – 2 marks, 33.9% scored 3 – 3.5 marks and 36.3% scored 4 – 7 marks out of seven (7) marks allocated to this question. This implies that the candidates' performance in this question was good.

The candidates who performed well in this question had sufficient knowledge on gaseous exchange and respiration. They were able to define the term glycolysis and the ways in which fermentation processes is useful to human beings. The candidates' responses were clearly stated and systematically arranged. Sample 3.1 shows a sample of best responses.

#### Extract 3.1

3.	a) Glycolysis is the process in which six carbon sugar (glucose) is broken down into three carbon sugar (Pyruvate).
	b) → Anaerobic fermentation is very useful in brewing industries for manufacturing of alcohol eg. beer.
	→ Anaerobic fermentation is very useful in baking industries for manufacture of loaf and cakes.
	→ Lactic acid fermentation is the source of energy production in an anaerobic supply of oxygen eg. during physical exercise.
	→ Fermentation is very useful in souring of milk.
	→ Fermentation is involved in manufacturing of vinegar which is very useful in different purposes.
	→ Fermentation is involved during decomposition of different organic substances.

Extract 3.1 shows a sample of the candidate who performed well in this question.

Candidates who performed poorly in this question had inadequate knowledge on the topic of Gaseous Exchange and Respiration. Some candidates gave incorrect definitions of glycolysis such as ‘glycolysis is the conversion of glycogen and lactic acid, glycolysis is the breakdown of large food substances...’. In part (b) of the question some of the candidates failed to explain how fermentation is useful to human beings. For example, some candidates wrote that, ‘fermentation is the preparation of medicine; fermentation is the production of antibiotics for example penicillin’ while another candidate wrote that ‘fermentation is the production of insecticides’. Extract 3.2 shows a sample of poor responses.

### Extract 3.2

3: (a) Glycolysis	this is enzyme controlled reaction
where by large food substrates are broken	down into pyruvate and two Adenosine triphosphate
ATP.	
(b) Fermentation	process are usefull to human being
since	it takes place in the absence of oxygen, other
human being such as athletes, manual workers require	more oxygen in order to obtain energy which
they can use to perform their work.	

Extract 3.2 shows a sample of candidate's poor responses. The candidate had superficial knowledge on gaseous exchange and respiration as all his/her responses were incorrect.

### 2.1.4 Question 4: Reproduction

In part (a), the question required the candidates to account for the birth of identical twins, fraternal twins and conjoined twins. In part (b), the candidates were required to outline one feature for each of the births mentioned in part (a) of this question.

A total of 10980 of the candidates attempted this question of whom 15.5% scored 0 – 2 marks, 09% scored 2.5 – 3.5 and 75.5% scored 4 - 8 marks out of the eight (8) marks allocated to this question.

The candidates who did well in this question were able to account for the birth of identical twins, fraternal twins and conjoined twins. They also managed to outline feature for each type of the births. This implies that the candidates had enough knowledge on the topic of reproduction. The candidates had also good understanding of the question demand and good mastering of English language. Extract 4.1 shows a sample of best responses from the candidate.

### Extract 4.1

4 a)	i) Identical twins	
	Identical twins are formed when a fertilized egg undergoes cleavage to form two blastomeres each developing into an organism. They share one placenta but separate umbilical cord. They have the same genetic constitution and same sex.	
	ii) Fraternal twins	
	These are formed when two different ovum are fertilized by two different sperms. They have separate placenta and separate embryonic membranes. They have different genetic constitution and may be of different or same sex.	
	iii) Conjoined twins	
	These are also known as Siamese twins. These twins are identical twins and have resulted as a result of the failure of the twins to undergo total separation. They have similar genotype and sex.	
4 b)	Feature of the births	
	Twins	Feature
	i) Identical twins	Have the same genetic constitution
	ii) Fraternal twins	Have different genetic constitution
	iii) Conjoined twins	Have the same genetic constitution

Extract 4.1 shows a sample of good candidate's responses. The candidates had sufficient knowledge on the topic of reproduction, good understanding of the demand and good mastering of English language.

Candidates who performed poorly lacked knowledge on reproduction. Most of them failed to distinguish the categories of twins. For example, in part (a) one candidate wrote 'identical, fraternal and conjoined twins are the process of delivery'. Some wrote 'Conjoined twins is the type of birth of a babies that are of the different sex. In part (b), another candidate produced incorrect responses such as 'conjoined twins are of different sex'. Extract 4.2 shows a sample of poor responses.

### Extract 4.2

4	a/ (i) Identical twins, this is the birth of the babies thus <del>of</del> are of similar or the same characteristics.
	(ii) Fraternal twins, this is the birth of the babies that are not looking similar.
	(iii) Conjoined twins, this is the type of birth of babies that are of different sex.
4	b/ features for each of the birth.
	(i) Identical twins
	(ii) Fraternal twins
	⇒ They are of different in appearance
	(iii) Conjoined twins
	⇒ Are of different sex.

Extract 4.2 shows a sample of candidate's poor responses. The candidate did not understand the demand of the question as he/she gave some features of the respective twins which were not required.

### 2.1.5 Question 5: Cytology

Part (a) of the question required the candidates to classify cells into two major groups with examples and give four features for justification of each group. In part (b), the candidates were required to outline three advantages of the presence of membranes in cell organelles.

The analyses of the candidates' performance revealed that, the performance in this question was very good compared to other questions in this paper as out of 10980 of the candidates who attempted this question, 13.2% scored 0 – 2 marks, 6.2 % scored 2.5 – 3.5 marks and 80.6% scored 4 - 8 marks out of eight marks allocated to this question.

Majority of candidates who performed well in this question had sufficient knowledge on the topic of Cytology. Moreover, the candidates managed to identify the demand of the question as they provided correct responses in both parts (a) and (b). In addition to that, the candidates demonstrated good command of English Language. Extract 5.1 shows a sample of best responses.

## Extract 5.1

5.	(a) — The cells are divided into two major groups.
	(i) Eukaryotic cells — Examples plants cells and the Animal cells.
	(ii) Prokaryotic cells — Example the Bacteria
	— The following are the features that are given to distinguish between the two (2) groups.
	(i) Features of the Eukaryotic cells.
	(i) They have got the true nucleus. Example cell.
	(ii) They contain the 80's ribosomes.
	(iii) They have the linear Nuclear material (DNA) surrounded by the membrane.
	(iv) They have large size.
5.	(a) (i) Features for prokaryotic cells
	(i) They have 70's ribosomes.
	(ii) They Nuclear material is not bound with membrane.
	(iii) They do not have the true nucleus.
	(iv) They lack some of the cell organelles such as mitochondria.
	(b) The Advantages of the cell membranes in cell organelles.
	(i) They form separately compartment for which each cell specialized a particular function. For example chloroplast for photosynthesis.
	(ii) They contain receptor sites which can receive hormones and other materials for uses.
	(iii) They contain Enzymes that catalyse various chemical reactions.

Extract 5.1 shows a sample of good responses from the candidate who did well in this question. The candidate had sufficient knowledge on the topic of Cytology, good understanding of the question demand and good English grammar. Thus, all his/her responses were correct.



The candidates who performed poorly had insufficient knowledge on Cytology as in part (a) they classified cells as '*plant and animal cells*'. Other candidates classified cells as '*unicellular and multicellular cells*'. In addition, some candidates failed to understand the demand of the question. For example, in part (b) some of the candidates wrote the function of the cell organelles instead of functions of a membrane in cell organelles. Others wrote the function of a cell wall. Extract 5.2 shows candidates' poor responses.

### Extract 5.2

5	a	Classification of cell fall into - Plant cell - Animal cell
		Features for each group
		Animal cell
		- Presence of centriole - which tend/participate in spindle fibre formation
		- Nucleus - which carries the heredity material
		- Ribosomes of 80's - for protein synthesis
		- Cell membrane - for protection and constitute the cytoplasm
		Animal cell Plant cell
		- Large and permanent vacuole - Have pigment called Anthocyanins which are red, yellow which give the colour of the plant
		- Cell wall - Enable the exchange of material in and out of the cell
		- Presence of plastids e.g chlorophyll - which aid in trapping the sunlight rays necessary for photosynthesis
		- Ribosome of the 80's - which aid in protein synthesis
		b) Advantage of the presence of membrane in cell organelles
		- Provide the necessary energy needed by the cell e.g mitochondria
		- Enable plant to manufacture their own food through photosynthesis e.g chloroplast
		- Provide surface area for attachment e.g microtubules in cilia

Extract 5.2 shows a sample of poor candidate's responses. The candidate had insufficient knowledge on the topic of Cytology.

### 2.1.6 Question 6: Principles of Classification

In part (a), the question required the candidates to state what a taxonomic key is, as used in Biology and in part (b), to explain how to construct and use a dichotomous key.



It was noted that, candidates' performance in this question was very poor compared to other questions as out of 10,979 of the candidates who attempted this question, 92.7% scored 0 - 2 marks, 5.6% scored 2.5 – 3.5 marks and 1.7% managed to score between 4 and 8 marks out of the eight marks allocated in this question.

A few candidates who performed well had good knowledge on the topic and managed to adhere to the question demand. Furthermore, the candidate had good mastery of English language as they managed to provide responses which were clear with correct English grammar. Extract 6.1 shows a sample of good responses.

#### Extract 6.1

6 a)	Taxonomic key is a method used in identifying organism basing on observable features such as wings, legs, scales and leaf morphology.
b)	The way used to construct a dichotomous key are :-
	i) Analysing all observable features such as wings, legs, scales, and leaf morphology of an organism
	ii) Analysing all distinctive observable features of an organism
	iii) Use two observable features to group or identify organisms
	Example: Presence of scales – Snake
	Absence of scales – Earthworm
	iv) To observe features which complete the identification of an organism.
	The way how to use a dichotomous key are :-
	i) To observe the features which present to the organisms with respect to constructed dichotomous key.
	ii) If it is numbered dichotomous key to follow the direction required by number up to appropriate organism name.
	iii) The organisms observed should be identified by taking reading with respect to observable features.

Extract 6.1 shows a sample of responses of a candidate who had sufficient knowledge on the topic. He/she managed also to identify the demand of the questions and used clear English language to answer them.

The candidates who performed poorly in this question failed to understand the demand of the question. Most of the candidates constructed the keys instead of giving explanations on how to construct and use the dichotomous key. Some candidates made a list of organisms and tried to classify them by using branched or numbered key and others outlined the uses of Dichotomous key instead of explaining how to use it. Extract 6.2 shows a sample of poor responses.

## Extract 6.2

6	(a) Taxonomic key is the method used to enable the scientific naming of organisms. or is the way used to give an organism a scientific name.
	(b) Dichotomous key is the system used to separate or classify organisms into the same group according to their features also dichotomous key divided into two ways which are number key and branched key. In order to construct the dichotomous key must have the organism more than one. In order to construct the dichotomous key may use either number key or branched key. Example of used numbered key are. Example of organisms Butterfly, Milliped, the Cockroach, Snail, Snake, Bee.
6(b)	By using number key to classify organisms
	(a) Organism of wings — — — — 2.
	(b) Organism of shells — — — — Snail.
	(c) Organism of have no wings — — — — 3.
	(d) Organism has a pair of wing — — — — Cockroach.
	(e) Organism has no pair of wing — — — — 4
	(f) Organism of has wings and consist antennae — — — — Butterfly.
	Uses of Dichotomous key are
	- Used to separate the groups of organisms.
	- Used to classify the organisms into the same group.
	- Used to help during the scientific study to be easily.
	- Organisms of the same properties/feature can be classified into the same group.
	- Used to help the biologist to give an organism a scientific name according to their feature.
	- It is easy to study the organisms.
	- Simplify during the study of organisms.
	- Used to separate from one group of organisms into another group of organisms.

Extract 6.2 shows sample of the candidate's poor responses. The candidate failed to understand the demand of the question as in part (b) he/she defined and constructed a numbered key instead of explaining how to construct and use a Dichotomous key. The candidate had also poor command of English language.

### 2.1.7 Question 7: Co-ordination

In part (a), the question required the candidates to distinguish nastic movements from tactic movements in living organisms and to give one example in each case. Part (b) required the candidates to explain the importance of tropic movement in plants.

Candidates' performance in this question was good as the analysis indicates that out of 10,979 of the candidates who attempted this question, 34.1% scored 0 – 2 marks, 17.3 % scored 2.5 – 3.5 marks and 48.6% scored 4 - 8 marks out of the eight marks allocated to this question.

The candidates who performed well had adequate knowledge on Coordination in plants as they managed to distinguish nastic movements from tactic movements and to explain the importance of tropic movement in plants. Besides, the candidates had good command of English language. Extract 7.1 shows a sample of candidates' best responses.

#### Extract 7.1

7(a)	NASTIC movement is a non-direction movement of an organism or part of an organism in response to diffuse stimulus. Example Movement of Mimosa pudica leaves in response to touch
	WHILE
	TACTIC movement is the movement of whole body or a cell of an organism in response to Unilateral source of stimulus Example Movement of Sperm towards an egg is chemotaxis
7(b)	Importance of tropic Movement in plants are
	i/ Exposure of plant leaves to sunlight with

7(b)	ich they trap it and use for the process of photosynthesis. This is PHOTOTROPISM
ii/	Helps plant to anchor well in the soil and hence facilitate proper growth. This is GEOTROPISM where roots grow towards the soil
iii/	Helps plant to get water necessary for different chemical reactions in their bodies such as respiration and photosynthesis. This is HYDROTROPISM where plant grow towards the water
iv/	Helps to give support to non-wood plants by coiling themselves around the wood plants. This is THIGMOTROPISM where movement is in response to touch
v/	It ensures that during germination shoot always grows upwards and root always grows downwards into the soil.
vi/	It exposes leaves to the air for proper gaseous exchange. This is PITOTROPISM where shoot grows upwards
vii/	Plagiogeotropism ensures maximum colonization of an area by a plant because in this case plant grows horizontally
viii/	It helps plant to escape from direct heating from the sun by bending opposite to the sun. This is AEROTROPISM and occur in the sunflower

Extract 7.1 shows a sample of responses of a candidate who performed well in this question. The candidate had sufficient knowledge on the topic of Coordination and managed to adhere to the question demand. The candidate's responses were also clear in terms of English language and straight to the point.

The candidates who performed poorly, most of them had insufficient knowledge on the topic of Co-ordination in plants as they provided unclear responses. For example, some candidates wrote '*nastic movement is the movement in which whole of the body can be moved*'. Extract 7.5 shows a sample of candidate's poor responses.

## Extract 7.2

7(a)	Nastic Movement is the type of movement only one part of the organism can be moved, and Tactic Movement is the type of movement in which whole of the body can be moved. example photoreceptor and mechanoreceptor.
(b)	Importance of tropic movements in plant
	- It helps the plant grow
	- Used to show the positive growth, during the tropic movement.
	- Body part of the plant can grow to the place which has the stimulus example photoreceptor.
	- Plant can grow according to the place which has the photoreceptor.

Extract 7.2 shows a sample of a candidate's poor responses. The candidate had poor knowledge on the topic of Co-ordination as all his/her responses were wrong.

## 2.2 SECTION B

This section consisted of four (4) optional questions. Candidates were required to attempt only three (3) questions in this section each carrying fifteen (15) marks.

### 2.2.1 Question 8: Cytology

In part (a), the candidates were required to describe the tertiary structure of protein whereas in part (b), they were required to elaborate six categories of protein basing on their functions.

A total of 5,164 (46.6%) of the candidates attempted this question of whom 26% scored 0 – 4 marks, 14.9% scored 4.5 – 7 and 59.1% scored 7.5 – 15 marks out of the 15 marks allocated to this question. This indicates that the performance in this question was good.

The candidates who performed well in this question had good knowledge on the topic of Cytology and good mastering of English language. They were able to

describe the tertiary structure of protein and managed to elaborate categories of protein basing on their functions. Extract 8.1 shows candidate's sample of good responses.

### Extract 8.1

8	(a) <u>The description of tertiary protein structure of protein</u>
	<p>Tertiary proteins are those proteins which are consists folded polypeptide chains and of which they are associated with the following bonds</p> <ol style="list-style-type: none"> <li>i Hydrogen bonding</li> <li>ii ionic bonding</li> <li>iii disulphide bonding</li> <li>iv Hydrophobic interaction</li> </ol> <p>Example of Tertiary proteins are Hormones and Enzymes.</p> <p>The diagr.</p> <p>Disulphide Bond</p> <p>Hydrogen Bond</p> <p>Hydrophobic Interaction</p> <p>Ionic bond.</p> <p><u>Simplified diagram showing the structure of Tertiary protein [Tertiary structure]</u></p>



(b) Elaboration of six categories of protein having on their function.

1. Structural proteins

These are Keratin and Elastin protein.

Example of keratin are hair, horn and Elastin are there in bone tendons.

2. Storage protein

Function is storage. Example is Egg white Albumen.

3. Protective protein

These are proteins whose function is to protect especially body organisms against disease.

Example of protective protein are Antibodies.

4. Respiratory (Respiration) protein.

These are proteins which are involved in the whole process of respiration.

Examples are

Myosin and Haemoglobin for carrying respiratory gases ( $O_2$  and  $CO_2$ ) produced and used during respiration.

5. Toxin (Toxin proteins)

These proteins produced by some animals or plant which are toxic in nature and mostly used in defense mechanism.

Examples are Snake venom.

6. Catalytic function (Catalyzing) protein.

These are proteins which are important in catalyzing several metabolic activities such as digestion.

Example of these are

Enzymes such as pepsins, Amylase and Trypsin.

Extract 8.1 shows a sample of candidate's good responses. The candidate had good knowledge on the topic, good understanding of the question demand as all the responses were correct.

The majority of candidates who performed poorly in this category failed to understand the demand of the question. For example, in part (a) some candidates drew the general structure of the amino acid and explained it instead of describing the tertiary structure of protein. In part (b) some candidates classified proteins based on their structure. For example, they mentioned 'fibrous, globular and simple proteins' and others provided the function of tertiary protein instead of categorising the proteins based on their functions. Extract 8.2 shows a sample of poor responses.

### Extract 8.2

8.	(a) Tertiary structure of protein is $\text{NH}_2-\overset{\text{R}}{\underset{\text{H}}{\text{C}}}-\overset{\text{O}}{\text{C}}-\text{OH}$
	— Protein exist as an amphiprotic in which it poses both basic and acidic characteristics
	• Where as
	R- is the alkyl group
	$\text{NH}_2$ - Amino group in a protein which act as a basic
	$-\text{C}-\text{OH}$ - Acidic group in a protein molecule.
	• Protein has a zwitterion which have both positive and negative charges.
8	(b) 1. Simple proteins
	— Is the proteins which contains amino acid only which used for growth of the body.
	2. Conjugate proteins
	— Is the proteins which contains amino acid with a prosthetic group.
	3. Globular proteins
	— Is the proteins which consist three dimensional structure which used for manufacture of keratin and enzyme.
8(b)	4. Fibrous protein
	— Is the protein which contain parallel chains with a cross-link.
	• It is function for manufacture nails, hairs
	5. Functional protein

Extract 8.2 shows a sample of a candidate's poor responses. The candidate failed to comprehend the question demand as in part (a) the candidate explained the structure of amino acids and in part (b) he/she explained the groups of proteins based on their structure instead of their functions.



## 2.2.2 Question 9: Coordination

The question required the candidates to explain the seven roles of synapse. It was recognized that, the question was the most opted as 9,824 (88.7%) candidates attempted it.

The analysis shows that, 49.5% of the candidates who attempted this question scored 0 - 4 marks, 26.5% scored 4.5 - 7 marks and 24% scored 7.5 - 15 marks out of the 15 marks allocated to this question. Therefore, the general performance of candidates in this question was good.

The candidates who did well were able to explain the roles of the synapse which indicated that they had adequate knowledge on the topic of coordination. In addition, they managed to adhere to the demand of the question and their responses were clearly elaborated and well organised. Extract 9.1 shows a sample of good responses.

### Extract 9.1

9	<p>Synapse is the link between two adjacent neurones. A synapse consists of a tiny gap known as the synaptic cleft. The synapse is a link between the axon of one neurone and the dendrites of another neurone.</p> <p><u>Roles of Synapse</u></p> <p>(i) <u>Unidirectionality</u> The <del>presence</del> release of the neurotransmitter substances at the pre-synaptic membrane and the presence of receptor sites at the post-synaptic membrane ensures that nerve impulses flow <del>or pass</del> in only one direction along a given pathway. This ensures that the nerve impulses reach their particular destination.</p> <p>(ii) <u>Adaptation and fatigue</u> The amount of neurotransmitter substances released at the synapse continuously falls in response to <del>a</del> constant stimulation. This is known as adaptation. The neurotransmitter substances may be exhausted in which case the synapse is said to be fatigued. Fatigue prevents the damage of the nerve cell as a result of constant stimulation.</p> <p>(iii) <u>Amplification</u> Sufficient amount of neurotransmitter substances are released at the synapse. Therefore the weaker nerve impulses arriving at the synapse may cause a response as they are amplified by the sufficient release of the neurotransmitter substances.</p>
---	--

9	
	(iv) Facilitation.
	Each nerve impulse passed at the synapse leaves the synapse responsive to the successive/coming nerve impulse. This increases the sensitivity of the system and helps the successive/coming nerve impulse to be able to cause a response.
	(v) Filter out low level stimuli
	For the neurotransmitter substance to be released there is a threshold frequency of stimulation below which no release of neurotransmitter substance. Thus low level stimuli which have not attained threshold frequency will not cause the release of neurotransmitter substance hence they are not carried any further. They end at the synapse
	(vi) Transmission of nerve impulses.
	This is the major role of the synapse. The synapse passes nerve impulse from one neurone to another. Because the two adjacent neurones have no physical contact, the synapse plays a role of transmitting nerve impulses from one neurone to another.
	(vii) Convergence, integration and summation
	The synapse receives a number of both inhibitory and excitatory presynaptic potentials and then adds or combines them to give a response. The combination of these excitatory presynaptic potentials is very helpful as it allows a synapse to give a coordinated response.

Extract 9.1 shows a sample of good candidate's responses. The candidate's responses indicate that he/she had enough knowledge on the topic, good understanding of the demand of the question and used correct English language in his/her explanations.

Majority of candidates who performed poorly in this question lacked knowledge on the topics of Coordination. Most of the candidates were not able to provide proper definition of a synapse. For example, some candidate wrote 'synapse is a lubricant in a synovial joint'. In addition to that, some of the candidates mixed up the roles of the synapse and the adaptation of neuron while others explained the types and functions of neurons. This misconception indicates that, the concept of the synapse taught in the topic of Coordination was not well understood by the candidates. Extract 9.2 shows a sample of poor responses.

## Extract 9.2

Q	The following are the roles of Synapse
Q	(i) It has protein channel for passage of nerve impulse.
	(ii) Its membrane is permeable for passage of Ions.
	(iii) Its membrane is full with synaptic vesicles that carries nerve impulse
	(iv) Avoid the direct contact of adjacent neurones
	(v) Separates the one neurone from another
	(vi) Facilitate the provide energy for the transmission of nerve impulse since it possesses the number of mitochondrion
	(vii) Carries axoplasm to allow movement of nerve impulse.

Extract 9.2 shows a sample of candidate's poor responses. The candidate did not understand the demand of the question as instead of explaining the functions of the synapse he/she explained the adaptations of the synapse.

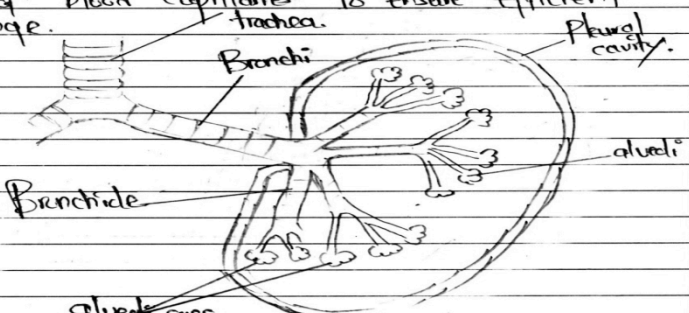
## 2.2.3 Question 10: Gaseous Exchange and Respiration

In part (a), the question required the candidates to describe the internal structure of the mammalian lung, whereas in part (b), the candidates were required to give reasons on why it is not advisable to warm the room at night by using charcoals while people are sleeping in the house and both door and windows are closed.

A total of 9,796 (88.5%) of the candidates opted for this question of whom 32.9% scored 0 – 4 marks, 26.8 % scored 4.5 - 7 marks, 40.3% scored 7.5 -15 marks out of the fifteen (15) marks allocated to this question. This implies that the general performance in this question was good.

The candidates who scored good marks adhered to the demand of the question. They demonstrated enough knowledge on the topic of Gaseous Exchange and Respiration. Furthermore, the candidates had good drawing skills as their responses were illustrated by a well labelled diagram of the mammalian lung. Extract 10.1 shows a sample of good responses.

## Extract 10.1

10.(a)	<p>There are two lungs in mammals one is in the right side and other in the left side. Lungs are found in the abdominal cavity below the thoracic cavity. Lung consist of a system of trachea running from the mouth and nose from the buccal cavity and the trachea branches into two bronchi and each one enters into either of the lungs. In the lung the bronchi branches again to form bronchioles, and the bronchioles enters the alveoli sacs that contains billions of alveoli for gaseous exchange. Alveoli are well supplied with the network of blood capillaries to ensure efficient gaseous exchange.</p>  <p>Internal structure of Mammalian lung.</p>
10.(b)	<p>It is not advisable to warm the room at night by using charcoal while people are sleeping in the house because the charcoal produces carbon-monoxide when burnt. And hence carbonmonoxide will combine with the haemoglobin to form carboxyhaemoglobin and prevents haemoglobin from transporting oxygen around the body. And haemoglobin affinity to carbon monoxide is greater than that of oxygen and this would results into death of an individual.</p>

Extract 10.1 shows a sample of a candidate's good responses. The responses provided indicate that, the candidate was knowledgeable and managed to identify the question demand. In addition, the candidate had good drawing skill.

Most of candidates who performed poorly had inadequate knowledge on the topic of Gaseous Exchange and Respiration. For example, in part (a) some candidates wrote "there will be a competition between charcoal and human being". In part (b) of the question, some candidates wrote wrong spellings. For example, instead of bronchus they wrote 'branch, bronchitis, bronchilis' and instead of alveoli they wrote 'alviolet, alviori'. The misspelt words either lost the intended meaning or brought other different meanings. Other candidates did not understand the demand of the question as they explained and drew the internal longitudinal lining of the lungs instead of internal structure of mammalian lungs. Extract 10.2 shows a sample of candidate's poor responses.

## Extract 10.2

10. (a) The mammalian lung is an organ which are responsible for the exchange of respiratory gases such as carbon dioxide ( $\text{CO}_2$ ) and oxygen gas ( $\text{O}_2$ ). The internal structure of mammalian lung has blood vessels both oxygenated blood and deoxygenated blood which aid in the transportation of respiratory gases. Also it has other structures such as nucleus, cytoplasm and also mitochondrion for provision of energy.
- Consider a well labeled diagram of a mammalian lung;
- 
- An internal structure of mammalian lung:
10. (b) It is not advisable to warm the room at night by using charcoals while people are inside or sleeping in the house: - This is because of when charcoals are warmed in the room at night, while people are sleeping in the house, the charcoals which are burnt at night produces harmful gases which react/combine together with oxygen gas and form another harmful gas in the human body which prevent transportation of blood from one part to another and therefore an individual die slowly death.

Extract 10.2 shows a sample of poor candidate's responses. Responses in both parts (a) and (b) were incorrect, indicating that, the candidate lacked enough knowledge on the topic.

### 2.3.4 Question 11: Transportation

In part (a), the question required the candidates to state three disadvantages of a closed as compared to an open circulatory system whereas in part (b), the candidates were required to describe foetal blood circulation in human being.

The analysis indicated that, a total of 8,159 (73.7%) of the candidates opted for this question in which 66% of the of the candidates scored 0 - 4 marks, 21.2 % scored 4 - 7 marks, 12.8% scored 7.5 - 15 marks out of the fifteen marks allocated to this question. The question was averagely performed.

The candidates who did well in this question had good knowledge on the topic. The candidates were also able to identify the demand of the question. Extract 11.1 shows a sample of good responses.

### Extract 11.1

11 (a) - In closed blood circulation blood are pumped with high pressure compared to open circulatory system which facilitate sufficient working systems of the body.

+ In blood In closed blood circulation there is a pumping organ called the heart ~~serving~~ serving the pumping of the blood to all part of the body with high pressure while in open circulatory system no pumping blood organ.

• In closed blood circulation the blood is confined in closed blood vessels facilitate smooth and efficient transfer of blood to the region which need it while in open circulatory system no such character have less efficiently transfer.

11 (b) Fetal blood circulation in human beings: diagram

Explanation  
The lung of fetus is not well already developed for gaseous exchange hence oxygen get the oxygen from mother through

11 (b) placenta. The oxygenated blood from the maternal body pass to the placenta and go to ductus venosus which carry blood directly to the inferior vena cava. A little blood amount of that oxygenated blood is allowed to pass in the liver because at that time it is not functioning -

↓ Inferior vena cava transport that blood to the right atrium. Much of that blood is ~~to~~ diffused & directly across the foramen ovale to the left atrium. But a little of it is transmitted by tube called ductus arteriosus which by passes the lung. Because the lungs at that time is non-functional. Then blood travel along the ductus arteriosus come to meet with the blood transmitted by diffusion through foramen ovale they meet at aorta -

~~The~~ Then aorta pump that mixture of deoxygenated blood and oxygenated blood to the body tissues and the umbilical artery.

→ the blood by pass the gut because it is not functioning

↓ Oxygenated blood is used by body tissues while deoxygenated is transported by umbilical artery to the placenta where they pass out to the mother's body and then the oxygenated blood from the mother is brought again and the cycle starts.

Extract 11.1 shows a sample of candidate's good responses. The candidate had enough knowledge and good drawing skill as his/her descriptions were accompanied by good illustration of foetal blood circulation.



The candidates who performed poorly, most of them wrote the differences between open and closed circulatory system. Other candidates drew the diagrams showing open and closed circulatory systems. These responses indicate that, the candidates did not understand the demand of the question. There were also some spelling mistakes which made the sentences unclear. For example, the word umbilical was written as 'umbirical', the word maternal was written as 'materal'. These responses indicate poor English language. Extract 11.2 shows a sample of poor responses.

### Extract 11.2

11(a) Closed Circulatory System is the type of blood circulation in which the blood can pass only once to the heart while Open circulatory system is the type of circulation in which blood can pass twice to the heart. The following are the disadvantages of Closed Circulatory system. Blood flow in low pressure, In the closed system the blood can be flow in low pressure. Blood can not be efficient because it can contains the same of waste materials, In the closed system the pressure is very low so the blood can be flow in low pressure. Blood pass only once to the heart, In the closed system circulatory the blood can be pass only once to the heart - for the purpose of filter the blood / pump the blood. The advantages of Open Circulatory system are Blood flow in high pressure, In the open circulatory system the blood can be flow in high pressure - for the purpose to pass into the part of the body - for used easily in a specific. Blood pump twice to the heart; In the open system the blood can be pump twice in order to pass in all parts of the body used to combine with Oxygen to realise the energy. Blood is very efficient, In the open circulatory system the blood flow is very efficient because it pass twice to the heart.

Closed Circulatory System.



11(a) Diagram of Open Circulatory System example Human being.

(b) Foetal blood Circulation. Is the pass of the blood from the mother to the foetal through the connecting body part called Umbilical Cord.

Blood flow from the maternal to the foetal in the high pressure because the maternal blood can be pass twice to the heart before to the reach in the foetal blood. also the blood can used to carry some the nutrients from the maternal to foetal.

Foetal has a low metabolic activities, because so the blood of mother can be depending on how the mother can be work for the easily to pass the blood from the mother to maternal to the foetal for the purpose of support life.

Blood of foetal has high affinity of Oxygen, Because the foetal can used to depending the blood from mother has the high affinity of Oxygen.

Foetal has the high partial pressure compared to the maternal because in side of the foetal Oxygen can be released from the mother but in maternal - foetal it can depending from it.

Extract 11.2 shows a sample of a candidate's poor responses. In part (a) the candidate did not understand the demand of the question as he/she drew the diagrams showing closed and opened circulatory system instead of stating disadvantages of closed system. In part (b) the candidate lacked enough knowledge on the topic of Transport as all his responses were incorrect.

### 3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE PER QUESTION IN PAPER 2 (133/2)

The performance in a given topic in this paper was also classified as a poor, average or good if the percentage of the candidates who scored an average of 30% or more lies in the range 0 – 29, 30 – 49 or 50 – 100 respectively.

#### 3.1 SECTION A

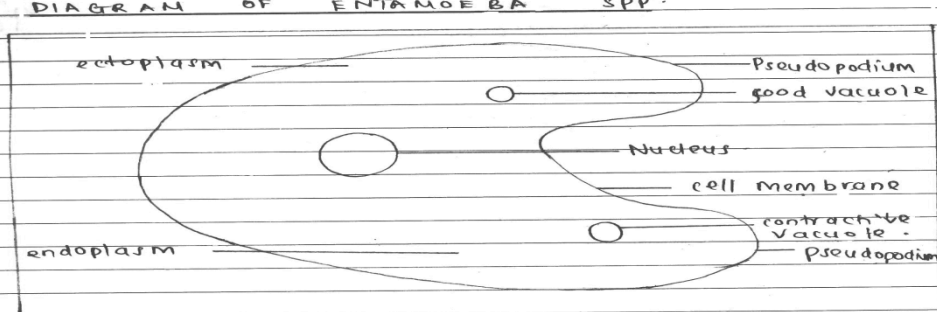
##### 3.1.1 Question 1: Comparative Studies of Groups of Organisms

In part (a), the candidates were required to describe the structural adaptations of *Entamoeba spp* whereas in part (b), the candidates were required to explain the advantages of algae to human being and other living organisms.

A total of 7,913 (71.5%) candidates attempted this question and their performance was good as 19.2% scored between 0 – 5.5 marks, 37.2% scored 06 - 9.5 and 43.6% scored 10 - 20 marks out of 20 marks allocated to this question.

The candidates who performed well in this question had sufficient knowledge on the topic. The candidates also adhered to the question demand and used clear English language to answer the question. In addition, the candidates had good drawing skills. Extract 1.1 shows a sample of candidate's good responses.

##### Extract 1.1

1 (a)	DIAGRAM OF ENTAMOEBA SPP.
	
The structural adaptations of <i>Entamoeba spp</i>	
i)	<i>Entamoeba spp</i> possesses pseudopodium which is used for locomotion from one locality to another. The movement is achieved through pseudopodium.
ii)	<i>Entamoeba spp</i> has ectoplasm and endoplasm; presence of two layers of cytoplasm regulates the entry and exit of food materials and other materials.
iii)	<i>Entamoeba spp</i> possesses food vacuole. This helps an organism to store food which is used in times of lack of nutritive contents.
iv)	The cytoplasm is mobile; The mobility of the cytoplasm leads to net motion of <i>entamoeba spp</i> which is called CYTOPLASMIC STREAMING motility.

r).	It possesses cell membrane which regulates the entry and exit of materials from the cell and also conducts intracellular impulses.
ri).	It has the nucleus which carries its genetic information and it is involved in reproduction i.e. it divides to give two daughter cells by the process called binary fission.
1 (b).	Advantages of Algae to human beings.
(i).	Algae are used in culturing of other organisms such as bacteria, viruses and protozoans for example red algae.
(ii).	Algae are used to manufacture alginic acid which is a chemical constituent used industrially to form products such as paints and hence they are industrially valuable for example brown algae.
iii).	Algar gel is produced from Algae and it is a good constituent used in chemical laboratories and industrial use to manufacture products for example salt bridges in laboratories. Algar is manufactured by blue algae.
iv).	Green algae are photosynthetic and therefore they are used to balance levels of carbon dioxide gas and oxygen gas in the air and to release oxygen gas to be used

Extract 1.1 shows a sample of candidate's good responses. The candidate had enough knowledge on the topic and good command in English Language. In addition, the candidate was systematic and precise in answering the question.

The candidates who performed poorly were unable to adhere to the demand of the question. For example in part (a) some candidates drew the diagram of a 'bacterium' instead of *Entamoeba spp.* In part (b) the candidates lacked enough knowledge on topic of '*Comparative Studies of Natural Groups of Organisms*'. For example, they gave wrong explanations that '*algae are plants*', '*green algae are used to make cosmetics and paints*' instead of brown algae. Extract 1.2 shows the sample of candidate's poor responses.

## Extract 1.2

**DIAGRAM OF ENTAMOEBA SPP**

2.3/ Algae are plants found inside the water bodies  
algae found in Kingdom protista and phylum  
Chlorophyta. The following are the advantages of  
green algae to human being and things  
such as

2.3. Green algae can be used as the cosmetics in  
the same area. In many industrial they use the  
algae for making the ~~cos~~ cosmetics for ma  
nufacturing the cosmetics.

Green algae used as the paints, In industri  
al they use algae for manufacturing paints  
in the area, that paints can be used in painti  
ng the house, and other substance

Extract 1.2 shows poor candidate's responses. In part (a) the candidate failed to understand the demand of the question as he/she drew the diagram of a bacterium instead of *Plasmodium spp*. In part (b) the candidate lacked enough knowledge on the topic as all the responses were incorrect.

### 3.1.2 Question 2: Comparative Studies of Groups of Living Organisms

In part (a), the candidates were required to account for the general characteristics of Phylum Apicomplexa and in part (b) they were required to describe the life cycle of *Plasmodium falciparum* and the effects it causes to its host.

The total of 4,346 (39.2%) candidates opted for this question. The performance in this question was good as the examination result data show that 44.3% scored 0 - 5.5 marks, 34.9% scored 6 - 9.5 marks and 20.8% scored 10 - 20 marks.

The candidates who did well in this question adhered to the demand of the question and had enough knowledge on the topic. In part (a) the candidates managed to mention the characteristics of Phylum Apicomplexa correctly. In part (b) they managed to explain the life cycle of *Plasmodium falciparum* and mention the effects of the parasite to its host. Extract 2.1 shows a sample for a responses of a candidate who performed well.

#### Extract 2.1

Q2	(a) phylum apicomplexa is among the phylum of the kingdom protista in which the plasmodium is present and the phylum has the following characteristics and these are Non-motile, Most of the organisms of which are found in the phylum are non motile example plasmodia can not move by themselves in the body instead it is always been carried into body tissues such as blood during its life cycle. Endo-parasite, the members of the phylum such as plasmodium they tend to live and feed on the digested food within the body of the hosts. have high reproduction potential, the members of phylum apicomplexa are able to reproduce very large amount of young and this helps them in perpetuation of the generation. Asexual and sexual life cycle, the members of phylum apicomplexa have the double life that is in the mosquito they have the asexual life cycle and in the human body they tend to have the asexual life cycle. they are unicellular, that means they are made up of the single cell so their body tend to be like a cell.
----	---

Q2 (b) *Plasmodium falciparum* tend to have the two types of life cycles and these include the sexual life cycle taking place in the body of the Mosquito and the sexual reproduction that takes place in the human body.

In Mosquito the *Plasmodium falciparum* sporozoites always been attached to the gut walls and from the gut wall the sporozoites are always moved by the body fluids to the saliva of the Mosquito and once the Mosquito comes to a human body for taking meal it tends to introduce its saliva that contains also the *Plasmodium* sporozoites.

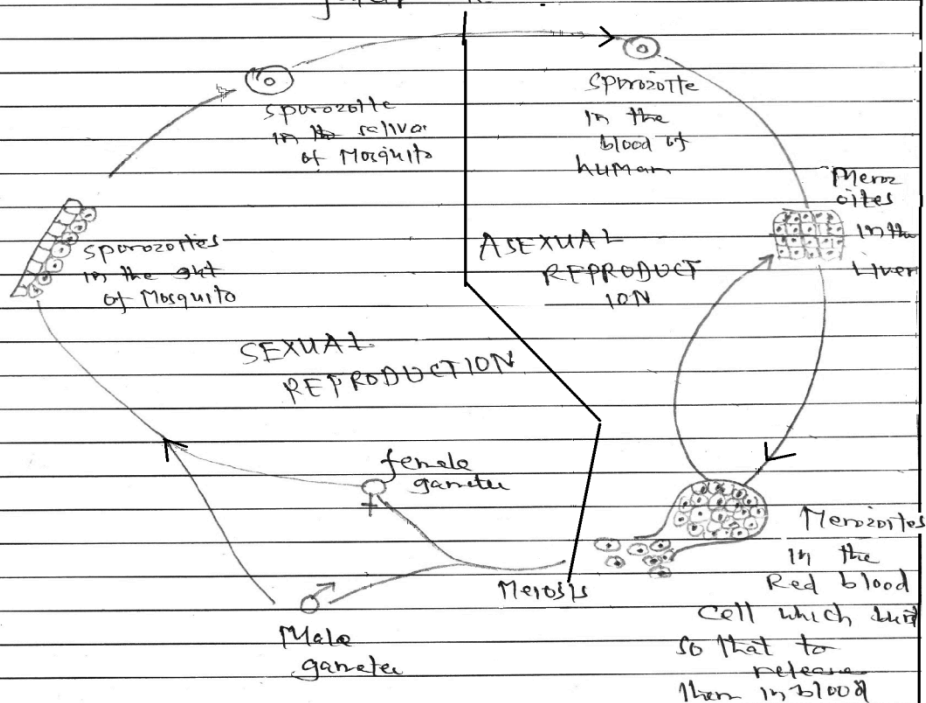
Once the *Plasmodium* sporozoites are been introduced into the body they always be incorporated into the blood and then been moved to the liver at this stage the *Plasmodium* is known as the sporozoites of which after reaching to the liver the sporozoites tend to undergo the asexual reproduction to produce many others called merozoites.

Some of the merozoites been produced are been moved to the blood and enter to the red blood cells while others remain in the liver so that to continue undergoing the asexual reproduction so that to produce as many merozoites as possible.

The merozoites in the red blood cells tend to divide by asexual reproduction and produce many other merozoites and these merozoites tend to produce the male gametes and female gametes.

b2/b) etc of which are been sucked by the Mosquito  
 Once it comes to take Meal once again and once  
 they reach into the gut of Mosquito the  
 gametes tend to combine (fertilization) by  
 Sexual reproduction and produce the other  
 Plasmodium (Sporozoites) of which will be introduced  
 once again to the human body so that to make  
 the continuation of its life cycle.

⇒ Diagram for Life cycle of Plasmodium  
 falciparum.



b2/b) effects that falciparum causes are

- destruction of the Liver
- destruction / bursting of the red blood cells
- cause disease called malaria to the human body

Extract 2.1 shows a sample of candidate's good responses. The candidate had enough knowledge about the topic, good understanding of the demand of the question and good command of English language.

The candidates who performed poorly in this question lacked knowledge on this topic. Example, some wrote that phylum Apicomplexa have the following characteristics; 'have two pairs of wings, have compound eyes, they have antenna for sensitivity, they possess apies for food taking'. These responses were wrong. Extract 2.2 shows the sample of responses of the candidate who scored poor marks.

### Extract 2.2

2	@ The characteristics of the Phylum Apicomplexa
	1. They passes apies for for food taking
	2. They have compound eyes
	3. They produce inside the host
	4. They are triploblastic
	5. They have two pair of wings
	6. They have the antennae for sensitivity
	7.
2	(5)
<pre> graph TD     Mosquito1[Mosquito] --&gt; Plasmodium     Plasmodium --&gt; Mosquito2[Mosquito]     Mosquito2 --&gt; Egg     Egg --&gt; Man     Man --&gt; Mosquito1 </pre>	

Extract 2.2 shows a sample of candidate's poor responses. The responses indicate complete lack of knowledge on the topic of Classification of Natural Groups of Living Organisms as all the responses were wrong.



## 3.2 SECTION B

### 3.2.1 Question 3: Genetics

In part (a), the candidates were required to identify the probability that the children will have blood group A if a father with blood A and a mother of blood group B (both heterozygous) have four children. In part (b) the candidates were provided with the following information; In an experiment conducted on pure – breeding varieties of oats, one with black – hulled grains, and the other with white – hulled grains, the offspring (F1) all had black – hulled grains. When F1 generation was crossed gave F2 generation with the following phenotypes:

- (i) 418 – black – hulled grains
- (ii) 106 – grey – hulled grains and
- (iii) 36 – white – hulled grains

The candidates were then asked to use punnet square to show the gametes, genotype and phenotype in each generation and to suggest the genetic ratio.

The analysis of candidates' performance shows that the question was opted by 7,116 (64.3%) of the candidates. The performance was average as 65.1% of the candidates scored between 0 – 5.5 marks, while 24.6% scored 6.5 - 9.5 marks and 10.3% scored 10 - 20 marks.

The candidates who performed well in this question had sufficient knowledge and adhered to the demand of the question. They managed to provide correct responses which were accompanied by clear illustrations. The language used was also clear. Extract 3.1 shows candidates' good responses.

### Extract 3.1

3.

a) Let

A be the dominant allele for blood group A.  
 B be the dominant allele for blood group B.  
 O be the recessive allele for blood group O.

Crossing between a heterozygous blood group A father and a heterozygous blood group B mother.

Parent phenotype: heterozygous blood group A (father)  $\times$  heterozygous blood group B (mother)

Parent genotype (2n):  $I^A I^O$   $\times$   $I^B I^O$

Meiosis

Gametes (n)  $I^A$   $I^O$   $I^B$   $I^O$

fertilisation by punnett square:

		♂ gametes	
		$I^A$	$I^O$
F <sub>1</sub> genotypes:	♀ gametes $I^B$	$I^A I^B$	$I^B I^O$
	$I^O$	$I^A I^O$	$I^O I^O$

F<sub>1</sub> phenotypes: 1 blood group A ; 1 blood group B ; 1 blood group AB ; 1 blood group O

3.

a continuation.

$$P(E) = \frac{n(E)}{n(S)}$$

but  $n(S) = 4$   
 $n(E) = 1$

$$P(E) = \frac{1}{4} \times 100\% = 25\%$$

3

b Let A be the allele for black colour formation  
 a be the allele for other colours formation.  
 B be the allele for white colour formation.  
 b be the allele for grey colour formation.  
 consider that;  
 A > B, b meaning A is epistatic to B, b.

Crossing pure breedings to obtain  $F_1$  offsprings -

Parent phenotype      Black hulled grains      x      White hulled grains

Parent genotype (2n)      A A B B      B b      a a b b

Meiosis

Gametes (n) :

(AB)

(ab)

Fertilization by  
 punnett square

		♂ gametes	
	♀ gametes	(Bb) (ab)	
$F_1$ offspring	(AB)	AaBb	

$F_1$  genotype : AaBb

$F_1$  phenotype : All Black hulled grains.

Selfing of  $F_1$  generations to obtain  $F_2$  generations.

Parent phenotype	Heterozygous black hulled grains	x	Heterozygous black hulled grains.		
Parent genotype (2n):	AaBb		AaBb		
Meiosis					
Gametes (n) :	(AB) (Ab) (aB) (ab)		(AB) (Ab) (aB) (ab)		
Fertilization by punnett square					
	♀ gametes	♂ gametes :			
		(AB)	(Ab)	(aB)	(ab)
F <sub>2</sub> offspring genotypes :	(AB)	AA BB	AA Bb	Aa BB	Aa Bb
	(Ab)	AA Bb	AA bb	Aa Bb	Aa bb
	(aB)	Aa BB	Aa Bb	aa BB	aa Bb
	(ab)	Aa Bb	Aa bb	aa Bb	aa bb
F <sub>2</sub> phenotypes :	12 Black hulled grains.				
	3 White hulled grains.				
	1 Grey hulled grain.				
The genetic ratio is	12 : 3 : 1				
It is	Epistatic dominant 1.				

Extract 3.1 shows a sample of candidate's good responses. The candidate had good knowledge about the topic, good understanding of the question demand and was very systematic in presenting his/her work.

The candidates who performed poorly in this question lacked sufficient knowledge on the topic of Genetics as in part (a) the candidates used incorrect symbols such as 'X' and 'Y' which represent sex chromosome to represent blood groups. In part (b) the candidates failed to get the correct F<sub>2</sub> genotype ratio. Extract 3.2 shows the candidates sample of poor responses in this question.

### Extract 3.2

3 (a) Let  
 $X^B Y^A$  — represent heterozygous male  
 $X^B X^A$  — represent heterozygous female

Parents  $X^B Y^A$   $X^B X^A$

Gametes  $X^B$   $Y^A$   $X^B$   $X^A$

fertilization

F<sub>1</sub> generation  $X^B X^B$   $X^B X^A$   $X^B Y^A$   $X^A Y^A$

→ 3 children have a probability of having blood group A (2-boys, one female).

3 (b) Let  
 BB — Homozygous black-hulled grains  
 bb — Homozygous white-hulled grains  
 black-hulled are dominant over white hulled grains.  
 for F<sub>1</sub>-generation

♀ \ ♂	B	B
b	Bb	Bb
b	Bb	Bb

→ Black-hulled grains are dominant over the white hulled all F<sub>1</sub> — are black-hulled grain

3b F<sub>2</sub> generation

♀ \ ♂	Bb	b
B	Bb	Bb
b	Bb	bb

Genotype

Phenotype — 1 — homozygous black,  
 2 — heterozygous black (grey)  
 1 — homozygous white

Genotypic ratio : 3 : 1

Extract 3.2 shows candidate's sample of a poor responses. The candidate had insufficient knowledge in Genetics as all the responses provided were wrong.

### 3.2.2 Question 4: Genetics

In part (a) the question required the candidate to elaborate the Mendel's work in genetics by considering his success and failures. In part (b) the candidates were required to show the probability of having haemophiliac children when a carrier haemophiliac woman marries a normal man.

The analysis revealed that the question was opted by 7,350 (66.4%) of the candidates where 25.5% scored 0 – 5.5 marks, 39.4% scored 6.5 – 9.5 marks and 35.1% scored 10 – 20 marks. The general candidates' performance in this question was good.

The candidates who performed well adhered to the demand of the question. The candidates also demonstrated enough knowledge on the topic 'Genetics' as they managed to provide correct responses in both parts (a) and (b).

#### Extract 4.1

4.	@ Success of Mendel's work in Genetics. Basing on his experiments and observations he made, the following are the success.
	He succeeded to formulate Laws of Inheritance. These are the Laws of Segregation and the Law of Independent assortment.
	He succeeded to examine Basic Monohybrid and Dihybrid ratios on his experiments.
	He predicted the existence of genes and chromosomes even though by the time he knew nothing about Meiosis and Mitosis and the whole concept of genetics.
	Using his Dominance – Recessive system He managed to elaborate the roles of chromosomes and Variation within the population.
4.	@ Failures of Mendel's work. Despite of his success the following are the failures of his work.
	- He knew nothing about mitosis and Meiosis by the time of formulation of his laws.
	- He didn't consider about sex linked traits.
	- He Based on plants observable features only.
	- He used Dominant – Recessive system which is not applicable in all cases.
	- He didn't consider factors like Mutation and Variation on change in Genetics of an organism.

4 (b). Haemophilia is the sex linked trait in which an individual's blood fails to clot due to lack of pigment responsible for blood clotting

It is controlled by recessive genes

let  $h$  - stand for affected person  
 $H$  - stand for Normal.

$H$  is dominant over  $h$

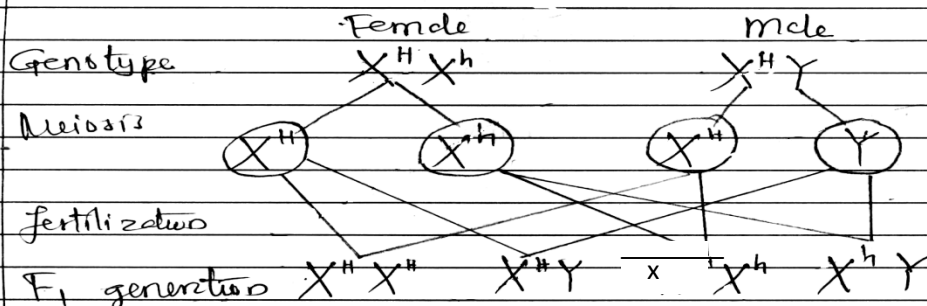
A normal man

$X^H Y$

Carrier female

$X^H X^h$

A cross between them



Genotype 1 female Normal, 2 female recessive 1 male Normal 1 male affected.

Genotype 1: 1: 1: 1

Phenotype 3: 1

Three are Normal, one male is Haemophilic

4 (b) Probability of Having Haemophilic children

$$\frac{\text{Number of affected} = 1}{\text{number of all} = 4}$$

$$P(E) = \frac{1}{4} = 0.25$$

$$\text{probability} = 0.25 \text{ or } 25\%$$

Extract 4.1 shows a sample of a good candidate's responses. The candidate had sufficient knowledge on the topic of Genetics. Thus, he/she used correct symbols and English language to illustrate his/her answers.

The candidates who performed poorly demonstrated misconception as their responses were based on the topic of 'Evolution' instead of 'Genetics'. For example, among the wrong responses in explaining the failures of Mendel's work was: 'he failed to explain the role of environment for genetic recombination, he failed to explain acquired characters of inheritance from one generation to another'. Actually these are failures of Lamarck theory of Evolution and not failures of Mendel's work. English language was another problem of the candidates as they wrote unclear statements such as; 'Mendel failed to explain the acquired inheritance characteristics from one generation to another'. Extract 4.2 presents a sample of poor responses.

#### Extract 4.2

4	(a) Genetics is the study of hereditary materials and variation in living organisms. Mendel was the first person to work on the genetics. Mendel had success and failures to his work so the following are few success and failures of his work starting with the success
	He done his experiment specifically; Mendel when he was conducting his experiment he done it specifically.
	It is experiment was Scientific proved. The experiment of Mendel was Scientific proved to all people.
	He opened the way for scientists to conduct other more research; Due to his work Mendel opened the way for the other scientists for to conduct other experiments.
	He used few specimen for his experiment; Mendel in his experiment used few organism in conducting it his experiment that is why he succeeded through his experiment.

4a) Apart from the success Mendel's work has failures so the following are the failures of Mendel's work

He was not able to explain how genetic materials are transferred from one generation to another generation. Mendel's work failed to convince people how genetic materials are transferred.

He did not explain the role of environment. Mendel was not able to explain clearly how environment is important for the genetic recombination in the environment.

He failed to explain the acquired inheritance characteristics from one generation to another generation. He failed to convince other scientists to explain how acquired inheritance characteristics are transferred from one generation to another.

Therefore even though Mendel's work had some failures it showed different important process for the genetics formation and helped many other scientists.

Extract 4.2 shows a sample of a poor candidate's responses. The candidate failed completely to understand the demand of the question as he/she discussed the failure of Lamarck theory instead of that of Mendel's work.

### 3.3 SECTION C

#### 3.3.1 Question 5: Growth and Development

In part (a) the question required the candidate to explain how mitosis is significant in living organisms. In part (b) the candidates were required to describe in detail the process of metamorphosis in housefly and grasshopper.



The question was attempted by 7,541 (68.1%) candidates. The performance was good as the analysis indicates that 17.8% scored 0 - 5.5 marks, 31.8% scored 6 – 9.5 marks and 50.4% scored 10 – 20 marks.

The candidates who performed well adhered to the demand of the question. They also demonstrated enough knowledge on the topic of Growth and Development as they managed to describe metamorphosis in housefly and grasshopper using clear and well organized diagrams. Extract 5.1 shows a sample of good responses.

### Extract 5.1

5:	a) Mitosis is the type of nuclear division that ends up with the formation of two diploid cells daughter cells.
	The significances of mitosis in living organisms are:
	It is a means of growth in multicellular organisms. Cell increase in multicellular organisms is a result of mitosis.
	It is a means of asexual reproduction in unicellular organisms. Small unicellular organisms like bacteria reproduce asexually by dividing into two equal halves; a process of this cell division is mitosis.
	It brings about wound healing and the replacement of worn out cells. Mitosis ensures constant number of cells by replacing the dead cells.
	It is a means of regeneration of the lost body organs. For example crustaceans are able to loose all their feet, also starfish can loose all its arms. The replace regeneration of these organs is done through mitosis.
	It maintains the genetic stability of the species. This is because the two daughter cells are diploid like their diploid mother cell.

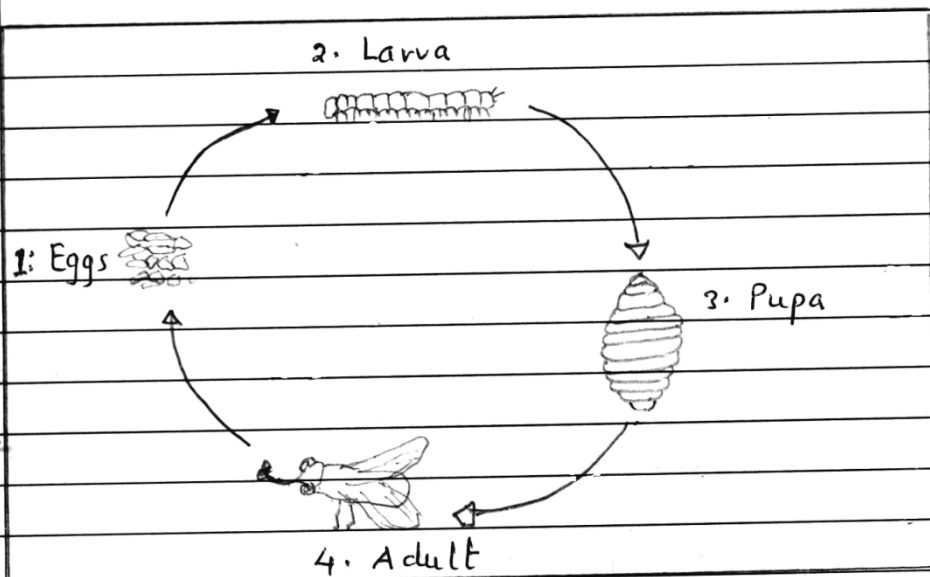
5: (b)

which an

Metamorphosis are developmental stages that an organism passes from eggs to adult forms. It is divided into two types namely; complete metamorphosis and incomplete metamorphosis.

Complete metamorphosis is the one which involves four stages: egg  $\rightarrow$  larva  $\rightarrow$  pupa  $\rightarrow$  adult. An example of an organism exhibiting complete metamorphosis is a house fly.

Consider the life cycle of a housefly below showing complete metamorphosis.

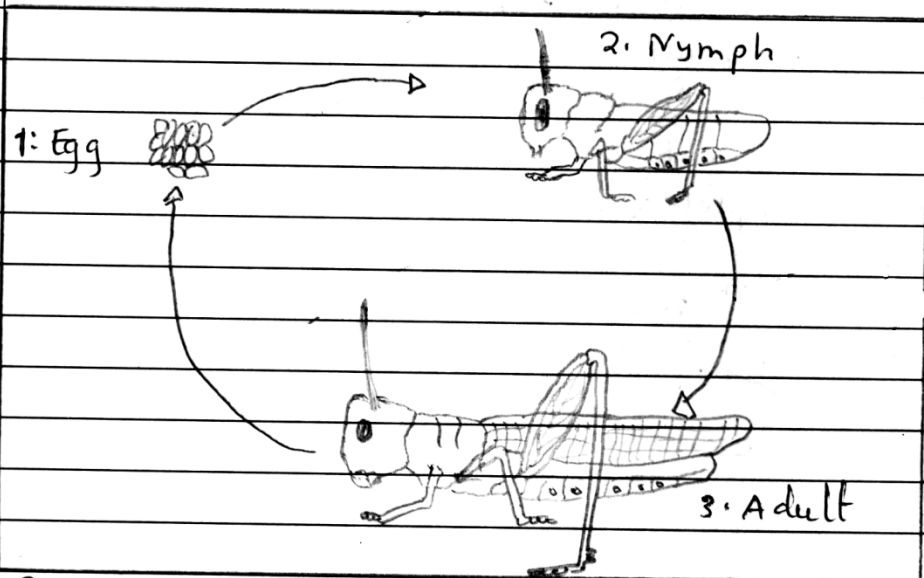


- The eggs are laid in dirty places and they hatch into larvae. The larvae have different feeding habits from the adult and can move about.
- The larvae develop into pupae which are incased and can't move. They also don't feed.
- The pupae hatch into adult houseflies which will then lay eggs and life cycle begins again.

5b) Incomplete metamorphosis involves three stages such as egg  $\rightarrow$  nymph  $\rightarrow$  adult. There is no larval and pupal stages.

An example of organisms exhibiting incomplete metamorphosis is a grasshopper.

Consider the life cycle of a grasshopper below showing incomplete metamorphosis.



The eggs hatch into nymphs which have similar life forms to adults. The only difference is that the nymph has no wings and is small whereas the adult has wings and is large.

- The nymphs develop wings after some time and become adult grasshoppers.

- Adult grasshoppers lay eggs and the life cycle begins again.

Extract 5.1 shows a sample of good candidate's responses. The candidate had sufficient knowledge, good command of English language as well as good drawing skills.

The candidates who performed poorly in this question did not understand the demand of the question in part (a). Instead of explaining the significances of mitosis in living organisms, some candidates explained where mitosis process occurs. They wrote '*it occurs in somatic cells*'. Others explained the characteristics of mitosis that '*there is no crossing over*'. In part (b) some of the candidates confused the metamorphosis of housefly to that of grasshopper. For example they wrote '*housefly undergoes incomplete metamorphosis and grasshopper undergoes complete metamorphosis*'. In addition to that, the candidates had poor command of English language. Extract 5.2 shows a sample of poor responses.

### Extract 5.2

5	<p>① Mitosis is a significant in living organism</p> <p>(a) It occur in somatic cell that all cell in the body can replicate and grow</p> <p>(b) There is no crossing over</p>
5	<p>② With reference to housefly and grasshopper, the process of Metamorphosis are as follows. In Metamorphosis Metamorphosis are described in two types that is complete and incomplete Metamorphosis. Start with Housefly it undergoes Incomplete Metamorphosis that has three stages Pulpa - Nymph - larva. and they are controlled by two antagonist hormones called juvenile hormone and ecdysone (ecdysone). That juvenile hormone promote secretion of ecdysone and ecdysone promote ecdysis and hardening of coat during Moulting. While Grasshopper under goes complete Metamorphosis that have Pulpa, larva, Nymph and Adult that also controlled by juvenile and ecdysone hormones of Moulting. Grass hopper Undergoes periodic shedding from small to adult that lead to its growth and Maturation until adult. Juvenile and ecdysone work antagonistically and both lead to growth of an grass-hopper. Pulpa - Nym grasshopper we have Pulpa - larva - &gt; Nymph - &gt; Adult. House fly we have Pulpa - &gt; Nymph - &gt; Adult.</p>

Extract 5.2 shows a sample of candidate's poor responses. The candidate did not understand the demand of the question. He/she also exchanged the answer for the housefly with that of the grasshopper.

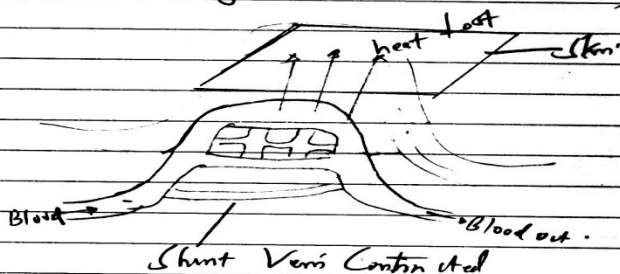
### 3.3.2 Question 6: Regulation

The question required the candidates to describe how mammals are adapted to warm environment. The question was attempted by 8,981 (81.1%) of the candidates.

The performance of candidates in this question was good as 47.4% scored between 0 – 5.5, 43.6% scored 6 – 9.5 marks and 9.0% scored 10 – 20 marks.

The candidates who performed well adhered to the demand of the question and they had basic and advanced knowledge on the topic 'Homeostasis'. The candidates managed to describe the adaptation features of mammals in warm environment such as; large surface area to volume ratio, fluctuation of body temperature within narrow ranges, sweating, panting and licking, aestivation, reduction of the rate of metabolism and vasodilatation. Extract 6.1 shows a sample of best responses.

#### Extract 6.1

6	How mammals adapted to warm environment
	Mammals adapted to warm environment as follows:
	i) Vasodilation this is the situation where by superficial arteries dilates so as to have more contact with skin and much heat is lost through the skin mainly by radiation.
	 <p style="text-align: center;">Shunt Vess Constricted</p>
	ii) Sweating this is the situation where heat is lost through the skin as or in form of water vapour this is common in mammals with sweat glands throughout the body.
	iii) Relaxation of erector pili muscle when erector pili muscle relax hair are pulled down so cover the skin allowing air to pass or flow over the skin and cooler heat away.

### 6) Panting and Licking

This is the best mechanism for mammals with fur in all parts of their body or mammals with few sweat glands where to  
Example dogs tend to hang out their tongue so as to allow heat to get lost  
- for such mammal (dogs) sweating occurs in body parts with no fur example in pads

### v) Larger Surface area to volume ratio

- Organisms in warm environment have long & extremities compared to those of cold environment, this is so as to allow much heat to get lost  
- Example European counterparts have longer & longer ears than fennec foxes

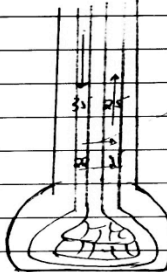
### vi) Variation of body temperature

Some organisms in warm environment are able to vary their body temperature so as to reduce temperature difference between inside and outside their body.

- Example Camel are able to fluctuate their body temperature between  $34^{\circ}\text{C}$  to  $41^{\circ}\text{C}$ .

### vi) Behavioral mechanisms

Some of organisms in warm environment tend to perform some behavioral mechanisms so as to avoid period of heat stress in warm environment Example some of them tend to hibernate so as to prevent heat

6	<p>gave in their bodies.</p> <p>This Hibernation in warm environment is called Aestivation.</p> <ul style="list-style-type: none"> <li>- Other Organisms tend to shelter themselves in burrows or rocks so as to prevent heat gain.</li> <li>- Taking (Ingest) cold meals (eaten)</li> <li>- This is common to humans being at risk when environment temperature is high as the cooling of the body is by taking cold meals sub in water so as to cool the body.</li> </ul> <p>(ix) Variation between Superficial and Core temperature.</p> <ul style="list-style-type: none"> <li>- When temperature of body of Organism is warm is high Organism tend to vary between core temperature and superficial temperature so as to lose heat.</li> <li>- This is possible since some of mammals contain Counter Current heat exchanger system.</li> </ul>  <p>Heat flow from warm blood to cold blood</p> <p>0°C Superficial Temperature</p>
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ix) Insulation.	<ul style="list-style-type: none"> <li>- Some mammals are insulated by fur that is thick fur, these furs are lighter being lighter assist in reflecting sunlight radiation thus preventing heat gain.</li> </ul>
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Extract 6.1 shows a sample of responses of a candidate who performed well in this question. The candidate had enough knowledge about the topic and used clear English language to describe the adaptations of mammals to warm environment.

The candidates who performed poorly had insufficient knowledge as they provided wrong responses. For example; 'the camel drink a vast amount of water, they have delicate skin, they eat food rich in liquids'. The candidates also demonstrated poor command of English Language. For example, one candidate wrote '....they have tough with fur skin...'. Extract 6.2 shows a sample of responses of a candidate who scored poor marks.

#### Extract 6.2

6	Adaptation of mammals to warm environments
i/	They have long loop of henle so that to ensure maximum absorption of water, no water lost as urine or faeces.
ii/	They have tough with fur skin to prevent maximum loss of water to the surroundings.
iii/	They eat food rich in liquids such as fruits, seed and leaves.
iv/	They excrete more concentrated and in small amount of urine so that water can conserve in the body.
v/	Most of animals in the warm condition lives in burrow so that they run from the excess temperature, where they can experience desiccation. Examples Kangaroo.
vi/	Some mammals such as camel may drink a vast amount of water and stay for long time without it.
vii/	Most of mammals in the warm condition used metabolic activities especially oxidation of food to release water and energy. This help these organisms to obtain water. Example the hump of the camel.
viii/	They have a delicate skin which is very
6	tolerant to desiccation. even if the temperature is high the organism will survive.
ix/	Their body are tolerant to shortage supply of water.

Extract 6.2 shows a sample of candidate's poor responses. It shows that, the candidate lacked the knowledge about the topic of 'Regulation'. The candidate had also misconception about the demand of the question as all of his/her answers were based on osmoregulation instead of thermoregulation.



### **3.4 SECTION D**

#### **3.4.1 Question 7: Ecology**

The question required candidates in part (a) to describe the two types of competition and to explain briefly why intraspecific competition is density dependent. In part (b) the candidates were required to explain six ways in which excess intraspecific competition is avoided among organisms in the ecosystem.

Statistics analyses indicated that the question was opted by 5,651 (51.0%) of the candidates. Further analyses of candidates' performance on this question revealed that 63.9% scored 0 - 5.5 marks, whereas 32.7% scored 6 - 9.5 marks, and only 3.5% scored 10 - 20 marks. The trend indicates that the performance of the candidates in this question was average.

The candidates who performed well in this question had sufficient knowledge on the topic of 'Ecology' and adhered to the demand of the question. The candidate had good mastery of English Language. Extract 7.1 shows a sample of good responses.

## Extract 7.1

Qn 7 a/ Competition is the situation in an ecosystem where there is little resources or vital substance such as food, water, shelter, mating partner, light and so on. due to such limited resources individual are forced to compete for such resources and those who cannot struggle they are eliminated. There are two types of struggle which are Intraspecific struggle or competition and interspecific struggle or competition.

Intraspecific competition. This is the competition which occurs between individuals of the same species within an ecosystem. These species compete for food, water, air and mating partner. This can lead to reduction of other individuals who cannot struggle for existence where the nature select them.

Interspecific competition. This is the competition between individuals of different species where they compete for resources like water, air food and so on. The group of species which cannot struggle they will be eliminated.

The intraspecific competition is a density dependant because it is the number of individual per unit area.

Q07] is small automatically there will be not or scarce competition between organisms of the same species. But when the number of individual increases is when the intraspecific competition comes in cause the number of individual are more compared to the available resources.

Also because it is affected by the increase of number of individual of the same species. If individuals of different species increases it is not affected.

by ways in which excess intraspecific competition is avoided among organisms in the ecosystem:

By migration: where organism decides to move from the place of competition to the place where there is no competition hence intraspecific competition is avoided.

Climination by the nature through death: other organisms in an ecosystem do die due to excessive increase of competition. where those who are weak are reduced hence intraspecific competition is avoided.

Each individual develops its own ecological niche where it will feed on different food from other organisms in an ecosystem.

	through the occurrence of natural
	hazard such as flood where the organisms
	will be reduced and hence intraspecific
	struggle is avoided.
	By proper dispersal of seeds
	and spores to avoid overcrowding.
	This will reduce competition among the
	individuals.

Extract 7.1 shows a sample of responses of a candidate who performed well in this question. The candidate's responses were well organized, clear and adhered to the question demand of the question.

The candidates who performed poorly lacked enough knowledge on the topic of 'Ecology'. For example, some candidates wrote '*intraspecific competition is density dependent because many organisms are able to gain its needs such as food in the same ecological niche*'. Other candidates explained the ways in which excess intraspecific competition can be avoided as; *replacement of organisms, isolation, by using chemicals like DDT*. These responses were wrong. Others made mistakes in spellings; for example, the word '*intraspecific competition*' was mistakenly written as '*extraspecific competition*'. In addition to that, poorly constructed sentences like '*....because the ecological niche which belong have satisfy its needs*' were observe in candidates answers. Extract 7.2 shows a sample of poor responses.

## Extract 7.2

7. (a) There are two types of competition which are extraspecific competition and intraspecific competition. Extraspecific competition is the type of competition where by an organism competes in the different <sup>resources in</sup> ecological niche. Intraspecific competition is the type of competition where by an organism compete for the <sup>same</sup> available resources in the limited ecological niche. Intraspecific competition is density dependent because many organisms are able to gain it's needs such as food in the same ecological niche. Hence the organism does not move from one ecological niche to another because the ecological niche which belong have satisfy its needs.
- 7 (b) Excess intraspecific competition is avoided among organisms in the ecosystems as follows. The one weaker tend to shift from one ecological niche to another in order to avoid competition. Other organism (unfit) are eliminated by nature to avoid excess competition to the available
- 7 (b) resources. Fit able to survive while unfit are eliminated. The unfit can be eliminated either by death or other factors like prey.

Extract 7.2 shows a sample of poor candidate's responses. The candidate lacked enough knowledge on the topic of 'Ecology'. Thus, he/she used incorrect ecological term like 'extraspecific competition'.

### 3.4.2 Question 8: Ecology

The question required the candidates to elaborate how primary and secondary ecological successions take place. It was realized that 5,998 (54.2%) candidates opted for this question and their performance was poor as 72.2% scored 0 – 5.5 marks, 21.5% scored 6 – 9 marks and only 6.3% scored 10 – 16 marks. None of the candidates scored over 16 marks out of 20 marks allocated to this question.

The candidates who performed well in this question had good mastery of content knowledge, good mastery of English Language and good essay writing skills. They managed to elaborate how primary and secondary ecological successions take place. The candidates also managed to give examples on how natural forest community might have begun long time ago. Extract 8.1 shows a sample of candidates' good responses.

#### Extract 8.1.

8	Ecological succession is the gradual change of an ecosystem through successive stages from colonization until a stable or climax community is established. There are two types of succession, primary succession and secondary succession.
	Primary succession is the type of succession in which the organism starts to colonize the area where life never existed before. Primary succession involves the start of beginning of life in an area. Example It shows how the life started under the bare rock

8	<p>Under the bare rock there is harsh condition such as high temperature no fertile soil which can support plant growth hence no life existed. But the lichen bore tolerate the harsh condition then the start their colony and are called pioneers. They lead to breakdown of the rock and through weathering process the soil developed on the bare rock and when the pioneers died they added nutrients to the soil hence brought favorable condition for Moss plants to survive. Moss added nutrients for to the soil then ferns then shrubs developed and their root penetrated in the soil hence supported the large trees hence the new ecosystem was established.</p> <p>Secondary succession occurs where the life existed before then the new colony is established. Example after fire outbreak or clearing of agriculture land. Here the organism establishes their new ecosystem adapting the new environment until a stable community is established and the organism have able to colonize the new area.</p> <p>The diagram showing how primary succession took place</p> <p>pioneers → Moss plants → Fern plants → Shrubs → trees</p>
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Extract 8.1 shows a sample as of candidate's good responses. The candidate had enough knowledge on the topic of 'Ecology' as evidenced by detailed explanation on how primary and secondary successions take place.

The candidates who performed poorly lacked enough knowledge on the topic of 'Ecology'. For example, among the poor responses provided were; "primary succession is misplacement/replacement/displacement of organisms in the new environment; Some candidates failed to understand the demand of the question as they wrote causes of succession such as 'succession is caused by geographical factors such as climate, temperature, rainfall' instead of describing how successions occur. Extract 8.2 shows a sample of candidate's poor responses.

### Extract 8.2

Q The primary ecological succession takes place when the new generation - formed, exist from the replacement of the ancestors by struggling for existence. Organisms do compete for the limited resources like food, shelter, oxygen for their survival.

Secondary ecological succession takes place by the replacement of the primary ecological succession or primary organisms/ancestors.

Organisms are competing for the limited resources found in their environment, the one which become able to survive, become dominant over that area. But if it fails to struggle for the limited resources it will be replaced by the stronger ones.

Therefore ecological succession involve the compete for the limited resources which makes them to adapt on such an environment.

And it happens for both primary and secondary ecological succession till the stable community exist.

DIDBIRAN

Where by; A is primary organisms  
B is secondary organisms  
C is till a stable organisms.

Extract 8.2 shows a sample of candidate's poor responses. The candidate did not understand the demand of the question as his/her responses based much on competition/struggling for existence. This concept is based on Evolution specifically Darwin's Theory of Evolution and not Ecology.



## **4.0 CONCLUSION AND RECOMMENDATIONS**

### **4.1 Conclusion**

The overall performance of candidates in Biology was good as the candidates' scores in most of the questions were thirty percent (30%) or above out of the total marks allocated to the particular question. The analysis indicates that, out of twelve (12) topics which were tested namely: Transport, Nutrition, Gaseous Exchange and Respiration, Reproduction, Cytology, Principles of Classification, Coordination, Comparative Studies of Natural Groups of Living Organisms, Genetics, Growth, Regulation and Ecology, the performance of nine (9) topics was good. However, two (2) topics were averagely performed while only one topic was performed poorly. (Refer: Appendix) which shows a summary of candidates' performance topic wise.

Generally, the factors which made some candidates unable to score the full marks allocated in each question include; candidates' insufficient knowledge on the topic concerned. This may have been contributed by unavailability of enough Biology subject teaching and learning resources such as books, internet, online studies, journals and magazine in some schools, inability of teachers to cover the syllabus in their teaching process, lack of enough field execution and laboratory work, inadequate competent teachers, failure of students to revise all the topics before the national examination commences and lack of enough tests and examinations to students to enable them to internalize the content knowledge.

Lack of skills for responding to question demand was another factor. Generally, this may have been attributed by lack of enough homework/assignment, tests and examinations to students accompanied by teachers' feedback to enable the students to build up skills for responding to the demand of the question.

Incompetence in using English language was another factor which affected the performance negatively. This may have been attributed by lack of students' practices in reading English books, speaking English, writing essay competitions, communication skills and dramatizing.

## 4.2 Recommendations

Based on the observations made through the analyses in this report, to make the candidates' performance the best and attain the 'Big Results Now in Education Sector' the following recommendations are put forward:

- (i) School libraries should be equipped with Biology subject resources such as books, internet, online studies, journals and magazine. This may facilitate students' extensive reading and self-studying to equip them with content knowledge.
- (ii) Heads of school and school inspectors should work hand in hand to ensure that the students cover the Biology syllabus before they sit for the national examination.
- (iii) Candidates should be advised to make thorough revision before the commencement of the national examination. This is to ensure that the candidates have enough knowledge needed in answering the National examination questions.
- (iv) Teachers should make sure that they provide enough tests and examinations accompanied with feed-back to help the candidates to internalize the content knowledge and also build up an experience in realizing the question demands.
- (v) Students should be advised to read the question(s) carefully so as to identify the demand of the question(s) before attempting it/them.
- (vi) Candidates should be encouraged to improve their ability in reading and writing in English language through reading English books, practicing to speak in English, involving in essay writing competitions and dramatizing.

## APPENDEX

**Table 1: Biology ACSEE 2014 a summary of candidates' performance topic-wise**

S/N	TOPIC	NUMBER OF QUESTIONS	PERCENTAGE OF CANDIDATES SCORED 30% OR ABOVE	REMARKS
1.	Nutrition	1	88.30	Good
2.	Reproduction	1	80.40	Good
3.	Growth	1	82.20	Good
4.	Cytology	2	80.40	Good
5.	Gaseous Exchange and Respiration	2	68.65	Good
6.	Coordination	2	58.20	Good
7.	Comparative Study of Natural Groups of Living Organisms	2	68.25	Good
8.	Genetics	2	54.7	Good
9.	Regulation/Homeostasis	1	52.80	Good
10.	Transportation	2	39.15	Average
11.	Ecology	2	31.95	Average
12.	Principles of Classification	1	7.30	Poor

