THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE ADVANCED CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (ACSEE) 2018

133 BIOLOGY

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FOREWORD

This is the analysis of candidates' items response on the Advanced Certificate of Secondary Education Examination (ACSEE) for Biology subject which was conducted in May, 2018. The report was prepared and issued to provide feedback to candidates, teachers, parents, policy makers and the general public on the performance of the candidates who sat for the examination.

The ACSEE marks the end of two years of the advanced level of secondary education. It is a summative evaluation, which among other things shows the effectiveness of the education system in general and the educational delivery system in particular. Primarily, the candidates' response to the examination questions is a strong reflection of the competencies they gained from the educational system in their two years of advanced secondary education.

The analysis presented in this report shows some of the reasons that made most of the candidates to score high marks in the questions. Such reasons include but not limited to sufficient Biology content knowledge, good understanding of question requirements and good drawing skills. The report also pinpoints factors which made a few of the candidates to score low marks. These include scanty Biology content knowledge, failure to grasp the requirement of the concerned question, imprecise explanation and description and poor drawing skills. Furthermore, it highlights areas where the candidates experienced learning difficulties.

The National Examinations Council of Tanzania hopes that the report offers a valuable feedback which educational stakeholders can use for more success in the teaching-learning process, hence achieving best candidates' performance in future examinations administered by the Council. The Council welcomes and greatly appreciates fruitful and genuine comments and suggestions from teachers, candidates and the public in general, which can be used for refining future Candidates' Item Response Analyses reports.

Finally, the Council would like to express sincere appreciation to Biology subject 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 the analysis of Candidates' Item Response in Biology Advanced Certificate of Secondary Education Examination (ACSEE), 2018. The examination was set according to 2015 examination format. It is a report of two papers namely 133/1 Biology 1 and 133/2 Biology 2, all of which aimed at measuring theoretical competences gained by candidates after completing two years of advanced level.

The examination papers were structured in such a way that paper 1 contained ten (10) questions grouped into sections A and B. Section A had seven (7) compulsory short answer questions, while section B consisted of three (3) essay type questions (where candidates were required to attempt only two (2) questions). Section A carried a total of 70 marks, while section B carried a total of 30 marks. On the other hand, paper 2 had eight (8) essay type questions presented into four sections, namely: A, B, C and D. The candidates were required to answer five (5) questions by choosing at least one (1) question from each section. Each question carried 20 marks.

A total of 27,109 school candidates registered for 2018 ACSEE out of which 26,936 sat for the examination. The results show that 25,988 (96.98%) passed the examination, while 948 (3.02%) failed. The results indicate the increase in performance by 1.92 percent compared to the year 2017; where 95.06 percent passed. The analysis of the candidates' performance in 2018 in each grade and gender is indicated in Table 1.

Table 1: Candidates' Performance by Grades and Gender in the 2018 ACSEE

Gender	Grades and marks range							
	A (80-100)	**B (70-79)**	**C (60-69)**	**D (50-59)**	**E (40-49)**	**S (35-39)**	**F (0-34)**	**Total**
Male	19	923	4,513	6,072	3,325	645	463	16,085
Female	6	423	2,551	4,270	2,683	558	347	10,851
Total	25	1,346	7,064	10,342	6,008	1,203	810	26,936

The highest pass marks range is 80 to100 (Grade A) while the lowest pass marks range is 35 - 39 (Grade S). Few of the candidates (25) out of 26,936 scored grade A.

The following section analyses the candidates' performance in each question by giving a brief overview of what the candidates were required to do, what they did and the reasons for their high or low performance. In addition, extracts from candidates' answer sheets have been used to exemplify correct and incorrect responses. The performance in each question is ranked as weak, average or good if the percentage of the candidates who passed that particular question/topic falls within the range of 0 - 34, 35 - 59 or 60 - 100, respectively. Furthermore, green, yellow and red shades in figures connote questions with good, average and weak performances, respectively.

2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH QUESTION IN 133/1 - BIOLOGY 1 AND 133/2 - BIOLOGY 2

2.1 133/1 - BIOLOGY 1

This paper contained ten (10) questions composed from seven topics according to 2015 ACSEE format. The paper was divided into sections A and B. Section A had seven (7) questions carrying 10 marks (in which, the pass mark was 3.5 and above). On the other hand, section B had three (3) questions; carrying 15 marks each, whereby, the pass marks was 5.5 and above.

2.1.1 Question 1: Cytology

Part (a) of the question required the candidates to describe the features of the cell membrane, while part (b) required them to assess the suitability of the structure of a mitochondrion to its function by giving five points. The question was attempted by 26,929 candidates, which corresponds to 100 percent. The performance in the question is summarized by Figure 1.

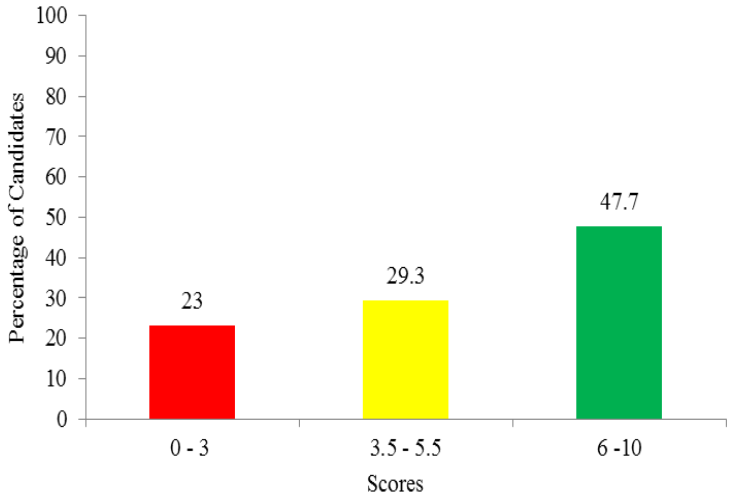


Figure 1*: The Candidates' Performance in Question 1.*

Figure 1 shows that 47.7 percent of the candidates scored marks ranging from 6 to 10; 29.3 percent scored from 3.5 to 5.5 marks out of 10 marks; while 23 percent scored marks ranging from 0 to 3 out of ten marks allocated to the question. The results indicate that the performance in the question was good considering that 77 percent of the candidates scored 3.5 marks and above.

Most of the candidates who scored more than half of the marks allotted to the question, correctly described the features of the cell membrane in part (a). Moreover, in part (b), the candidates appropriately assessed the suitability of the structure of a mitochondrion to its function and gave at least five correct points as required. The performance is an indicator that the candidates had enough competence in the topic of Cytology, particularly, about the features of the cell membrane. Extract 1.1 is a sample of correct responses from one of the candidates.

Extract 1.1

1 (a) Features of the cell membrane.

The cell membrane has got the following features

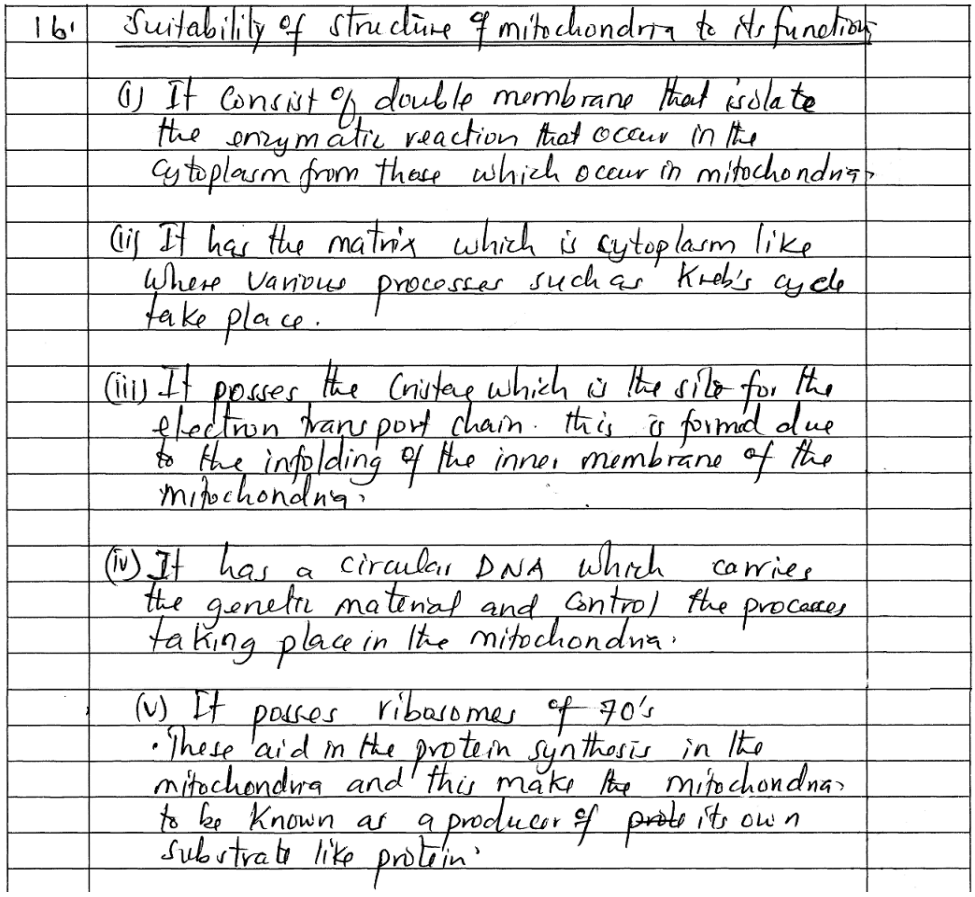
(i) Glycoprotein layer, one of the membrane component is the glycoprotein this is a protein combined with glycogen

(ii) The phospholipid layer
- Also the large part of the membrane is composed of the layer of the phospholipid which protein layer float over the lipid layer

(iii) The protein layer.
- Also membrane consist of the protein layer which is float over the lipid layer.

(iv) Also membrane has a glycolipid layer
- This is the layer of the lipid combined with the glycogen to form glycolipid layer

(v) Cholesterol
- This provide the flexibility of the membrane and prevent solidification of the membrane.


16' Suitability of structure of mitochondria to its function

(i) It consist of double membrane that isolate the enzymatic reaction that occur in the cytoplasm from those which occur in mitochondria.

(ii) It has the matrix which is cytoplasm like where various processes such as Kreb's cycle take place.

(iii) It posses the cristae which is the site for the electron transport chain. this is formed due to the infolding of the inner membrane of the mitochondria.

(iv) It has a circular DNA which carries the genetic material and control the processes taking place in the mitochondria.

(v) It posses ribosomes of 70's. These aid in the protein synthesis in the mitochondria and this make the mitochondria to be known as a producer of ~~prote~~ its own substrate like protein.

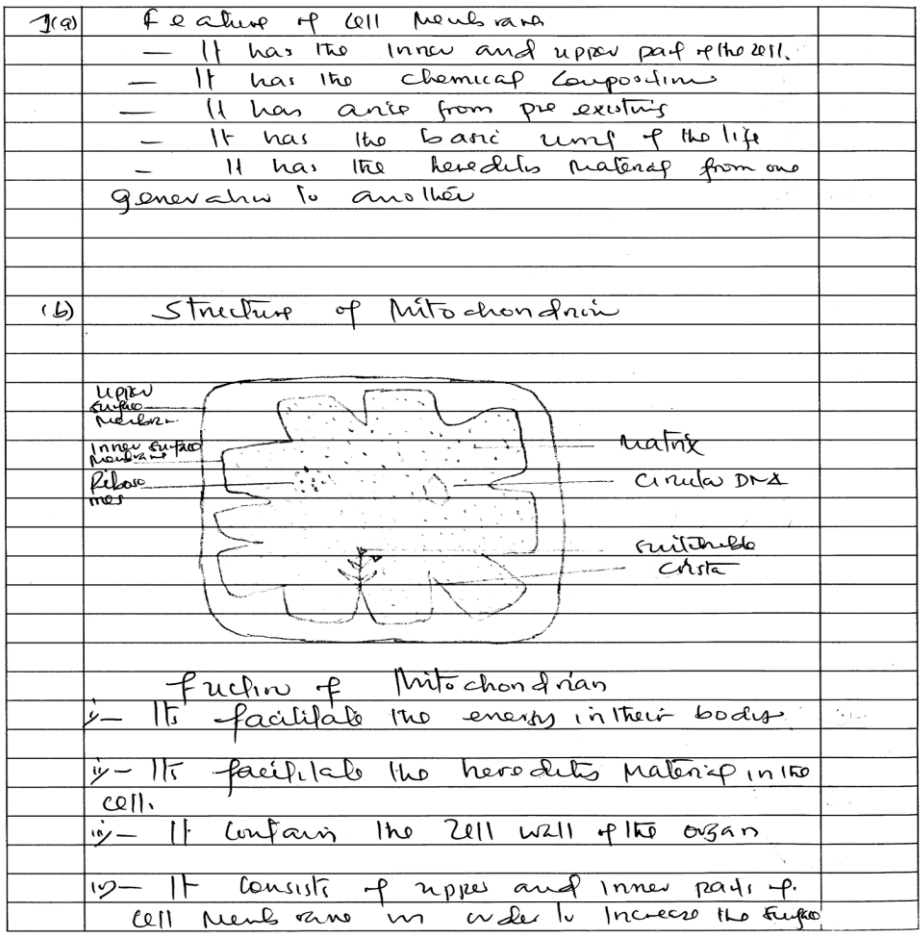
Extract 1.1 is a sample of responses from a candidate who correctly described the features of the cell membrane such as possession of glycolipids, glycoprotein and cholesterol. He/she also assessed correctly the suitability of the structure of a mitochondrion to its function.

Despite the good performance of some candidates in the question, further analysis revealed that 12.6 percent failed by scoring marks below 3.5. The candidates failed to give correct answers to most or all parts of the question. Their failure is mostly attributed to misunderstanding of the requirements of the question. For example, in part (a), some of the candidates wrote the functions of the cell membrane or its location instead of describing the features of the cell membrane. Some of the responses given by these candidates include: *it protects internal organelles, is located near the cytoplasm along nucleus,* just to mention a few. Others wrote the ideas of cell theory such as; *it arises from pre-existing cell* and *it is the basic unit of life*.

Likewise, in part (b), most of the candidates who scored low marks did not comprehend the requirements of the question. These wrote the functions of

mitochondrion instead of writing the suitability of mitochondrion to its function. They gave responses such as: *is a site for cellular respiration, site for Krebs cycle, production of energy in form of ATP facilitate the energy in their body*. Other candidates described the structure of a plant cell or chloroplast. In addition, most of the candidates who failed the question ended up drawing the structure of mitochondrion; which was not the demand of the question. Such responses imply that the candidates did not only fail to understand the requirements of the requirements of the question but also had scanty knowledge of some of the concepts related to cell structure and function in the topic of Cytology, particularly, the adaptation of mitochondrion to its function. Extract 1.2 illustrates a candidate's incorrect responses.

Extract 1.2



Extract 1.2 is a sample of incorrect responses from a candidate who in part (a) pointed out some ideas of cell theory, such as: it is a basic unit of life, instead of describing the features of cell membrane. Similarly, in part (b), the candidate pointed out some structure of plant cell such as possession of cell wall instead of assessing the suitability of mitochondria to its function.

2.1.2 Question 2: Cytology

In part (a), the candidates were instructed to state three importance of each of the following groups of carbohydrates in living things: (i) pentose (ii) hexose and (iii) disaccharide. In part (b), they were instructed to explain the role of: (i) dilute hydrochloric acid and (ii) dilute sodium hydroxide in testing carbohydrates.

Data analysis shows that 26,930 (100%) candidates attempted the question, out of which, 43.2 percent scored marks ranging from 0 to 3; 40.2 percent scored 3.5 to 5.5 marks and 16.6 percent scored 6 to 10 marks out of the 10 marks allocated to the question. The candidates' performance in the question is summarized by Figure 2.

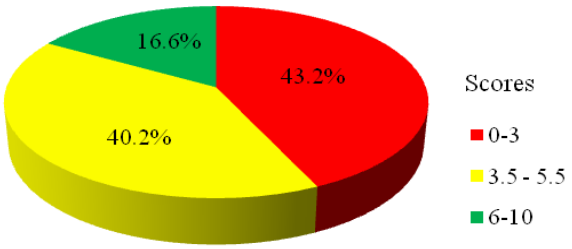


Figure 2: *The Candidates' Performance in Question 2.*

Figure 2 indicates that the candidates' performance in the question was average (as 56.8 percent passed the question by scoring 3.5 and above out of 10 marks allocated to this question). Most of the candidates who scored 6 to 10 marks correctly stated all or most of the required importance of each of the groups of carbohydrates i.e. pentose, hexose and disaccharide in living things. They also correctly explained the role of dilute hydrochloric acid and sodium hydroxide in testing carbohydrates. Correct responses provided by most of these candidates indicate that they had adequate competence in the topic of Cytology, particularly, in biochemistry. Extract 2.1 is a sample of a candidate's correct responses.

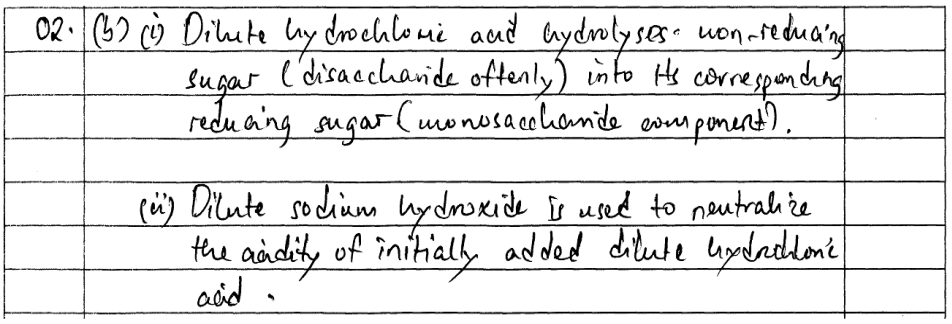
Extract 2.1

Q2.	(a) Importance of the following groups of carbohydrates	
	(i) Pentose.	
	- It is important in the synthesis of Ribonucleic and Deoxyribonucleic acids (RNA and DNA). Ribose and Deoxyribose pentose sugars are the components of RNA and DNA respectively.	
	- It is important in the synthesis of Adenosine Triphosphate molecule (ATP) which is the universal energy carrier. Pentose sugar is a component.	
	- It is important in the physiological processes like photosynthesis. Ribulose combines with phosphate molecules to form ribulose biphosphate which is the carbondioxide acceptor in photosynthesis	

Extract 2.1 Continues

02.(a)	(ii) Hexose	
	- It is a major energy source in the bodies of living organisms. Glucose is the main respiratory substrate which is oxidized to release energy. Other hexoses like fructose and galactose are also important.	
	- It is important in forming disaccharides like sucrose formed from fructose and glucose and maltose from two glucose molecules. These are important in living organisms.	
	- It is important in forming polysaccharides like cellulose which is the major component of the plants.	
	(iii) Disaccharide	
	- It is important in plants as it is a means of food transport to various parts of the plants. After photosynthesis, sucrose (disaccharide) is transfered to other parts.	
	- It also acts as source of energy as its hydrolysis results to monosaccharide constituents which can be oxidized to produce energy.	
	- It is important in forming polysaccharides like starch and which is the stored form of food in plants. a	

Extract 2.1 Continues



Extract 2.1 is a sample of correct responses from a candidate who was able to state the importance of pentose, hexose and disaccharide. The candidate also explained the role of dilute hydrochloric acid and sodium hydroxide in testing carbohydrates correctly.

Most of the candidates who scored from 3.5 to 5.5 marks stated the importance of hexose and disaccharides correctly in living things but they gave wrong points on pentose. Some of them correctly stated the importance of the named carbohydrates but failed to explain the role of dilute hydrochloric acid and sodium hydroxide in testing carbohydrates.

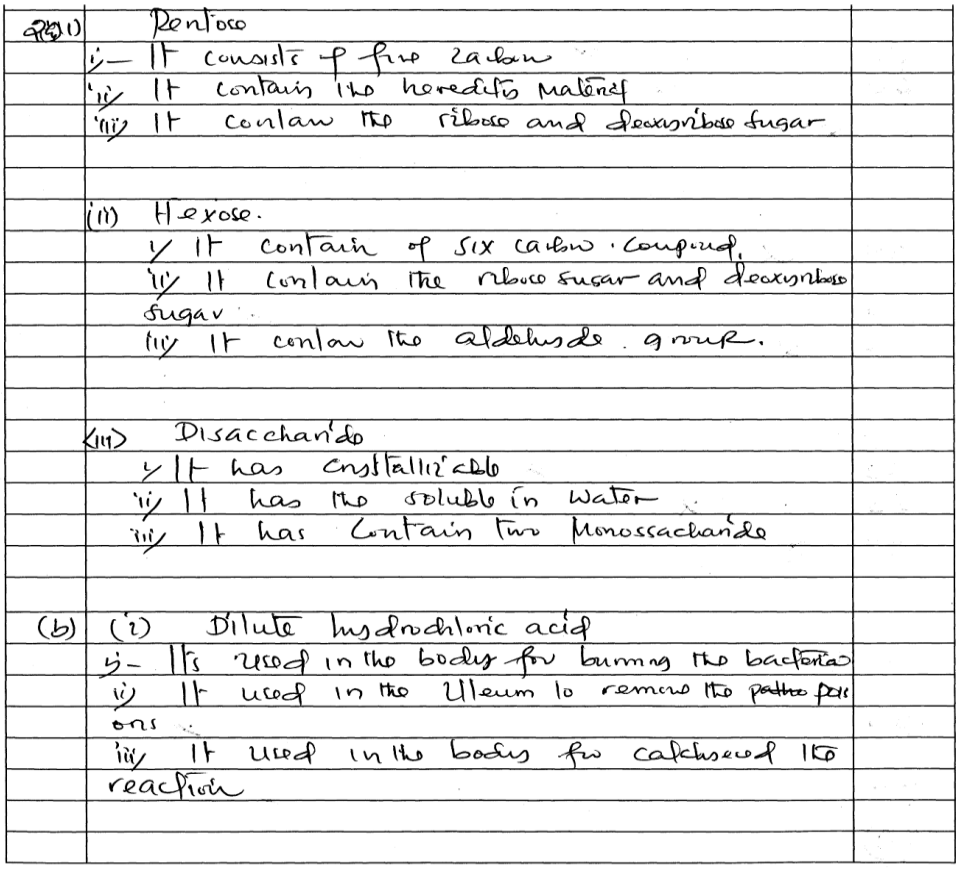
Conversely, in part (a) the candidates who showed weak performance (scoring from 0 to 3 marks) failed to correctly state the importance of pentose, hexose and disaccharide. Some of these candidates wrote the importance of pentose such as:

> *It is easy to be absorbed by body nutrients direct, hexose as; it helps to increase the uptake of water in the body, increase glucose in the body, provide the body with enough mineral salts and other nutrients, prevent body from diseases, helps in the production of enzymes, it form more than one typical food, is essential nutrients that provide the body with enough iron and other mineral salts, helps to improve reproductive hormones for reproduction.*

Analysis of the responses given by the candidates who scored such low marks reveals that they lacked clear understanding of the roles performed by the asked groups of carbohydrates. This is an indicator that the candidate acquired little competence in the topic of Cytology, especially, in the importance of different groups of carbohydrates.

Similarly, in part (b) some of the candidates incorrectly explained the roles of dilute hydrochloric acid and sodium hydroxide in testing carbohydrates. Some of the incorrect responses observed on the candidates' scripts about the role of dilute hydrochloric acid include: *is to convert the carbohydrate by adding the acidic strength in the sample food, to control the acidic medium of the acid*, while responses such as; *to make the reagent react with the food sample so as to produce the food needed, to control the basic medium of the base* were given as the role of dilute sodium hydroxide in testing carbohydrates. The responses indicate that the candidates lacked enough knowledge of the roles of different reagents used during food testing. Extract 2.2 is a sample of incorrect responses from one of the candidates.

Extract 2.2


(a) (i) Pentose
i) It consists of five carbon
ii) It contain the hereditis material
iii) It conlain the ribose and deoxyribose sugar

(ii) Hexose.
i) It contain of six carbon compound.
ii) It contain the ribose sugar and deoxyribose sugar
iii) It conlain the aldehyde group.

(iii) Disaccharide
i) It has crystallizable
ii) It has the soluble in water
iii) It has contain two Monossacharide

(b) (i) Dilute hydrochloric acid
i) It is used in the body for burning the bacteria
ii) It used in the Ileum to remove the pathogens
iii) It used in the body for catalysed the reaction

Extract 2.2 shows incorrect responses from a candidate who outlined some properties of pentose, hexose and disaccharide instead of explaining their importance. The responses given on the roles of dilute hydrochloric acid and sodium hydroxide based on the human body instead of in testing carbohydrates.

2.1.3 Question 3: Coordination

In part (a), the candidates were required to distinguish between the terms: (i) nervous and hormonal coordination, by giving four points, (ii) positive and negative feedback of body temperature regulation process; by giving two points. In part (b), the candidates were required to examine four properties of a hormone which enables it to accomplish its function. A total of 26,930 (100%) candidates responded to the question and their performance is illustrated by Figure 3.

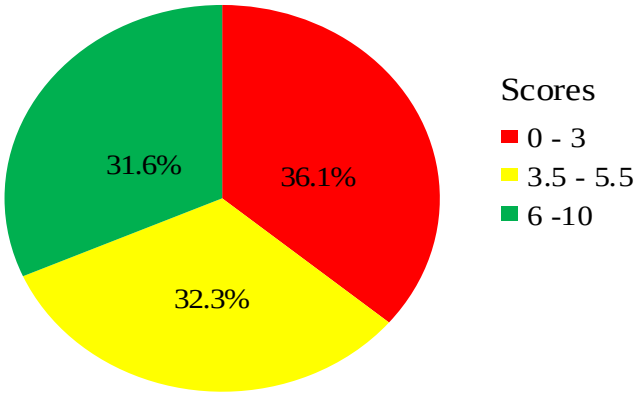


Figure 3: *The Candidates' Performance in Question 3.*

Figure 3 shows that the performance in this question was good; since 63.9 percent scored marks ranging from 3.5 to 10. Only 36.1 percent scored below 3.5 marks out of the 10 marks allocated to the question.

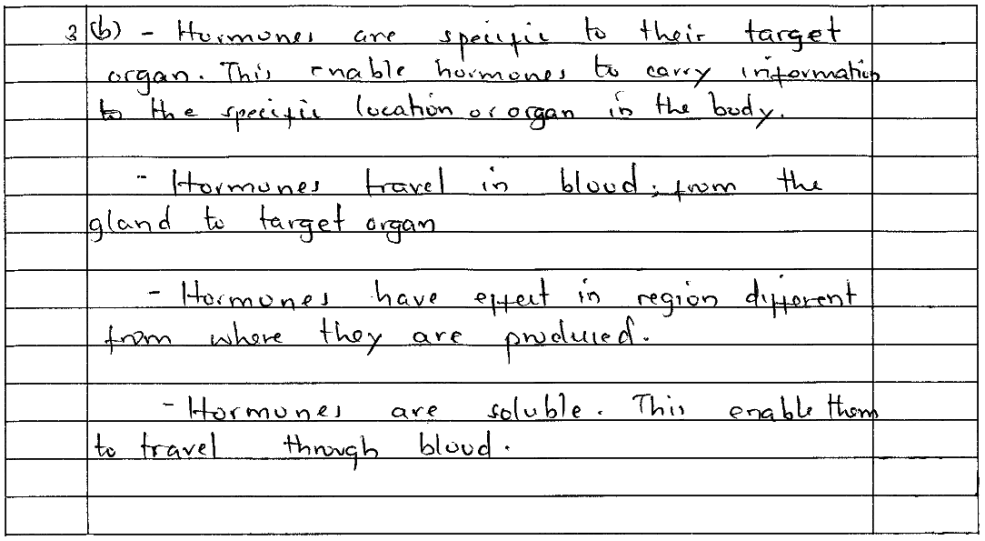
The candidates who performed well correctly gave all or most of the distinctions between nervous and hormonal coordination. Most of them also gave correct distinction between positive and negative feedback of body temperature regulation process. Furthermore, most of them correctly examined the properties of a hormone which enable it to accomplish its function. Correct responses given by these candidates are indicators that they had adequate knowledge of the topic of Coordination, particularly, hormonal coordination. Extract 3.1 presents correct responses from one of the candidates.

Extract 3.1

3 (a) (i) Nervous coordination	Hormonal coordination
- Involve both chemical and electrical traimission of information.	- Involve the chemical tranimission of information.
- Rapid traimission and response	- Slower traimission and slower response except adrenaline.
- Short term changes	- Cause long term changes example growth
- Pathway specific through nerve cells	- Pathway not specific as it travel in blood.

(ii) Positive feeback of body temperature regulation	Negative feedback of body temperature regulation
-This ~~ea~~ lead to further increase of body temperature in the body or a further dencrease of body temperature from the optimum or reference point.	- This cause the temperature of the body to return to its optimum level in the body by preventing further deviation from optimum point.
-This increase unstability of the system.	- This increase the stability of the system.

Extract 3.1 Continues


3 (b) - Hormones are specific to their target organ. This enable hormones to carry information to the specific location or organ in the body.

- Hormones travel in blood; from the gland to target organ

- Hormones have effect in region different from where they are produced.

- Hormones are soluble. This enable them to travel through blood.

Extract 3.1 is a sample of responses from a candidate who correctly distinguished the terms: nervous and hormonal coordination, and positive and negative feedback of body temperature regulation process. He/she correctly examined the properties of a hormone which enables it to accomplish its function.

Despite the good performance (63.9%) of the candidates in the question, 36.1 percent scored below 3.5 marks because of poor mastery of English Language, and giving incorrect distinctions between nervous and hormonal coordination. One of the incorrect response noted from one of the candidates in responding to part (a) (i) was *in nervous coordination the one nucleus is located at the centre of the body while in hormonal coordination have contain many nucleus.* The response indicates that the candidates lacked knowledge of Coordination. Similarly, in part (a) (ii) some of the candidates showed lack of enough knowledge of the difference between positive and negative feedback of temperature regulation. These wrote incorrect responses such as: *positive feedback obtain to their mother for flowing large amount of blood while negative feedback the have not obtain to feedback of the body temperature, in positive feedback temperature is highly regulated while in negative feedback temperature is lowly regulated, positive feedback occurs when an organism in cold condition while negative feedback occurs in hot condition*. Likewise, in part (b) they gave incorrect responses such as: *provide mechanical support to the body, it is used to control the secretion of digestive system, used to control excretory organs of the body.* Extract 3.2 is a sample of incorrect responses given by one of the candidates in the question.

Extract 3.2

3. a)

1) NERVOUS	HORMONAL COORDINATION
- The nucleus are the located at the Centre, end of the body.	- They have Contain many nuclear that into hormon Coordination.
- Nervour its deals away to transmitted a nervous im pluse away from one place to another.	- It help to deals away to inte rpeted the problem and manu facture the Food material where its necessary at that time.

II) Positive Feedback of body temperature its occurs away by increased the activities in order to become a normal while

Negative Feedback its deals away to decreased the activities in order to become a normal.

- Positive its occurs when the body temperature its lower into the body their need to increased in order to become a normal while.

Negative its means they temperature of body its high or that by its need to reduced away by decreased the tempe rature of the body.

3. b) They have ability to transfer the messages away from body parts.

- They have located at the Some of parts in body of the living organism.
- They have specialities to function of its own function

Extract 3.2 is a sample of incorrect responses from a candidate who had inadequate knowledge of the topic of Coordination. He/she gave incorrect responses in all parts of the question.

2.1.4 Question 4: Nutrition

In part (a), the candidates were instructed to study the photosynthesis equation,

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$ and then required to:

(i) give two reasons which justify the fact that the equation is not correct although it is balanced.

(ii) identify two types of reactions that take place in photosynthesis process and state specifically where in the cell each reaction takes place.

In part (b) the candidates were instructed to explain how (i) temperature and (ii) inorganic ions affect the rate of photosynthesis.

Data show that 29,630 candidates (corresponding to 100 percent) answered the question. The analysis of the data indicates that 35 percent scored marks ranging from 3.5 to 5.5; 30.4 percent scored 6 to 10 marks while 34.6 percent scored marks below 3.5. The performances are shown by Figure 4.

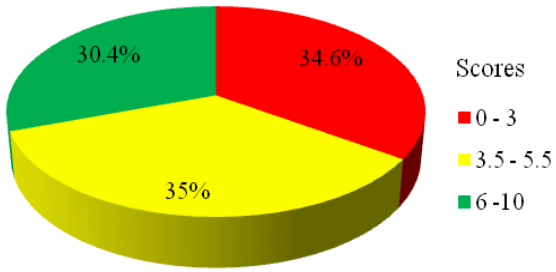


Figure 4: *The Candidates' Performance in Question 4*

Figure 4 shows that the general performance of the candidates in the question was good (as 65.4 percent scored marks ranging from 3.5 to 10 out of 10 marks allotted to the question). Most of the candidates with good performance gave good reasons to justify why the equation is not correct despite being balanced. Most of them correctly identified the two types of reactions which take place in photosynthesis process and stated specifically where each takes place in the cell. In addition, most of them correctly explained how temperature and inorganic ions affect the rate of photosynthesis. The candidates' ability to give correct responses to the question indicated that they had good understanding of the topic of Nutrition, particularly, photosynthesis. Extract 4.1 is a sample of correct responses from one of the candidates.

Extract 4.1

$6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$.

4 (a) (i)

The equation above is not correct although its balanced because:-

- Equation show that oxygen released comes from carbondioxide, but the radioactive reveals that the oxygen released come from photosplitting of water molecules.

$$H_2O \xrightarrow{Light} 2e^- + 2H^+ + \frac{1}{2}O_2$$

- Also the equation does not show water (H_2O) molecules as end product, but its clear that during photosynthesis water molecules are released.

hence

$$6CO_2 + 12H_2O \longrightarrow C_6H_{12}O_6 + 6O_2 + 6H_2O$$

(ii) Types of reactions that take place in photosynthesis process are :-

- light dependent photosynthesis also known as light reaction
- take place in grana and thylakoids.

- light independent phase, also known as dark reaction
- take place in stroma.

Extract 4.1 Continues

4 (b) (i) Temperature affect the rate of photosynthesis in three ways: since we know that photosynthesis is an enzymatic reaction example ribulose carbo xylase. hence:-

- When temperature increase the rate of photosynthesis also increase due to activation of enzymes but more increase in temperature denature the enzymes.
- But also ~~att~~ at low temperature the rate of photosynthesis is low because the enzymes are in inactive.
- Now the high rate of photosynthesis is favoured by moderate or optimum temperatures.

(ii) Inorganic ions example Mg^{2+}, K^{+}, Ca^{2+}

- The rate of phosynthesis increase with the increase in required organic ions, As the required organic ions facilitate health and mantain leaf greenish and thus support the increase in rate of photosynthesis

Extract 4.1 is a sample of correct responses from a candidate with adequate knowledge of the topic of Nutrition; as he/she managed to respond to all parts of the question correctly. In addition, the candidate had a good command of English Language.

Despite the general good performance of the candidates in the question, 34.6 percent of the candidates failed to provide correct responses to almost all the parts of the question. For example in part (a) (i), some of the candidates wrote unclear responses on reasons for the incorrectness of the equation such as: *not true the equation shows that the first product of photosynthesis is 6 carbon compounds which is not true as the first product of photosynthesis is a 3 carbon compound known as pyruvate.* In part (a)

(ii), one of the candidates wrote *positive photosynthesis and negative photosynthesis reactions,* as another one wrote *endothermic and exothermic* as the two types of photosynthesis reactions. In real sense, endothermic and exothermic are chemical reactions where heat energy is absorbed and given out, respectively.

Most candidates failed in part (b), which required them to explain how temperature affects the rate of photosynthesis. Most of these candidates did not realize that since photosynthesis is enzymes controlled reaction, optimum temperature is necessary for maximum rate of reaction while low or very high temperature slows down the rate of reaction. The candidates ended up giving general statements such as: *rate of photosynthesis can be affected by temperature such that the increase in temperature increases in the rate of photosynthesis process.* Likewise in part (b) (ii), some candidates wrote incorrect responses such as, *rate of photosynthesis can be affected by inorganic ions by decreasing the photosynthetic activities when inorganic ions exceed.* Extract 4.2 is a sample of a candidate's incorrect responses to the question.

Extract 4.2

4. $6CO_2 + 6H_2O \longrightarrow C_6H_{12}O_6 + 6O_2$

This equation is not collect due to the following reason

(i) i/ It show that the end product is oxygen

ii/ the end product is hexose sugar and not triose sugar

iii/ It represent photosynthesis equation

(ii) photosynthesis : Is the process in which green plant manufacture food and use by using energy from the sun.

: reaction take place

i/ Kreb's cycle : take place in mitochondria especially in matrix

ii/ absorption of light take place in chlorophyll

iii/ cutation take place through stomata cells

(b)

(i) Temperature : temperature can affect or support the rate of photosynthesis this is were by when temperature is moderate support photosynthesis to take place but when temperature is high cause some leaves to lose chlorophyll hence affect photosynthesis

(ii) in organic ions : affect photosynthesis when exceeds to the soil hence affect the plant root towards absorption of waters and mineral from soil.

Extract 4.2 is a sample of wrong responses from a candidate who identified the types of photosynthesis as Kreb's cycle and guttation. However, Kreb's cycle is a process which takes place in respiration, while guttation is a process in which plant loses water in form of droplets at the leaf apex.

2.1.5 Question 5: Cytology

In part (a) of the question, the candidates were instructed to identify two categories of carbohydrates while in part (b), they were required to use one example in each case, to describe six functions of carbohydrates in organisms. This question was attempted by 26,930 candidates (corresponding to 100 percent).

Data analysis indicates that the candidates' performance in the question was good (as 71 percent scored above the pass mark, by scoring marks ranging from 3.5 to 10. The percentage of the candidates who scored from 0 to 3 marks out of the 10 marks allocated to the question was 28.3. Figure 5 summarizes the candidates' performance in the question.

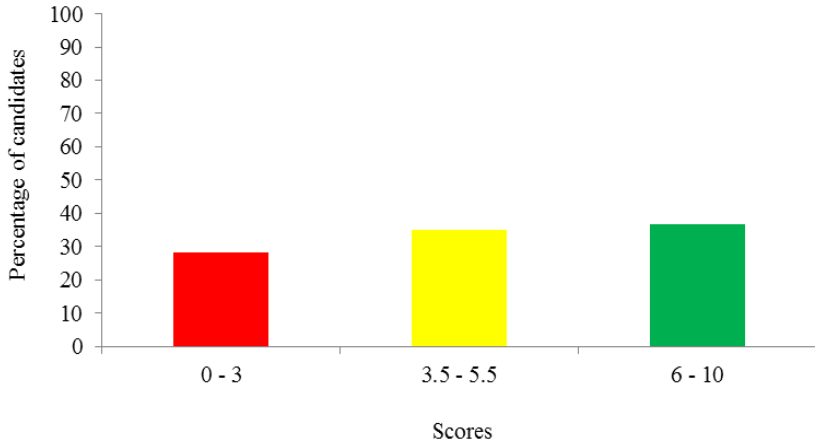
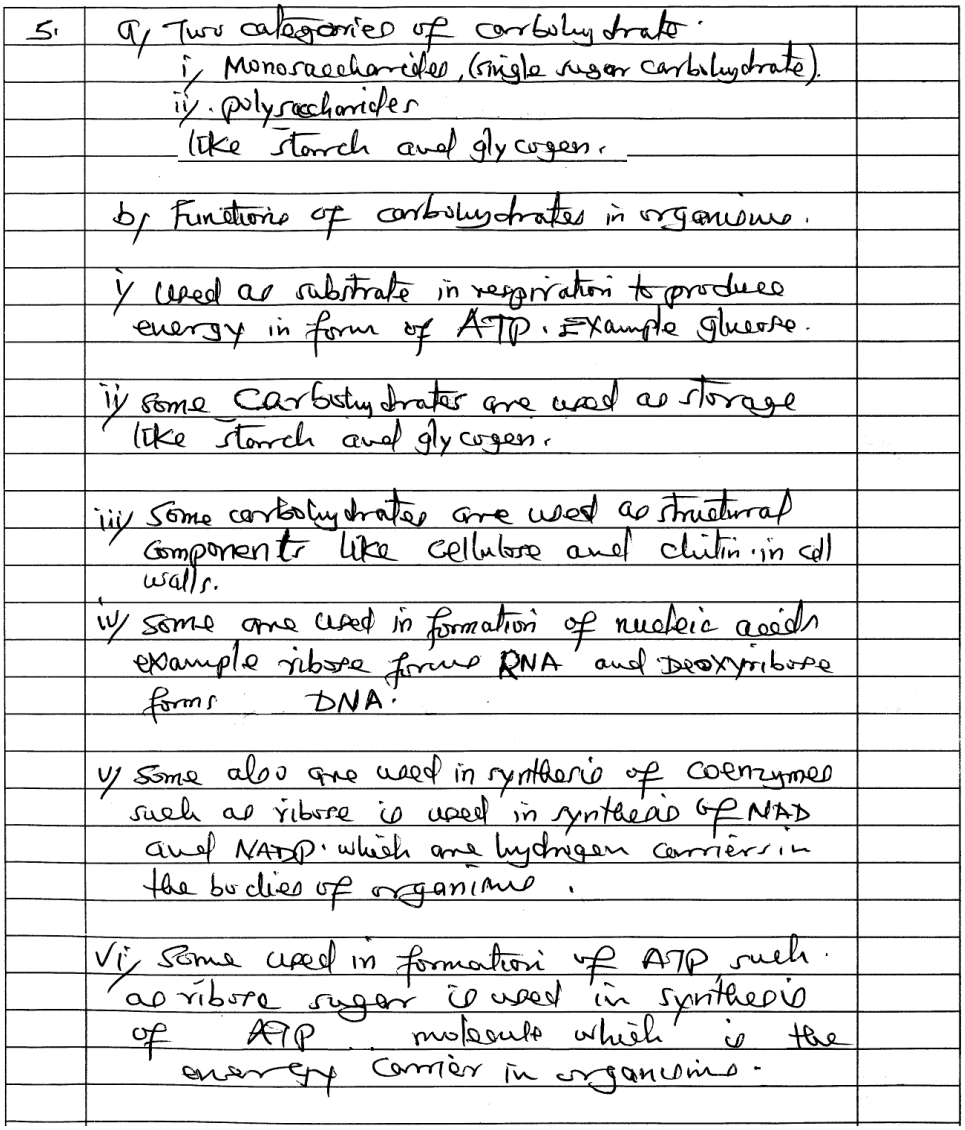


Figure 5: *The Candidates' Performance in Question 5*

Figure 5 shows that 36.7 percent scored marks ranging from 3.5 to 5.5, whereas, 35 percent scored above 5.5 marks. Most of the candidates with marks above 5.5 correctly identified the two categories of carbohydrates in part (a), and in part (b), they correctly described all or some of the functions of carbohydrates in organisms and gave one example in each case. These candidates demonstrated good understanding of the topic of Cytology, particularly, the roles of chemicals of life. Extract 5.1 illustrates correct responses from the candidates.

Extract 5.1


5. a/ Two categories of carbohydrate.
i/ Monosaccharides, (single sugar carbohydrate).
ii/ polysaccharides
like starch and glycogen.

b/ Functions of carbohydrates in organisms.

i/ used as substrate in respiration to produce energy in form of ATP. Example glucose.

ii/ some Carbohydrates are used as storage like starch and glycogen.

iii/ Some carbohydrates are used as structural components like cellulose and chitin in cell walls.

iv/ Some are used in formation of nucleic acids example ribose forms RNA and Deoxyribose forms DNA.

v/ Some also are used in synthesis of coenzymes such as ribose is used in synthesis of NAD and NADP which are hydrogen carriers in the bodies of organisms.

vi/ Some used in formation of ATP such as ribose sugar is used in synthesis of ATP molecule which is the energy carrier in organisms.

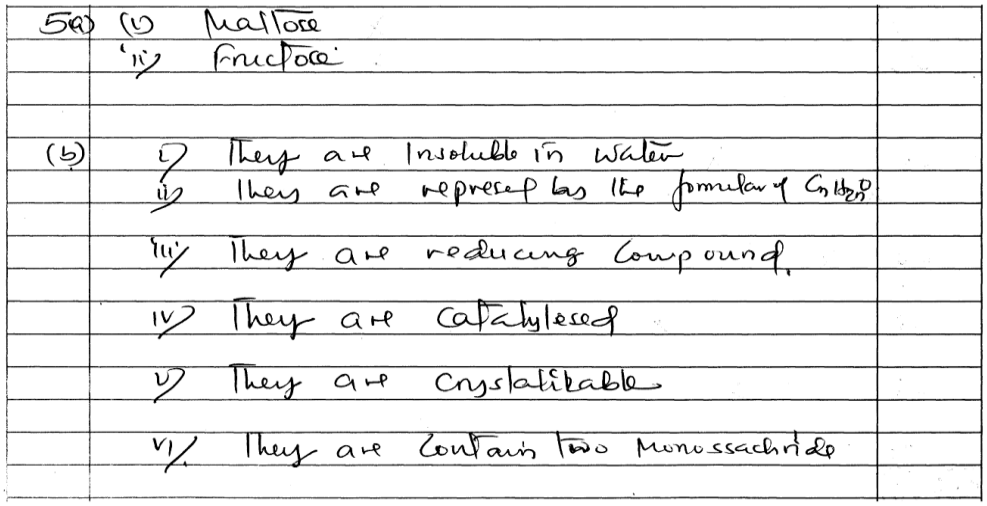
Extract 5.1 shows a response from the candidate who had adequate knowledge of the topic of Cytology, specifically on categories and roles of carbohydrates in the body. He/she correctly identified the categories of carbohydrates and described the functions of carbohydrates in organisms; with examples in each case.

Despite this general good performance from the question, some of the candidates scored marks ranging from 0 to 3 because they gave incorrect responses in most parts of the question. For example, in part (a), some of such candidates gave examples of carbohydrates such as *maltose and fructose* instead of the categories of carbohydrates such as:

monosaccharide, disaccharides and polysaccharides. Others wrote *aldose and ketoses, trioses and pentose* which are the groups of sugar based on functional groups and number of carbons, respectively.

Furthermore, in part (b), some of the candidates gave unclear descriptions of the functions of carbohydrates in organisms; such as: *store of metabolic activity of the body, act as medicine during muscle clump, helps to produce lipid, used in medicine for example glycogen.* Others wrote some of the characteristics of carbohydrates, instead of functions such as: *they are insoluble in water, they are reducing compounds, they are crystalizable, they contain two monosaccharide, they are represented by the formula of* $C_nH_{2n}O$. The responses indicate that the candidates did not either understand the requirements of the question or had scanty knowledge of the tested concept. Extract 5.2 shows wrong responses from one of such candidates.

Extract 5.2



Extract 5.2 is a sample of responses from a candidate who, in part (a), gave examples of carbohydrates instead of the categories of carbohydrates. In part (b), the candidate wrote some properties of disaccharides, instead of the functions of carbohydrates.

2.1.6 Question 6: Coordination

In part (a), the candidates were required to explain the term phytohormone while in (b) they were instructed to outline three roles of: (i) auxins (ii) gibberellins and (iii) cytokinins. A total of 26,930 candidates

(corresponding to 100 percent) attempted the question. The performance in the question is summarised by Figure 6.

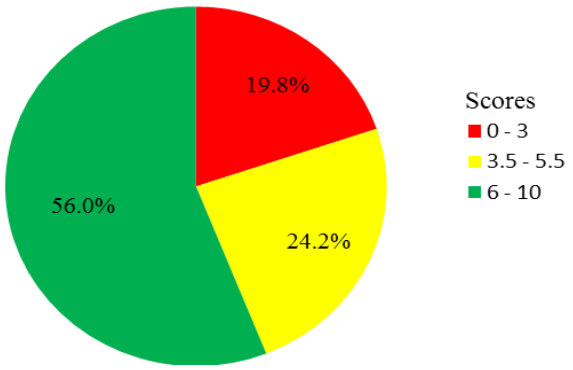
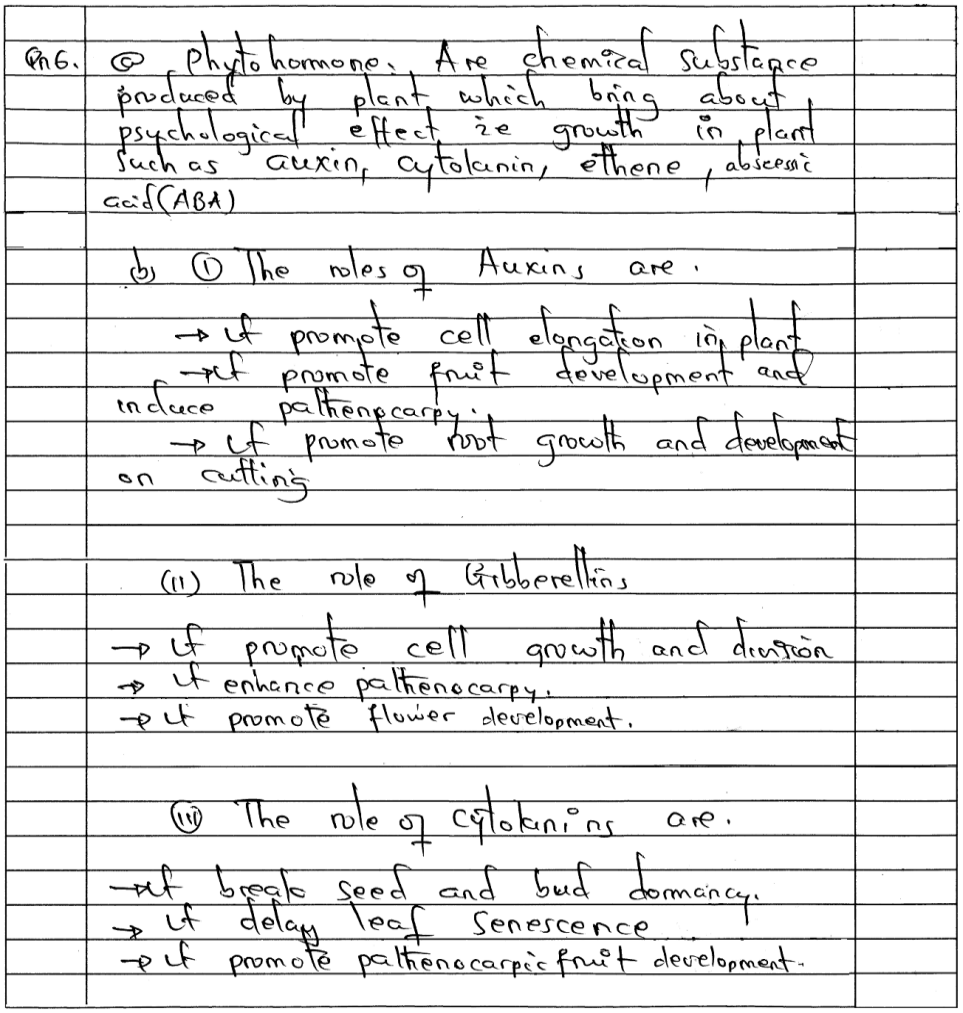


Figure 6: *The Candidates' Performance in Question 6*

Figure 6 reveals that the candidates' performance in the question was generally good (since more than half (56%) of the candidate scored marks ranging from 6 to 10; as 24.2 percent scoring 3.5 to 5.5 marks). That is, only 19.8 percent scored from 0 to 3 out of the 10 marks allocated to the question.

Most of the candidates who scored marks above 5.5 in the question had adequate knowledge of the tested concept of phytohormones; which is covered under the topic of Coordination. In part (a), most of them correctly explained the meaning of phytohormones; and in (b), outlined the roles of each of the listed phytohormones correctly. Extract 6.1 is a sample of correct responses from one of the candidates.

Extract 6.1


Q6. (a) Phytohormone: Are chemical substance produced by plant which bring about psychological effect ie growth in plant such as auxin, cytokinin, ethene, abscessic acid (ABA)

(b) (i) The roles of Auxins are:

→ It promote cell elongation in plant
→ It promote fruit development and induce parthenocarpy.
→ It promote root growth and development on cutting

(ii) The role of Gibberellins

→ It promote cell growth and division
→ It enhance parthenocarpy.
→ It promote flower development.

(iii) The role of cytokinins are.

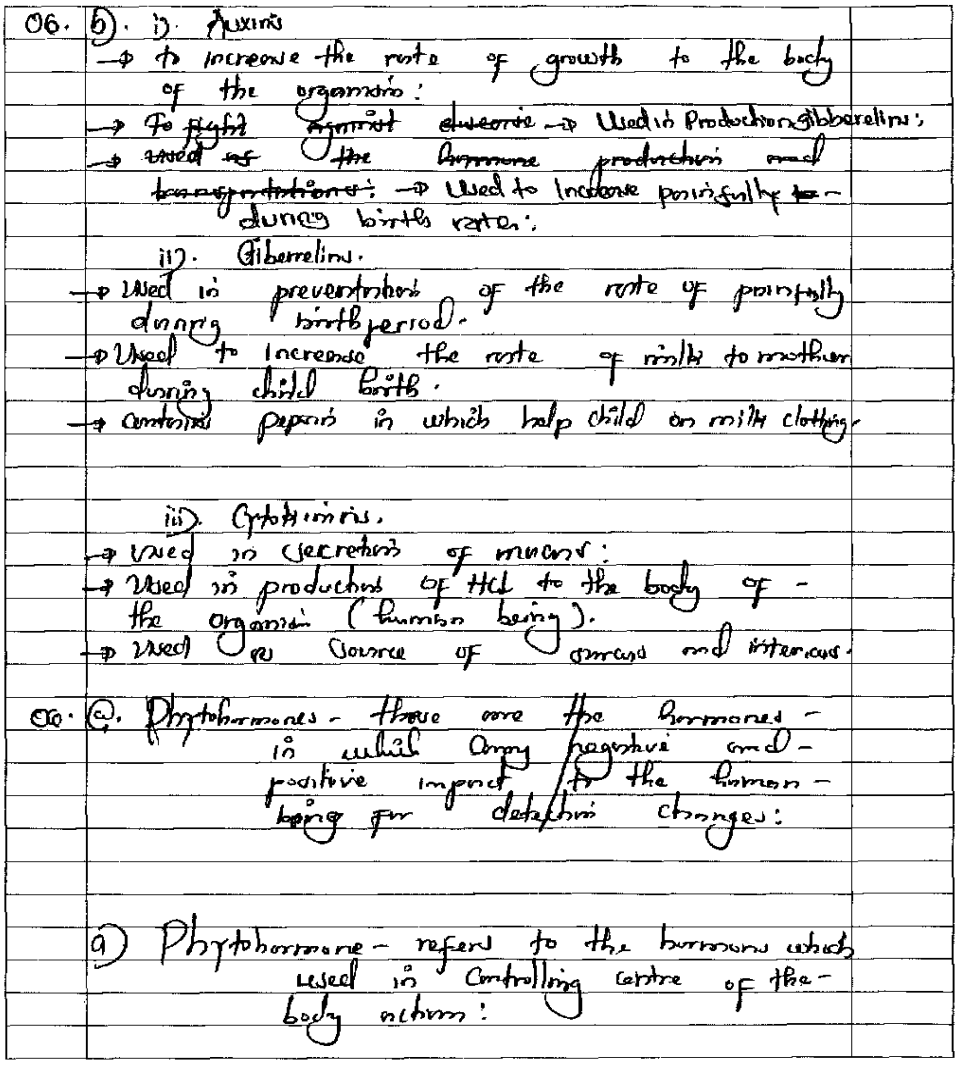
→ It break seed and bud domancy.
→ It delay leaf senescence
→ It promote parthenocarpic fruit development.

Extract 6.1 is a sample of responses from a candidate who knew the concepts of phytohormone. He/she correctly explained the meaning of phytohormone and outlined the roles of auxins, gibberellins and cytokinins.

Further analysis of the candidates' responses revealed that the candidates with weak performance in the question had low competence in the topic of Coordination, particularly, phytohormones. One of such candidates incorrectly explained phytohormone as *substance that control plant development when applied* while another candidate wrote *is a system of coordination which occur in plants only because they are slow response to stimulus.* Similarly, in part (b), some of the candidates incorrectly explained the roles of auxin as: *inhibit falling of premature fruits, prevent abscission of the seed, breakdown materials of molecules, used for storage of fruits, promote fruit ripening, remove the seed dormancy or bud dormancy.* Roles

of gibberellin as: *protect the falling down of young leaves, it is more water resistant during drought, promote ripening of fruits, used to inhibit growth, breaking bud dormancy.* The roles of cytokinins as: *help to preserve vegetable for long time while are still active, inhibit plant growth, promote seed dormancy and bud dormancy, prevent the young falling of leaves, promote development of seed from ovary.* Extract 6.2 is a sample of incorrect responses from one of the candidates.

Extract 6.2


06. b). i). Auxins
→ to increase the rate of growth to the body of the organism.
→ To fight against diseases → Used in Production Gibberelins;
→ used as the hormone production and transportations. → Used to increase painfully during births rates.

ii). Gibberelins.
→ Used in prevention of the rate of painfully during birth period.
→ Used to increase the rate of milk to mothers during child birth.
→ contains papain in which help child on milk clothing.

iii). Cytokinins.
→ Used in secretion of mucus.
→ Used in production of HCl to the body of the organism (human being).
→ Used as source of gonads and intercous.

06. a). Phytohormones - these are the hormones in which they negative and positive impact to the human being for detection changes.

a) Phytohormone - refers to the hormones which used in controlling centre of the body mothers.

Extract 6.2 shows weak responses from a candidate who did not realize that phytohormone are plant hormones. All of his/her responses were focused on animal instead of plant. For example, one of the roles of auxin he/she outlined was actually the role of a hormone produced by the mother during child birth.

2.1.7 Question 7: Principles of Classification

In part (a), of this question, the candidates were required to study diagrams of organisms labelled S3, S4, S5, S6 and S7 and identify the observable features only. They were asked to fill in the Table 1 by putting a (√) if the feature is present and (X) if it is absent.

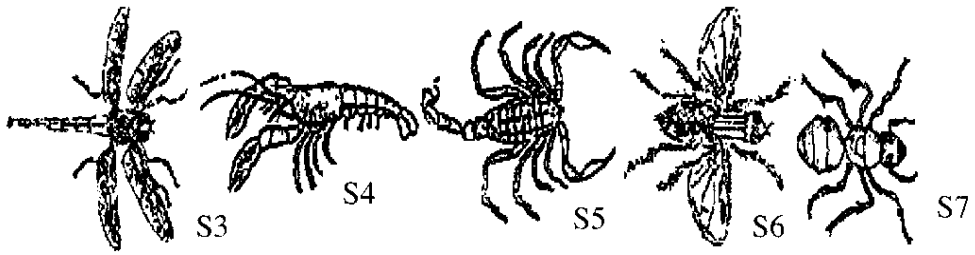


Table 1

Organisms	Wings two pair	Antennae present	Legs three pair	Legs four pair
S3				
S4				
S5				
S6				
S7				

In part (b), the candidates were instructed to use the characteristics filled in the Table 1 to construct a simple bracketed key. The question was attempted by a total of 26,930 candidates (corresponding to 100 percent).

This was the best performed question in 133 - Biology 1. That is 95.2 percent of the candidates passed it; by scoring marks ranging from 3.5 to 10. The remaining 4.8 percent scored from 0 to 3 out of the 10 marks allocated to the question. The performance is shown in Figure 7.

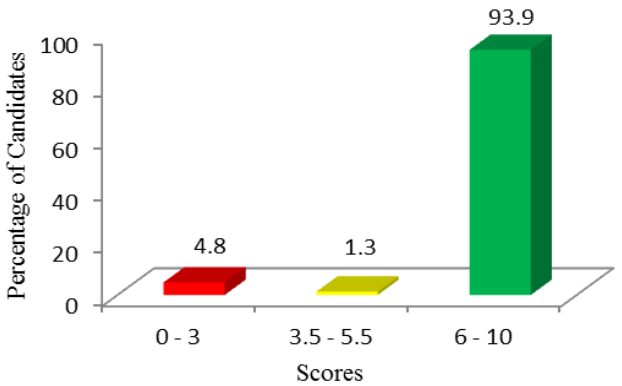
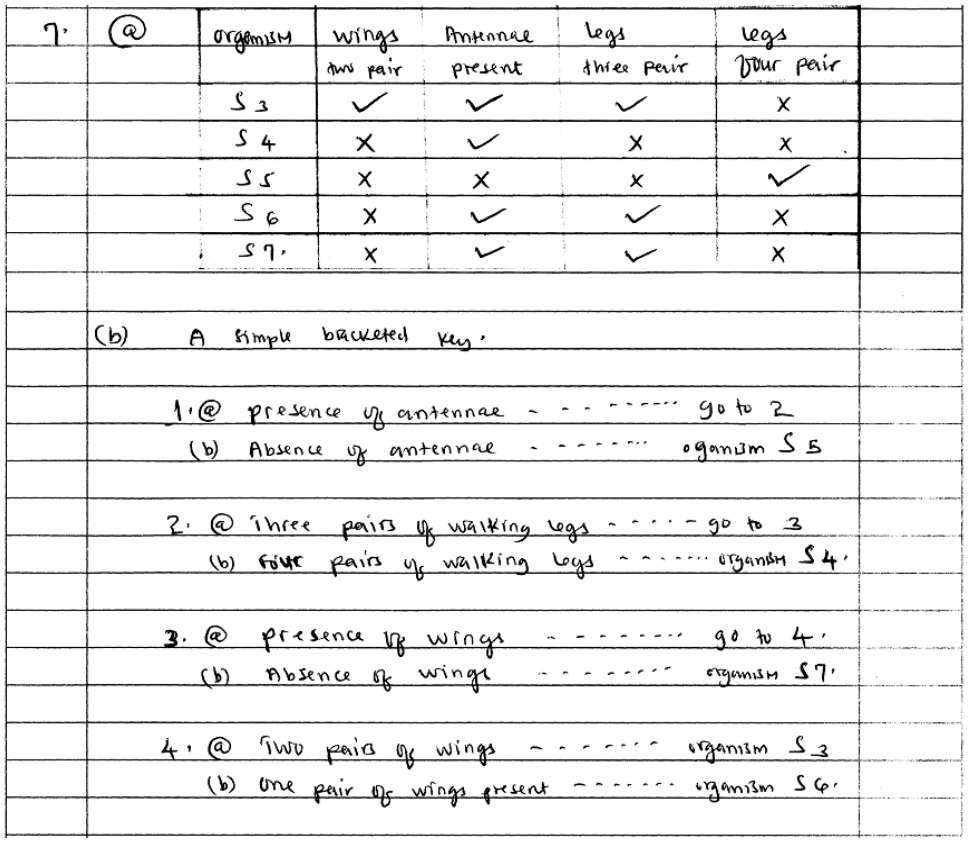


Figure 7: *The Candidates' Performance in Question 7.*

Figure 7 reveals that the candidates' performance in the question was good. Most of the candidates who scored marks above 5.5 had enough knowledge of the topic of Principles of Classification, specifically, the concept of classification keys. This was revealed, by not only their ability to appropriately fill in the table given after observing the given diagrams of the organisms, but also their ability to construct bracketed key correctly. Extract 7.1 shows correct responses from one of the candidates.

Extract 7.1



7.	@	organism	wings two pair	Antennae present	legs three pair	legs four pair
		S 3	✓	✓	✓	X
		S 4	X	✓	X	X
		S 5	X	X	X	✓
		S 6	X	✓	✓	X
		S 7.	X	✓	✓	X

(b) A simple bracketed key.

1. @ presence of antennae - - - - - - go to 2
(b) Absence of antennae - - - - - - organism S 5

2. @ three pairs of walking legs - - - - go to 3
(b) four pairs of walking legs - - - - - organism S 4.

3. @ presence of wings - - - - - - go to 4.
(b) Absence of wings - - - - - - organism S 7.

4. @ two pairs of wings - - - - - - organism S 3
(b) one pair of wings present - - - - - organism S 6.

Extract 7.1 shows good responses from a candidate who correctly identified the observable features of the given organisms and correctly constructed a simple bracketed key.

Further analysis of the candidates' responses reveals that most of the candidates who scored average marks (3.5 – 5.5), managed to correctly mark some of the characteristics of the organisms in the table, but totally failed in constructing the bracketed key as instructed in part (b). Some of the candidates constructed a simple bracket key that identified the organisms without showing directives. Others constructed a numbered key

which was not actually the requirements of the question. A sample from one of such candidate is hereunder given:

1. *(a) Organisms with two wings ……S3, S6*
   (b) Organisms without wings ……S4, S5, S7

2. *(a) Organisms with antennae ……S4, S7*
   (b) Organisms without antennae ……S3, S5, S6

3. *(a) Organisms with three pair of legs ……S3, S6, S7*
   (b) Organisms without three pairs of legs ……S4, S5

4. *(a) Organisms with four pair of legs ……S4*
   (b) Organism without four pair of legs ……S3, S5, S6, S7

Another candidate constructed a wrong key as follows:

1. *(a) Organism with two pair of wings ……S3*
   (b) Organism without two pair of wings ……Go to 2(a)

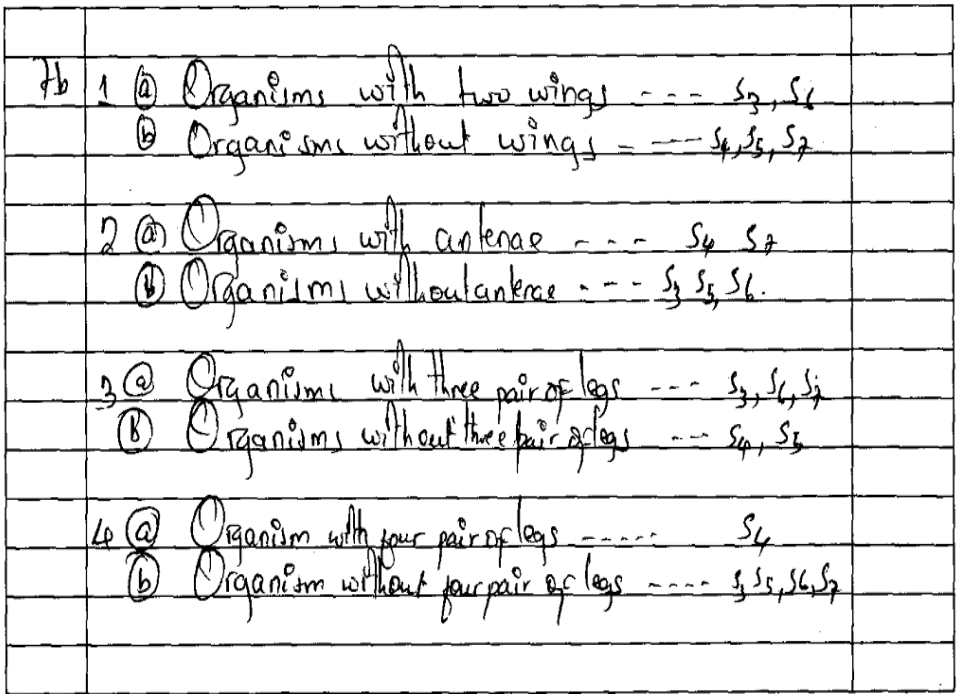
2. *(a) Organism with antennae present ……S4*
   (b) Organism without antennae present ……Go to 3(a)

3. *(a) Organism with three pair of legs ……S6, S3*
   (b) Organism without three pairs of legs ……Go to 4(a)

4. *(a) Organism with four pair of legs ……S5, S7*
   (b) Organism without four pair of legs ……Go to 3(a)

These wrong responses indicate that the candidates were incompetent in the topic of Principles of Classification, particularly, the construction of keys. Extract 7.2 is from a candidate who gave incorrect responses.

Extract 7.2



Extract 7.2 indicates a part of wrong responses from a candidate who in part (b) of the question constructed wrong simple bracketed key by establishing wrong leads.

2.1.8 Question 8: Transportation

The question required the candidates to explain the concepts of: (a) active transport, (b) closed circulatory system, (c) symplast and (d) apoplast as used in the movement of materials in the body of an organism. The question was the most opted for among the questions in section B. That is a total of 24,098 candidates; equivalent to 89.5 percent, attempted it.

Statistics indicate that 76.2 percent of the candidates scored marks ranging from 0 to 5; 23 percent scored from 5.5 to 8.5 while 0.8 percent scored from 9 to 15 out of 15 marks allocated to the question. However, none of the candidates scored full (15) marks allotted to the question. The trend of the performance in the question is depicted in Figure 8.

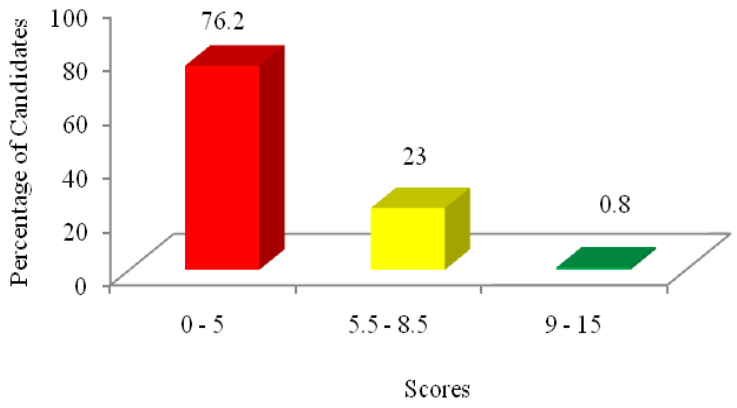


Figure 8: *The Candidates' Performance in Question 8.*

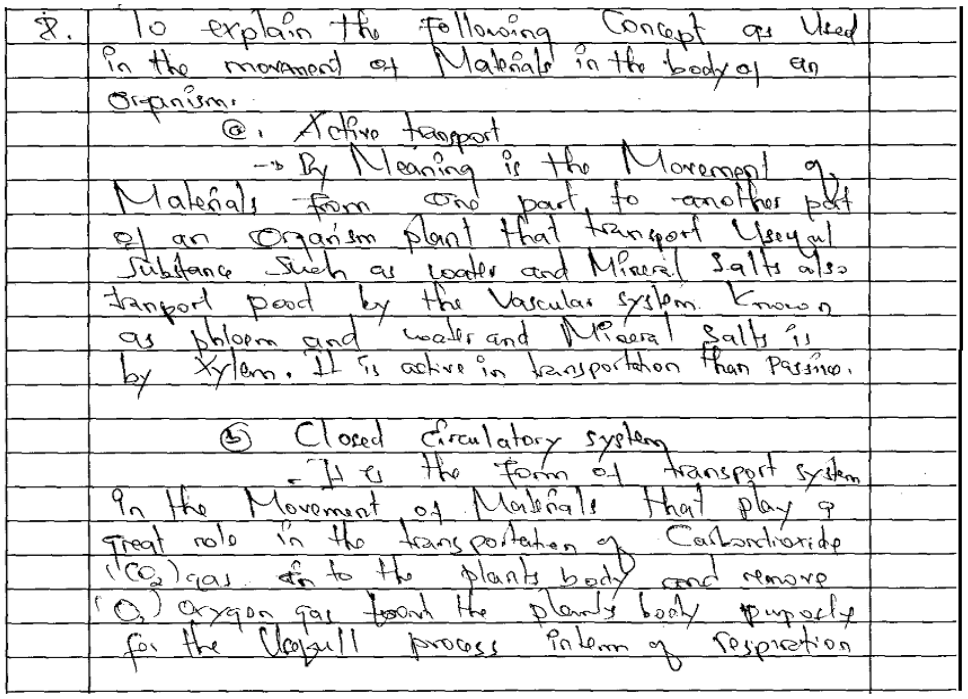
Figure 8 indicates that the candidates' performance in the question was weak (since more than three quarters (76.2%) scored marks below the pass mark of the question). That is, only 23.8 passed the question. Most of the candidates who failed the question provided unclear explanations on the asked concepts. For example, one of such candidates wrote the meaning of active transport as, *is the movement of materials from one part to another part of an organism plant that transport useful substances such as water and mineral salts.*

In explaining the meaning of closed circulatory system, one of the candidates wrote:

> *Is the transport of the blood of the anthropod is that the blood transported direct into the body tissue, is the form of transport system in the movement of materials that only play a great role in the transportation of carbon dioxide gas to the plants body and remove oxygen gas from the plants body purposely for the useful process in term of respiration.*

All these wrong responses, and others which were given concerning symplast and apoplast, indicate candidates' insufficient knowledge of the topic of Transportation, particularly, of plants and animals. Extract 8.1 shows wrong responses from one of the candidates.

Extract 8.1



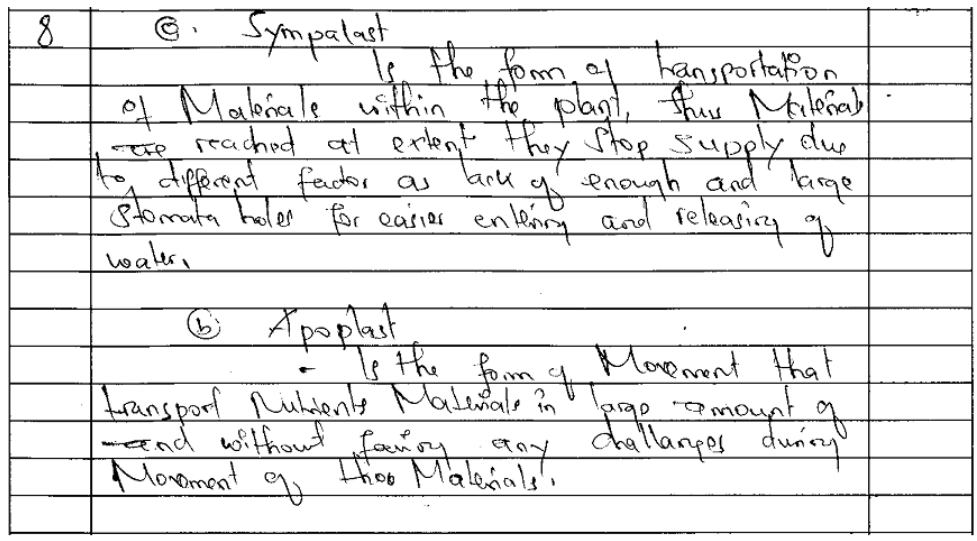
8. To explain the following Concept as Used in the movement of Materials in the body of an Organism.

@. Active transport

--> By Meaning is the Movement of Materials from one part to another part of an Organism plant that transport Useful Substance Such as water and Mineral Salts also transport food by the Vascular system known as phloem and water and Mineral Salts is by Xylem. It is active in transportation than Passive.

(b) Closed Circulatory System

- It is the form of transport system in the Movement of Materials that play a Great role in the transportation of Carbondioxide (CO_2) gas in to the plants body and remove (O_2) oxygen gas from the plants body properly for the Usefull process in term of respiration



8 @. Sympalast

Is the form of transportation of Materials within the plant, thus Materials reached at extent they Stop Supply due to different factor as lack of enough and large Stomata holes for easier entering and releasing of water.

(b) Apoplast

- Is the form of Movement that transport Nutrients Materials in large amount of and without facing any challenges during Movement of thoo Materials.

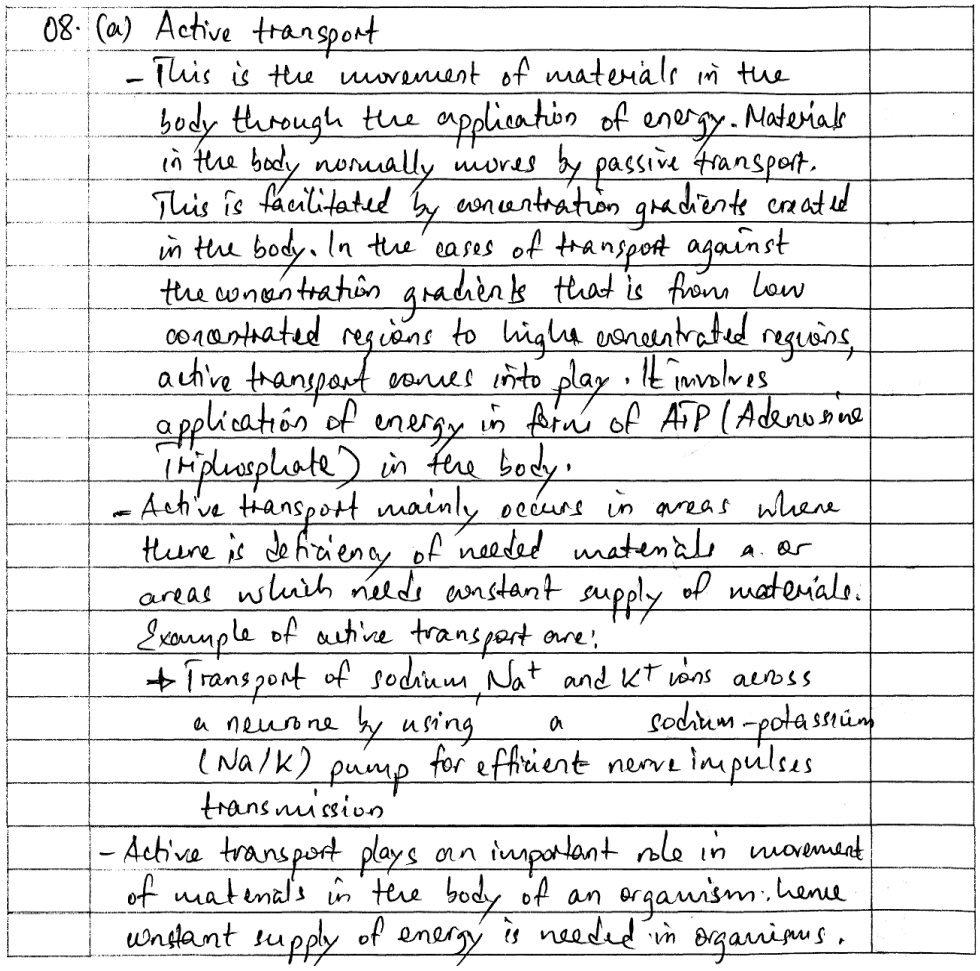
Extract 8.1 shows responses from a candidate who was incompetent in the topic of Transportation, especially on the concept of movement of materials in the body. He/she incorrectly explained the concepts of active transport, closed circulatory system, symplast and apoplast.

Despite the observed weak performance in the question, some of the candidates scored average marks. Observations from their scripts show that

most of them correctly explained the concepts of active transport and closed circulatory system; despite facing difficulties in explaining the terms symplast and apoplast. Although symplast and apoplast are applicable to transportation in plants only, most of these candidates' responses attributed them to the transportation in animals. In a real sense, symplast is a pathway in which materials in plants move from the cytoplasm of one cell to another; while in apoplast, the materials move through spaces in the cell wall.

A few of the candidates (0.8%) who scored marks above 5.5 in the question demonstrated enough competence in the topic of Transportation, particularly, on the concept of movement of materials in the body of organisms. They correctly explained most of the asked concepts. Extract 8.2 shows correct responses from one of the candidates.

Extract 8.2



08. (a) Active transport

- This is the movement of materials in the body through the application of energy. Materials in the body normally moves by passive transport. This is facilitated by concentration gradients created in the body. In the cases of transport against the concentration gradients that is from low concentrated regions to highly concentrated regions, active transport comes into play. It involves application of energy in form of ATP (Adenosine Triphosphate) in the body.
- Active transport mainly occurs in areas where there is deficiency of needed materials a. or areas which needs constant supply of materials. Example of active transport are:
  - Transport of sodium, Na^+ and K^+ ions across a neurone by using a sodium-potassium (Na/K) pump for efficient nerve impulses transmission
- Active transport plays an important role in movement of materials in the body of an organism. Hence constant supply of energy is needed in organisms.

Extract 8.2 Continues

08. (b) Closed circulatory system.

- It is a system of circulation where by the fluid under circulation mainly blood is confined in blood vessels and has no direct contact with the body tissues. Closed circulatory system is characterized by continuous flow of blood (circulatory fluid) in the vessels.
- In comparison to open circulatory system, which is the system where by circulating fluid bathes the body tissues directly, closed circulatory system has the following advantages:-
  - ⇒ Blood in closed circulatory system is confined to blood vessels where it is transferred at high pressure. This ensures transporting materials efficiently.
  - ⇒ Closed circulatory system ensures efficient mechanism of movement of ~~an~~ transported materials from the blood to the body tissues.
- Closed circulatory system is possessed by mainly large animals. On the other hand open one is possessed by arthropods and some molluscs.

(c) Symplast

- It is the movement pathway which involves a systems of connected ~~cyto~~ cytoplasm of different plant cells through the plasmodesmata. It is a pathway used to transfer water and mineral ions within the plants.
- In plants, symplast pathway occurs in movement of pool water and dissolved ions in both leaves

Extract 8.2 Continues

08. (c) and roots, as well as stem.
- The mechanism of water movement from one cell to another is governed mainly by osmosis. The plant cell either in roote or leaves with water has higher water potential (less negative) with respect to the next having low water potential (more negative), this makes water and dissolved ions to move osmotically from the cell of high to that of low water potential hence movement is continuous through the plasmodesmata in the walls of cells.
- Symplast pathway ensures efficient transport of materials mainly water and dissolved ions in the plants.

(d) Apoplast
- It is the movement pathway of materials which involves a system of interconnected cell walls in plants. Materials mainly water and dissolved ions move within the cell walls of plants without crossing the cell membrane.
- Apoplast pathway also involves the movement of materials (water and dissolved ions) due to osmotic differences. A cell with high water potential sends water to that with low water potential. The flow is continuous in leaves and stem but in roots it is blocked by caspanian strips which are impregnation of water-proof substance (suberin) in the cell walls.
- Presence of caspanian strips makes water to change pathway from apoplast to symplast.

08. (d) - This ensures efficient transport of materials (water and dissolved ions) within the plants for their development.

Extract 8.2 shows responses from a candidate who had adequate knowledge of the topic of Transportation, particularly, the concept of movement of materials in plant body. The candidate adequately explained the concepts of active transport, closed circulatory system, symplast and apoplast.

2.1.9 Question 9: Reproduction

The question required the candidates to describe the events which constitute the mechanism of fertilization in mammals. It was the least chosen among the questions in section B. That is only 8,579 of the candidates (equivalent to 31.8 percent) attempted it.

Data analysis shows that 58.1 percent of the candidates scored marks ranging from 0 to 5; 35.4 percent scored from 5.5 to 8.5, while 6.5 percent scored from 9 to 15 marks out of the 15 marks allocated to the question. Nevertheless, none of the candidates scored full (15) marks in the question. The general performance of the candidates in the question was average (as 41.9 percent passed after scoring marks ranging from 5.5 to 15). The performance is summarized by Figure 9.

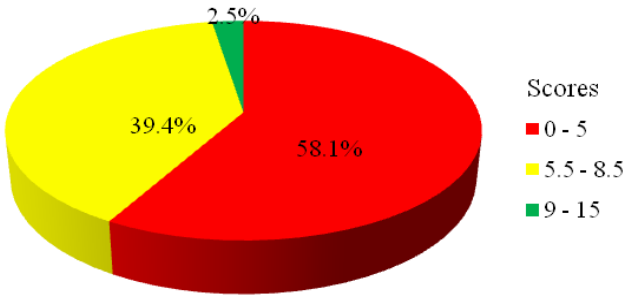
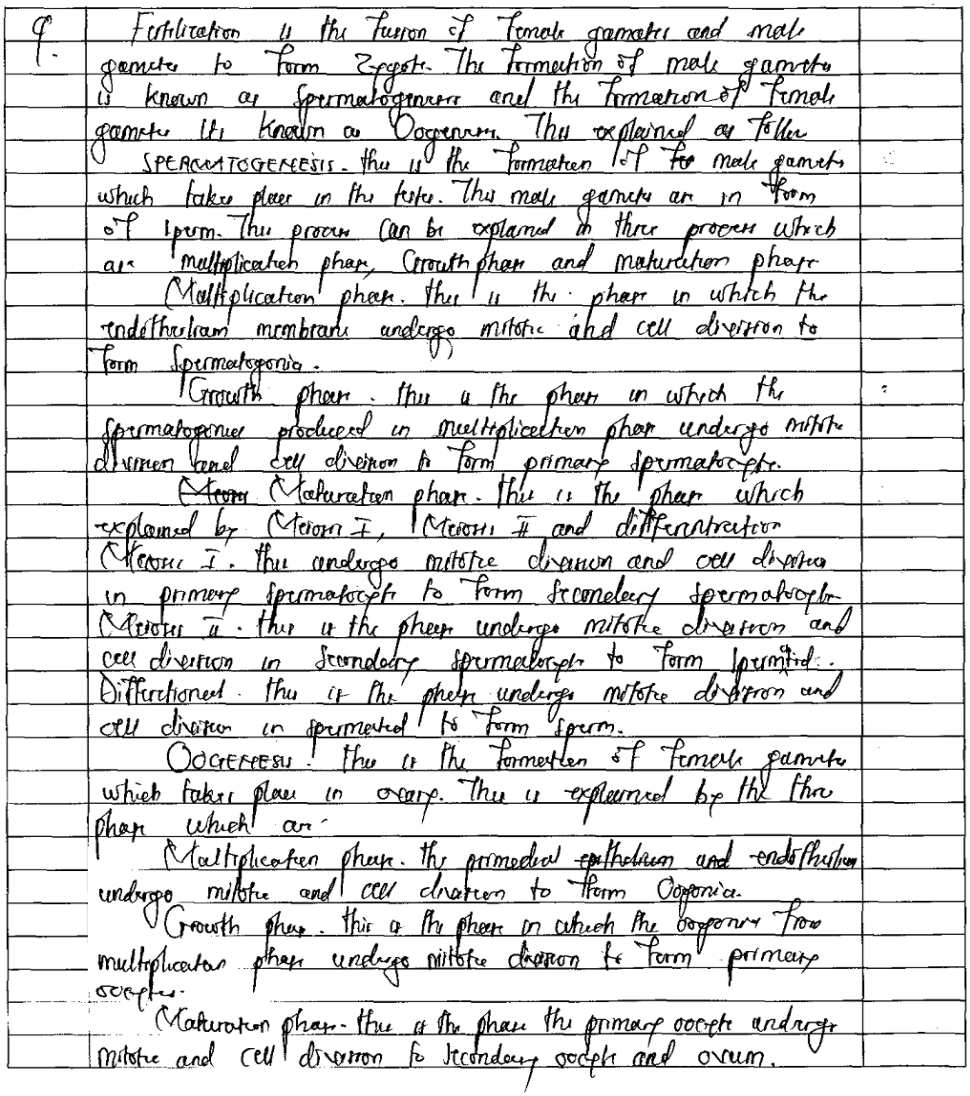


Figure 9: *The Candidates' Performance in Question 9*

Figure 9 reveals that 58.1 percent of the candidates attained poor results in the question. Responses in the scripts of most of these candidates revealed scanty knowledge of the topic of Reproduction, especially, the concept of fertilization. Some of them just explained the concept of gametogenesis instead of fertilization contrary to the requirement of the question. For example, some candidates explained the process of spermatogenesis and oogenesis; pointing out the multiplication, growth and maturation phases. Others explained the events which take place during fertilization; by pointing out *preparatory stage, ovulation, growth stage and maturation stage.* Others wrote the stages of embryonic development instead of fertilization, such as: *cleavage, blastulation and grastulation stage.* All these responses indicate that the candidates either did not understand the requirement of the question or had unclear understanding of the concept of fertilization. Extract 9.1 shows incorrect responses from one of the candidates.

Extract 9.1


9. Fertilization is the fusion of female gametes and male gametes to form Zygote. The formation of male gametes is known as Spermatogenesis and the formation of female gametes is known as Oogenesis. This explained as follow

SPERMATOGENESIS - this is the formation of the male gametes which takes place in the testes. This male gametes are in form of sperm. This process can be explained in three process which are multiplication phase, Growth phase and maturation phase.

Multiplication phase. This is the phase in which the endothelium membrane undergo mitotic and cell division to form Spermatogonia.

Growth phase. This is the phase in which the spermatogenes produced in multiplication phase undergo mitotic division and cell division to form primary spermatocyte.

Maturation phase. This is the phase which explained by Meiosis I, Meiosis II and differentiation

Meiosis I. this undergo mitotic division and cell division in primary spermatocyte to form secondary spermatocyte

Meiosis II. this is the phase undergo mitotic division and cell division in secondary spermatocyte to form Spermatid.

Differentiation. this is the phase undergo mitotic division and cell division in spermatid to form sperm.

OOGENESIS. this is the formation of female gametes which takes place in ovary. This is explained by the three phase which are

Multiplication phase. the germinal epithelium and endothelium undergo mitotic and cell division to form Oogonia.

Growth phase. this is the phase in which the oogenes from multiplication phase undergo mitotic division to form primary oocyte.

Maturation phase. this is the phase the primary oocyte undergo mitotic and cell division to secondary oocyte and ovum.

Extract 9.1 is a sample of responses from a candidate who described the process of gametogenesis instead of the events constituting the mechanism of fertilization in mammals.

On the other hand, most of the candidates with average performance (39.4%) correctly explained the events which constitute the mechanism of fertilization in mammals. However, their explanation had less than half of the correct points. Nevertheless, a few candidates (6.5%) scored high marks. The analysis of their responses indicates that they were competent in the topic of Reproduction, particularly, in the concept of fertilization in mammals. That is, they correctly described the events which constitute the

mechanism of fertilization in mammals. Extract 9.2 is a sample of the candidate's correct responses.

Extract 9.2

9. Fertilization, is the process whose by the male nucleus fuses with the female nucleus to form a zygote. In animals the events which comprise the mechanism of fertilization are as follows:-

Capacitation; this is the preparatory stage whereby some substances like glycoprotein, plasma protein are removed on the head of the sperm, this stage causes the acrosomal reaction to take place.

Acrosomal reaction; this is another event during fertilization where by the sperm membrane fuses with the acrosome membrane, this increases the moving capacity of tail of the sperm towards the wall of the secondary oocyte.

Then after the sperm has reached to the wall of the secondary oocyte its acrosome rapture and releases hyaluronidase enzymes which digest the corona radiata of the secondary oocyte then the sperm penetrates to another

Extract 9.2 Continues

9. membrane called Zona pelucida.
The sperm after reaching to the Zona pelucida it releases another enzymes which digests the zona pelucida and the sperm penetrates to the membrane of the secondary oocyte where it fuses with the microvilli of the membrane and cortical reaction takes place.
Then after the fusion of sperm to the membrane of the secondary oocyte, this aids the completion of the second Meiotic division of the Secondary oocyte to form the ovum and the second polar body.
Then the sperm nucleus swell at this stage the sperm nucleus and the ovum are called pronucleus where they fuse together to form the zygote, this now called fertilization process.
Then after fertilization the polar body degenarate and the tail is lost in the cytoplasm and the development of the zygote follows.

Extract 9.2 is a sample of correct responses from a candidate who to had sufficient knowledge of the concept of fertilization in mammals. He/she correctly described the events which constitute the mechanism of fertilization in mammals.

2.1.10 Question 10: Gaseous Exchange and Respiration

In part (a) of the question, the candidates were instructed to: (i) define the term respiratory quotient and (ii) name a specific location in the cell where the metabolic pathways listed in Table 2 occurs, substrates used and products formed.

Table 2

Metabolic pathway	Precise location	Substrate	Products
Glycolysis			
Krebs cycle			
Alcoholic fermentation			

In part (b), the candidates were instructed to briefly explain how (i) temperature and (ii) size of an organism affect the rate of respiration.

A total of 21,180 candidates (corresponding to 78.6 percent) chose the question. Data analysis reveals that the candidates' performance in the question was good (as 62.1 percent) scored marks ranging from 5.5 to 15, out of which, 40.9 percent scored from 5.5 to 8.5. Further, 21.2 percent of the candidates scored from 9 to 15 out of the total 15 marks. The candidates who scored from 0 to 5 were 37.9 percent. Figure 10 displays the performance of the candidates in the question.

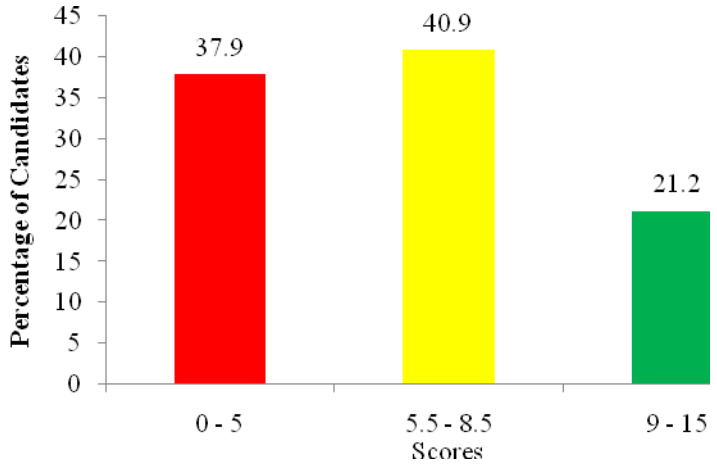


Figure 10: *The Candidates' Performance in Question 10.*

Figure 10 indicates that 21.2 percent scored marks ranging from 9 to 15. Further analysis of data reveals that 8 candidates scored all 15 marks allocated to the question. These demonstrated excellent competence in the topic of Gaseous Exchange and Respiration. They equally defined the term respiratory quotient and named the specific location in the cell where the given metabolic pathways take place, the substrate used and the products correctly. Moreover, they explained correctly how temperature and size of an organism affect the rate of respiration. Extract 10.1 is a sample of good responses from one of the candidates.

Extract 10.1

SECTION B

10 a/ (i) Respiratory quotient is the ratio ratio of volume of carbondioxide produced to the volume of oxygen used in respiration of food.

(ii)

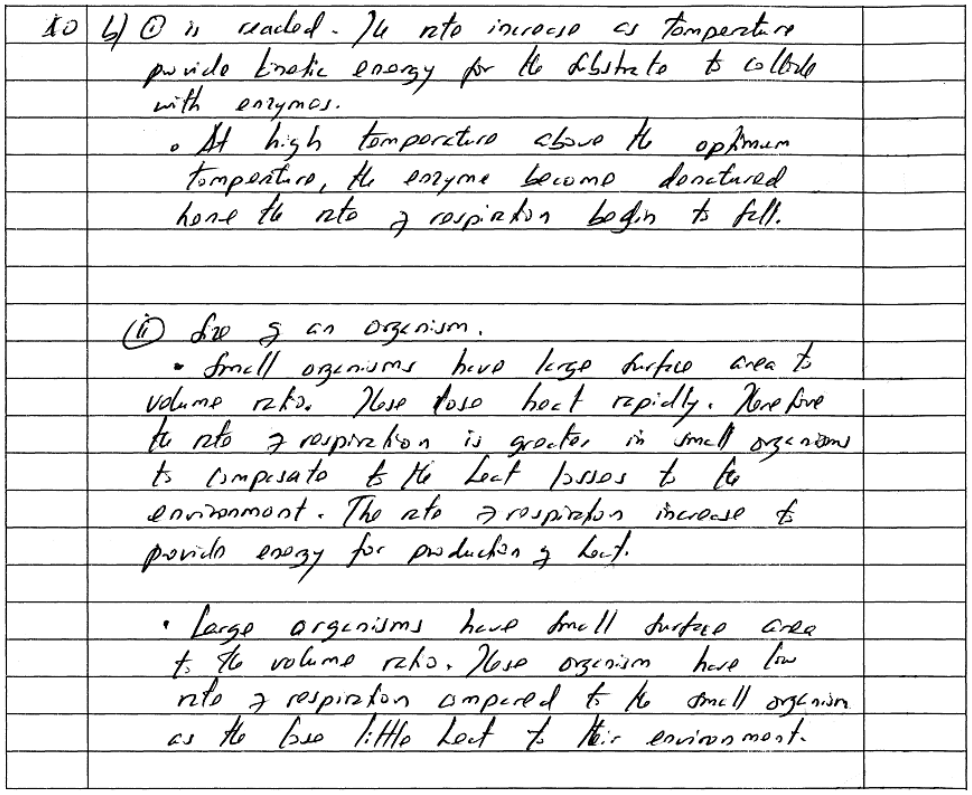
Metabolic Pathway	Precise location	Substrates	Products
Glycolysis	Cytoplasm	Glucose	- 2ATP
			-2 $NADH_2$
			- Pyruvate
Krebs Cycle	Matrix of Mitochondria	Acetyl CoA	- 2ATP
			- Carbon dioxide
			- 6 $NADH_2$
			- 2 $FADH_2$
Alcoholic fermentation	- Cytoplasm	- Pyruvate, $NADH_2$.	- Ethanol.
			- Carbondioxide (CO_2)

b/ How the factors affect respiration

① Temperature

- Respiration is an enzyme controlled reaction. Enzymes are affected by temperature. At low temperature the enzymes become denature deactivated hence the respiration rate is low.
- The rate of respiration increase as the temperature increases until an optimum temperature is

Extract 10.1 Continues


10 b) (i) is cracked. The rate increase as temperature provide kinetic energy for the substrate to collide with enzymes.
• At high temperature above the optimum temperature, the enzyme become denatured hence the rate of respiration begin to fall.

(ii) Size of an organism.
• Small organisms have large surface area to volume ratio. Hence lose heat rapidly. Therefore the rate of respiration is greater in small organisms to compsate the heat losses to the environment. The rate of respiration increase to provide energy for production of heat.

• Large organisms have small surface area to the volume ratio. Hence organism have low rate of respiration compared to the small organism as the lose little heat to their environment.

Extract 10.1 represents correct responses from one of the candidates who had enough knowledge about the metabolic pathways and the factors that affect it.

Most of the candidates with average performance correctly defined the term respiratory quotient and named the specific location in the cell in which it occurs, substrates used and products formed under each metabolic pathway. However, most of them failed to explain how temperature and size of the organism affect the rate of respiration.

Conversely, candidates who scored from 0 to 5 marks, correctly named some specific location in the cell where the given metabolic pathways occur, substrates used and products formed under each metabolic pathways but mostly failed to define the term respiratory quotient. In addition, most of them incorrectly explained how temperature and size of the organism affect the rate of respiration. Some of such candidates defined respiratory quotient as: *the rate at which glucose is burned in oxygen at any time throughout the reaction, a place where respiration takes place.* Furthermore, in explaining how temperature and size of the organism affect

the rate of respiration, most of such candidates gave general and unclear explanation such as:

> *The rate of respiration decrease with the increase in the temperature of the surrounding this is because the rate tends to produce less energy so as to maintain temperature change. Size of an organism is a factor which affect the respiration due to the size of organism since organism has large size can affect due to size of organism.*

These candidates failed to understand the fact that respiration is an enzymatic controlled reaction, where optimum temperature is required for maximum rate of reaction to take place. At low or high temperature the rate of respiration decreases. On the other hand, small organism have higher rate of respiration. Extract 10.2 shows the candidates' incorrect responses.

Extract 10.2

10 (a) (i) Respiratory quotient

This is the process in which the rate of Carbon dioxide produced is equal to the rate of Oxygen Consumed of the plant.

(ii)

	Metabolic pathway	precise location	substrates	product
–	Glycolysis	mitochondria	Carbohydrates	Glucose
–	Krebs Cycle	mitochondria	starch	sucrose
–	Alcoholic fermantation	muscles	Glucose	matose

b The following are the factors affecting the rate of respiration

(i) Temperature, also this can affect the rate of respiration on which the temperature increase especially in the body it reduce the rate of the enzymes to perform its function well in the body. example the enzymes which concerned with the digestion of the food within the body, such as high temperature lead the pepsin to fail to its function of protein molecule in the body.

(ii) The size of ~~the~~ an organism.

Also the rate of respiration in the body depend on the size of an organism such as the small organism have the – higher respiration than large organism this is the be cause the small organism it need more nutrient for better grow than the larger one organisms.

Extract 10.2 is a sample of responses from a candidate who gave incorrect responses in parts (a) and (b) (i) of the question. In part (b), he /she failed to understand that increase in temperature until optimum causes increase in rate of enzyme reaction.

2.2 133/2 - BIOLOGY 2

This paper had 8 questions composed from six topics according to 2015 ACSEE format. Each question carried twenty (20) marks and the pass mark was 7 and above.

2.2.1 Question 1: Comparative Studies of Natural Groups of Organisms

In part (a), the candidates were required to give six reasons to justify that human being belongs to the Phylum Chordata. In part (b), they were asked to use examples to explain seven advantages of the Kingdom Animalia to human being.

This was the most opted for question in the paper (as a total of 25,930 candidates, corresponding to 96.3 percent) attempted it. Data analysis reveals that 61.9 percent of the candidates scored marks ranging from 12 to 20; 28.7 percent scored from 7 to 11.5, and 9.4 percent scored from 0 to 6.5 out of 20 marks allocated to this question. The data are summarized by Figure 11.

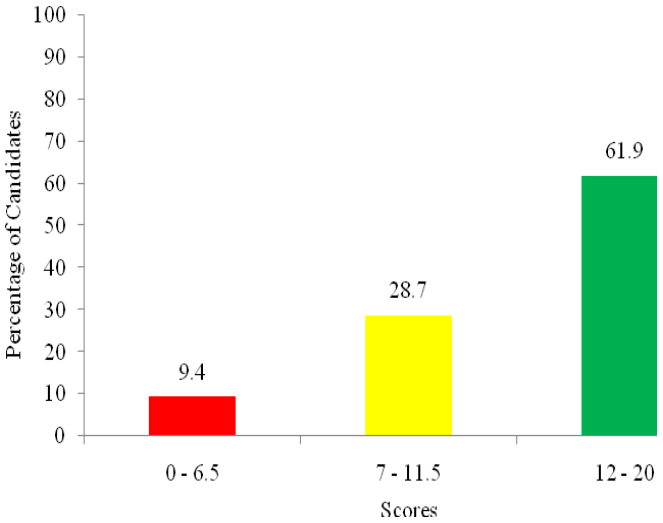


Figure 11: *The Candidates' Performance in Question 1.*

Figure 11 indicates that the general performance of the candidates in the question was good (as 90.6 percent of the candidates scored marks ranging from 7 to 20). In part (a), most of the candidates (61.9%) who scored marks from 12 to 20 managed to give at least six reasons to justify that human being belongs to phylum Chordata. In part (b), most of them gave correct advantages of Kingdom Animalia to human being. Correct responses given by these candidates indicate that they acquired enough competence in the

topic of Comparative Studies of Natural Groups of Organisms. Extract 11.1 is a sample of correct responses from one of the candidates.

Extract 11.1

1. (a) Reasons that justify, Human being belongs to Phylum Chordata.

(i) Human being have/ posesses a hollow nerve cord. all chordates posses a dorsal hollow nerve cord.

(ii) Human being have a notochord during it earlier stages of life. All chordates have a notochord, ~~either~~ rather in human it is replaced by a Vertebral Column in adult life.

(iii) Human being posses a post-anal tail. as a characteristics of all chordates human being have a post-anal tail.

(iv) Human being have pharyngeal slits. All chordates posses pharyngeal slits.

(v) Human being has a Closed circulatory system. All chordates have Closed Circulatory system.

(vi) Human being has segmented muscles. all chordates have segmented muscles.

Extract 11.1 continues

1. (b) Advantages of Kingdom animalia to human being.

(i) Some organisms are used as source of food to man (human being). for example, locust, cows, domesticated animal (goat, sheeps), poultry are consumed by man providing man with nutrients.

(ii) Some organism are used as source of power to human being. for example horses, bulls are used to drive cart and carry people and laggages from place to place. And also Camel, which are widely used as source of transport in desert areas.

(iii) Some organisms are used by human being for providing security. for example dogs are reared by man to offer security and also there are kinds of rats which are used in millitary to detect bombs.

(iv) The dug produced by animals including cows they increase soil fertility and hence led to increased Crop production by man.

(v) Some organism are sources of raw materials required by industries. for example wool from sheeps, skin of cows are required by industries to produce other useful products such as belts, shoes and jackets.

(vi) Some animals are used in biological Control of pests which are disease causing agent. for example by employing ducks to feed on locust in farms

vii) Some animals are used by ~~many~~ human for decoration purpose. for example, some Coloured fishes are reared in houses for decoration purpose.

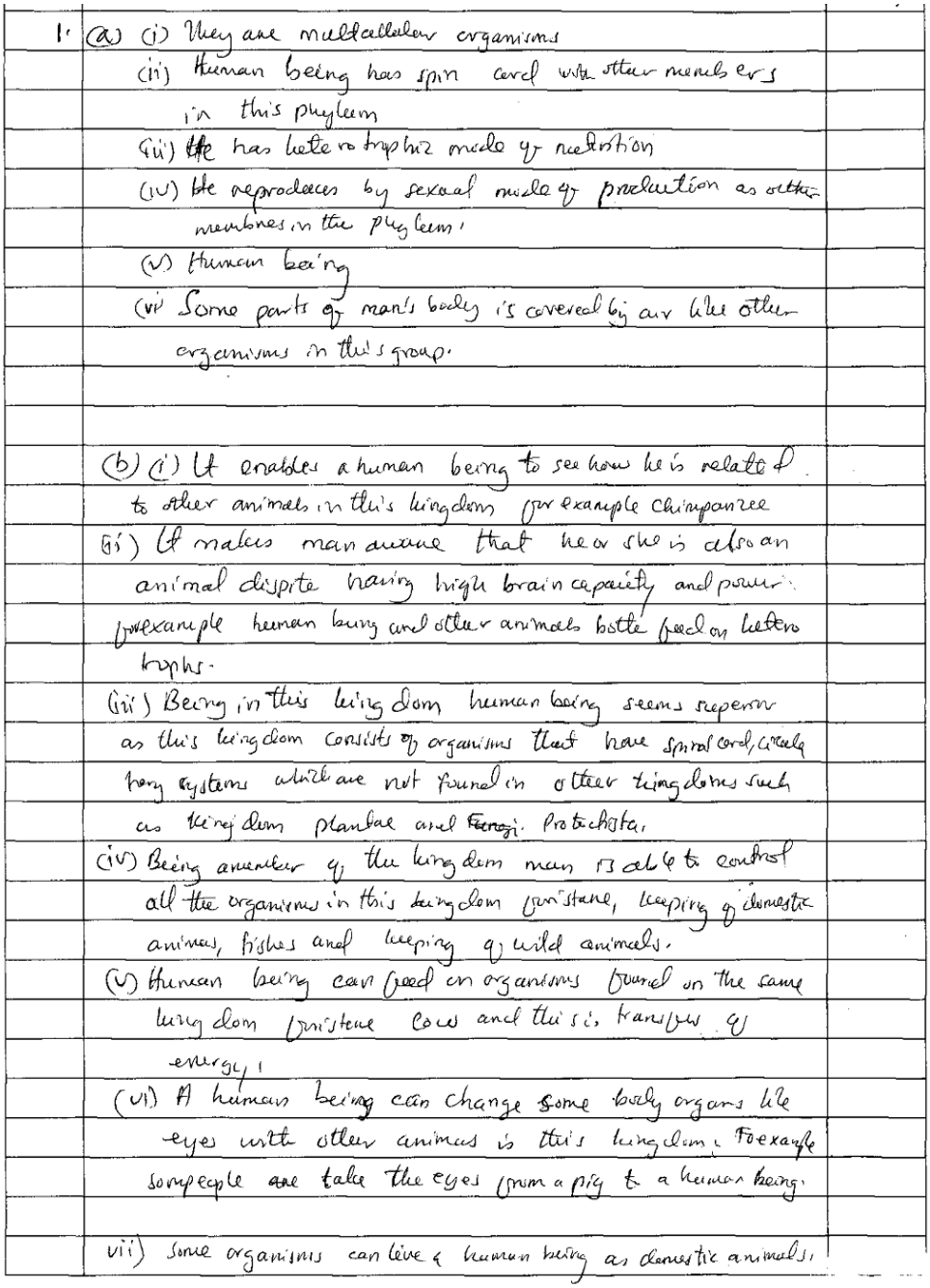
Extract 11.1 shows responses from a candidate who in part (a) gave correct reasons to justify that human being belong to the phylum Chordata. In part (b), he/she gave correct advantages of Kingdom Animalia to human being.

Although 28.7 percent of the candidates scored average marks (7 to 11.5), 9.4 percent scored low marks (0 to 6.5). Most of the candidates with low marks failed to meet the demand of the question. For example in part (a), they wrote the characteristics of living things instead of justifying the fact that human being belongs to the phylum Chordata. For example, they wrote:

> *They are multicellular organism, they possess female and male gamete special for sexually reproduction, they possess heterotrophic mode of nutrition, they possess lungs for gaseous exchange like other chordates in the phylum, they possess Holozoic mode of nutrition since they feed on the other organism, presence of organs such as heart and kidney, fertilization inside of the body, they are genetically stable.*

Likewise, in part (b), the candidates wrote the characteristics of animals such as *being in this Kingdom human being seems superior, they are locomotive, they have eyes for looking, their body are sensitive to change in environmental conditions, they have fluids which transport material in the body called blood* instead of the advantages of Kingdom Animalia to human being. Extract 11.2 is a sample of the candidates' incorrect responses.

Extract 11.2



1. (a) (i) They are multicellular organisms
(ii) Human being has spinal cord with other members in this phylum
(iii) He has heterotrophic mode of nutrition
(iv) He reproduces by sexual mode of production as other members in the phylum.
(v) Human being
(vi) Some parts of man's body is covered by air like other organisms in this group.

(b) (i) It enables a human being to see how he is related to other animals in this kingdom for example chimpanzee
(ii) It makes man aware that he or she is also an animal dispite having high brain capacity and power for example human being and other animals bottle feed on heterotrophs.
(iii) Being in this kingdom human being seems superior as this kingdom consists of organisms that have spinal cord, circulatory systems which are not found in other kingdoms such as kingdom plantae and ~~Fungi~~ Protichista.
(iv) Being member of the kingdom man is able to control all the organisms in this kingdom for instance, keeping of domestic animals, fishes and keeping of wild animals.
(v) Human being can feed on organisms found on the same kingdom for instance cow and this is, transfer of energy.
(vi) A human being can change some body organs like eyes with other animals in this kingdom. For example some people are take the eyes from a pig to a human being.

vii) Some organisms can leive a human being as domestic animals.

Extract 11.2 is a sample of responses from a candidate who failed to understand the demand of the question. As a result, in part (a), he/she explained the characteristics of Kingdom Animalia instead of giving reasons to justify why human being belongs to Phylum Chordata. In part (b), the candidate gave the advantages of human being instead of the advantages of the Kingdom Animalia to human being.

2.2.2 Question 2: Comparative Studies of Natural Groups of Organisms

In part (a) (i), the candidates were instructed to draw the structure of *Escherichia coli* and label its five parts. In (ii), they were instructed to state the role played by each of the parts labelled in 2(a) (i). In part (b), they were instructed to explain how the reproduction of bacteria takes place.

Data show that the question was attempted by 2,642 candidates (equivalent to 9.8 percent). Further, analyses of data reveal that 44.4 percent scored marks ranging from 7 to 11.5; while 28.8 percent scored from 12 to 20 and 26.8 percent scored from 0 to 6.5 out of the 20 marks allocated to the question. The candidates' performance is summarized by Figure 12.

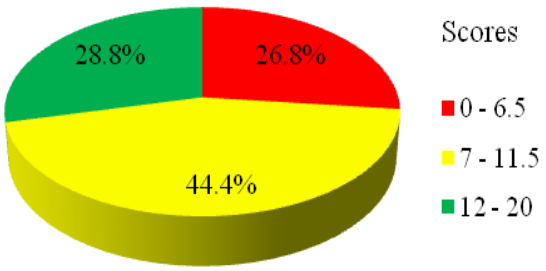
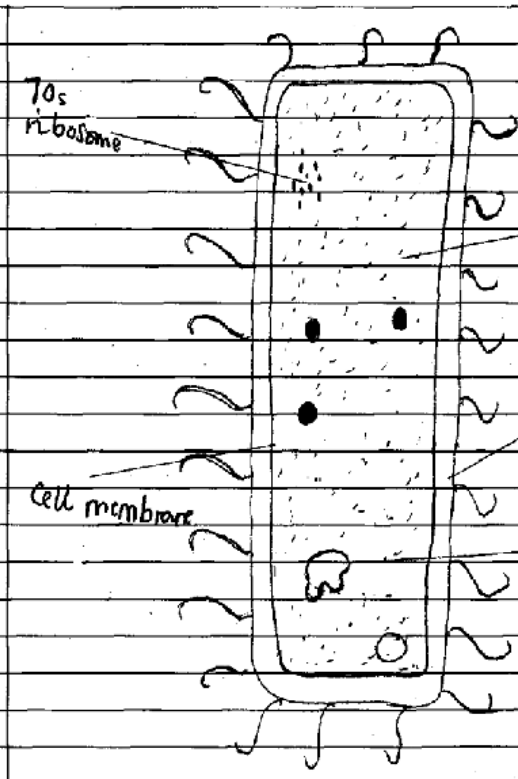


Figure 12: *The Candidates' Performance in Question 2.*

Figure 12 depicts that about three quarters of the candidates (73.2%) who attempted this question scored 7 and above of the total 20 marks allocated to the question. The data signify that the general performance of the candidates was thus good. Most of the candidates who scored more than 7 but less than 20 marks, failed to explain how the reproduction of bacteria takes place. A few of the candidates (0.1%) who scored 20 marks demonstrated both good knowledge of the Kingdom Monera, and good skills in drawing and labeling the structure of *Escherichia coli.* They also gave correct explanation on how reproduction of bacteria takes place. Extract 12.1 shows responses from a candidate who scored full marks in the question.

Extract 12.1

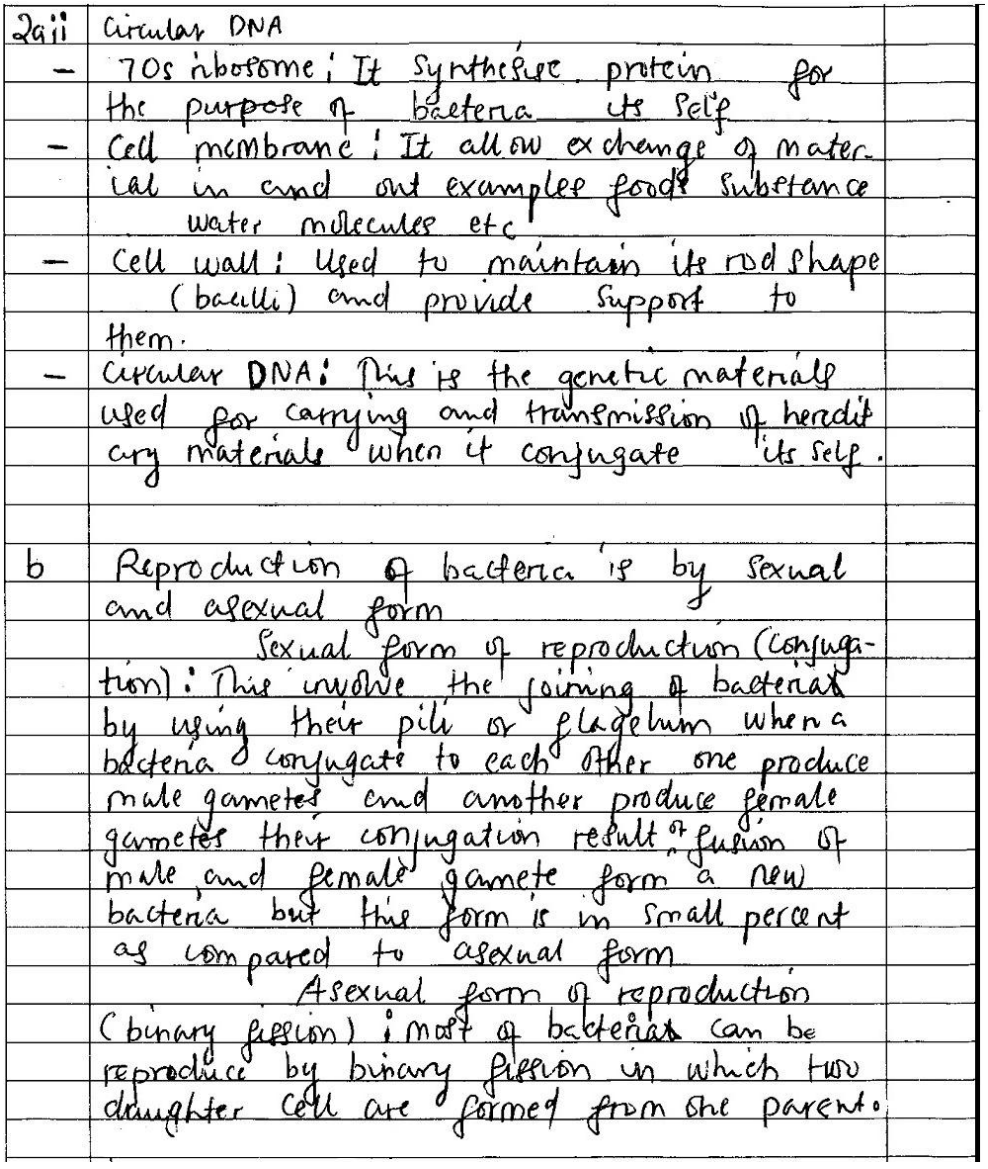
2a i



Structure of escherichia coli

ii- Cytoplasm; Provide medium for other organelles to suspend in the organism like

Extract 12.1 Continues



2a ii
- Circular DNA
- 70s ribosome ; It Synthesize protein for the purpose of bacteria its self
- Cell membrane ; It allow exchange of material in and out examples food substance water molecules etc
- Cell wall ; Used to maintain its rod shape (bacilli) and provide support to them.
- Circular DNA ; This is the genetic materials used for carrying and transmission of hereditary materials when it conjugate its self.

b
Reproduction of bacteria is by sexual and asexual form

Sexual form of reproduction (Conjugation) : This involve the joining of bacterias by using their pili or flagellum when a bacteria conjugate to each other one produce male gametes and another produce female gametes their conjugation result of fusion of male and female gamete form a new bacteria but this form is in small percent as compared to asexual form

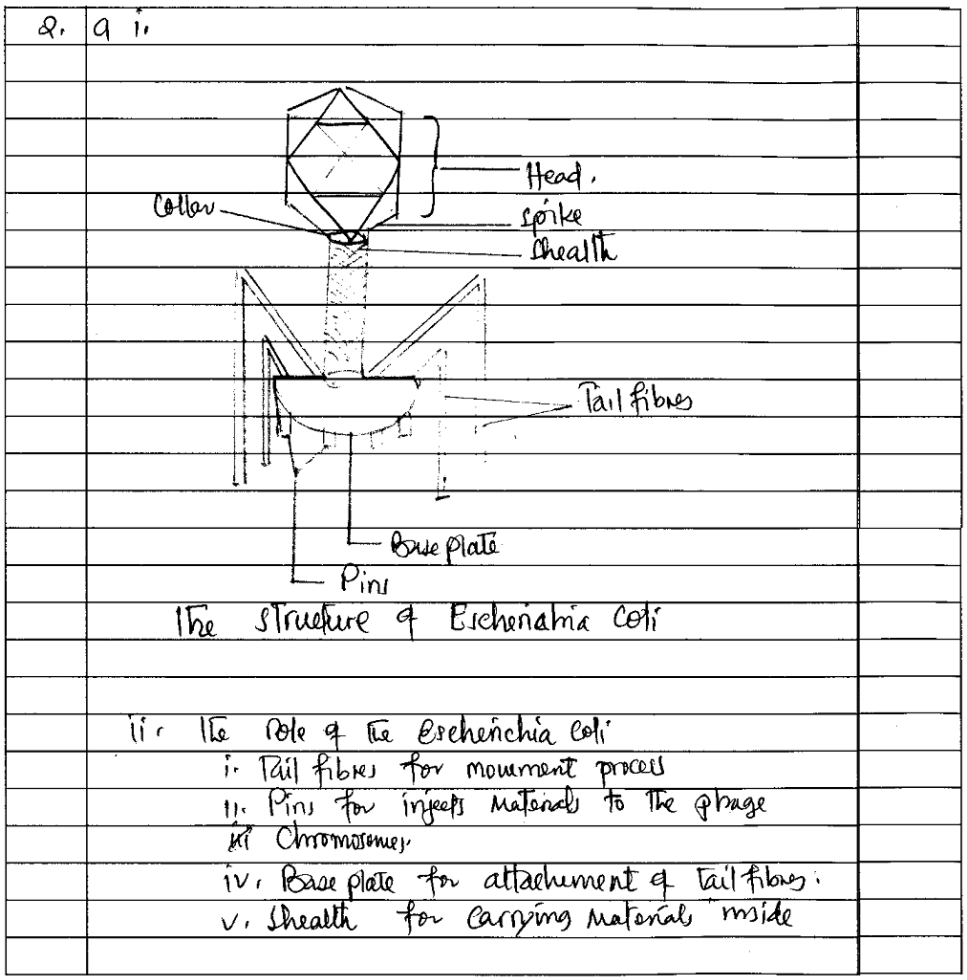
Asexual form of reproduction (binary fission) ; most of bacterias can be reproduce by binary fission in which two daughter cell are formed from one parent.

Extract 12.1 shows responses from a candidate who correctly responded to all parts of the question. He/she demonstrated enough competence in the topic of Comparative Studies of Natural Groups of Organisms and good drawing skills.

Further analysis of the candidates' responses revealed that most of those who scored poorly (0 to 6 marks) confused the structures of viruses, fungi and protoctists with bacteria. In part (a) for instance, they drew the structure of fungi (phytophthora) or protoctists (trypanosome) instead of *Escherichia coli.* In part (b), most of them explained the process of

replication of viruses instead of the reproduction of bacteria. A few of the candidates drew poor diagrams implying that they were incompetent in drawing. Extract 12.2 shows candidate's incorrect responses.

Extract 12.2

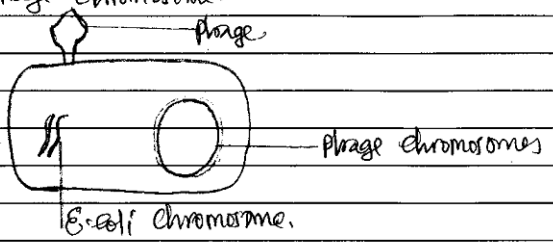


Extract 12.2 Continues

2. b. The reproduction of bacteria takes place as following:

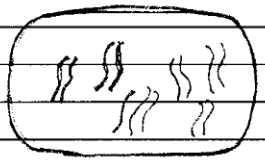
First stage:

Phage attack to the Escherichia and injects the phage chromosome.



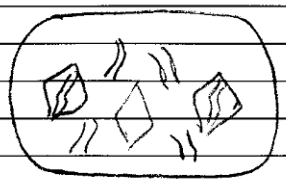
The second stage:

The phage chromosome break down due to the injection of another chromosome

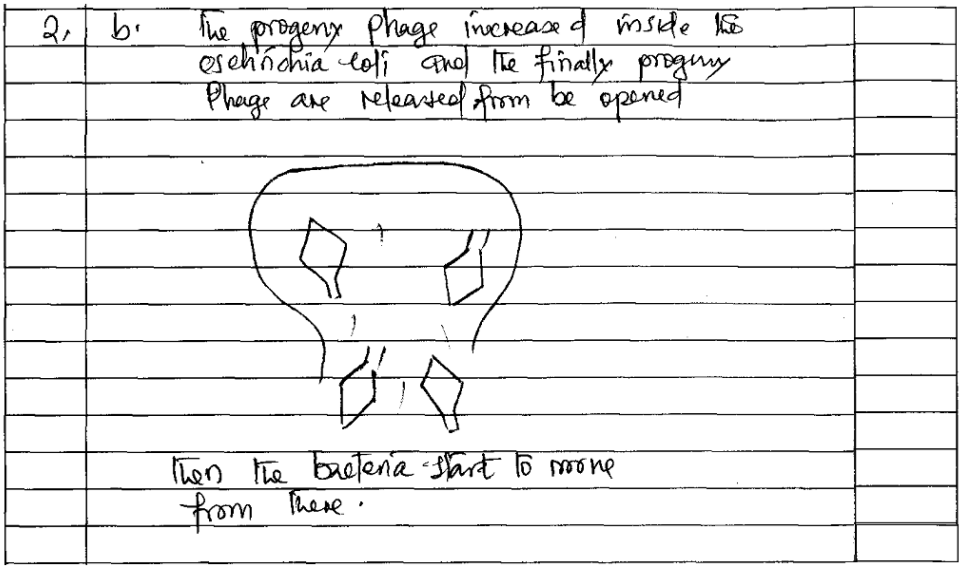


Third stage:

The phage chromosome replicate and multiply and resemble the structure of phage happen.



Extract 12.2 Continues



Extract 12.2 is a sample of wrong responses from a candidate who in part (a) drew the structure of a bacteriophage instead of *Escherichia coli.* In part (b), he/she described the process of the replication of bacteriophage instead of the reproduction of bacteria.

2.2.3 Question 3: Regulation (Homeostasis)

In part (a), the candidates were instructed to: (i) identify three major types of nitrogenous excretory wastes in animals, (ii) identify animals which excrete each of the identified types of nitrogenous wastes in (a) (i) and give three reasons for the answer. The answer had to be given in tabular form as shown in Table 2:

Table 2: How to present the answer for question 3.

SN	Nitrogenous wastes	Animals excreting it	Reasons

In part (b), they were instructed to enumerate five responses which occur in the body when body temperature is lower than normal.

Data show that a total of 24,100 candidates (corresponding to 89.5 percent) opted for this question. Analysis reveals that 35.0 percent scored marks ranging from 7 to 11.5; 52.5 percent scored from 12 to 20 out of the 20 marks allocated to the question. The candidates who scored from 0 to 6.5 marks were 12.5 percent. Figure 13 portrays the performance of the candidates in question 3.

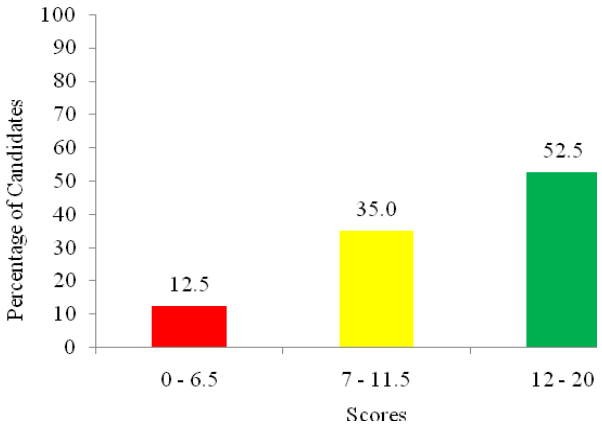


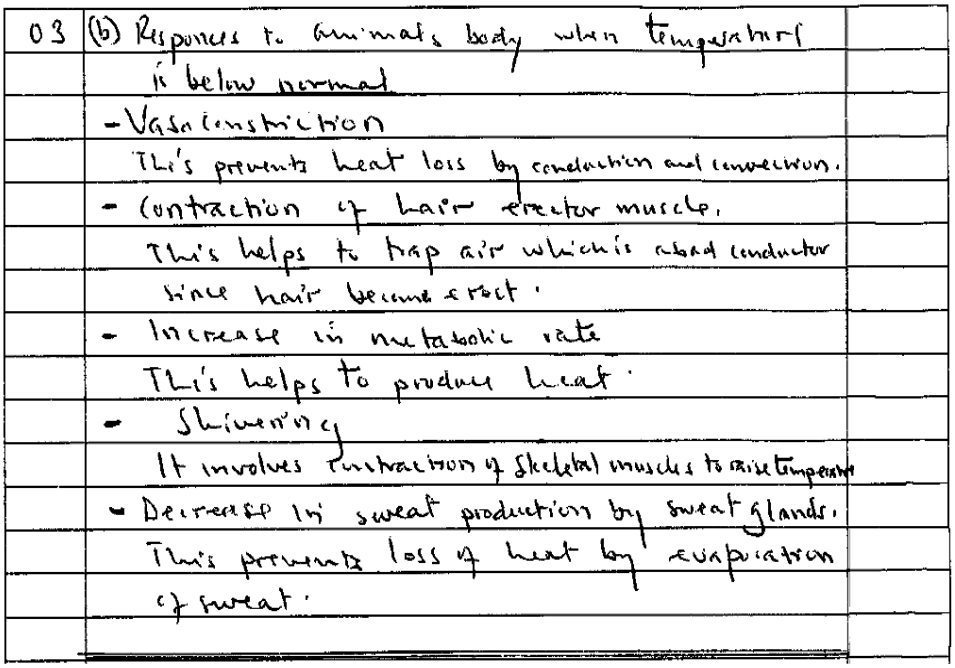
Figure 13: *The Candidates' Performance in Question 3.*

Figure 13 shows that the general performance of the candidates in the question was good (as 87.5 percent scored marks ranging from 7 to 20). Some of the candidates who scored full marks in the question demonstrated great competence in the topic of Regulation. They also understood the need of the question going by how they correctly identified three major types of nitrogenous wastes excreted in animals and animals which excrete the wastes. Furthermore, most of them correctly enumerated five responses which occur in the body when the body temperature is lower than normal. Extract 13.1 shows correct responses from one of the candidates who attempted the question.

Extract 13.1

03 (i) - Urea
- Uric acid
- Ammonia.

Sn	Nitrogenous waste	Animals excreting it	Reasons.
1	Ammonia	Aquatic animals like - Fish	Ammonia is toxic and soluble, thus it needs alot of water to be excreted. Since fish lives in wat It can excrete ammoni easy.
2	Urea	Terrestrial animal like, human being - goat - cow.	Ureas is less soluble compared to Ammonia and less toxic, it needs relatively less water to be excrete which terrestrial animals can have.
3	Uric acid	Insects, such as cockroach and grasshoper	It is insoluble and low toxicity. - It needs very little water to be excreted - Since water is a problem to insects, They are only able to excrete Uric acid.



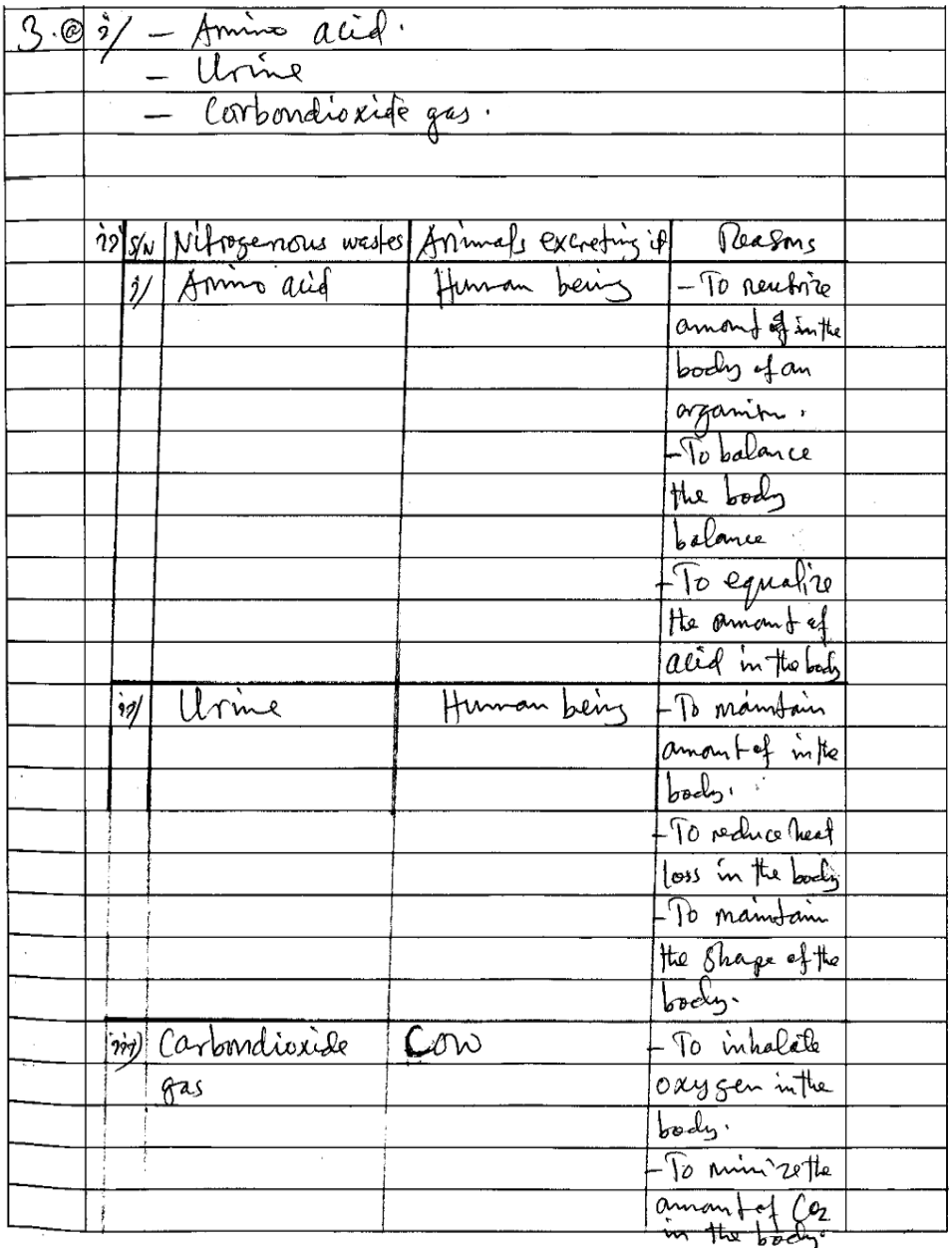
Extract 13.1 shows responses from a candidate who responded to all items of question 3 correctly. He correctly identified the excretory products secreted by different animals and gave correct responses shown by animals when temperature is below normal.

Most of the candidates who opted for this question and scored average marks (7 to 11.5) accurately identified the major types of nitrogenous wastes and the animals which excrete them. However, most of them failed to give reasons to support their responses to part (a). In part (b), most of them enumerated less than five responses which occur in the body when the body temperature is lower than normal. Some of them totally failed to enumerate the responses that occur in the body when the body temperature is lower than normal.

The candidates with weak performance (0 to 6.5) demonstrated the lack of sufficient knowledge of the topic of Regulation. Moreover, most of their responses did not match with the demand of the question. Examples of responses given by one of such candidates, on why human beings excrete urea, include: *to reduce heat loss in the body.* Others wrote; *to isolate oxygen in the body, to minimize the amount of carbon dioxide in the body*. Such candidates mixed up the concepts of homeostasis with those of excretion and gaseous exchange. Likewise, in enumerating the responses that occur in the body when temperature is lower than normal, one of the candidates listed the components involved in the mechanism of

homeostasis, such as: *stimulus, detector, receptor, effector, response*s. Further, the candidate failed to understand the requirement of the question. Extract 13.2 is a sample of incorrect responses from one of the candidates.

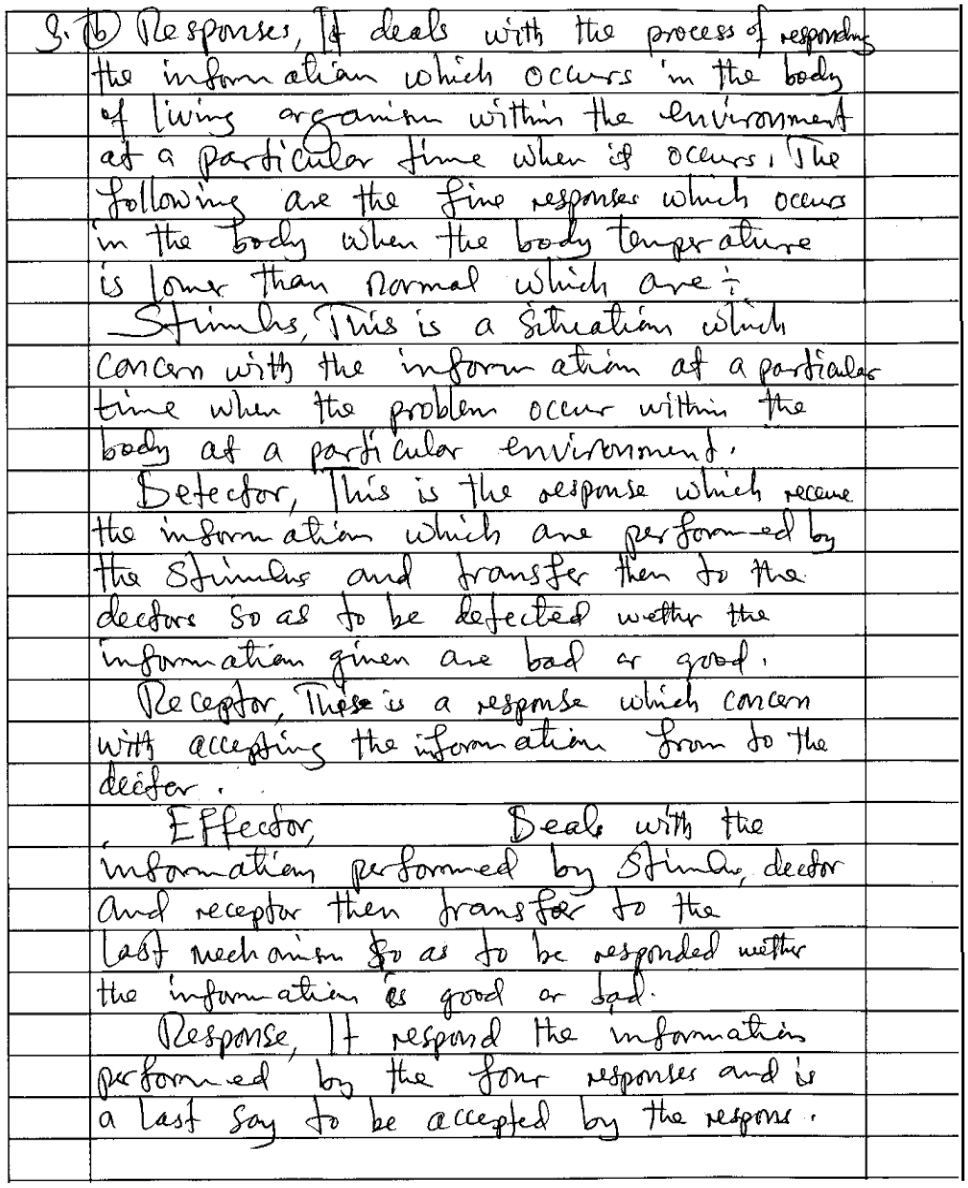
Extract 13.2



3.@ i/ – Amino acid.
– Urine
– Carbondioxide gas.

ii/ S/N	Nitrogenous wastes	Animals excreting it	Reasons
i/	Amino acid	Human being	– To neutrize amount of in the body of an organism. – To balance the body balance – To equalize the amount of acid in the body
ii/	Urine	Human being	– To maintain amount of in the body. – To reduce heat loss in the body – To maintain the shape of the body.
iii/	Carbondioxide gas	COW	– To inhalate oxygen in the body. – To minize the amount of CO_2 in the body.

Extract 13.2 Continues



3. (b) Responses, It deals with the process of responding the information which occurs in the body of living organism within the environment at a particular time when it occurs. The following are the five responses which occurs in the body when the body temperature is lower than normal which are :-

Stimulus, This is a situation which concern with the information at a particular time when the problem occur within the body at a particular environment.

Detector, This is the response which receive the information which are performed by the Stimulus and transfer them to the receptors so as to be detected wether the information given are bad or good.

Receptor, This is a response which concern with accepting the information from to the detector.

Effector, Deals with the information performed by Stimulus, detector and receptor then transfer to the last mechanism so as to be responded wether the information is good or bad.

Response, It respond the information performed by the four responses and is a last say to be accepted by the respons.

Extract 13.2 displays responses from a candidate who in part (b) of the question enumerated the components of homeostasis instead of the responses that occur when the body temperature is lower than normal.

2.2.4 Question 4: Growth and Development

This question required the candidates to use diagrams to describe events which take place in animal cell during the first four mitotic stages. The data indicate that the question was opted for by 9,354 candidates (equivalent to 34.7 percent).

Data analysis shows that 49.5 percent of the candidates scored marks ranging from 12 to 20; 27.8 percent scored from 7 to 11.5 and 22.7 percent scored from 0 to 6.5 out of the 20 marks allotted to the question. The summary of the performance data is shown by Figure 14.

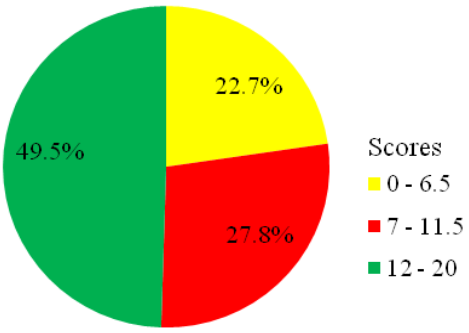


Figure 14: *The Candidates' Performance in Question 4*

Figure 14 shows that the candidates' performance in the question was generally good (as 72.2 percent scored marks ranging from 7 to 20). Most of the candidates (49.5%) who performed well in the question showed remarkable competence in the topic of Growth and Development, particularly, in mitotic cell division. They demonstrated understanding of the contents; through drawing well labeled diagrams which described the events which take place in animal cell during the first four mitotic stages. Extract 14.1 is a sample of the candidates' correct responses.

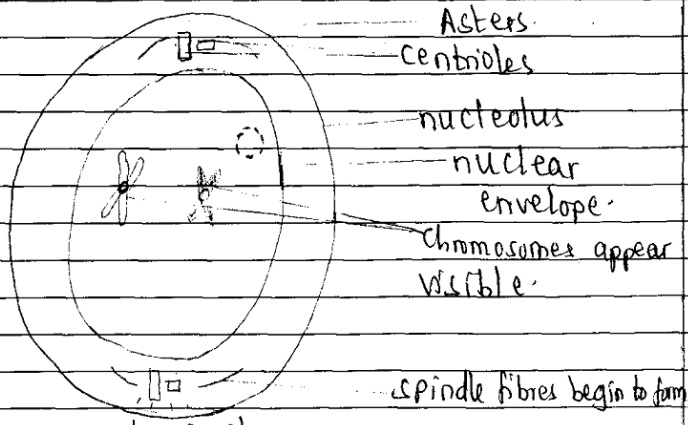
Extract 14.1

4. Events taking place in first four mitotic states which are; prophase, metaphase, Anaphase and Telophase are explained as follows.

(a) Prophase stage

⇒ This is the longest phase of the cell division. The main events taking place in this phase are;

- Chromosomes condense and thicken by coiling and appear visible.
- Nucleolus disappears and the nuclear membrane disintegrates.
- Centrioles migrate to the opposite cells and spindle fibres begin to form.
- Asters are seen radiating from the Centriole. This process can be summarized in the following diagram;

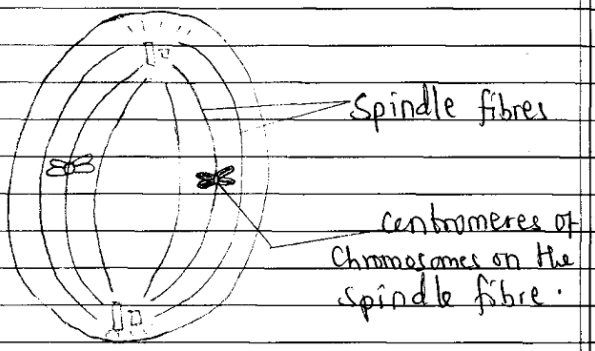


prophase stage.

Extract 14.1 Continues

4. (b.) Metaphase stage

⇒ During this stage, chromosomes align themselves on the equatorial plane of the spindle fibres with their centromeres first. This can be shown as in the following diagram.



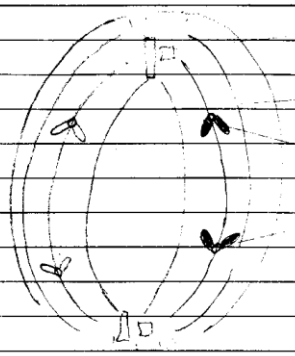
Metaphase stage.

(c.) Anaphase stage.

⇒ During this stage, centromeres split into two. The spindle fibres pull the sister chromatids towards the opposite poles of the cell as they contract. This can be shown in the following diagram;

Extract 14.1 Continues

4.



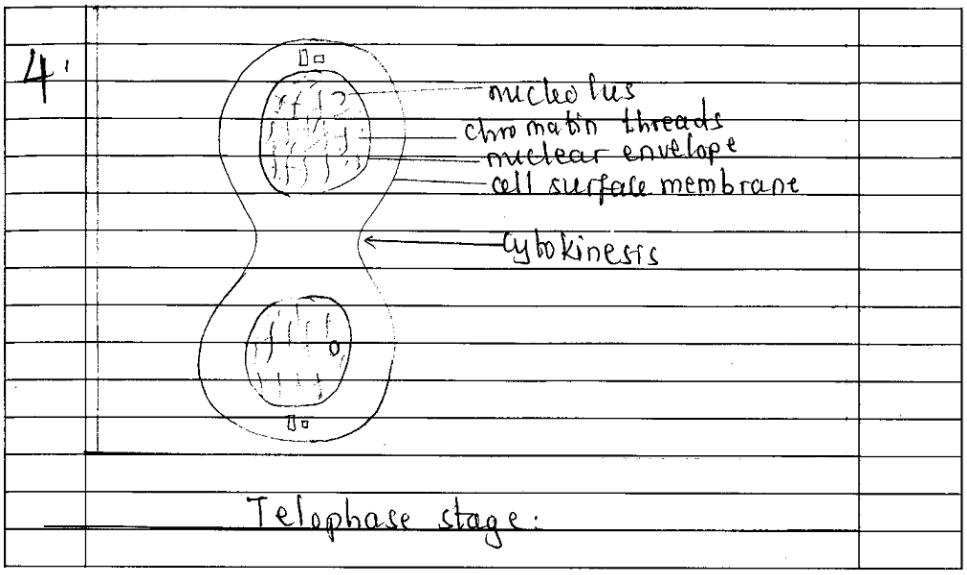
Anaphase stage.

(d.) Telophase stage.

⇒ In this stage, sister chromatids reach the opposite poles of the cell, lengthen, uncoil and become invisible.

- The nuclear envelope reforms around chromatids and the nucleolus reappear
- The spindle fibres replicate and centrioles replicate. Chromosome replicate and appear as chromatin fibres.
- Cytokinesis occurs in which there is constriction of the cell from outside to inwards which result to formation of two daughter cells.
  - This process can be summarized in the following diagram.

Extract 14.1 Continues

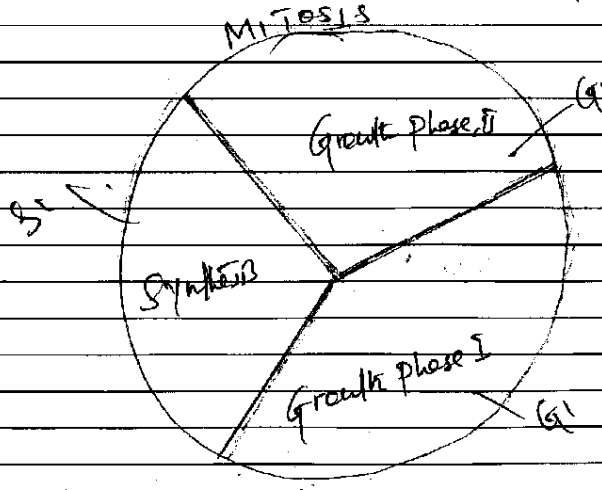


Extract 14.1 is a sample of correct responses from a candidate who drew and labelled diagrams required for each event. In addition, he/she gave correct description of each event.

On the other hand, observations from the candidates' scripts show that most of the candidates who scored low marks (0 to 6.5) managed to draw the correct diagrams but failed to provide correct labels and descriptions. A few of such candidates mixed-up the events of mitosis such that the events of metaphase like, *chromosome attracted to the center of the cell, chromatids are arrange to the equator at the middle forming sister chromatid, chromatids fibres join the centralmores in each pores* were written under prophase stage. Likewise, events such as *the sister chromatids become separated into two half chromosome, the half chromosome tend to be pulled in opposite side toward the poles* were written under metaphase instead of telophase stage. In addition, a few of the candidates (3%) scored zero mark. These mostly drew diagrams which were out of the scope of mitosis. Extract 14.2 is a sample from one of the candidates who drew the diagram showing events of a cell cycle.

Extract 14.2

4. Cell circle Is the circle that present different events occurs in either Meiosis, Growth Phase I and II and those occur in Synthesis.

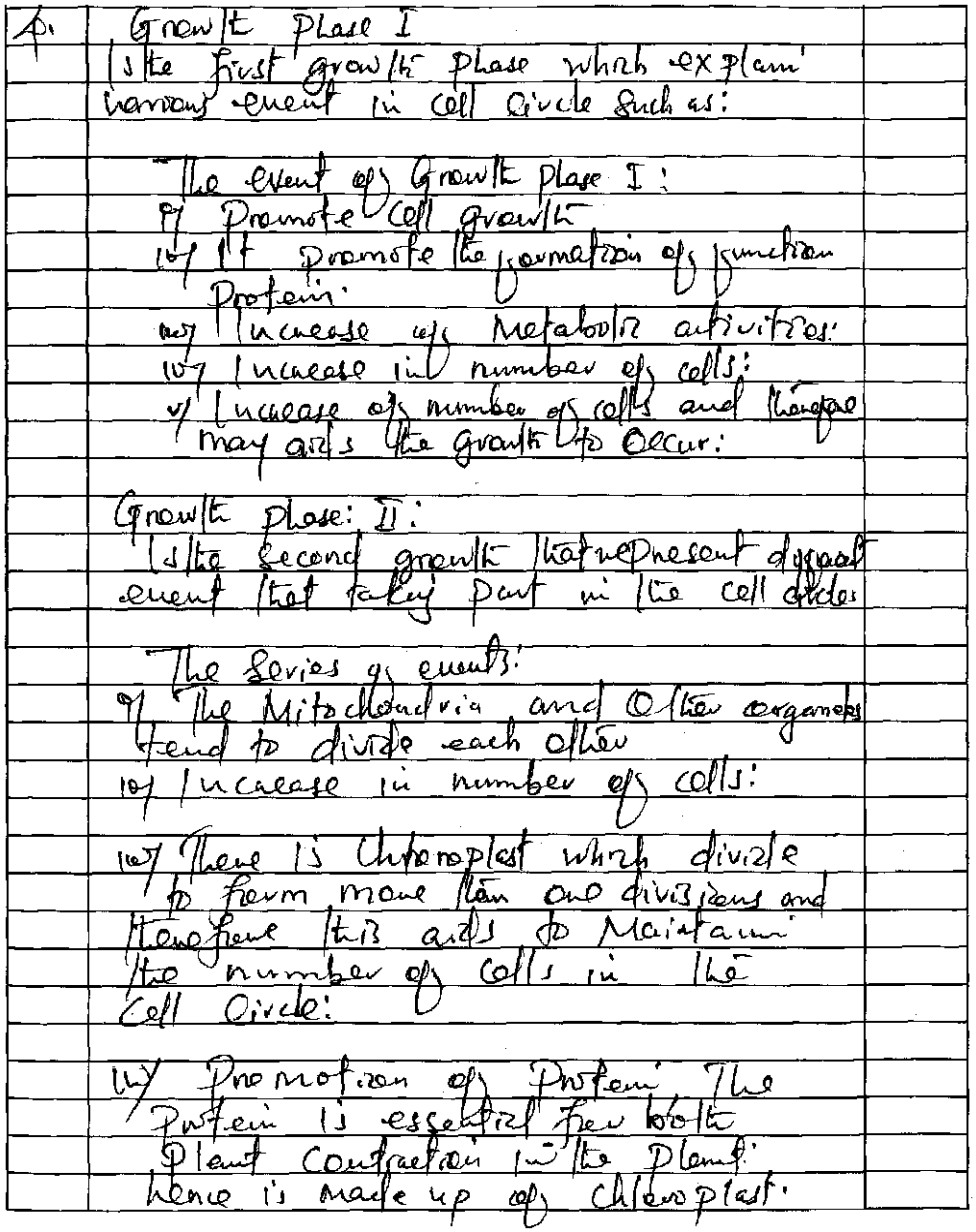


A Cell Circle to Show the different events taken place.

Synthesis Phase
Is the another Phase in which Show different event occur in the cell circle.

The events occurs: May be:
a) There Must development of cells
b) The number of cells tend to increase
c) The growth rate also Increase rapidly.
d) Protein always Continue to be produced
e) Production of Chromatids.

Extract 14.2 Continues



Growth Phase I
It is first growth phase which explain various event in cell circle such as:

The event of Growth phase I:
- Promote cell growth
- It promote the formation of function Protein.
- Increase of Metabolic activities.
- Increase in number of cells;
- Increase of number of cells and therefore may aids the growth to occur.

Growth phase: II:
It is second growth that represent diagram event that take part in the cell divide.

The Series of events:
- The Mitochondria and Other organels tend to divide each other
- Increase in number of cells:
- There is Chloroplast which divide to form more than one divisions and therefore this aids to Maintain the number of cells in the Cell Circle.
- Promotion of Protein. The Protein is essential for both Plant Contraction in the Plant. hence is made up of Chloroplast.

Extract 14.2 shows wrong responses from a candidate who drew the diagram of a cell cycle and described its events instead of the events taking place during the first four mitotic stages.

2.2.5 Question 5: Genetics

In part (a) of the question, the candidates were instructed to evaluate three merits of genetic engineering to human being. In part (b), they were given the information that when pure strain of mice with brown-coloured fur, were allowed to breed with a pure strain of a mice with grey-coloured fur they produced offspring with brown-coloured fur. When F1 offspring produced were allowed to interbreed, they produced F2 generation with fur colour in the proportion of three brown-coloured to one grey-coloured. The candidates were next required to carry out genetic crosses to illustrate the results.

Statistics indicate that a total of 23,505 candidates (equivalent to 87.3 percent), opted for the question. Further analysis reveals that 79.1 percent of those candidates scored marks ranging from 12 to 20; 9.6 percent scored from 7 to 11.5 and 11.3 percent from 0 to 6.5 out of 20 marks allocated to the question as Figure 15 illustrates.

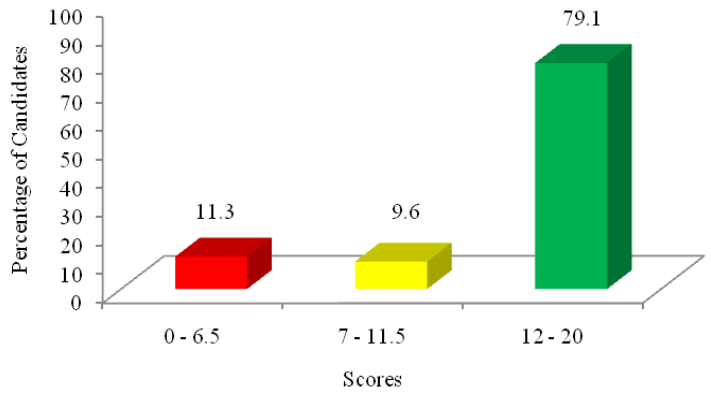


Figure 15: *The Candidates' Performance in Question 5.*

Figure 15 shows that the candidates' performance was good (as 88.7 percent passed the question by scoring marks ranging from 7 to 20 out of 20 marks given to this question). Most of the candidates who scored marks above 6.5, but less than 20, lost some marks in part (a), whereby, they failed to give all the required points on the merits of genetic engineering to human. Others managed to carry out crosses to show the formation on F1, but not F2. On the other hand, a few candidates (0.6%) scored all 20 marks in the question. These candidates demonstrated great competence in the topic of Genetics, particularly, in genetic engineering; considering the fact

that they responded to all parts of the question correctly as illustrated in extract 15.1

Extract 15.1

5 (a) Three Merits of genetic engeneering to Humans include

(i) Selective Breeding ; The knowledge of genetic engeneering ~~for~~ has enabled humans to produce organism that are resistant to diseases and harsh environments for example. plants obtained Thrash selective breeding are highly resistent to disease and can survive extreme conditions of drought hence increasing stability of agricultural produce . also cows can be artificialy inseminated by sperm from one bull enabling one bull to sire many offspring with required characters hence increase efficiency and output

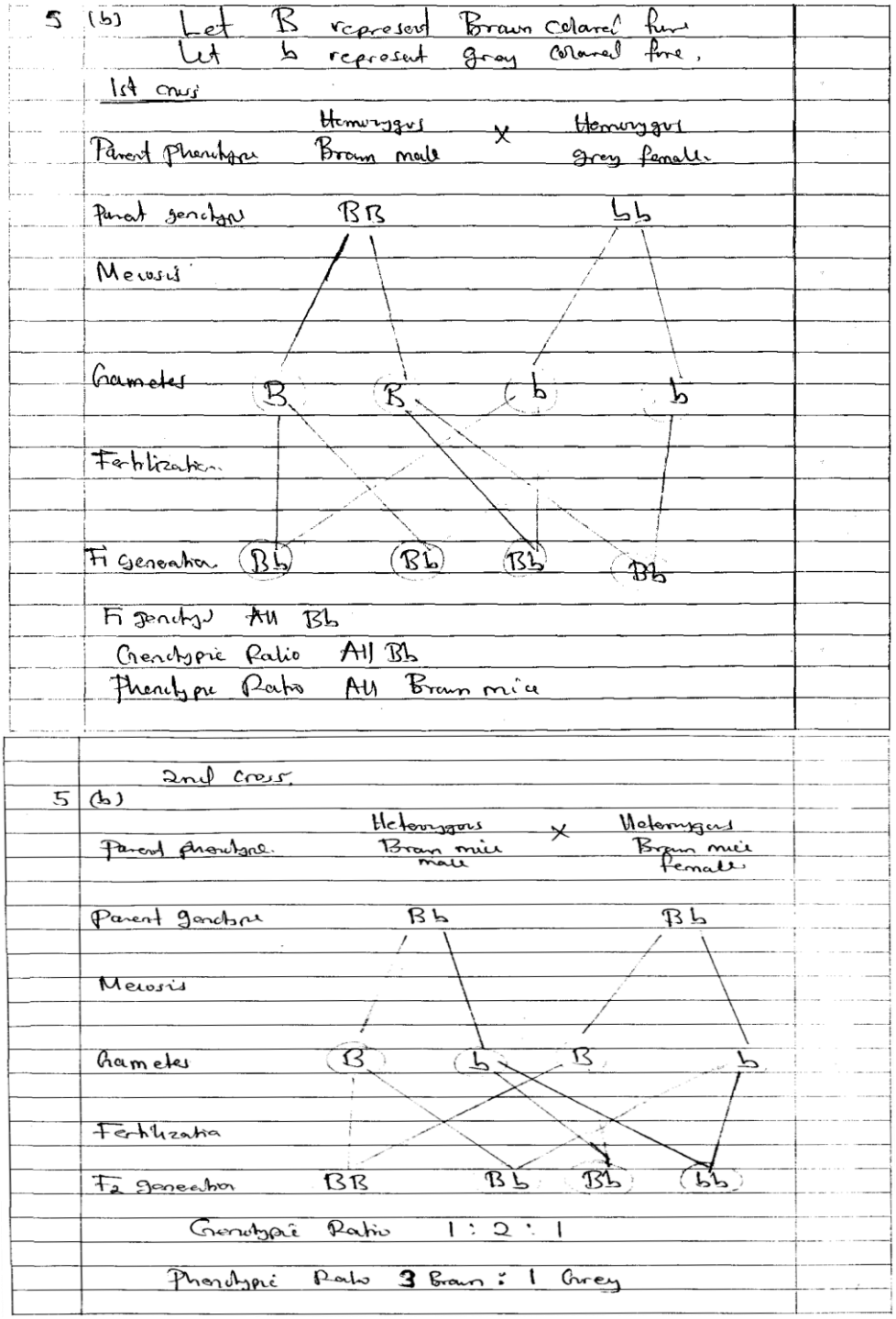
(ii) Medicine Advancement ;

~~The~~ Genetic Engeneering has led to the discovery of cures and treatments for many diseases . for example people suffering from diabetes can obtain insulin from cow which is mass produced by bacteria at very low cost hence has aided man in Medicine Advancement .

(iii) Bio Weapons .

Genenetic engeneering has enabled us to produce bio weapons which are essential in conditions of war to protect countries from invasion hence it has helped us humans .

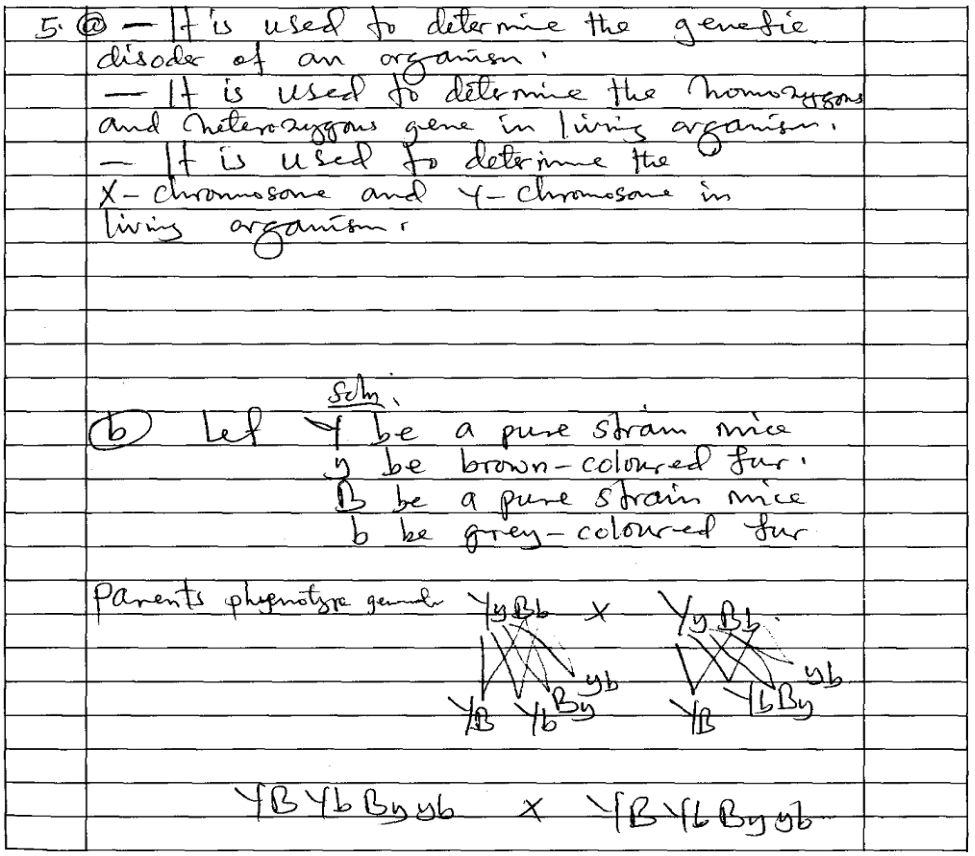
Extract 15.1 Continues

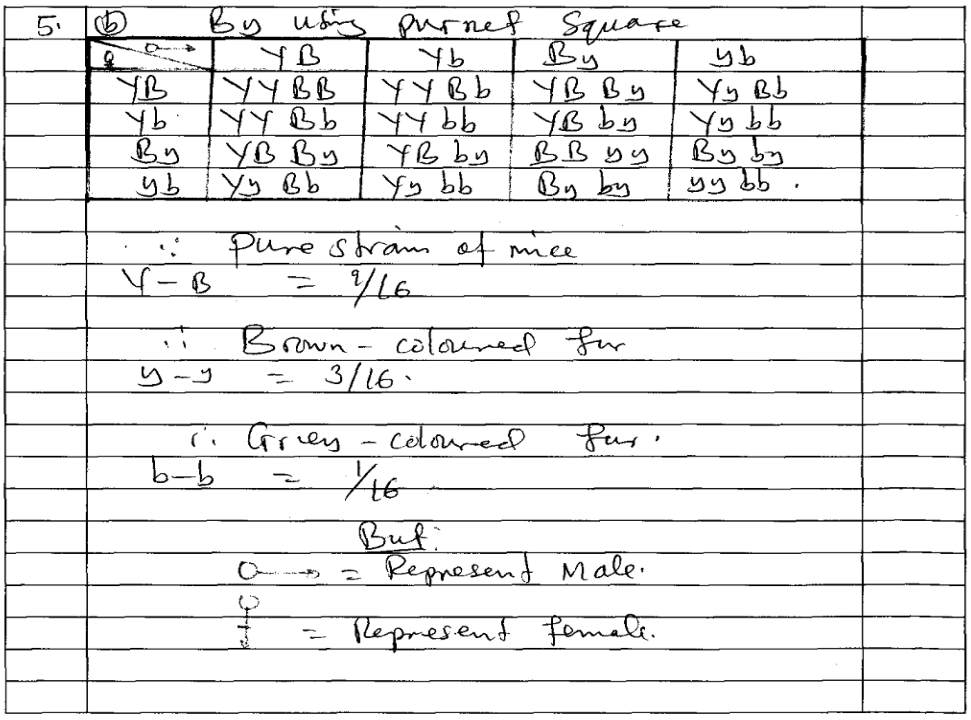


Extract 15.1 shows correct responses from a candidate who successfully gave merits of genetic engineering to human being. He/she correctly carried out genetic crosses to establish the 3 brown: 1 grey ratio formed when F1 brown-coloured mice are allowed to interbreed.

On the other hand, the candidates who scored below 7 marks gave unclear statements on the merits of genetic engineering. Some of them wrote statements such as: *used to prevent super wood in the farm, used to provide nitrous vitamins* in part (a). In part (b) of the question, some of the candidates incorrectly made genetic crosses to illustrate the ratio asked. However, most of them failed to follow the principles of writing genetic crosses. For example, some used two different letters to represent one character or carried out wrong crosses for the formation of either both F1 and F2 or one of it. Extract 15.2 is a sample of wrong responses from one of the candidates.

Extract 15.2





Extract 15.2 shows wrong responses from a candidate who failed to give the merits of genetic engineering to human being and used different letters (Y and B) to represent one character (colour) in the process of carrying out genetic crosses to illustrate the required results.

2.2.6 Question 6: Genetics

In this question, the candidates were provided with a diagram labelled Figure1 and were instructed to study it and answer questions that followed it.

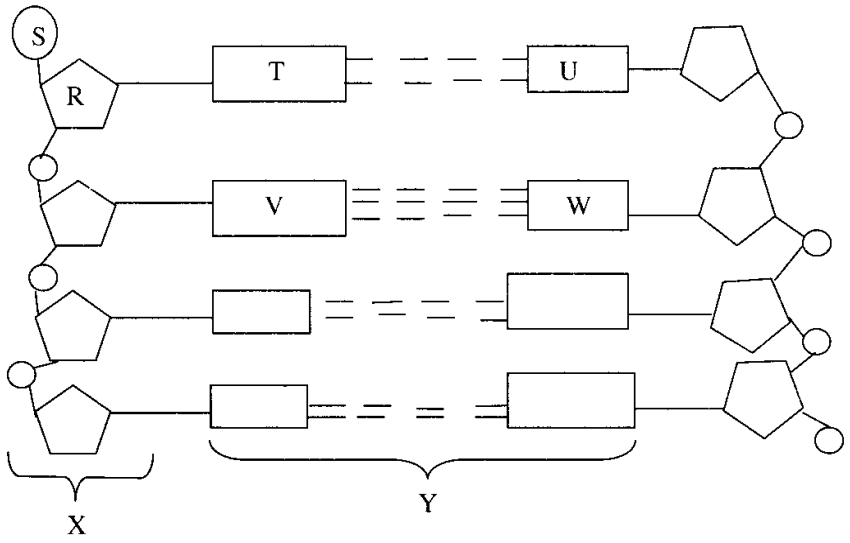


Figure 1

In part (a), the candidates were required to:

(i) name the structure represented by Figure 1

(ii) identify the structures represented by letters R, S, T, U, V, W, X and Z.

(iii) state the name given to both structures T and U.

(iv) state the name given to both structures V and W.

(v) name the bonds which help in the formation of the structure shown in Figure1.

In part (b), the candidates were required to enumerate five differences between deoxyribonucleic acid and ribonucleic acid. The data indicate that the question was opted for by 21,409 of the candidates (corresponding to 79.5 percent).

Analysis of the data shows that 54.9 percent of the candidates scored marks ranging from 11.5 to 20; 33.7 percent scored from 6.5 to 11.0 and 11.4 percent from 0 to 6.0 out of 20 marks allocated to the question. The performance in the question is summarized by Figure 16.

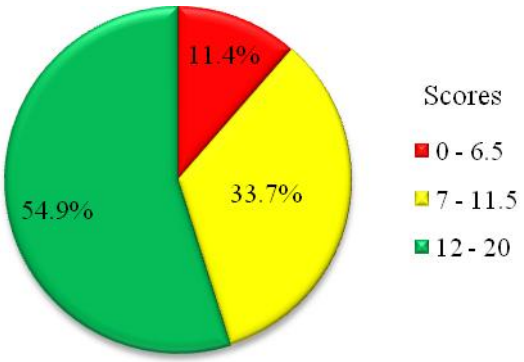


Figure 16: *The Candidates' Performance in Question 6.*

Figure 16 indicates that 88.6 percent of the candidates scored marks ranging from 7 to 20. This suggests that the general performance of the candidates in the question was good. Most of these candidates demonstrated good mastery of the knowledge areas of the topic of Genetics, particularly, DNA and RNA. Most of them identified structures given in Figure 1 of the question items and gave the differences between deoxyribonucleic acid and ribonucleic acid correctly. Extract 16.1 shows correct responses from one of such candidates.

Extract 16.1

06. (a) (i) DEOXYRIBONUCLEIC ACID (DNA) STRUCTURE (Polynucleotide)

(ii) R- Pentose sugar (Deoxyribose)
S- Phosphate group (Inorganic phosphate)
T- Adenine
U- Thymine
V- Guanine
W- Cytosine
X- Sugar-phosphate backbone of polynucleotide
Y- Complementary bases pairs

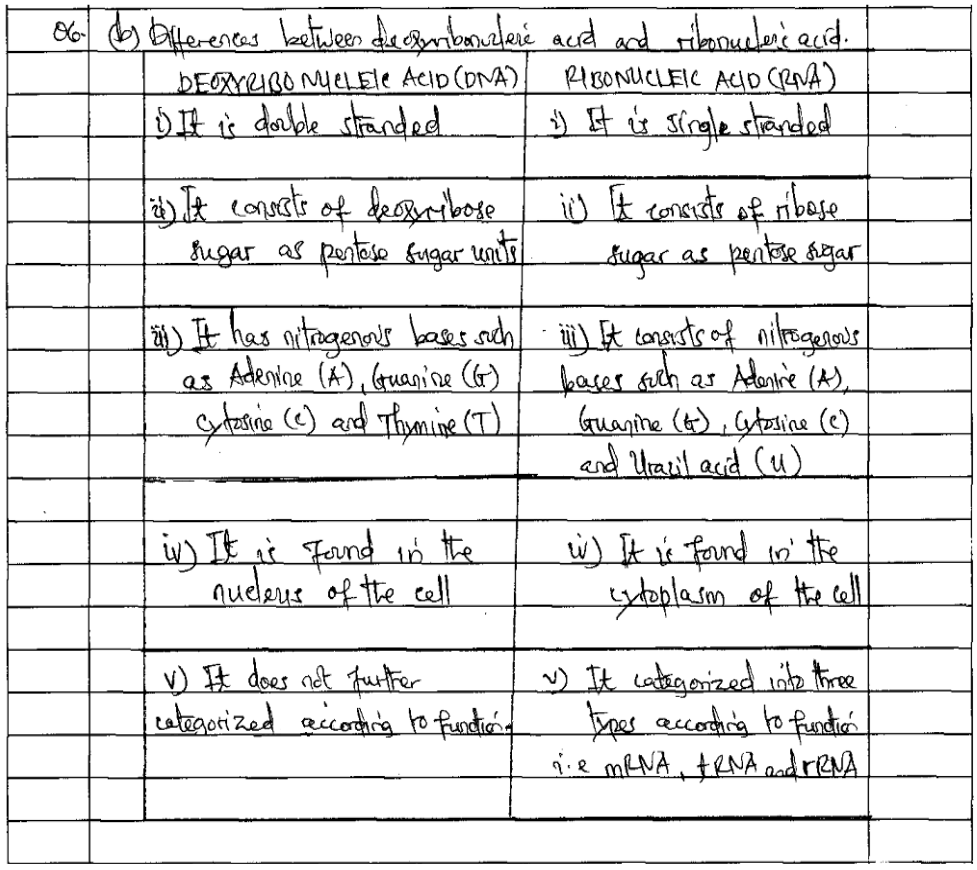
(iii) Nitrogenous bases i.e Adenine and Thymine

(iv) Nitrogenous bases i.e Guanine and Cytosine

(v) 1. HYDROGEN BONDS between complementary nitrogenous bases
2. PHOSPHODIESTER BOND between phosphate group and pentose sugar in polynucleotide chain

⇒ T(Adenine) and V(Guanine) are PURINES
⇒ U(Thymine) and W(Cytosine) are PYRIMIDINES

Extract 16.1 continues



06. (b) Differences between deoxyribonucleic acid and ribonucleic acid.

	DEOXYRIBONUCLEIC ACID (DNA)	RIBONUCLEIC ACID (RNA)
	i) It is double stranded	i) It is single stranded
	ii) It consists of deoxyribose sugar as pentose sugar units	ii) It consists of ribose sugar as pentose sugar
	iii) It has nitrogenous bases such as Adenine (A), Guanine (G) Cytosine (C) and Thymine (T)	iii) It consists of nitrogenous bases such as Adenine (A), Guanine (G), Cytosine (C) and Uracil acid (U)
	iv) It is found in the nucleus of the cell	iv) It is found in the cytoplasm of the cell
	v) It does not further categorized according to function	v) It categorized into three types according to function i.e mRNA, tRNA and rRNA

Extract 16.1 is a sample of responses from a candidate who correctly identified the structures given in Figure 1 of the question and gave correct differences between deoxyribonucleic acid and ribonucleic acid.

Most of the candidates who scored lower marks (0 to 6.5) failed to identify structures given in Figure 1 of the question. Most of them misspelled the required terms. For example, they wrote *adonine* instead of adenine, *cytocine* instead of cytosine, *thiamine* instead of thymine and *gunnine* instead guanine. In part (b), the candidates gave all or some incorrect differences between deoxyribonucleic acid and ribonucleic acid. Some of the incorrect responses were such as: *deoxyribonucleic acid consists of pentose sugar while ribonucleic acid consists of hexose sugar; deoxyribonucleic acid consists of phospholipids while ribonucleic acid consists of phosphodiester.* The responses signify that the candidates had scanty knowledge of Genetics, specifically, the types of nucleic acids. Extract 16.2 shows incorrect responses from one of such candidates.

Extract 16.2

06 (a) Is the structure of DNA

(i)

the letter	represent
R	Pentose sugar
S	Adenin
T	Guanin
U	Alanin
V	Uanin
W	Peptide bond
X	Hydrogen bond
Y	

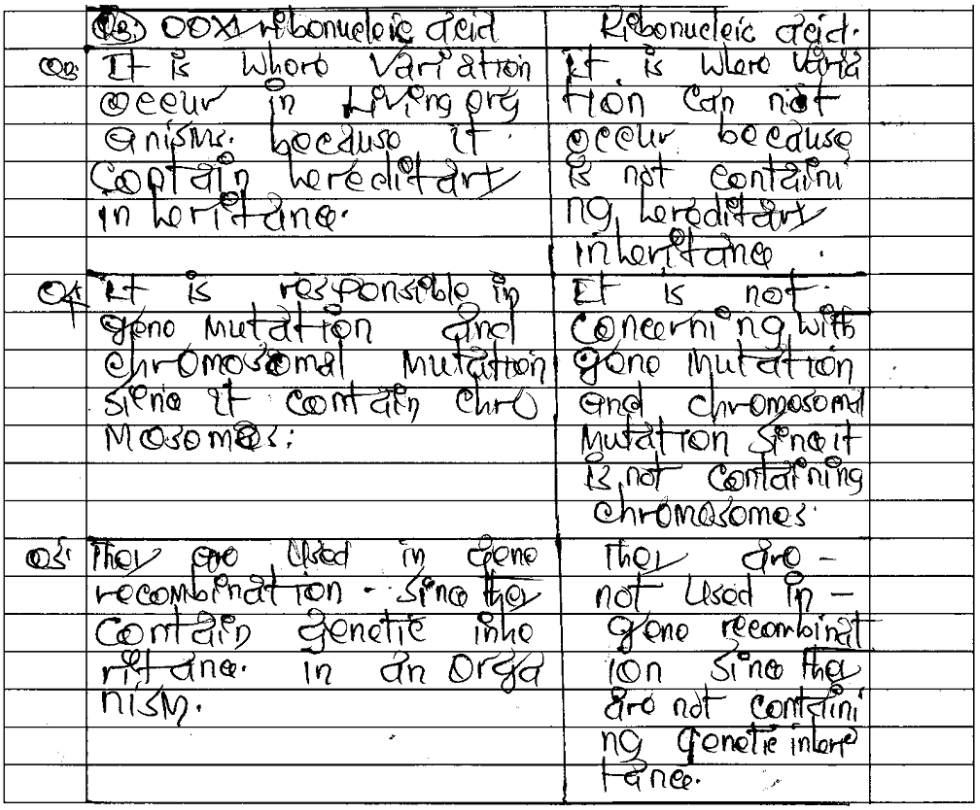
(ii) T and U are called Alanin in V and W are called Adenin.

(iii) Peptide bond and Hydrogen bond.

06 (b): The following are the five differences between Deoxyribonucleic acid and Ribonucleic acid.

Deoxyribonucleic acid	ribonucleic acid.
(i) It carry genetic material hence is responsible for genetic inheritance	It contain is not containing genetic material hence is not playing part in inheritance.
(ii) It is not responsible for protein synthesis in the body	It is responsible in protein synthesis in the body.

Extract 16.2 Continues



	(b) OOX nbonucleic acid	Ribonucleic acid.
(a)	It is where Variation occur in Living organisms. because it contain hereditary in heritance.	It is where Variation can not occur because is not containing hereditary inheritance.
(c)	It is responsible in gene mutation and chromosomal mutation since it contain chromosome;	It is not concerning with gene mutation and chromosomal Mutation since it is not containing chromosomes.
(d)	They are used in gene recombination. since they contain genetic inheritance. in an Organism.	They are not used in gene recombination since they are not containing genetic inheritance.

Extract 16.2 shows responses from a candidate who in part (a) misspelt some words. In part (b), he/she enumerated the roles of deoxyribonucleic acid and ribonucleic acid instead of their differences.

2.2.7 Question 7: Ecology

In this question, the candidates were instructed to clearly described nine procedures used to estimate population for each of the following methods:

(a) quadrant method

(b) capture-recapture method.

The analysis indicates that most of the candidates skipped the question, as only 2,153 of the candidates, constituting 8 percent attempted it. Further, data analysis shows that the majority of the candidates who opted for the question, (91.9%), scored marks ranging from 0 to 6.5; 8.1 percent scored from 12 to 20 marks and only a few, (6 percent), scored from 7 to 11.5. Figure 17 summarizes the performance of the candidates in the question.

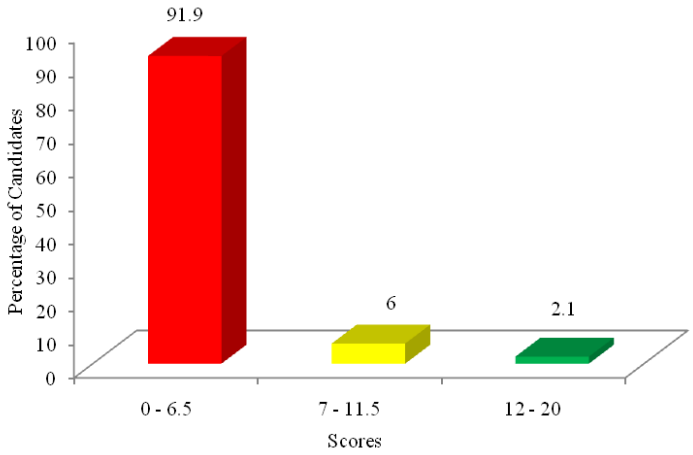


Figure17: *The Candidates' Performance in Question 7.*

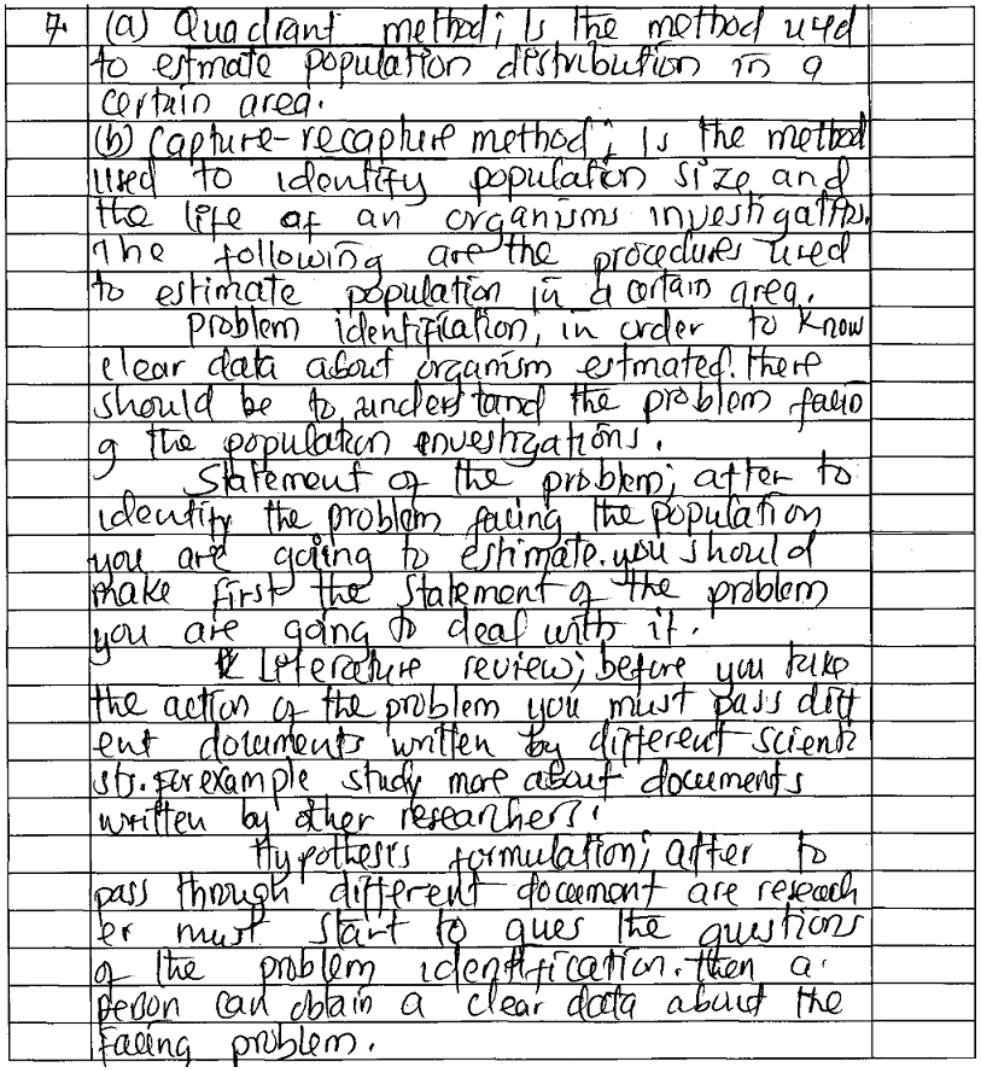
Figure 17 shows that 91.9 percent of the candidates scored marks below the pass range. Most of these candidates failed to give procedures required by the question. The responses given by most of these candidates were not in a correct sequence. Some failed to outline the correct procedures used to estimate the population by using the given methods. This shows that they had inadequate knowledge of the topic of Ecology, particularly, of the methods of population estimation as part of ecological study techniques. For example, one of the candidates wrote that, the procedure used in estimating population size using quadrant includes*: the square of equal length are prepared, organism are divided into equal sample, and organisms which are found within the quadrant will be as a sample to represent all organisms.* On the capture recapture method, some of the procedures written were:

> *Organism are estimated by using through this way for counting organism in a certain area, for example in national park, the counted organisms are marked then are allowed to interbreed for a certain time, after certain time they are counted then marked but already marked are not counted again, the end of the day both marked for the first with second are calculated to get estimation of population.*

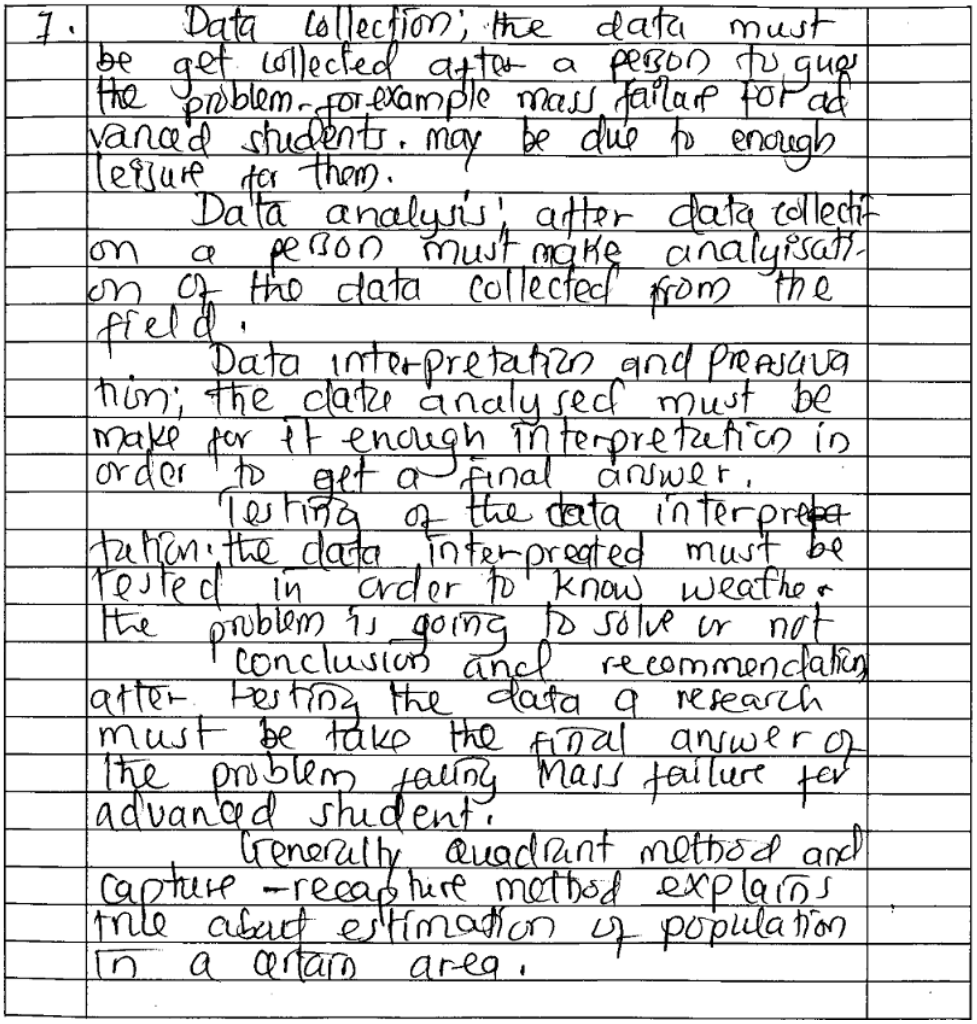
Other candidates did not meet the demand of the question going by how they outlined the steps of scientific investigation. They wrote things such as: *identification of the problem, formulation of the hypotheses, literature*

review, experimentation, data collection, data analysis and conclusion instead of describing the procedures used in estimating a population size using capture-recapture method. The majority of the candidates failed to arrange the outlined procedures in a chronological order. The candidates' failure in the question might be attributed to failure of teachers to cover the syllabus; considering that Ecology is the last topic in the syllabus and that the candidates do not usually take self-initiatives to cover it, or that the concept is not taught practically to enable candidates to internalize its respective contents. Extract 17.1 is a sample of the candidates' incorrect responses.

Extract 17.1


7. (a) Quadrant method; Is the method used to estmate population distribution in a certain area.
(b) Capture-recapture method; Is the method used to identify population size and the life of an organisms investigation. The following are the procedures used to estimate population in a certain area.
Problem identification, in order to know clear data about organism estmated. There should be to understand the problem facing the population enviestigations.
Statement of the problem; after to identify the problem facing the population you are going to estimate. you should make first the statement of the problem you are going to deal with it.
Literature review; before you take the action of the problem you must pass different documents written by different scientists. For example study more about documents written by other researchers.
Hypotheses formulation; after to pass through different document are research er must start to ques the questions of the problem identification. then a person can obtain a clear data about the facing problem.

Extract 17.1 Continues


7. Data collection; the data must be get collected after a person to give the problem. for example mass failure for advanced students. may be due to enough leisure for them.

Data analysis; after data collection a person must make analysisation of the data collected from the field.

Data interpretation and preasavation; the data analysed must be make for it enough interpretation in order to get a final answer.

Testing of the data interpretation; the data interpreted must be tested in order to know weather the problem is going to solve or not

Conclusion and recommendation after testing the data a research must be take the final answer of the problem saying mass failure for advanced student.

Generally quadrant method and capture-recapture method explains mle about estimation of population in a certain area.

Extract 17.1 shows responses from a candidate who described the scientific procedures instead of outlining the procedures used to estimate a population by quadrant and capture-recapture methods.

Despite the weak performance by the majority, a few candidates performed the question well. Such candidates described some or all of the nine procedures used to estimate population using quadrant and capture-recapture methods. Extract 17.2 shows correct responses from one of the candidates.

Extract 17.2

7. (a)

Quadrant method is the method/technique of sampling which is done by a special square like object in order to estimate the number/population of a given species in a particular Community/habitat. It involves a series of procedures such as the following

Identification of the area of interest, this must be done in order to prepare all the means of doing a sample at a particular area/place

Conducting a research at the area of interest this is also very important in order to know if there are any dangerous animals which can harm a person.

Planning a Course Work this must be done in order to minimize the time that might be consumed in doing Sampling.

Preparing the instruments and devices needed for the Sampling process in this case a quadrant, notebook, pen and other materials

Measuring the total area covered by the given species of a particular population in the habitat.

Throwing the quadrant in a particular direction within the habitat where the sampling of a population is done.

Counting the number of each particular species found in the quadrant separately in a notebook

After the Sampling the total number of each particular species is Calculated and mathematical analysis is Conducted for the number of times of the quadrant, the number of organisms and the area of the square of the quadrant.

Estimation is done by Comparing the area covered by a given species in a quadrant to the total area of the sampling where the estimation of the number population is obtained

Extract 17.2 Continues

7. (b)

Capture - recapture method is also one among the methods of estimating the population during the process of sampling which involves the Capturing of organisms, Counting them, marking them and releasing them for a short time before recapturing them again from the same population. It involves the following steps/procedures:

Identification of the area of interest. this is a very important procedures as it gives a person an awareness on the nature of the area and the distribution of the organism.

Identification of the Organism/species of interest in order to simplify the process of sampling.

Capturing of the Organisms of interest in the population, this may be done by sweep nets or any other capturing materials.

Counting the number of captured Organisms in order to record their number.

Marking the captured and Counted organisms and releasing them to their population in order to mix up for a certain period of time.

Recapturing on the organisms from the same population. after they have mixed themselves

Counting and recording of the total number of recaptured organisms on the second time.

Counting and recording the number of marked Organism. recaptured on the second time.

Finally estimation of the size of population is done through the general formula; $N = \frac{n_1 \times n_2}{n_3}$ Where by;

N = Is the total number (estimated) of the population

n_1 - Is the total number of organisms captured, marked, Counted and released.

n_2 - Is the total number of Organisms recaptured on the second time

n_3 - Is the total number of organisms marked recaptured on the second time.

Extract 17.2 is a sample of responses from a candidate who described the procedures required to estimate population size using quadrant and capture-recapture methods.

2.2.8 Question 8: Evolution

In part (a) of the question, the candidates' were instructed to explain the Lamarck's Theory of Evolution. In part (b), they were asked to explain why almost all modern biologists reject the Lamarck's Theory of Evolution. This question was attempted by 25,546 candidates (corresponding to 94.9 percent).

The candidates' performance was good, as 78.4 percent scored marks ranging from 7 to 20 out of 20 marks allotted to the question. However, 21.6 percent scored below the pass mark (0 to 6.5). Figure 18 summarizes the performance of the candidates' in the question.

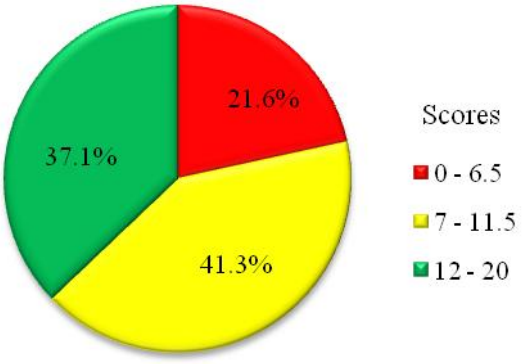


Figure 18: *The Candidates' Performance in Question 8.*

Figure 18 shows that the candidates' performance in the question was good (since 78.4 percent scored above the pass range). The candidates who scored high marks in the question had good mastery of the contents of the topic of Evolution, particularly, the theories of evolution. Most of such candidates correctly explained Lamarck's Theory of Evolution in part (a). In part (b), the majority of the candidates clearly explained why almost all modern biologists reject the Lamarck's Theory of Evolution. Extract 18.1 is a sample of correct responses from one of the candidates.

Extract 18.1

8 @ Lamark's theory of evolution can be divide into three ideas (subtheory) which are ; Theory of need; Law of use and disuse and inheritance of acquired characters:

Theory of need. According to Lamark an environment creates a need which requie the organisms to adapt with respect to the change in environment. If the organism fails to adapt it will be perished out and those who show better adaptation will survive and reproduce. For example the environ-ment may create a need which is lack of food on land therefore the organisms must adapt for life in water those which will fail to adapt will die and the better adapted will survive and reproduce.

Another theory is the theory of use and disuse. According to Lamark the body organ which is continously used will be strong while the one that is not continously used will be weaker and at last it will dissapea This may be seen to the long-necked giraffes where after continously stretching of their necks and forelimbs searching for food on higher plants led them to develop a long neck.

Last theory as stated by Lamark is Inheritance of acquired characters in which the characters obtained by an organism in the course of time are transmitted from

Extract 18.1 Continues

one generation to another. This can be illustrated by the presence of long-necked giraffes which indicates that the acquired characters are inherited from the ancestors to the current giraffes

(b) Almost all modern biologists reject Lamarck's theory of evolution due to the following reasons:

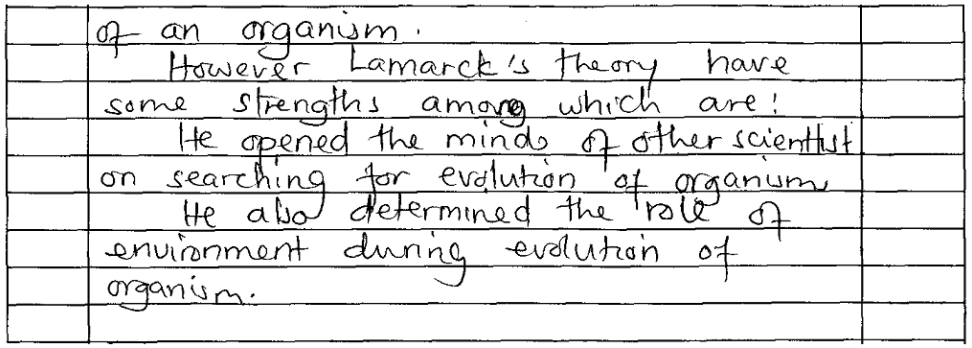
Lamarck's theory did not distinguish between inhentable and non-inheritable characters. Lamarck's theory did not explain about what is inhentable or what are not inheritable characters that can or can not be transferred from one generation to another

Also Lamarck's theory did not explain about role of genetic in variation ie recombination and mutation.

Also the use or disuse of an organ of the body does not explain about its existance or disappearance. This also disqualify the Lamarck theory of use or disuse of body organs.

After the experiment done on mice after cutting their tails and the next generation had long tails it was revealed that acquired characters can nd be inherited from generation to generation since they do not affect the genotype

Extract 18.1 Continues

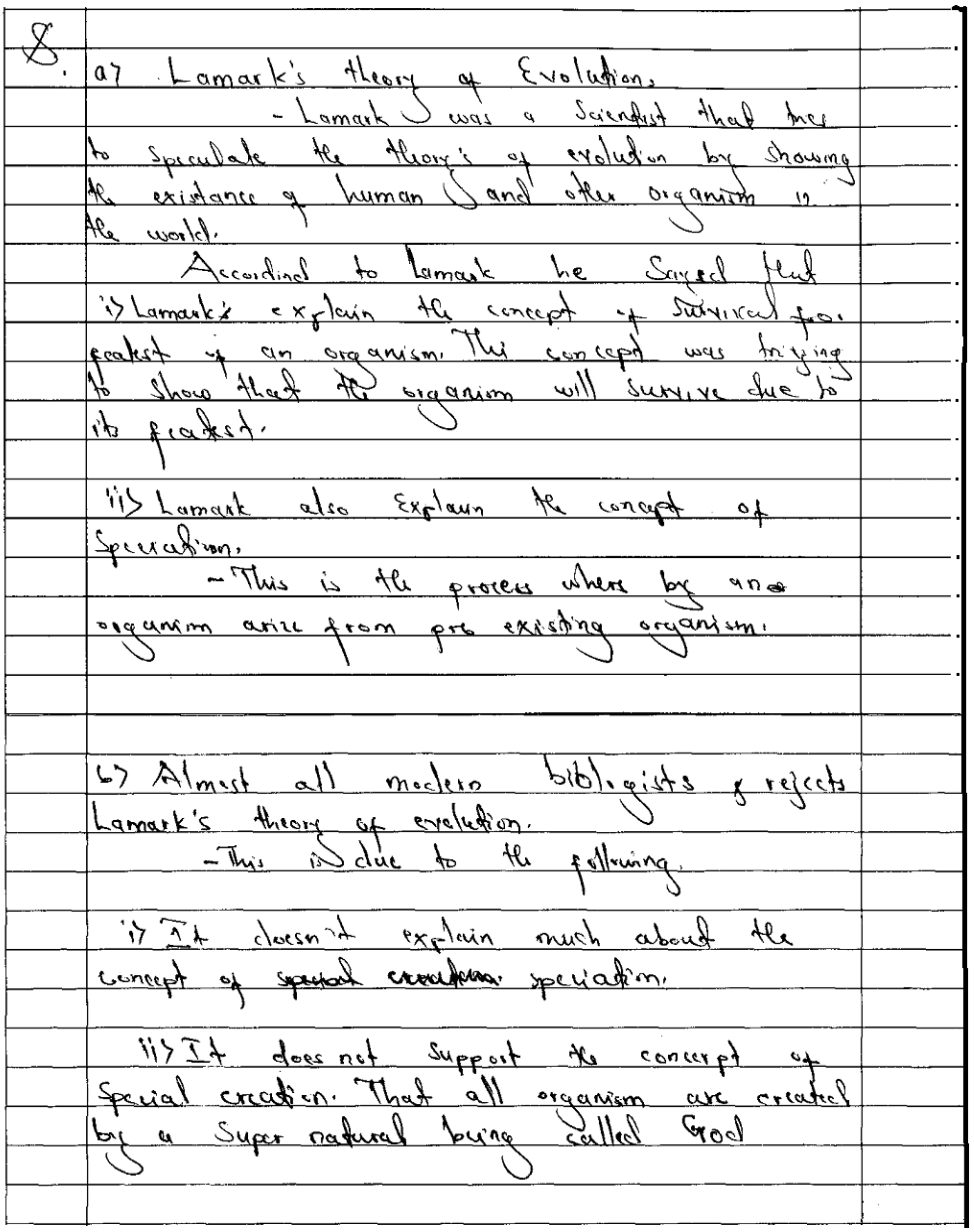

of an organism.
However Lamarck's theory have some strengths among which are!
He opened the minds of other scientist on searching for evolution of organism.
He also determined the role of environment during evolution of organism.

Extract 18.1 is a sample of correct responses from a candidate who correctly explained the Lamarck's Theory of Evolution and the reasons which make almost all modern biologists to reject the theory.

In addition, observations from the candidates' responses reveal that the candidates who scored average marks (from 7 to 11), explained the Lamarck's Theory of Evolution, but failed to exhaust all the required points in explaining why almost all modern biologists reject the Lamarck's Theory of Evolution, or vice-versa.

Furthermore, some of the candidates who scored from 0 to 6.5 marks demonstrated weak mastery of content knowledge of Evolution. Most of them mentioned only a few of the required points in explaining the Lamarck's Theory of Evolution in part (a). A few of the candidates appeared to have missed the demand of the question, going by their answers on the theories of origin of life such as, *special creation, spontaneous generation, steady state, cosmozoan, biochemical evolution (naturalist theory)* instead of the Lamarck's Theory of Evolution. In part (b), most of the candidates failed to explain correctly why almost all modern biologists rejected Lamarck's Theory of Evolution. Some of them wrote: *it does not explain much about the concept of speciation, it does not support the concept of special creation, he didn't show what are the types of variation are.* Some of the candidates gave statements such as: *Lamarck's theory protests the scientist to investigate, it did say about the environment, it was not actually provide.* The statements do not only indicate candidates' poor mastery of the content matter, but also the poor mastery of the English Language. Extract 18.2 is a sample of wrong responses from one of the candidates.

Extract 18.2



8. a) Lamark's theory of Evolution.

- Lamark was a Scientist that tries to speculate the theory's of evolution by showing the existance of human and other organism in the world.

According to lamark he Suyed that

i) Lamark's explain the concept of Survival for. fastest of an organism. This concept was trying to show that the organism will survive due to its fastest.

ii) Lamark also Explain the concept of Speciation.

- This is the process where by an organism arise from pre existing organism.

b) Almost all modern biologists rejects Lamark's theory of evolution.

- This is due to the following.

i) It doesn't explain much about the concept of ~~special creation~~ speciation.

ii) It does not support the concept of Special creation. That all organism are created by a Super natural being called God

Extract 18.2 shows incorrect responses from a candidate who explained the concept of survival of the fittest which was put forward by Darwin instead of Lamarck's Theory of Evolution. He/she also incorrectly explained why almost all modern biologists reject Lamarck's Theory of Evolution.

3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH TOPIC

The analysis of the candidates' performance in different topics indicates that 10, out of 13 topics, which were tested in Biology paper one and two, had good performance. One topic had an average performance while two had weak performances. The topics that had good performances are: *Principles of Classification* (95.2%), *Genetics* (88.65%), *Regulation/Homeostasis* (87.5%), *Comparative Studies of Natural Groups of Organisms* (81.9%), *Evolution* (78.4%), *Growth and Development* (77.3%), *Coordination* (72.1%), *Cytology* (68.5%), *Nutrition* (65.4%), *Gaseous Exchange and Respiration* (62.1%). The topic that had an average performance was *Reproduction* (41.9%). *Transportation* and *Ecology* had weak performances of 23.8 and 8.1 percent, respectively, the latter being extremely weak. Appendix 1 summarizes the candidates' performance in different topics in the 2018 ACSEE while, Appendix 2 compares the performances between the year 2017 and 2018. In the appendices, the performance in each topic is shown to be weak with red colour, average with yellow colour and good with green colour. This is if the percentage of the candidates scored from 35 percent or above of the marks allocated to the respective question lies in the ranges of 0 to 34, 35 to 59 or 60 to 100, respectively.

4.0 CONCLUSION

The analysis of the Candidates' Item Response in this report shows that the performance of the candidates in Biology ACSEE 2018 was generally good, (as 96.98 percent passed the examination). The analysis shows that the good performance was caused by factors such as the candidates' competence in most topics, good understanding of question's demands and good drawing skills.

Despite the good performance in Biology, the analysis shows that only a few of the candidates scored all the marks allotted to the respective questions. Majority of the candidates were able to give some correct points in some parts of the questions. That is, most of the candidates either provided fewer responses than the required or lacked details that could have attracted full marks.

Factors thought to have contributed to the candidates' weak performance include:

(a) candidates' scanty or lack of competencies in some Biology topics in the ACSEE syllabus, making them to write fewer points than expected or giving undetailed information. This might be due to:
    (i) failure of some teachers or candidates to cover all topics in ACSEE Biology syllabus, especially the last topics such as Ecology; which was attempted by only a few candidates, yet portrayed weak performance
    (ii) the tendency of students' to cram, instead of comprehending the content matter of the subject
    (iii) poor concentration while revising; leading to the failure to internalise the subject matter
    (iv) lack of self-evaluation through quizzes, tests and examinations to enable them to do self-rectification in areas in which they have learning weaknesses

(b) failure of the candidates to read questions carefully to understand their demand before attempting them

(c) inability of some candidates to spell some words correctly. Thus, distorting the intended meaning of some sentences

(d) little skills in drawing caused by the lack of drawing practices.

5.0 RECOMMENDATIONS

Based on the information from this analysis of the candidates' performance, the following recommendations are put forward:

(a) in order to ensure that candidates acquire enough competencies to pass the examination, the following should be done:

(i) teachers and candidates should ensure that they cover on time all topics stipulated in ACSEE syllabus

(ii) candidates need to pay more attention to their studies to be able to internalise the subject content

(iii) candidates need to do self-evaluation through quizzes, homework and school examinations in order to master the subject

(iv) teachers need to continue teaching all topics by practical demonstrations wherever necessary, especially the topic of Ecology which has shown weak performance for two consecutive years: 2017 and 2018. Practical as hands on activity, helps candidates to internalise content matter. There is a say which go as that "I hear I forget, I see I remember and I do I understand"

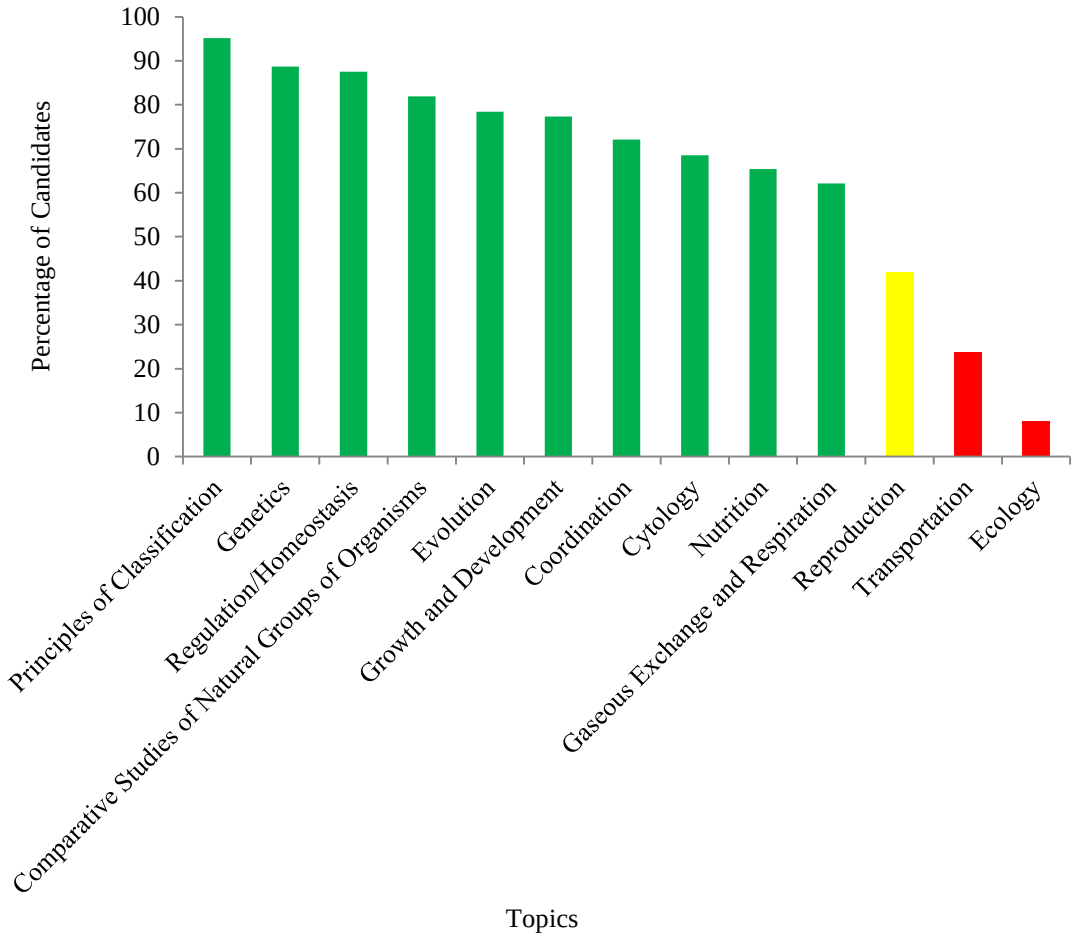
(b) candidates need to read questions between the lines, and go through them two or three times to ensure that they clearly comprehend the requirement of each question before attempting them

(c) candidates need to develop the ability to spell some words correctly. This can be achieved through practicing writing the difficult words from time to time. In addition, they need to develop a habit of reading subject and non-subject books

(d) candidates need to practice drawing diagrams which seem to be hard to draw.

Appendix A

The Candidates' Performance in 2018 ACSEE by Topic



Appendix B

Comparison of the Candidates' Performance in 133 Biology ACSEE between 2017 and 2018 by topic

S/N	Topic	2017		2018		
		No of Question	Percentage of Candidates who Scored an Average of 35 Percent or Above	No of Question	Percentage of Candidates who Scored an Average of 35 Percent or Above	Remarks
1.	Principles of Classification	1	82.4	1	95.2	Good
2.	Genetics	2	72.2	2	88.7	Good
3.	Regulation/Homeostasis	1	73.2	1	87.5	Good
4.	Comparative Studies of Natural Groups of Organisms	2	74	2	81.9	Good
5.	Evolution	1	92.8	1	78.4	Good
6.	Growth and Development	1	78.4	1	77.3	Good
7.	Coordination	1	82.2	1	72.1	Good
8.	Cytology	4	57.93	3	68.5	Good
9.	Nutrition	1	73	1	65.4	Good
10.	Gaseous Exchange and Respiration			1	62.1	Good
11.	Reproduction	1	23.7	1	41.9	Average
12.	Transportation	2	41.1	1	23.8	Weak
13.	Ecology	1	6.3	1	8.1	Weak