



THE UNITED REPUBLIC OF TANZANIA
MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY
NATIONAL EXAMINATIONS COUNCIL OF TANZANIA



**CANDIDATES' ITEM RESPONSE ANALYSIS
REPORT ON THE CERTIFICATE OF SECONDARY
EDUCATION EXAMINATION (CSEE) 2021**

BIOLOGY



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033 BIOLOGY

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FOREWORD

The National Examinations Council of Tanzania (NECTA) is pleased to issue the Candidates' Item Response Analysis (CIRA) report on the Biology subject for Certificate of Secondary Education Examination (CSEE), 2021. The CSEE is a summative evaluation which marks the end of the four years of secondary education. This evaluation among other things, evaluates the knowledge and skills acquired by the candidates in their ordinary secondary education. This report provides feedback to students, teachers, parents, policy makers and the public in general on the performance of the candidates in Biology subject.

Generally, the analysis shows that the candidates' performance in the CSEE Biology subject was good because 325,656 (67.23%) candidates passed the examination. Furthermore, the analysis indicates that in 033/1 Biology 1 candidates performed well in questions 1 and 15. The questions with average performance were 2, 3, 4, 11 and 13. However, candidates had weak performance in questions 5, 6, 7, 8, 9, 10, 12 and 14. In 033/2 Biology 2 question 1 had weak performance while question 2 had average performance. The good performance of candidates to some questions was attributed to the ability of the candidates to understand the demands of the questions, adequate knowledge about the assessed topics and good mastery of the English language. It was established that factors such as failure to understand the demands of the questions, lack of adequate knowledge in the respective topics and poor proficiency in the English language contributed to weak performance in some of the topics.

The feedback provided in this report will help decision makers to devise some mechanisms so as to improve candidates' performance in future Biology examinations administered by the Council.

Finally, the Council would like to express its gratitude to everyone who directly or indirectly participated in the preparation of this report.



Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report presents an analysis of Candidates Item Responses (CIRA) for the Certificate of Secondary Education Examination (CSEE) in Biology subject which was held in November 2021. The examination paper comprised questions which aimed to measure candidates' competencies on the content stipulated in the 2005 Biology syllabus, reprinted in 2012. The CSEE Biology paper was set in accordance with the NECTA format issued in 2019.

The Biology subject examination consisted of two papers, namely 033/1 Biology 1 (Theory Paper) and 033/2 Biology 2 (Actual Practical Paper). The theory paper consisted of fifteen questions, distributed in sections A, B and C contributing a total of 100 marks. The practical paper had three (3) alternative papers; 033/2A Biology 2A, 033/2B Biology 2B and 033/2C Biology 2C. Each alternative paper consisted of two structured questions, each weighing 25 marks, thus making a total of 50 marks.

A total of 501,029 candidates were registered for this examination, of whom 487,446 sat for it. Among them, 325,656 (67.23%) passed. Generally, the performance in this subject was good. The candidates' performance in grades is as follows: A – 12,431, B – 24,832, C – 118,492 and D – 169,901. However, 158,741 candidates failed by scoring F. The performance in the CSEE 2021 has increased by 12.07 per cent compared to CSEE 2020 Biology where 240,285 (55.16%) candidates passed.

The next part analyses the performance of the candidates on each question in 033/1 Biology 1 (Theory Paper) and 033/2 Biology 2 (Actual Practical Paper).

2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH QUESTION IN 033/1 - BIOLOGY 1

The analysis was based on describing the demand of the question and candidates' responses. It also highlights misconceptions observed on candidates' responses and spots some possible reasons for the observed misconceptions. The samples of the candidates' responses were inserted as extracts to illustrate correct and incorrect responses. In addition, some charts and graphs were used to illustrate candidates' performance in each question.

Three levels were used to present the performance of the candidates in each question. The performance was considered to be good, average or weak if the percentage of the candidates who scored 30 percent or more of the marks allocated in a question fell within the range of 65 to 100, 30 to 64, and 0 to 29, respectively. In addition, green, yellow and red colours have been used in charts and appendices to indicate good, average and poor performance, respectively.

2.1 SECTION A: Objective Questions

The section consisted of questions 1 and 2, which were multiple choice items and matching items, respectively. The candidates were instructed to answer both questions.

2.1.1 Question 1: Multiple Choice Items

The question consisted of 10 multiple choice items. The candidates were instructed to choose the correct answer from among the given five alternatives and write its letter besides the item number in the answer booklet provided. The items were set from 10 topics, namely; Gaseous Exchange and Respiration, Introduction to Biology, Safety in Our Environment, Cell Structure and Organisation, Nutrition, Coordination, Growth, Classification of Living Things, Balance of Nature and Transport of Materials in Living Things.

The analysis of candidates' performance indicates that, out of 487,390 candidates who attempted this question, 116,096 (23.82%) scored from 0 to 2, out of which 11,951 (2.45%) scored 0 out of 10 marks allocated to this question. The candidates who scored from 3 to 6 marks were 274,888 (56.40%) whereas 96,406 (19.78%) scored from 7 to 10 marks, as shown in Figure 1.

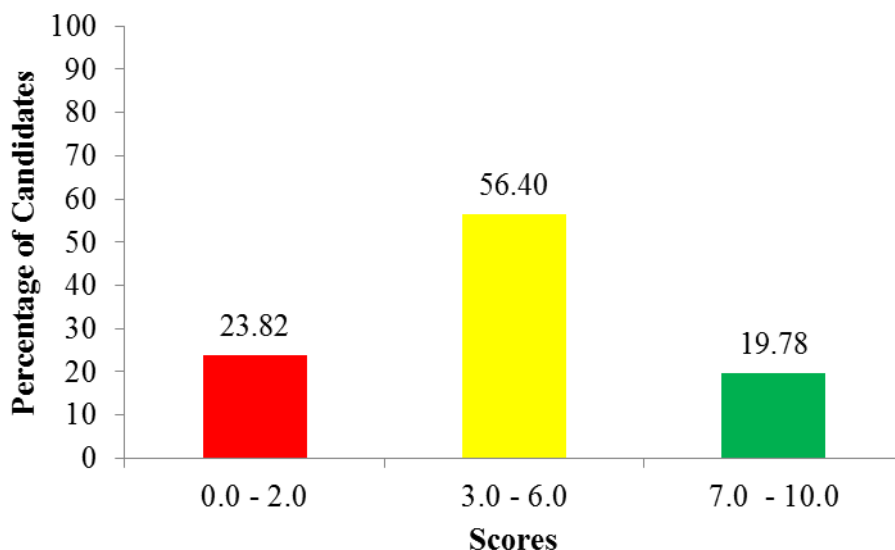


Figure 1: *Candidates' Performance in Question 1*

Figure 1 shows that 76.18 per cent of the candidates scored from 3 to 10 marks. This suggests that the general performance in this question was good. The analysis shows that out of 371,294 (76.18%) candidates, only 4850 (0.99%) provided correct responses in all parts of the question, thus scored all the ten marks. This indicates that these candidates had adequate knowledge of the tested topics. The following is the analysis of candidates' responses in each item.

Item (i) *Which respiratory surface is used for gaseous exchange in tadpoles?*

- | | | |
|--------------------|--------------------|----------------|
| <i>A Spiracles</i> | <i>B Gills</i> | <i>C Lungs</i> |
| <i>D Skin</i> | <i>E Book lung</i> | |

The correct response for this item was alternative *B, Gills*. The candidates who chose the correct response were aware that tadpoles are aquatic larva of an amphibian (frog or toad) which respire by using gills until the later stages of its development. The candidates who chose *A, Spiracles* were not aware that spiracles are tubes in insects which allow air to enter the tubes called tracheal tubes. Those who chose *C, Lungs* and *D, Skin* did not understand that lungs are used for gaseous exchange by both adult frogs and mammals and skin is used by adult frogs only. Similarly, those who chose *E, Book lung* failed to understand that *Book lung* is a respiratory surface used by spiders.

Item (ii) *Which of the following apparatuses are used for magnifying specimens?*

- A Hand lens and petri dish*
- B Hand lens and watch glass*
- C Microscope and watch glass*
- D Microscope and hand lens*
- E Measuring cylinder and beaker*

The correct response for this item was alternative *D, Microscope and hand lens*. The candidates who chose the correct response were familiar with the common apparatus and equipment of biology laboratory and their uses. Those who chose *A, Hand lens and petri dish* and *B, Hand lens and watch glass* failed to understand that hand lens is used to magnify specimens but petri dish is used for growing microorganisms or keeping specimens and watch glass is used as an evaporating surface or cover for beakers. On the other hand, those who chose *E, Measuring cylinder and beaker* did not understand that measuring cylinder is used for measuring volume of liquids while beaker is used for mixing substances or measuring liquids.

Item (iii) *Which safety precaution should be taken when administering First Aid to a wounded person?*

- A Washing hands with soap*
- B Wearing protective gloves*
- C Calling the ambulance for pick-up*
- D Washing the wound with soap*
- E Drying the wound with clean cloth*

The correct response for this item was alternative *B, Wearing protective gloves*. The candidates who chose the correct response were aware of the risks and safety precautions to be taken when administering First Aid to wounded persons. Those who chose *A, Washing hand with soap*, failed to realize that this is done after administering First Aid. Those who chose *C, Calling the ambulance for pick-up* failed to understand that this is the last step taken to help the victim for further treatment. On the other hand, those who chose *D, Washing the wound with soap* and *E, Drying the wound with clean cloth*, did not understand that these are procedures of First Aid to a wounded person and they are not safety precautions.

Item (iv) *The following are the characteristics of prokaryotes except*

- A *have nuclear materials.*
- B *they are microscopic.*
- C *have nuclear membrane.*
- D *have cell wall.*
- E *they are single celled organisms.*

The correct response for this item was C, *have nuclear membrane*. The candidates who responded correctly to this item had adequate knowledge of the characteristics of prokaryotic cells that they have nucleus which is not bounded by a nuclear membrane. Those who chose A, *have nuclear materials*, B, *they are microscopic*, D, *have cell wall* and E, *they are single celled organisms* did not understand that these are the characteristics of prokaryotes.

Item (v) *Which of the following are end products of digestion when lipids are digested completely?*

- A *Glucose and fructose*
- B *Fatty acids and glucose*
- C *Amino acids and fructose*
- D *Glucose and glycerol*
- E *Fatty acids and glycerol*

The correct response for this item was E, *Fatty acids and glycerol*. The candidates who responded correctly had adequate knowledge of the end products of digestion of foods. Therefore, they could identify fatty acids and glycerol as the end products of digestion of lipids. Those who chose A, *Glucose and fructose* failed to understand that these are the end products of digestion of carbohydrate. Those who chose B, *Fatty acids and glucose*, C, *Amino acids and fructose* and D, *glucose and glycerol* failed to realize that fatty acids and glycerol are the end products of digestion of lipid, glucose and fructose are the end products of digestion of carbohydrate while amino acid is the end product of digestion of protein.

Item (vi) *What happens when a person moves from a bright lighted to a dim lighted room?*

- A *Pupil becomes large*
- B *Pupil becomes small*
- C *Circular muscles contract*
- D *Radial muscles relax*
- E *Radial and circular muscles relax*

The correct response for this item was A, *Pupil becomes large*. Candidates who responded correctly to this item demonstrated adequate knowledge of the functions of the iris in controlling the amount of light entering the eye. They understood that in dimlight, the radial muscles of the iris contract and the pupil widens. Those who selected B, *Pupil becomes small* failed to understand that in dimlight the radial muscles of the iris contract and the pupil widens. Similarly, those who selected C, *circular muscles contract*, D, *radial muscles relax* and E, *radial and circular muscles relax* failed to recognize that in dim light the radial muscles contract while the circular muscles relax.

Item (vii) *Which of the following set of conditions is necessary for seed germination?*

- A *Temperature, soil and water*
- B *Water and carbon dioxide*
- C *Water, temperature and oxygen*
- D *Water, temperature and food*
- E *Soil, oxygen and water*

The correct response for this item was C, *Water, temperature and oxygen*. The candidates who selected the correct response were familiar with the conditions necessary for seed germination. They understood that, water softens the testa and it is a solvent for enzymes, optimum temperature promotes enzymatic reactions in the seed and oxygen is used for respiration in the germinating seed in order to generate energy for cell division and transport of food to growing regions. Those who selected A, *Temperature, soil and water* and E, *Soil, oxygen and water* did not recognize soil is not among the necessary conditions for seed germination. Likewise, those who selected B, *Water and carbon dioxide* failed to recognize that carbon dioxide is produced during respiration in a germinating seed. On the other hand,

those who chose *D, Water, temperature and food* failed to realize that food stored in the seed is a factor for seed viability and not germination.

Item (viii) *The laboratory technician investigated the faeces of a patient and found organisms with flattened segmented bodies. What is the name of the organisms?*

- A Tapeworms B Roundworms C Liver flukes*
D Filarial worms E Planaria

The correct response for this item was *A, Tapeworms*. The candidates who selected the correct response had clear understanding of the distinctive features of members in the Phyla of Kingdom Animalia. Thus, they could identify tapeworms as the organisms with flattened segmented bodies. Those who chose the responses *B, Roundworms* and *D, Filarial worms* did not realize that these worms are round and tapered at both ends. Those who chose *C, Liver flukes* did not understand that these are dorso-ventrally flattened. Those who chose *E, Planaria* did not realize that planaria are flat worms, but they are free-living.

Item (ix) *The following balanced habitat contains grasses, wildebeests, lions and bacteria. What would happen if lions were removed?*

- A The number of bacteria would remain the same*
B The number of wildebeests would decrease
C The amount of grasses would decrease
D The amount of grasses would increase
E The number of wildebeests would increase

The correct response for this item was *E, The number of wildebeests would increase*. The candidates who selected the correct response were familiar with the feeding relationship in food chain and food web. As a result, they realized that lions feed on wildebeests, so the decrease in number of lions will increase the number of wildebeests. Those who chose *A, The number of bacteria would remain the same* were not aware that bacteria are decomposers. Those who chose *B, The number of wildebeests would decrease* failed to recognize that the removal of lions results into increase in number of wildebeests because no predator to prey on them. Those who chose *C, The amount of grasses would decrease* and *D, The amount of grasses would increase* failed to recognize that the removal of lions has no

direct relationship with the grasses since lions feed on wildebeest and not grasses.

Item (x) *What will happen if phloem tissue is destroyed in green plants?*

- A Absorption of water in the plant body will stop*
- B Absorption of mineral salts will stop*
- C Transport of water and manufactured food will stop*
- D Transport of manufactured food will stop*
- E Transport of oxygen in the plant body will stop*

The correct response for this item was *D, Transport of manufactured food will stop*. The candidates who correctly responded to this item had adequate knowledge on the functions of vascular tissues in plants. They understood that translocation of manufactured food substance from the leaves to all parts of the plant occurs through phloem. Those who chose *A, Absorption of water in the plant body will stop* and *B, Absorption of mineral salts will stop* did not understand that the absorption of water with dissolved mineral salts occurs through root hairs and enter the plant through xylem. Those who chose *C, Transport of water and manufactured food will stop* failed to understand that water and manufactured food are transported by xylem and phloem tissues, respectively. On the other hand, those who chose *E, Transport of oxygen in the plant body will stop* did not understand that oxygen leaves or enters the leaf by diffusion through stomata.

2.1.2 Question 2: Introduction to Biology

The question comprised five matching items. This question required the candidates to match the descriptions of the parts of heart in **List A** with corresponding part in **List B** by writing the letter of the correct response beside the item number in the answer booklet provided.

<i>List A</i>		<i>List B</i>
(i)	<i>A chamber of the heart has relatively thick walls.</i>	A Auricle B Aorta
(ii)	<i>A valve that prevents the back flow of blood from the right ventricle to the right auricle.</i>	C Bicuspid D Myocardium
(iii)	<i>A valve that prevents the back flow of blood from the pulmonary artery to the right ventricle.</i>	E Semilunar F Septum
(iv)	<i>A tissue that separates left and right chambers of the heart.</i>	G Tricuspid H Ventricle
(v)	<i>A chamber of the heart which has relatively thin walls.</i>	

The analysis of candidates' performance shows that, out of 487,390 (100%) candidates who attempted this question, 254,369 (52.19%) scored from 0 to 1 mark, out of which 142,334 (29.20%) scored 0 out of 5 marks allocated to this question. The candidates who scored from 2 to 3 marks were 151,529 (31.09%), whereas 81,492 (16.72%) scored from 4 to 5 marks, as shown in Figure 2.

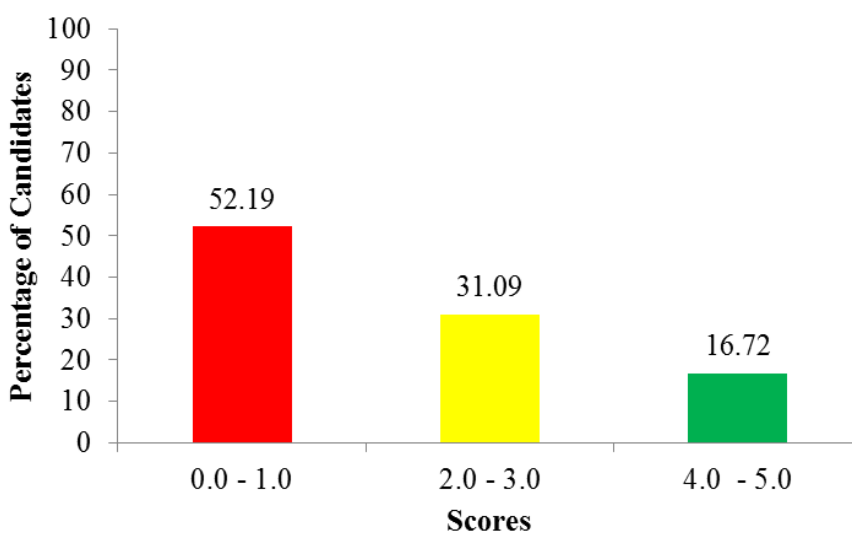


Figure 2: *Candidates' Performance in Question 2*

In view of Figure 2, the general performance of candidates in this question was average because 47.81 per cent scored from 2 to 5 marks. Candidates' average performance on this question was attributed to their moderate knowledge of the concepts tested which enabled them to correctly match some of the items given. Despite the average performance, 16.72 per cent of the candidates scored from 4 to 5 marks, which is a good performance. Further analysis shows that out of 81,492 (16.72%) candidates, only 32,287 (6.60%) scored all the five marks. This indicates that the candidates had sufficient knowledge of the tested concepts. Extract 1.1 is a sample of the candidate's correct responses.

I	LI.1 A	I	II	III	IV	V	
	LI.1 B	H	G	E	F	A	

Extract 1.1: Candidate's correct response to question 2

Extract 1.1 shows a response from one of the candidates who matched all the items correctly, thus scored all the marks.

Further analysis shows that 254,369 (52.19%) candidates provided incorrect responses, hence scored 0 – 1 mark. These candidates demonstrated lack of knowledge or had insufficient knowledge on the tested concepts. The analysis of the candidates' responses in each item is presented as follows:

Item (i) required the candidates to select a response which correctly matches the description of a chamber of the heart which has relatively thick walls. The correct answer was *H, Ventricle*. Some of the candidates selected alternative *A, Auricle*. These candidates failed to understand that ventricles have thick walls since they pump blood to greater distances than auricles.

Item (ii) required the candidates to select a response which correctly matches the description of a valve that prevents the back flow of blood from the right ventricle to the right auricle. The correct answer was *G, Tricuspid*. The candidates who matched it correctly had adequate knowledge of the parts of the mammalian heart and their functions. However, some of the candidates selected *C, Bicuspid*. These candidates failed to understand that bicuspid is a valve that prevents the back flow of blood from the left ventricle to the left auricle.

Item (iii) required the candidates to select a response which correctly matches the description of a valve that prevents the back flow of blood from the pulmonary artery to the right ventricle. The correct answer was *E, Semilunar*. Some of the candidates opted for *C, Bicuspid*, while others selected *G, Tricuspid*. The incorrect responses indicate lack of clear understanding of the parts of the mammalian heart and their functions.

Item (iv) required the candidates to select a response which correctly matches the description of a tissue that separates left and right chambers of the heart. The correct answer was *F, Septum*. Some of the candidates selected alternative *D, Myocardium*. These candidates did not understand that myocardium is the middle layer of the wall of the heart.

Item (v) required the candidates to select a response which correctly matches the description of a chamber of the heart which has relatively thin walls. The correct response was *A, Auricle*. Some of the candidates opted for alternative *H, Ventricle*. These candidates failed to understand that auricles have relatively thin walls since they pump blood to shorter distances than ventricles. Extract 1.2 is a sample of the candidate's incorrect responses.

2.	LIST A	i	ii	iii	iv	v
	LIST B	A	E	F	C	H

Extract 1.2: Candidate's incorrect response to question 2

In extract 1.2, the candidate responded incorrectly to all the items of the question hence scored 0 marks.

2.2 SECTION B: Short Answer Questions

This section consisted of 10 short answer questions. The candidates were instructed to answer all questions in this section. The analysis of each question, is as presented in the following subsections.

2.2.1 Question 3: Safety in Our Environment

In this question, candidates were given a statement: In a car accident many people were injured and felt pains all over their bodies. The victims were given First Aid before taken to hospital. The candidates were required to

state the aim of administering First Aid to the accident victims by giving four points.

Candidates' response analysis shows that, out of 487,390 candidates who attempted this question, 180,529 (37.04%) scored from 0 to 1.5 marks of which 141,086 (28.95%) scored 0 out of 5 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 69,209 (14.20%), whereas 237,652 (48.76%) scored from 4 to 6 marks, as shown in Figure 3.

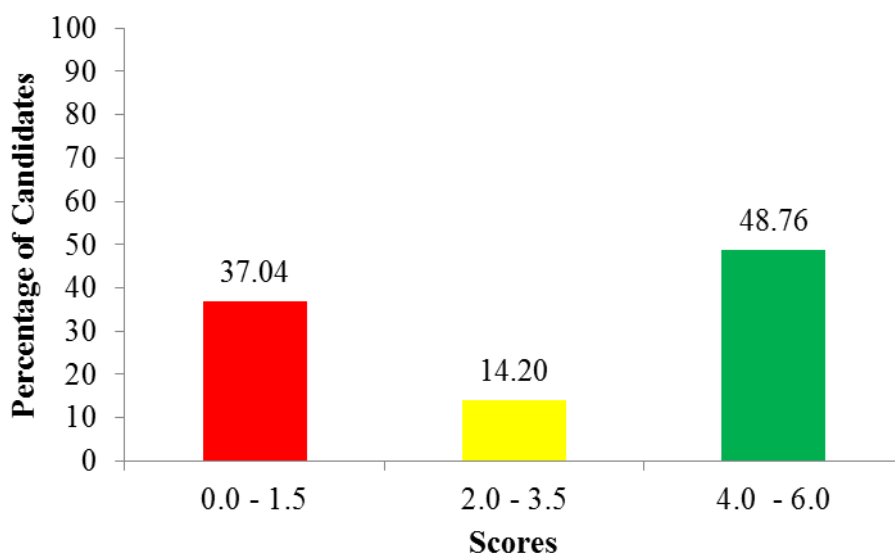


Figure 3: *Candidates' Performance in Question 3*

The analysis shows that the general performance on this question was average because 304,911 (62.96%) candidates scored from 2 to 6 marks. Most of the candidates who scored 2 to 3.5 marks gave 2 to 3 aims of administering First Aid to the accident victims, thus loss some of the marks. Further analysis reveals that out of 237,652 (48.76%) candidates who scored 4 to 6 marks, only 122,052 (25.0%) candidates gave correct responses and therefore, scored all the 6 marks. Extract 2.1 is a sample of the candidate's correct responses.

3.	Aims of administering first aid to accident victim	
	i) So as to save their lives. The accident that people can get might be the one that can cause death so first aid is rendered to save lives.	
	ii) So as to reduce pain. When one gets injured or gets an accident that person will feel pain at the part that is injured. So first aid is provided so as to reduce pain to the injured part.	
	iii) So as to reduce blood loss. Some accidents involve much flow of blood. So first aid is rendered so as to prevent further flow of blood.	
	iv) So as to bring hope and encouragement to the patient. To an accident a patient can have a thinking that he or she will die as no way to be treated but when first aid is provided the patient will have hope that his or her problem will be treated.	

Extract 2.1: Candidate's correct response to question 3

In Extract 2.1, the candidate correctly provided the aims of administering First Aid to the accident victims, hence performed well.

The analysis shows further that 37.04 per cent of the candidates scored from 0 to 1.5 marks. For those who scored 0 marks either failed to provide any response or provided incorrect responses. Some of the responses indicated that some of the candidates listed the procedures of administering First Aid to accident victims, such as *cleaning the damaged place, give pain killer, cover wound with a piece of bandages and to keep the victims away from the site of accident*. Other candidate provided the procedures of administering first aid to snakebite victims, such as *washing the wound with soap, immobilize the bitten area, tie a clean cloth above the bitten area and drying the wound with clean cloth*. Also, some candidates wrote the ways on how the victims can be treated, such as *give the victim antibiotics, use traditional medicine, give the victim pain killer*. Furthermore, some of the candidate mentioned ways on how road accidents can be minimized, such as *stop overspeeding, enforcement of traffic laws,*

look right then left then cross instead of the aims of administering First Aid to the accident victims. Extract 2.2 is a sample of incorrect responses from one of the candidates.

3.	In a car accident many people were In	
	jured and felt pain all over the bodies	
	The victims were given first aid	
	before taken to hospital	
	i) Pain killer.	
	ii) Bandage.	
	iii) petroleum jelly	
	iv) First Aid kit.	

Extract 2.2: Candidate's incorrect response to question 3

In Extract 2.2, the candidate listed components of First Aid kit, such as *bandage* instead of the aims of administering First Aid to the victim of the accident.

2.2.2 Question 4: Healthy and Immunity

The question required the candidates to give six physiological changes which occur in boys during puberty.

The data analyzed indicate that, out of 487,390 candidates who responded to this question, 215,329 (44.18%) scored from 0 to 1 marks, out of which 153,337 (31.46) scored 0 out of the 6 marks allocated to this question. The candidates who scored from 2 to 3 marks were 128,330 (26.33%) whereas 143,731 (29.49%) scored from 4 to 6 marks. Candidates' performance is as shown in Figure 4.

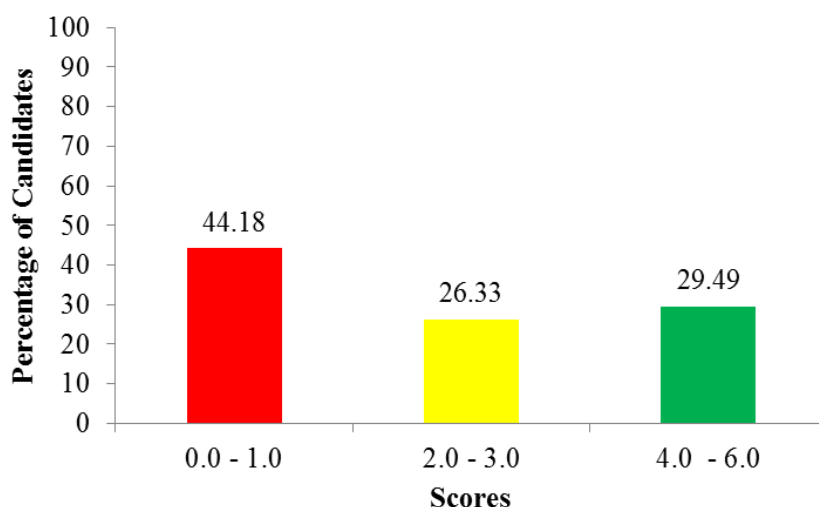


Figure 4: *Candidates' Performance in Question 4*

The analysis shows that, the general performance on this question was average because 55.82 per cent of the candidates scored from 2 to 6 marks. Candidates with average performance provided 2 to 3 physiological changes which occur in boys during puberty, hence loss some of the marks. However, out of 143,731 (29.49%) candidates who scored from 4 to 6 marks, 34,251 (7.0%) gave all the six physiological changes correctly, thus scored all the six marks. Extract 3.1 is a sample of correct responses from one of the candidates.

4.	The physiological changes which occur in boys during puberty are;	
	i) Deepening of the voice.	
	ii) Development of pimples.	
	iii) Growth of pubic hair in armpit and pubic regions.	
	iv) Development of sexual organs and production of sperms begins.	
	v) Increase in sweating due to activation of sweat glands leading to body smell	
	vi) Growth of a muscular body and rapid increase in body size.	

Extract 3.1: Candidate's correct response to question 4

In Extract 3.1, the candidate correctly provided the physiological changes which occur in boys during puberty hence scored good marks.

The analysis indicated further that 44.18 per cent of the candidates obtained low marks (0 - 1). The candidates (31.46%) who scored zero marks, either did not understand the demand of the question or lacked knowledge of the tested concepts, thus provided incorrect responses in all parts of the question. Those who scored 1 mark provided only one correct point. For example, some candidates mentioned the different processes which occur in the living organisms, such as *spermatogenesis*, *meiosis*, *mitosis* and *oogenesis*. Other candidates listed the principles of personal hygiene during puberty, such as *clean their bodies*, *cut the hair under armpit*, *have to be smart all the time*, *change bed sheet regularly* and *keep nails short*. There were other candidates who provided the behavioural changes instead of physiological changes, such as *the boy starts to get sexual feeling*, *boys change their behavior*, *boys begin to become too much knows*, *males want to stay with girls during puberty*, *boys start to look for girlfriends*. These responses indicate that the candidates had inadequate knowledge of the concept tested. Extract 3.2 is a sample of the candidate's incorrect responses.

4	(i) voice change like female soft voice	
	(ii) Menstruation begins	
	(iii) growth of hips	
	(iv) growth of breast feeding in female	
	(v) growth hair in the parts of which involve Intexual Intercourses like hair growth In vagina.	

Extract 3.2: Candidate's incorrect response to question 4

In Extract 3.2, the candidate mentioned physiological changes which occur in girls, such as *menstruation begins* instead of physiological changes which occur in boys.

2.2.3 Question 5: Reproduction

In this question, the candidates were required to give four factors in males which hinder fertilization.

A total of 487,390 candidates attempted this question. The analysis of candidates performance shows that 425,540 (87.31%) candidates scored from 0 to 1.5 marks, out of which 362,380 (74.35) scored 0 out of the 6 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 40,795 (8.37%) and those who scored from 4 to 6 marks were 21,055 (4.32%). The candidates' performance in this question is illustrated in Figure 5.

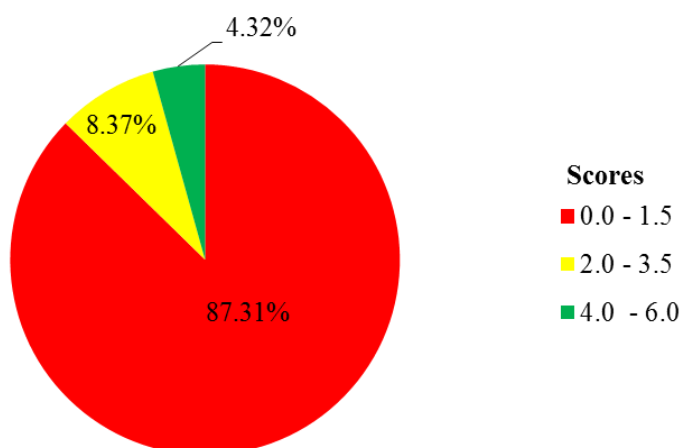


Figure 5: Candidates' Performance in Question 5

The analysis shows that, the general performance on this question was weak because 87.31 per cent of the candidates scored low marks (0 – 1.5). Majority of the candidates (74.35%) scored zero marks which suggests that many were incompetent in the tested concept. Those who scored 1.5 marks demonstrated inadequate knowledge about Gamete formation and fertilization. For example, some of the candidates provided diseases and disorders of the male reproductive system, such as *impotence* and *prostate cancer*. Other candidates mentioned the contraceptive methods such as *IUD (intra uterine devises)*, *vasectomy*, *use of injection* and *diaphragm*. There were also other candidates who provided factors to solve the problem of infertility such as *use artificial insemination*, *buy sperms from where they are stored*, *avoiding stress during sexual intercourse* instead of the factors

that hinder fertilization in males. Extract 4.1 is a sample of the candidate's incorrect responses.

05	i) Environmental factor:	
	Sometime the environment affect the the fertilization of the gametes between male and female. if the environment has been well affected by either the poisonous source like nuclear bombs. it may cause for the failure of fusion of gametes to lead fertilization	
	ii) Genetic factor	
	- Genetic disorders cause sometime effect on fertilization where by the presence of denetic disorders like haemophilia, Anaemi a and other causes the chromosomes to fail to fertilize the egg that will affect the occurence of fertilization.	
	iii) Mutation and Radiation	
	this are problem which sometime are affect the fertilization process in the fusion of gametes. when the male body Involved many time in ultra radiation it affect sometime to fail to produce the quality Sperms for fertilization of eggs.	
	iv) Inability of Spermducts to produce semen Also is the one of the factor that causes the Sperms to fail to fertilize eggs since the Sperm doesn't contain semen which are Very essential during fertilization	

Extract 4.1: Candidate's incorrect response to question 5

In Extract 4.1, the candidate provided factors which prevent males from producing sperms, such as *mutation* and *radiation* instead of factors which hinder fertilization. Also, the response in (iv) is incorrect.

Despite the weak performance for some candidates, 61,850 (12.69%) candidates scored from 2 to 6 marks. Some of these provided 1 to 2 factors which hinder fertilization, hence could not score full marks. Further analysis shows that out of 21,055 (4.32%) candidates who scored 4 to 6, only 2,728 (0.60%) gave six factors which hinder fertilization in males, and therefore, scored all the marks. Extract 4.2 is a sample of the candidate's correct responses.

5	The factors hindering fertilization in males are :
i)	Immaturity of the sperms.
	- Some males produce immature sperms which are not well developed resulting into failure of fertilization to occur
ii)	Low sperm count
	- This refers to the presence of small number of sperms in semen. For a normal condition semen produced should have more than 2 million sperms. Hence this reduces the probability of fertilization from occurring
iii)	Low sperm mobility
	- This refers to a condition in which the sperms have low speed of swimming. It can be due to lack of enough nourishment and energy from seminal glands. This causes them not to reach the egg cell resulting into hindered fertilization
iv)	Early ejaculation
	- This is a condition in which the man reaches orgasm so early which makes the sperms not to be deposited in the female's reproductive system. As a result fertilization does not occur due to absence of sperms.

Extract 4.2: Candidate's correct responses to question 5

In Extract 4.2, the candidate correctly provided the factors which hinder fertilization in males.

2.2.4 Question 6: Nutrition

In this question, the candidates were given a statement, You have visited a school farm and observed that all maize plants have small yellowish leaves and show stunted growth. The candidates were required to name four elements which are absent in the soil of the school farm and give one function played by each of the named elements in crop production in parts (a) and (b), respectively.

The analysis shows that out of 487,390 candidates who attempted this question, 449,032 (92.13%) scored from 0 to 1.5 marks out of which 352,836 (72.40) scored 0 out of the 6 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 36,944 (7.58%), whereas 1414 (0.29%) scored from 4 to 6 marks, as shown in Figure 6.

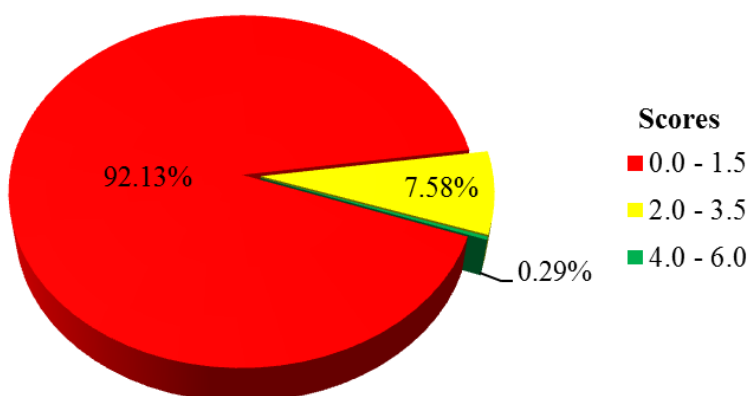


Figure 6: Candidates' Performance in Question 6

The analysis of the candidates' performance shows that, the performance on this question was weak because 449,032 (92.13%) candidates scored 0 to 1.5 marks. Majority of the candidates (72.39%) scored 0 marks. These candidates provided responses which were contrary to the demand of the question. For example, some of the candidates provided plant growth regulators, such as *auxins*, *giberellins*, *cytokinins*, *abscisic acid* and *ethylene* instead of the elements which are absent in the soil. Others listed general factors which hinder plant growth, such as *lack of enough rainfall*, *lack of fertile soil*, *growth of weeds in the farm* and *lack of enough sunlight*. Other candidates mentioned the conditions necessary for seed germination, such as *Oxygen*, *water* and *optimum temperature*. There were also some candidates who provided factors which contribute to soil infertility, such as *soil erosion*, *burning of vegetations*, *continuos cultivation without adding manure* and *cultivating one crop every year* instead of the elements which are absent in the soil.

The analysis of the candidates' responses indicate that some candidates provided incorrect elements and functions, such as *nitrogen facilitate formation of nitrogenous plants compounds such as hormones*, *magnesium*

helps in absorption of water in the soil, sulphur is used to make fruits and seeds ripe. There were also other candidates who wrote the functions of the named mineral in human being instead of plants such as *magnesium is used in strengthening of bones and potassium is needed for nerve function*. Extract 5.1 is a sample of the candidate's incorrect responses.

Q. 9)	i. Mineral salts	
	ii. Fertilizers	
	iii. Manure	
	iv. Humus	
	b) functions	
	i. Water	
	- Helps in transportation of mineral salts	
	ii. Fertilizers	
	- Add nutrients to the soil.	
	iii. Manures	
	- Add nutrients to the plant / increases soil fertility.	
	iv. Humus ; It increases Soil fertility.	

Extract 5.1: Candidate's incorrect responses to question 6

In Extract 5.1, the candidate provided materials which increase soil fertility, such as *fertilizers* and *manure* and its role, instead of mineral lacking in the soil and their functions.

Despite the weak performance for most candidates, 38,358 (7.87%) candidates scored from 2 to 6 marks. Some of the candidates correctly named the minerals which were lacking in part (a), but provided incorrect functions of those minerals in part (b), hence could not score full marks. Further analysis reveals that out of 1,414 (0.29%) candidates who scored 4 to 6 marks, only 87 candidates gave correct responses in all parts of the question, thus scored all the 6 marks. These candidates correctly named the elements which are absent in the soil of the school farm and stated the functions of each of the elements in crop production. This indicates that the candidates were knowledgeable on the tested concepts. Extract 5.2 is a sample of the candidates' correct responses.

6 a	i/ Nitrogen	
	ii/ Potassium	
	iii/ Magnesium	
	iv/ Sulphur	
b	i/ Nitrogen helps in protein synthesis in plants, hence is an important element for growth in plants	
	ii/ Sulphur helps to facilitate the growth of leaves and synthesis of chlorophyll	
	iii/ Magnesium provides the leaves with green colour, they therefore prevent yellowing of leaves, since they help in synthesis of chlorophyll	
	iv/ Potassium also helps in the growth of different plants organs such as the young leaves and also it aids photosynthesis.	

Extract 5.2: Candidate's correct responses to question 6

In Extract 5.2, the candidate correctly named the elements which were absent in the soil of the school farm and stated the functions of the named elements in crop production correctly.

2.2.5 Question 7: Gaseous Exchange and Respiration

In this question, the candidates were required to differentiate anaerobic from aerobic respiration using the criteria shown in the following table:

Feature	Aerobic respiration	Anaerobic respiration
(i) Site in the cell		
(ii) Substrates involved		
(iii) End products		
(iv) Amount of energy per molecule of glucose		

A total of 487,390 candidates attempted this question. The data analysis shows that 440,698 (90.42%) candidates scored from 0 to 1.5 marks, out of which 366,607 (75.22%) scored 0 out of the 6 marks allocated to this question. The candidates who scored from 2 to 3.5 were 35,823 (7.35%) whereas 10,869 (2.23%) scored from 4 to 6 marks, as illustrated in Figure 7.

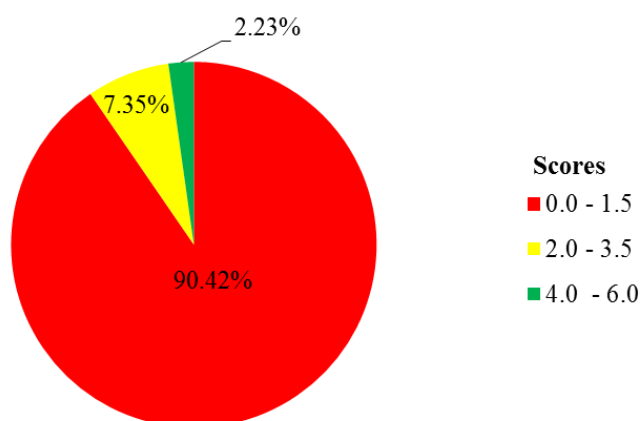


Figure 7: The candidates' Performance in Question 7

The analysis shows that the candidates' performance on this question was weak as 440,698 (90.42%) candidates scored from 0 to 1.5 marks. These candidates provided incorrect responses, such as *aerobic respiration take place in the cytoplasm* while *anaerobic respiration takes place in the vacuole*. These candidates were not aware of the site for aerobic and anaerobic respiration which is mitochondria and cytoplasm, respectively. Other candidates wrote *aerobic respiration involves food substances* while *anaerobic involve carbon dioxide*. These candidates were not aware that both aerobic and anaerobic respirations require food substrate which is glucose. Others wrote the types of food substrates, such as *carbohydrates and proteins* in aerobic respiration and *vitamins and lipids* in anaerobic respiration. The analysis shows that those candidates had no adequate knowledge on the tested area.

Similarly, some of the candidates were not aware of the end product of aerobic respiration as they wrote *oxygen and glucose* which are the substrates in aerobic respiration. In anaerobic respiration they wrote *fatty acids and glycerol* which are end products of digestion of lipids. Extract 6.1 is a sample of the candidate's incorrect responses.

7.	Aerobic respiration	Anaerobic respiration	
i	Occur in cytoplasm	- Occurs in mitochondria	
ii	Oxygen is used	No oxygen used	
iii	End products of aerobic respiration is alcohol and oxygen	End products of anaerobic respiration is amino acids.	
iv	Low energy per molecule	High energy per molecule produced	

Extract 6.1: Candidate's incorrect responses to question 7

In Extract 6.1, the candidate interchanged the responses in (i) where he/she wrote cytoplasm instead of mitochondria and mitochondria instead of cytoplasm. The responses in (iv) were also interchanged. In (ii), the candidate wrote *oxygen only* instead of glucose and oxygen in aerobic respiration, while in anaerobic respiration, he/she wrote no oxygen used instead of glucose. Likewise, in (iii), he/she wrote *alcohol and oxygen* in aerobic respiration instead of carbon dioxide, water and energy. In the anaerobic, he/she wrote *amino acid* instead of lactic acid and energy in animals or alcohol, carbon dioxide and energy in plants.

Conversely, the analysis indicates that 35,823 (7.35%) candidates scored from 2 to 3.5 marks. These candidates correctly provided 1 to 2 differences only, thus failed to score full marks. Further analysis reveals that out of 10,869 (2.23%) candidates who scored 4 to 6 marks, 2,512 (0.50%) candidates gave correct responses in all parts of the question, hence scored all the 6 marks. These candidates correctly differentiated aerobic from anaerobic respiration by considering the criteria given. Extract 6.2 is a sample of the candidates' correct responses.

7.	<u>DIFFERENCES BETWEEN AEROBIC AND ANAEROBIC RESPIRATION.</u>	
	<u>Feature</u>	<u>Aerobic respiration</u>
	i) Site in the cell	Mitochondria
	ii) Substrates involved	Oxygen and glucose
	iii) End products	Water, Carbon dioxide energy in form of ATP
		Lactic acid and energy in animals or alcohol energy in form of ATP and carbon dioxide in plants
	iv) Amount of energy produced	38 molecules of ATP are produced per molecule of glucose
		2 molecules of ATP are produced per molecule of glucose

Extract 6.2: Candidate's correct responses to question 7

In Extract 6.2 the candidate correctly differentiated aerobic from anaerobic respiration thus scored good marks.

2.2.6 Question 8: Movement

This question required the candidates to give three adaptations of the axial skeleton to its function.

The analysis of candidates' performance indicates that, out of 487,390 candidates who attempted this question, 415,890 (85.33%) scored from 0 to 1.5 marks out of which 415,099 (85.17%) scored 0 out of 6 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 27,099 (5.56%) while 44,401 (9.11%) scored from 4 to 6 marks. The performance is as presented in Figure 8.

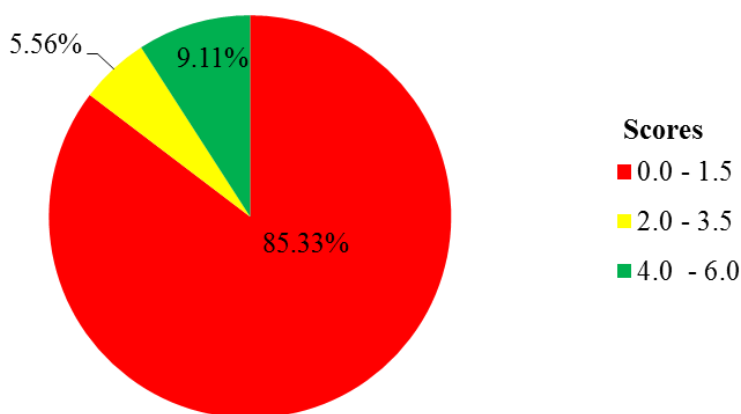


Figure 8: *Candidates' Performance in Question 8*

Considering Figure 8, the candidates' performance on this question was weak because 85.33 percent of the candidates scored from 0 to 1.5 marks. For the candidates (85.17%) who scored 0 marks either did not understand the demand of the question or provided incorrect responses, hence scored 0 marks. For example, some of the candidates listed the components of the axial skeleton, such as *skull*, *rib cage* and *vertebral column* while others listed the types of skeleton, such as *endoskeleton*, *exoskeleton* and *hydrostatic skeleton*. Others drew the diagrams of the components of the axial skeleton such as *skull* and *vertebral column*. Other candidates wrote adaptations of appendicular skeleton instead of axial skeleton, such as *it has tibia and fibula which helps in movement, it is made up of humerus which articulate with tibia and fibula to allow movement of the human body. It has clavicle which offer surface area for attachment of neck*

muscles. There were also other candidates who wrote the functions of the axial skeleton instead of the adaptation, such as *it protects the brain, It protects the spinal cord and nerve roots, it offers surface area for attachment of head muscles and it supports the trunk*. These responses imply that the candidates had inadequate knowledge about the human skeletal system. Extract 7.1 is a sample of the candidate's incorrect response.

8.	i/ The axial skeleton It help to move from one place to another place	
	ii/ It help to move to search food, shelter and clothes	
	iii/ It help to escape from dangerous area for example. The area when fire occur	
	iv/ It help in store of minerals and give shape the body.	

Extract 7.1: Candidate's incorrect response to question 8

In Extract 7.1, the candidate provided the functions of the skeleton instead of explaining structure and function (adaptation) of the axial skeleton.

Despite the weak performance on this question, 71,500 (14.67%) candidates scored from 2 to 6 marks. Some of these candidates correctly gave 1 to 2 adaptations of the axial skeleton, therefore, could not score full marks. Further analysis reveals that out of 44,401 (9.11%) candidates who scored 4 to 6 marks, 20,311 (4.20%) candidates gave three correct points, thus scored all the 6 marks. This indicates that the candidates were competent enough to the tested concepts. Extract 7.2 is a sample of the candidates' correct responses.

8.0	The axial skeleton is made up of hard bones hence provide protection of delicate organs of the body such as the skull protects the brain.	
ii)	The ribs have long shaft so as to provide surface area for intercostal muscles attachment.	
iii)	The axial skeleton have movable joints which provide movements of body parts.	

Extract 7.2: Candidate's correct response to question 8

In Extract 7.2, the candidate correctly explained the three adaptations of axial skeleton to its function.

2.2.7 Question 9: Regulation

The candidates were required to explain three ways in which the skin of a man regulates internal body temperature when external environment is overheated.

A total of 487,390 candidates attempted this question. The data analysis shows that, 430,853 (88.40%) candidates scored from 1 to 1.5 marks, out of which 311,757 (63.96%) scored 0 marks. The candidates who scored from 2 to 3.5 were 31,826 (6.53%), whereas 24,711 (5.07%) scored from 4 to 6 marks, as shown in Figure 9.

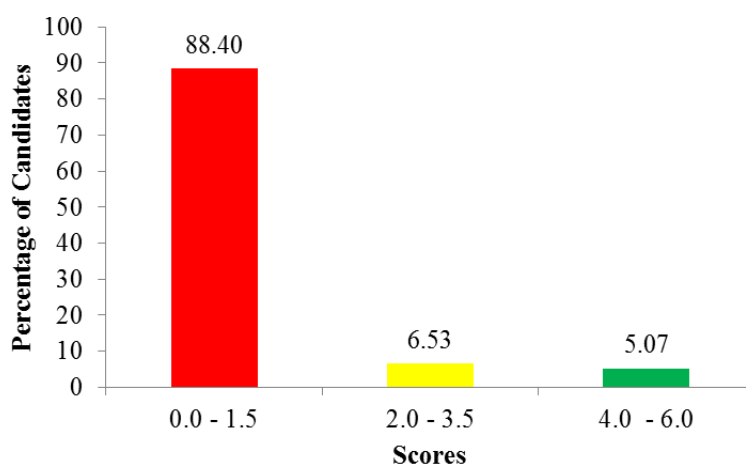


Figure 9: Candidates' Performance in Question 9

The analysis shows that the candidates' performance on this question was weak since 88.40 per cent of the candidates scored from 0 to 1.5 marks. For those who scored 0 marks they did not understand the demand of the question. For example, some of the candidates mentioned the mechanisms of heat gain, such as *shivering*, *vasoconstriction of arterioles* and *increased metabolic rates*. Other candidates listed different methods of heat loss, such as *evaporation*, *conduction* and *radiation* instead of how the skin of man regulates body temperature. There were also some candidates who drew the structure of the skin to show vasoconstriction, contrary to the demands of the question. Further analysis showed that for those who scored 1.5 marks were able to mention the ways, but failed to give the explanations. Extract 8.1 is a sample of the candidate's incorrect response.

9	Regulation of the body.	
	i- He/she will wear the light clothes, due to high temperature of the surroundings. the human being will wear the light clothes so as to overcome the overheating of the body.	
	ii- Drinking cold drinks, like juice or water so as to low the body temperature	
	iii. Using of aircondition and going to the shed that there is no directly sunshine so as to make the body cool from the high temperature.	

Extract 8.1: Candidate's incorrect response to question 9

In Extract 8.1, the candidate provided ways of cooling the body which do not involve the skin. For example, *drinking cold water* and *using air condition* instead of how the skin of man regulates internal body temperature when the external environment is overheated.

Furthermore, the analysis indicates that 31,826 (6.53%) candidates scored from 2 to 3.5 marks. These candidates correctly mentioned the ways, but provided explanations of 1 to 2 ways, thus failed to score full marks. Further analysis showed that out of 24,711 (5.07%) candidates who scored 4 to 6 marks, only 7,911 (1.60%) candidates correctly explained three ways on how the skin of man regulates internal body temperature when the external environment is overheated, thus scored all the 6 marks. Extract 8.2 is a sample of the candidates' correct responses.

9.		
	1.) The erector pili muscles in the skin relax causing the skin hairs to lie flat. This enables loss of heat from the body since an insulatory layer of air trapped in the skin is removed by lying down of the hairs	
	11.) The sweat glands in the skin produce sweat which evaporates from the skin surface. Evaporation causes cooling effect since it absorbs heat from the body for a change in state from liquid to vapour hence reducing temperature of the body	
	111.) Vasodilation of arterioles. This is the increase in size of the blood vessels superficial to the skin. This makes them more close to the surface and hence they easily lose heat from the body through means like conduction, radiation and evaporation	

Extract 8.2: Candidate's correct response to question 9

Extract 8.2 illustrates responses from the candidate who correctly explained ways in which man's skin can regulate internal body temperature when the external environment is overheated.

2.2.8 Question 10: Excretion

In this question, the candidates were required to briefly explain the importance of the four excretory products of plants.

The analysis of the candidates' performance indicates that, out of 487,390 candidates who attempted this question, 420,861 (86.35%) scored from 0 to 1.5 marks out of which 304,051 (62.38%) scored 0 out of 6 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 49,616 (10.18%), whereas 16,913 (3.47 %) scored from 4 to 6 marks, as presented in Figure 10.

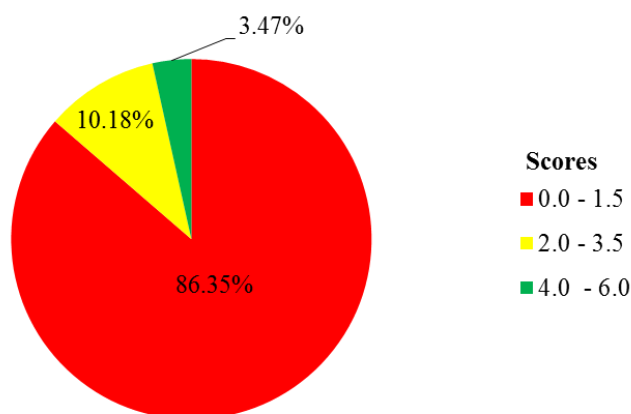


Figure 10: Candidates' Performance in Question 10

The analysis of candidates' performance indicates that 86.35 per cent of the candidates obtained low marks (0 – 1.5), making the general performance of this question to be weak. The candidates who scored 0 marks had either little or no knowledge of the concept of excretion in plants, thus provided incorrect responses. For example, some candidates listed parts of the plants, such as *roots, branches* and *leaf*. Others mentioned the products and raw materials of photosynthesis, such as *starch, sunlight* and *chlorophyll*, while other candidates provided plant growth regulators, such as *auxins, gibberellins* and *abscisic acid* instead of plants excretory products and its importance. There were also some candidates who provided the importance of plants to other organisms, such as *they produce food for other organisms, they absorb and reduce carbon dioxide from the atmosphere and they convert light energy to chemical energy*. These responses indicate that these candidates had inadequate knowledge about excretion in plants. Extract 9.1 is a sample of incorrect responses from one of the candidates.

10.	i/ Petals - Attracts insects For pollination'	
	ii/ Ovules - Transfer pollen grains From the	
	anthers to the stigma'	
	iii/ Stigma - It receives pollen grains.	
	iv/ Anthers - helps to produce pollen grains.	

Extract 9.1: Candidate's incorrect response to question 10

In Extract 9.1, the candidate mentioned parts of flower and their functions in (i), (iii) and (iv). Also, he/she defined pollination as a function of ovules

in (ii). This candidate failed to explain the importance of plants excretory products, thus scored low marks.

However, the analysis shows that the candidates who scored from 2 to 3.5 marks correctly mentioned the plant excretory products but managed to explain the importance of one to two products only, hence, could not score full marks. Furthermore, the analysis shows that out of 16,913 (3.47 %) candidates who scored 4 to 6 marks, only 3,864 (0.80%) correctly explained the importance of the four excretory products of plants, thus scored all the 6 marks. This shows that the candidates had enough knowledge about the concept of Excretion, specifically excretion in plants. Extract 9.2 is a sample of the candidates' correct response.

10	i) Papain - It is used for tenderizing meat and making it more edible and easier to chew.	
	ii) Rubber - It is used in manufacturing industries to make car tyres and shoes.	
	iii) Nicotine - It is used as insecticide and also it acts as stimulant.	
	iv) Caffeine - It is used to produce beverages such as coffee which stimulate nervous activities.	

Extract 9.2: Candidate's correct response to question 10

In Extract 9.2, the candidate correctly identified the excretory products of plants and explained their importance clearly.

2.2.9 Question 11: Genetics

The candidates were required to briefly explain two problems faced by albinos in their environment and how to overcome those problems.

The candidates' responses analysis shows that, out of 487,390 candidates who attempted this question, 314,367 (64.50%) scored from 0 to 1.5 marks while 241,147 (49.48%) scored 0 out of 6 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 79,883 (16.39%), whereas 93,140 (19.11%) scored from 4 to 6 marks, as shown in Figure 11.

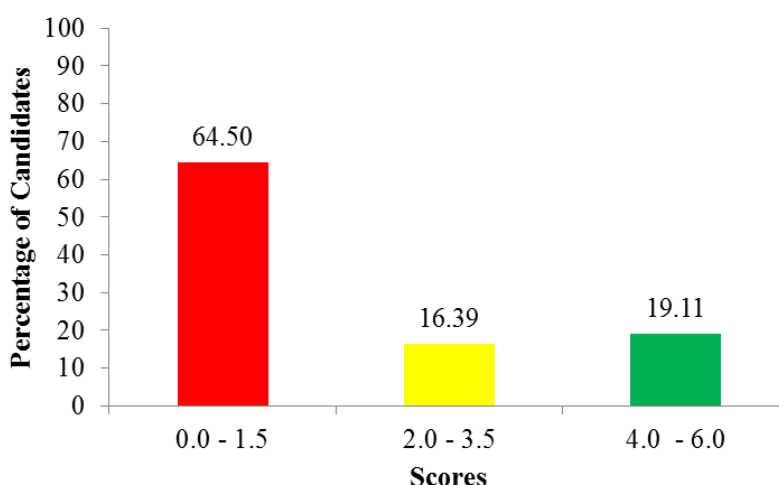


Figure 11: *Candidates' Performance in Question 11*

The analysis shows that the candidates' performance on this question was average because 173,023 (35.50%) candidates scored from 2 to 6 marks. Most of the candidates who scored 2 to 3.5 marks provided the problems faced by albinos correctly, but failed to explain how to solve the problems, hence could not score full marks. Further analysis reveals that out of 93,140 (19.11%) candidates who scored 4 to 6 marks, only 53,679 (11.00%) candidates provided the problems faced by albinos and explained how to solve them correctly, thus scored all the 6 marks. This indicates that the candidates had adequate knowledge of the tested concepts. Extract 10.1 is a sample of the candidates' correct response.

11.	Problems which are faced by albinos:	
	i/ They are faced by the problem of direct sunlight which burn their skin because albinos lack melanin so during sun day they get sunburns.	
	The way of overcoming the problem is through the use of special oil which should be applied to their skins to prevent direct sunlight and also they should cover their bodies with special hats and clothes.	
	ii/ Also they face problem in eyes; their eyes do not see well in the bright light as they cannot control the amount of light.	
	The way of overcoming the problem is through provision of spectacles which can help them to reduce sunlight in their eyes during sun day.	

Extract 10.1: Candidate's correct response to question 11

In Extract 10.1, the candidate explained the problems faced by albinos in their environment and how to overcome those problems correctly, hence performed well.

However, 314,367 (64.50%) candidates scored 0 - 1.5 marks in this question. Those who scored 1.5 marks provided only one problem, but did not explain how to solve it. For the 241,147 (49.48%) candidates who scored zero marks, either they did not understand the demands of the question or they lacked knowledge of the tested concept, thus provided incorrect responses. Some of the candidates' incorrect responses were as: *albinos faces or feel much hotness during the day and also feel much cold when it is night, albinos can get disease easily because they have no melanin which protect them from diseases, the skin of albinos feel pain because of sunlight.* Other candidates mentioned vitamin deficiency diseases such as *night blindness* and *rickets* which are vitamins A and D deficiency diseases. Other candidates listed basic needs as problems faced by albinos, such as *clothes, shelter* and *food*. There were also some of the candidates who used letters and crossed as Mendelian inheritance, such as A - gene controlling normal skin colour and a - gene controlling albinism, therefore, they crossed $Aa \times Aa$ instead of explaining the problems faced by albinos in their environment and how to overcome those problems. Extract 10.2 is a sample of the candidate's incorrect response.

11.	Problems which faced by albinos are:	
	i) change of climatic condition especially if there is cold condition and rain fall their bodies become destroyed	
	ii) poor life style. also is among of obstacle which face them.	
	Methods of Overcome the problems.	
	i) They supposed to wear the clothes such as sweater which can be friendly with change of climatic condition.	
	ii) They supposed to live a good life style in order to reduce the rate of deterioration of their bodies.	

Extract 10.2: Candidate's incorrect response to question 11

In Extract 10.2, the candidate provided the general problems faced by human being in life instead of problems faced by albinos in their environment and how to overcome those problems, thus performed poorly.

2.2.10 Question 12: Evolution

In this question, the candidates were required to briefly explain how homologous structures and cell biology provides an evidence for evolution in parts (a) and (b), respectively, by giving one example in each case.

A total of 487,390 candidates attempted this question. The analysis of the candidates performance shows that 444,353 (91.17%) candidates scored from 0 to 1.5 marks, out of which 437,806 (89.83) scored 0 out of the 6 marks allocated to this question. The candidates who scored from 2 to 3.5 marks were 33,240 (6.82%), while those who scored from 4 to 6 marks were 9,797 (2.01%). Figure 12 illustrates the candidates' performance in this question.

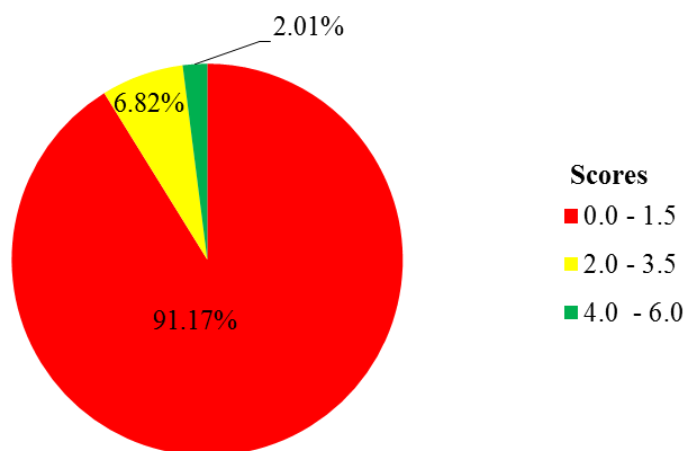


Figure 12: *Candidates' performance in question 12*

As shown in Figure 12, the candidates' performance on this question was weak since 91.17 per cent scored from 0 to 1.5 marks. Majority of the candidates (89.93%) scored 0 marks. These candidates provided incorrect responses in all parts of the question. For example, in part (a), most of them explained about analogous instead of homologous structures, and failed to show how it provides evidence for evolution. Other candidates provided responses such as *homologous structure is the existence of body parts with the same function like eyes of fish and dogs eyes are used for sight, homologous structure is the structure which show the evolution of living organism that living organisms were differ from one to another for the special traits and group* which were incorrect. Similarly, in part (b), some of the candidates mentioned the ideas of the cell theory such as *all cells are composed of cells, cells are produced from other cells, all cell are basically the same in composition* while others mentioned different types of cells such as *red blood cell* and *white blood cells* instead of explaining how cell biology provides evidence for evolution. This indicates that these candidates had insufficient knowledge about the evidence of organic evolution. Extract 11.1 is a sample of the candidate's incorrect response.

12.	a) Homologous structures; are the structure passed	
	by living organism that important for their existence	
	in the environment. For example Wings of butterfly	
	and wings of birds: all this work	
	b) cell biology; is unit a basic unit of living	
	organism. These are the cells found in living organism	
	containing nucleus that carry out all metabolism reaction and	
	activities of that organism for it to exist in a	
	particular environment	

Extract 11.1: Candidate's incorrect response to question 12

In Extract 11.1, the candidate incorrectly defined homologous structures and gave examples of analogous structures instead of homologous structures in part (a). He/she also provided explanation for cell biology instead of explaining how it provides an evidence for evolution.

However, the analysis indicates that 33,240 (6.82%) candidates scored from 2 to 3.5 marks. These candidates provided examples of homologous structures and cell biology correctly, but gave explanation of either homologous structures or cell biology on how they provide an evidence for evolution, therefore, could not score full marks. Further analysis revealed that, out of 9,797 (2.01%) candidates who scored 4 to 6 marks, only 3,245 (0.70%) candidates explained how homologous structures and cell biology provide an evidence for evolution giving one example in each case correctly. This indicates that these candidates had sufficient knowledge about evidences of organic evolution. Extract 11.2 is a sample of the candidate's correct response.

12	(a) Homologous structures are the structures found on different organisms that have the same origin but perform different functions. These structures help to show that organisms had one ancestral origin and that they are related. Example: forelimbs of birds are used for flying but forelimbs of man are used for manipulation (walking).	
	(b) Cell Biology. This evidence shows that each organism contains the same unit of cells that are similar in its composition and functions. Examples: All cells have ATP as energy carriers	

Extract 11.2: Candidate's correct response to question 12

In Extract 11.2, the candidate explained how homologous structures and cell biology in parts (a) and (b) provide an evidence for evolution, giving one example in each case correctly.

2.3 SECTION C: Essay Questions

This section had three essay type questions, namely 13, 14 and 15. Question 13 carried 15 marks, while questions 14 and 15 carried 10 marks each. The candidates were required to answer two questions including question 13.

2.3.1 Question 13: Reproduction

In this question, the candidates were given a statement; Irresponsible sexual behaviour among youths poses a problem to the Tanzanian community. The candidates were required to justify the statement by elaborating six effects.

The analysis indicates that, out of 487,390 candidates who attempted this question, 279,616 (57.37%) scored from 0 to 4 marks out of which 75,484 (15.49%) scored 0 out of 15 marks allocated to this question. The candidates who scored from 4.5 to 9.5 marks were 168,149 (34.50%) while 39,625 (8.13%) scored from 10 to 15 marks. The performance is as presented in Figure 13.

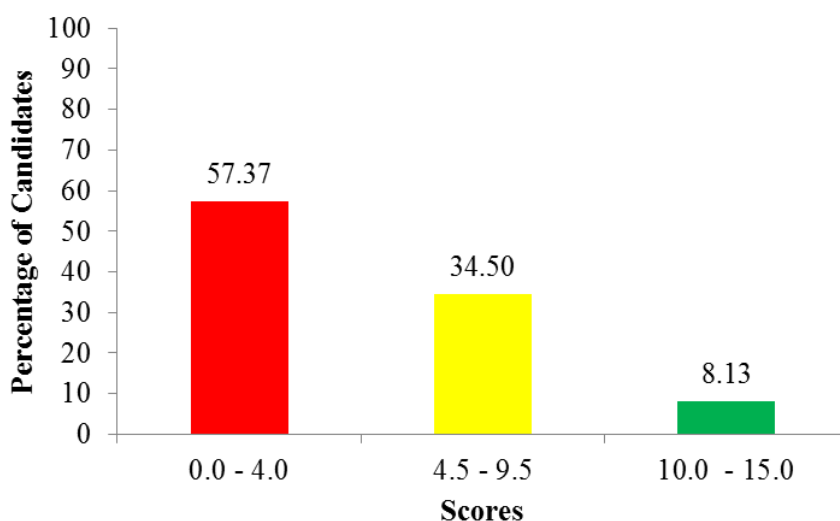


Figure 13: *Candidates' Performance in Question 13*

The analysis shows that the candidates' performance on this question was average because 42.63 per cent scored from 4.5 to 15 marks. The candidates who scored from 4.5 to 9.5 provided responses with some weaknesses thus scored low marks. Some provided a correct introduction and conclusion, but listed the effects without giving explanations. Also, other candidates mentioned the effects correctly but gave explanations of two to three effects. In addition, some provided points with neither introduction nor conclusion, contrary to the demand of essay type questions, thus lost some marks. Further analysis shows that, out of 39,625 (8.13%) candidates who scored from 10 to 15 marks, only 1,484 (0.30%) scored all the 15 marks. These candidates elaborated the effects of irresponsible sexual behavior correctly following the rules of essay writing, such as providing an introduction, main body and conclusion. This indicates that the candidates had adequate knowledge of sexuality, sexual health and responsible sexual behaviour. Extract 12.1 is a sample of the candidate's correct response.

13	<p>Irresponsible sexual behaviour refers to behaviour of engaging in sexual practices which can end up to endanger life and health. Irresponsible sexual behaviour includes prostitution, raping anal sex and oral sex. These sexual practices causes many negative effects in Tanzania community:</p> <p>spread of diseases; Irresponsible sexual behaviour leads to the spread of diseases such as HIV/AIDS, syphilis, chlamidia and gonorrhoea. This result into family confusion and costs especially to the close family members.</p> <p>Early pregnancy; This can be seen when the young girls engage in love affairs in young age. They get A pregnancy which in turn brings more negative effects to them, for instance complication during delivery.</p> <p>psychological disturbances; This is also the negative effects of irresponsible sexual behaviour. This can be seen when a person is raped without willing the person becomes - psychologically disturbed due to factors like early pregnancy, diseases. This makes someone to lose her confidence and hope of living.</p> <p>Moral decay; This because there some people engage in prostitution due to number of factors. This makes a person to lose his/her personality and destruct the moral of society for instance anal sex, oral sex and rape are the causative agent of moral decay.</p>	
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13.	Increase in number of school drop outs.	
	This is because some people drop out from school when they get pregnant and fail to continue with their education. This results into early marriage and forced marriage because of irresponsible sexual behaviours.	
	It increases the number of street children;	
	The number of street children now days has increased because children especially from poor families do not get their basic needs as a result they move to town.	
	By winding up irresponsible sexual behaviour has more negative effects but there are solutions to overcome these effects, provision of education for the parents to take care of their children and mass media should play a big role to provide information. This will eradicate this irresponsible sexual behaviour.	

Extract 12.1: Candidate's correct response to question 13

In Extract 12.1 the candidate elaborated the effects of irresponsible sexual behaviour among youths to the Tanzanian community correctly hence scored high marks.

However, 279,616 (57.37%) candidates scored low marks (0 - 4). The analysis shows that some of them listed the effects without giving explanations while others gave explanation of 1 effect with either correct introduction or conclusion, but not both. For the candidates who scored zero mark (15.49%), most of them provided incorrect responses. For example, in the introduction, some candidates wrote the meaning of the responsible sexual behaviour as *the behaviour which has no health effects to the person*. Others explained irresponsible sexual behaviour as *a tendency of people to develop sexual desires without being able to control themselves*. Other candidates wrote: *is the behavior practiced by youth during puberty*, instead of explaining about irresponsible sexual behavior.

Similarly, in the main body, these candidates gave incorrect responses. Some of the candidates mentioned examples of irresponsible sexual behaviour, such as *use of drugs, use of alcohol, prostitution, rapping, masterbation, anal sex, oral sex and homosexuality*. Other candidates provided the ways of minimizing irresponsible sexual behavior, such as *abstain from sex, use condoms and have*

one faithful partner. Other candidates listed general symptoms of sexually transmitted diseases, such as *painful intercourse, rashes in private parts, pain when urinating* and *menstrual irregularities*, instead of the effects of irresponsible sexual behavior. There were also other candidates who provided the disadvantages of family planning methods, such as *the man must concentrate in removing the penis just before ejaculation; it deprives both partners the sexual enjoyment, it does not protect against sexually transmitted infections* and *it is irreversible*, instead of the effects of irresponsible sexual behaviour. Incorrect responses imply that the candidates had inadequate knowledge of the topic of Reproduction, specifically sexuality and sexual health, and responsible sexual behaviour. Extract 12.2 is a sample of the candidate's incorrect response.

13.	<p><u>Irresponsible Sexual Behaviour</u>: Is the behaviour which is not acceptable in the society. In our society many youth they engage on sexual behaviour and this behaviour in our society is not supported to be practice. The following are problem of sexual behaviour among youths poses in Tanzanian community are;</p> <p><u>The use of alcohol/Drugs</u>: Many youth in our country now days they engage on use of alcohol or drugs which can make them to do sexual behaviour. Example raping when a man drink alcohol and meet a woman who working herself in the road or a woman go to fetch water far from the home place that man who drink or use drugs can rape that girl because of using alcohol. Example of those drugs are Marijuana, cocaine and Cigarette/Beer.</p> <p><u>Peer groups</u>: You can meet a group which there a people who having a bad manner or improper behaviour and u can adapt their manner because they will influence you to drink alcohol also if it is a girl they can influence that girl to be sell her body in order to get more money and if it is the case of a boy will go to do sex with women who were sell their body or they use those girl as their tool for enjoyment.</p>
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	The use of social media;	
	This are practise by many majori- ty of youths - Example the use of Internet like facebook, youtube, Instagram, and watching television can make th- e people / youth to adopt bad m- anner from the social media. Example the children / youth they look to Ex-c- Pnema usually after looking some of people they are gone to practise.	
	Lack of education. Other people they don't get much education so others they use to do sex without given any cancell about to prevent the disease also to check for HIV/AIDS if every one among those two people their safe but because they don't have education so they can't learning. It's better to give them education	
	Poor of parental care; Many children / youth they didn't live with their parents. Others their parent t- hey death so that girl see know an- yone who will help her to get her basic need it make her to engage in prostitution in order to fulfill her duties also same to boys if is not having any work it make him to engage on the issues of raping, to be a robber, thief also to sell the drugs or to trans- port the drugs from one place to another in order to get mon- ey.	
	In nutshell; These are behaviours which lead to irresponsible behaviours to the youth of Tanzania.	

Extract 12.2: Candidate's incorrect response to question 13

In Extract 12.2, the candidate provided correct introduction but he/she wrote the causes of irresponsible sexual behaviour among youths such as *peer pressure* and *use of alcohol* instead of the effects of irresponsible

sexual behaviour in the main body thus scored low marks. However the conclusion was incorrect as well.

2.3.2 Question 14: Coordination

In this question, the candidates were given a statement; ‘‘When the bell was rang after break time, students entered into their classrooms’’. The candidates were required to explain the role of each part of the ear involved in the hearing mechanism which made the student respond by entering the classroom.

The analysis shows that 21,365 (4.4%) candidates attempted this question. The analysis of the candidates performance shows that 15,590 (72.97%) scored from 0 to 2.5 marks, out of which 14,259 (66.74%) scored 0 out of 10 marks allocated to this question. The candidates who scored from 3 to 6 marks were 3,350 (15.68%), whereas 2,425 (11.35%) scored from 6.5 to 10 marks, as shown in Figure 14.

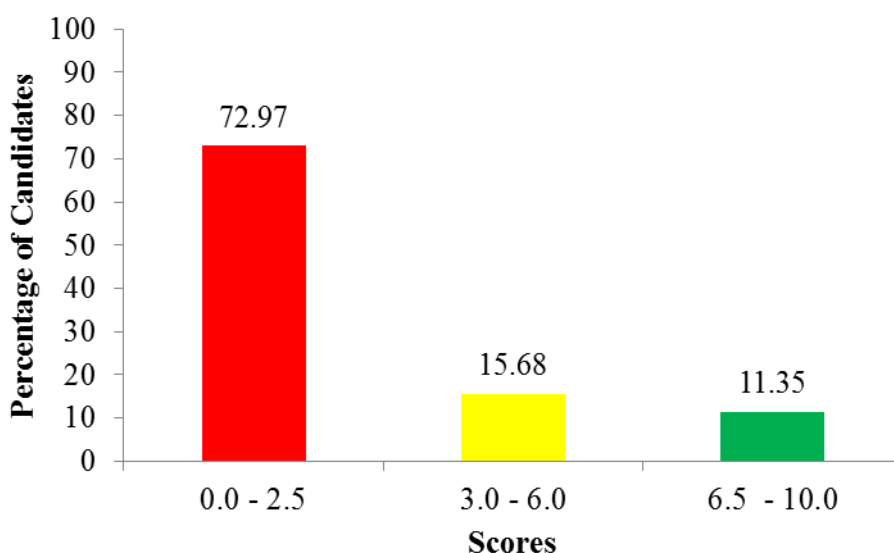


Figure 14: *Candidates' Performance in Question 14*

Figure 14 indicates that, the candidates' performance on this question was weak as 72.97 per cent of the candidates scored from 0 to 2.5 marks. Most of the candidates who scored 1 to 2.5 marks provided correct introduction and explained the mechanism by giving the function of pinna and ear drum only. Moreover, the candidates who scored 0 marks, provided incorrect responses signifying inadequate knowledge. Some provided neither

introduction nor conclusion, and a few provided incorrect introduction and conclusion. For example, some of the candidates wrote: *coordination is the branch of biology that deals with nerves*. Others defined the components of the nervous system, such as *stimulus is anything that evokes a response*. In the main body, the candidates were supposed to explain about mechanism of hearing, but some of them provided the mechanism of body balance by writing *vibration of sound waves are transmitted to semicircular canals of the inner ear, ear ossicle induce balancing of the body*. There were also other candidates who drew well labelled diagrams of the ear instead of explaining about the mechanism of hearing. Others wrote the functions of the parts of the ear without following the orderly sequence of events which occur in hearing mechanism. Moreover, other candidates wrote about reflex action instead of the mechanism of hearing. Extract 13.1 illustrates a candidate's incorrect response.

14.	THE MECHANISM OF HEARING:	
	The following are the Mechanism of hearing. These are:	
	Ear tube/canal: This is an organ which when the body collect the sound waves. it help to sound vibrates and to be breaking down of some word in order to get the meaning.	
	Ear drum: This is an organ which found in the human body or ear which when ear tube help to collecting the sound waves in will be able to having the person's say.	
	Ear Ossicle: This is an organ which found in the human body which help to breaking down the sound in order to help the person to having sense on what he/she say.	
	Oval/round Window: This is the ability where by the person the organ has already taking sound for oval with Ear ossicle to the oval window which help to close some of the word in order to get mean.	
	Eustean tube: This is help in the human body or an organ which found in the ear to balancing the temperature in the body.	

14.	Semicircular Canal : It help to sense the sound in order to hear person even the sound is too much big a person to not feel to hearing the words.
	Cochlea : This help the body to collect all the information from the Semicircular Canal and break down in to order form which can be used at the time.
	Auditory nerve : This organ help to collect the information from cochlea and help to sense what is the word is reflecting to doing and get the mean of that word.
	Auditory lobe : This is help know to collecting all the information from Pinnal Until Auditory nerve and to help a person to see what is the word spoke and able to hearing.
	Generally : I would like to say that this Mechanism of hearing help the student to centered at their class room and it help to see the process which making the human being to hearing and detect sound waves.

Extract 13.1: Candidate's incorrect response to question 14

In Extract 13.1 the candidate did not provided an introduction. In the main body, he/she wrote incorrect functions of the parts of the ear, instead of the mechanism of hearing. For example, he/she wrote *ear tube/canal which when the body collect sound waves*. The conclusion was incorrect as well.

The analysis indicates further that, 27.03 per cent of the candidates scored from 3 to 10 marks. In this category, most of the candidates explained the mechanism in a sequence of four to five points correctly out of the eight points required. Also, some of the candidates provided either correct introduction or conclusion, hence loss of some marks. Further analysis reveals that out of 2,425 (11.35%) candidates who scored 6.5 to 10, only 311 (0.10%) explained the mechanism of hearing correctly, hence scored all the 10 marks. This indicates that, these candidates had adequate knowledge of the topic of Coordination, specifically the sense organs. Extract 13.2 illustrates a sample of the candidates' correct responses.

14.	Ear is a sensory organ used for hearing and balance. The sound stimulus was received by an ear and the mechanism was as follows:	
	- Pinna collected the sound waves and the sound waves were directed to the ear drum through the auditory canal.	
	- Then the ear drum vibrates as the sound waves hit the ear drum.	
	- The vibrations were taken by ear ossicles (malleus, incus and stapes) in the middle ear.	
	- The ear ossicles amplified the vibrations and transmitted them to the oval window.	
	- The vibrations of the oval window were transmitted to the perilymph and finally to the endolymph in the inner ear cochlea.	
	- The vibrations of the endolymph initiates nerve impulses in the nerve fibres.	
	- This generated impulses which were sent to the brain by auditory nerve and was interpreted as sound.	
	Ear is the organ responsible for hearing and balance thus care must be observed to avoid damaging it.	

Extract 13.2: Candidate's correct response to question 14

In Extract 13.2, the candidate explained the role of each part of the ear involved in the hearing mechanism correctly, hence scored high marks.

2.3.3 Question 15: Introduction to Biology

The candidates were given a statement, Form One Students in a certain secondary school were interested to know why it is necessary to study Biology. The candidates were required to explain four importance of studying Biology.

This question was attempted by 466,018 (95.6%) candidates. The analysis of candidates responses shows that 143,487 (30.79%) candidates scored from 0 to 2.5 marks, out of which 26,025 (5.58%) scored 0 out of 10 marks allocated to this question. The candidates who scored from 3 to 6 marks were 147,262 (31.60%), whereas 175,269 (37.61%) scored from 6.5 to 10 marks, as shown in Figure 15.

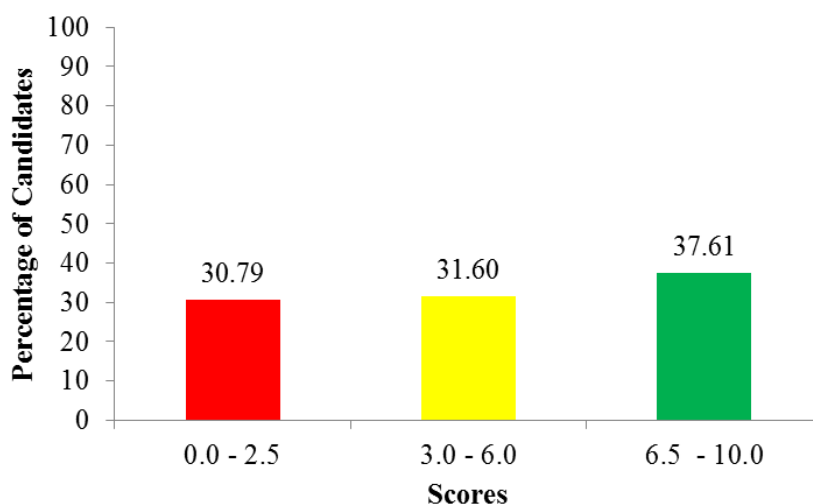


Figure 15: *Candidates' Performance in Question 15*

The analysis indicates that the general performance on this question was good because 322,531 (69.21%) candidates scored from 3 to 10 marks. For the candidates who scored from 3 to 6 marks, most of them explained two to three of the four points required correctly. Also, some candidates provided either correct introduction or conclusion, but not both, therefore, could not score full marks. Further analysis reveals that out of 175,269 (37.61%) candidates who scored from 6.5 to 10 marks, only 50,684 (10.40%) candidates gave correct responses thus scored all the 10 marks. These candidates explained the importance of studying biology correctly. They organized their responses in essay form by giving an introduction, main body and the conclusion. They also demonstrated good mastery of English language. This indicates that the candidates had adequate knowledge of the topic of Introduction of Biology, specifically the importance of studying Biology. Extract 14.1 is one of the candidates' correct responses.

15.	<p>Biology is the branch of science that deals with the study of living organisms and their life processes. Examples of these organisms are viruses, human beings and bacteria. Some of the branches of biology are Zoology which deals with the study of animals and Botany which deals with the study of plants.</p> <p>The following are the importances of studying biology:</p> <p>It helps to develop into different careers. As we study about different branches of biology we get to learn new things where by those things help us to develop into different careers which may serve as a source of employment and income. Apart from that it may be also a part of helping different people in their health problems. Example of careers are doctors and genetic engineers also surgeons.</p> <p>It helps us to understand our bodies. By studying Biology we are able to know how different parts of our bodies are able to do their functions and also how they are adapted to do their functions. Example the heart is able to pump blood fast without bursting due to the presence of cardiac muscles which contract</p>
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15	and relax without being fatigued and also we are able to move due to the presence of muscles and skeleton being coordinated by the brain and spinal cord.	
	It's knowledge is helpful in the agricultural sector; As in the agricultural sector biology is essential since it helps us to know the diseases which tend to affect plants and hence use the correct pesticides so as to treat those diseases. Also apart from that the scientists are able to make varieties of plants which can be resistant to diseases hence produce high quality and quantity crops.	
	It's knowledge is used in genetic engineering; As we study in biology through the topic of genetics. The scientists tend to study the genes so as to be able to know the varieties of the offspring to be produced and therefore establish different varieties of organisms which grow faster and are resistant to diseases. Example Broiler chickens which can reproduce without a male and also which can grow in three months.	
	Generally, the study of biology has been evolutionary to our life. Thus studying it is the best thing to do since we learn new stuffs which tend to happen in our bodies for our benefits.	

Extract 14.1: Candidate's correct response to question 15

In Extract 14.1, the candidate explained the importance of studying Biology correctly thus scored good marks.

The analysis indicates further that, 143,487 (30.79%) candidates scored low marks (0 – 2.5). Some of the candidates neither provided introduction nor conclusion, while others provided incorrect introduction as *biology is the study of living and non-living things. Biology is the study of science*. Other candidates defined biology as *a branch of zoology and botany*. Others defined biology as *a branch of science which deals with composition and decomposition of living things*. In the main body, some of the candidates explained the importance of studying civics as, *Biology help us to be good citizens, Biology help us to avoid corruption and crime*. Other candidates

some of the importance of studying Biology correctly such as *kupata wataalamu mbalimbali* (to get different professionals) *kuuelewa mwili wa binadamu* (to understand human body) and *kuelewa magonjwa* (to understand diseases), but lost marks due to the use of Kiswahili. Also, the candidate did not provide the conclusion.

3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH QUESTION IN 033/2 - BIOLOGY 2

3.1 Question 1: Transport of Materials in Living Things

There were three alternative practical papers, namely 033/2A Biology 2A, 033/2B Biology 2B and 033/2C Biology 2C; each with two questions. Question 1 from each alternative was set from the topic of Transport of Materials in Living Things, while question 2 was set from the topic of Classification of Living Things. The candidates were required to answer all the questions in each paper. The analysis of the candidates' responses in each question in all the three papers is as presented in the following:

The analysis shows that a total of 487,386 candidates attempted question 1 in all the three papers. The analysis shows that 411,013 (84.33%) candidates scored from 0 to 7 marks, out of which 204,563 (41.97%) scored 0. The candidates who scored from 7.5 to 16 marks were 68,380 (14.03%), whereas 7,993 (1.64%) scored from 16.5 to 25 marks. Figure 16 summarizes the candidates' performance in question 1 for papers A, B and C.

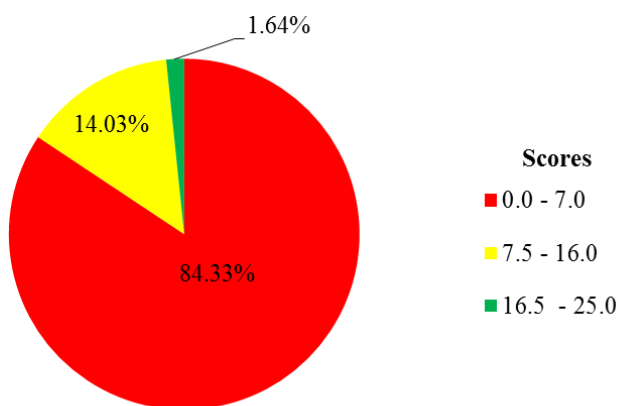


Figure 16: *Candidates' Performance in Question 1*

3.1.1 033/2A Biology 2A

Question 1 in this paper had eight parts (a) – (h), carrying a total of 25 marks. The candidates were provided with two irish potatoes, water troughs, watch glasses with sample A (table salt) and boiling water. They were required to carry out experiments as directed by procedures (i) – (xi), and then answer the questions that follow:

- (i) Peel off the two irish potatoes provided to remove the outer cover.
- (ii) Label one of the irish potatoes as specimen U and the other as specimen V.
- (iii) Put specimen V into boiling water for 2 minutes, then take it out and cool.
- (iv) Using a knife/scalpel, cut the cross section of the specimen U to obtain two halves.
- (v) Scoop out the central portion of one half of the specimen U to make a hole of about 2.5 cm deep from the cut surface. The walls of the hole must be thin (5-8 mm) thick but take care not to damage it.
- (vi) Place a scooped specimen U in the trough.
- (vii) Put 3 g of sample A in the hole of the specimen U.
- (viii) Using a pipette or dropper, add 1 drop of water to dissolve sample A in a hole of specimen U.
- (ix) Put water in the trough until specimen U is half immersed. Carefully observe the experiment and note the set up and the level of water in the beginning.
- (x) Repeat step (iv) and (ix) for specimen V that has been boiled and cooled.
- (xi) Leave the experiment for 40 minutes, there after observe the experiment again and note the changes.

The questions asked were:

- (a) *What is the aim of the experiment?*
- (b) *Draw well labeled diagrams to indicate the setup of the experiment;*
 - (i) *at the beginning*
 - (ii) *after 40 minutes*
- (c) *Identify two changes observed after 40 minutes of the experiment.*
- (d) *Give a reason for the observed changes in the holes and the troughs after 40 minutes of the experiment.*
- (e) *Identify the specimen which acts as a control experiment.*

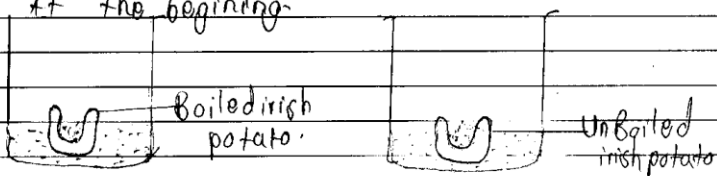
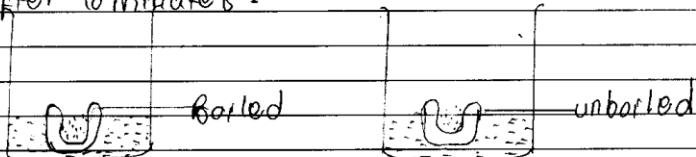
- (f) Give the biological terminologies used to identify the concentration of the solution in each of the following:
 - (i) Hole of the specimens
 - (ii) Water troughs
- (g) Based on the observation made from the experiment, why is it not advised to urinate frequently nearby the plants in the dry season?
- (h) What are the two benefits the plant gets by undergoing the process you investigated in the experiment?

Figure 16 shows that the general performance on question 1 for all alternative papers (A, B and C) was weak as 84.33 per cent of the candidates scored from 0 to 7 marks. 204,563 (41.97%) candidates who scored 0 marks provided incorrect responses in all parts of the question. For example, in part (a), some of the candidates provided the aim of the experiment as: *to test irish potato with salt water*. Others wrote *the aim of the experiment is food test, the aim is to test starch in irish potatoes*. There were also some of the candidates who wrote *the aim of the experiment is to determine the concentration of specimen U and V, aim is to obtain changes from the potatoes which one boiled and another is not boiled in order to get different result*. In part (b) (i) and (ii), the candidates drew specimen U (scooped unboiled irish potato) and specimen V (unscooped boiled irish potato) as both scooped and managed to label few parts only. They also did not provide captions. Other candidates drew the table with the heading showing the type of food tested, procedures for food test, observations and inferences. In part (c), some of the candidates wrote *the specimen U was dissolved in water and specimen V was turgidity*. Other candidates wrote *the water increase, solvent melt and salt disappears and V become hemolysis, specimen U become softer and V hard*, while others wrote *observation as if it was food test experiment such as irish potatoes change color into blue black and starch was present*. These candidates were not aware that the volume of water in trough of specimen U decreased and the level of water in the hole of specimen U -unboiled potato rose.

In part (d), some of the candidates considered the texture of the specimen V and U as they wrote, *V – become tough at the center part of the hole and U become smooth*. Other candidates wrote *U become strong and V become weak*. These candidates failed to recognize that the hole of specimen U had high concentration of solute than water in a trough. Therefore, water moved from a region of high water concentration (trough) to a region of low water

concentration (potato hole) through the irish potato membrane. Therefore, the volume of water in the trough decreased as water moved from the region of low concentration solute to the region of high concentration of solute through semi permeable membrane. Also, the specimen was unboiled, thus had live cells at the hole which were capable to allow the movement of water through the pores of the membrane. In part (e), some of the candidates wrote incorrect responses about identification of the specimen which acted as control experiment. For example, *specimen - A, salt, unboiled irish potato* and *water trough* instead of the specimen V (boiled potato).

In part (f), some of the candidates wrote incorrect biological terminologies. For example, in part (f) (i), they mentioned, *isotonic, osmosis, diffusion, mitosis, low concentration and plasmolysis*. Likewise, in part (f) (ii), they listed *diffusion, high concentration* and *haemolysis*. These candidates were not aware that the biological terminology used to identify the concentration of the solution in the holes of the specimen was hypertonic solution, while in the water a trough was hypotonic solution. Similarly, in part (g), some of the candidates provided incorrect responses as, *urine contain amount of acid which cause the cell to burst and plant fail to survive because of hypotonic solution, urine have high acid to the plant in dry season, plants absorb uric acid and nitrogen from the urine, plants absorb nutrients through root via semi permeable membrane found in the root, because of opening and closing of stomata*. These candidates were not aware that it is not advised to urinate frequently nearby the plant in dry season because urine has high concentration of solute (salt and urea) when added to the soil, it makes the soil to be more concentrated with solute, hence plant cell (low concentrated solute) loose water by osmosis to the soil (high concentrated solute) and finally, plasmolysis occurs and the plant cells wilts. In part (h), some of the candidates wrote importance of minerals and excretion in plants, such as, *it helps the plant to get calcium, it helps the plant in the removal of waste products, it help to lose excess water*. This indicates that these candidates lacked competence in practical skills on osmosis which is covered under the topic of Transport of Material in Living Things. Extract 15.1 is a sample of the candidates' incorrect responses to question 1 paper 2A.

1.	a) the aim of the experiment is to investigate whether plasmolysis takes place in living cells of plant tissues at the beginning.	
	b)	
		
	ii) After 40 minutes -	
		
	c) - Specimen u which was boiled it lost water through the cells by the process of plasmolysis.	
	Specimen which was not boiled it absorbed water by the cells through hypotonic solution by the process known as turgidity.	
	d) Reason specimen u lost all the water or the water remained too little and hence, due to absorption,	
	The water in unboiled specimen after 40 minutes has decreased.	
	f) i) \Rightarrow semi permeable membrane.	
	ii) \Rightarrow Hypertonic.	
	g) Because plant will absorb urine through osmosis that will make photosynthesis to take place.	
	h) i) It enables the transportation of nutrients in the plants.	
	ii) Enables soil aeration.	

Extract 15.1: Candidates' incorrect response to question 1 paper 2A

In Extract 15.1, the candidate wrote the aim of experiment is to investigate whether plasmolysis takes place in living cells of plant instead of investigating the process of osmosis in living tissues in part (a). The

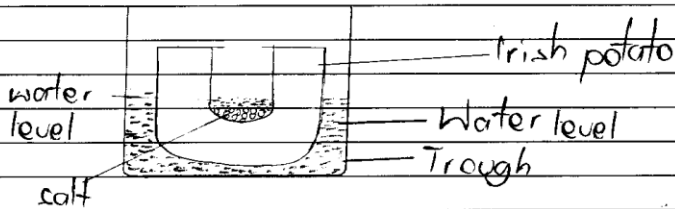
candidate drew scooped diagrams for specimen V instead of unscooped. He/she labeled the irish potatoe instead of labelling the trough and the level of water. For specimen U, the irish potatoe was scooped, but at the beginning the amount of salt was to the top of the hole and also after 40 minutes the level of water in the tough and in the hole of the potatoe remain the same in part (b). Also, the responses given in other parts were incorrect.

However, 76,373 (15.67%) candidates scored from 7.5 to 25 marks. In this category, there were 68,380 (14.03%) candidates who scored from 7.5 to 16 marks. These candidates gave correct responses to some of the parts, hence failed to score all the marks. Further analysis reveals that out of 7,999 (1.64%) candidates who scored from 16.5 to 25 marks, only 6 candidates provided correct responses in most part of the question, and therefore, scored 25 marks. This shows that the candidates had adequate knowledge about osmosis. Extract 15.2 is a sample of the candidates' correct responses to question 1 paper 2A.

1. a) To investigate osmosis process on living organisms using irish potatoes.

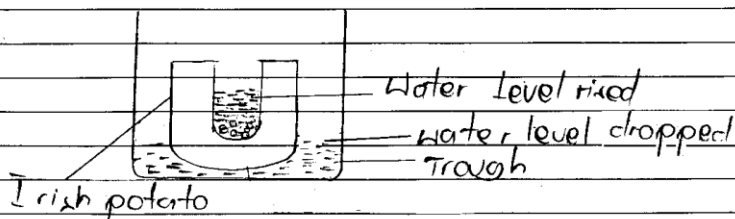
b) i) At the beginning :

DIAGRAM OF SPECIMEN U



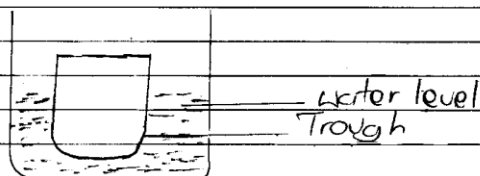
ii) AFTER 40 minutes.

DIAGRAM OF SPECIMEN U

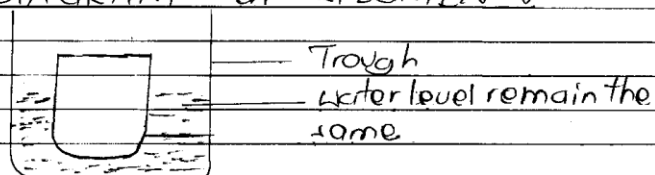


-1- b) ii) At the beginning

DIAGRAM OF SPECIMEN V



After 40 minutes
DIAGRAM OF SPECIMEN V



1c.	i) The volume of water in trough of specimen V decreased	
	ii) The level of water in the hole of specimen V raised.	
1d.	The hole had high concentration of solute than water in the trough. Therefore water moved from the trough to the potato hole through the raw potato membrane so the volume of water in the trough decreased as water moved from low solute concentration to a region of high solute concentration through a semi permeable membrane. Also specimen V was unboiled therefore the live cells of the hole allowed movement of water through pores of the membrane.	
	i) The volume of sample A solution in The hole remained the same	
	ii) The volume of water in the trough remained the same	
1e.	The specimen which acts as a control experiment is specimen V.	
1f.	i) Hypertonic solution in the potatoes	
	ii) Hypotonic solution in the trough	
1g.	It is not advised to urinate frequently nearby the plants in the dry season because: The urine increases the concentration of salt around the plants, it causes the area around the plant to be a hypertonic solution, this will make the plant to contain more water as compared to the surrounding area outside, that is, it will be a hypotonic solution, and the plant's cell membrane will act as a semi-permeable membrane, and hence water from the plant will be lost to the external surrounding area containing urine through osmosis. This will ultimately cause the plant to lose water and wilt.	
1h.	i) It enables the opening and closing of stomata, thus promoting the entry of air to and from the stomata.	
	ii) It ensures absorption of water from the soil through the root hairs.	

Extract 15.2: Candidate's correct response to question 1 paper 2A

In Extract 15.2, the candidate managed to give correct responses in all parts of the question, and hence, scored all the marks.

3.1.2 033/2B Biology 2B

The question had nine parts (a) - (i), carrying a total of 25 marks. In this question, the candidates were provided with Irish potato, knife/scalpel, scooper, table salt and water. They were required to carry out experiments as directed in procedures (i) – (vii), then answer the questions that follow:

- (i) Using knife/scalpel slice a small portion at the upper part of the Irish potato to create a flat surface.
- (ii) Mark the centre of the cut surface as “C” to determine the right and left side.
- (iii) On the left side of the Irish potato, use a scooper to make a shallow hole of about 2.5 cm deep. Do the same to the right side of the Irish potato. The distance from one hole to another hole must be 5-8 mm apart but take care not to damage the central part.
- (iv) Use a marker pen to label the hole on the left side as A and on the right side as B.
- (v) In hole A, put 3 g of table salt.
- (vi) In hole B put distilled water until the hole is full.
- (vii) Make sure that the setup of your experiment is as shown in Figure 1. Leave the experiment for 40 minutes and observe the changes.

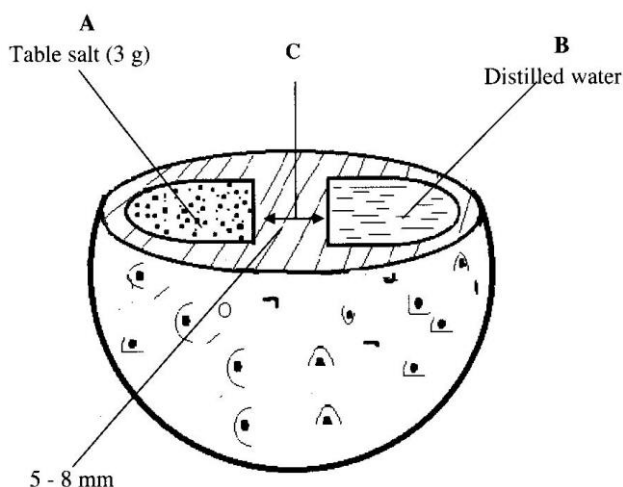


Figure 1

The questions asked were:

- (a) *With reference to your experiment, what does the part labelled by letter C represent?*
- (b) *How does part C work in the process of osmosis?*
- (c) *What are the observations in the holes A and B after 40 minutes*
- (d) *Account for the observations made in 1(c)*

- (e) *Give the biological terms used for the concentrations in the holes A and B.*
- (f) *Identify two osmotic activities which take place in plants by nature.*
- (g) *Based on the observation made from the experiment, how the knowledge of osmosis can be applied in your daily life? Give two points.*
- (h) *What is the aim of the experiment?*
- (i) *How does osmosis differ from diffusion?*

The candidates who scored 0 marks 204,563 (41.97%) provided incorrect responses in all the parts of the question. For example, in part (a), some of the candidates wrote *part C represent unscooped part of irish potato, remaining part of irish potato, surface C of irish potato*. Other candidates wrote *control of experiment, to test potato and potato root tuber*. These candidates failed to understand that part C stands for semi permeable membrane/selective permeable membrane/partially permeable membrane. In part (b), some of the candidates wrote *part C helps to protect the salty water from mixing with water*. Other candidate wrote *part C acts as a barrier for the water and salt not to mix, to determine the concentration of experiment when salt is added, movement of water molecules from weak solution to strong solution*. These candidates were not aware that part C represents a cell membrane with very minute pores where only smaller molecules can pass through it, and not larger ones. Also, part C allows water molecule to pass through it, but not soluble particles depending on concentration gradient.

In part (c), they wrote *A have salt and B have no salt, hole A will expand while hole B will decrease in size as water move from hole B, trough is semi permeable, solution B is greater than solution A, the Irish potato get wet*. They failed to understand that the observations made after 40 minutes were salts dissolved to form a solution in depression A, the volume of distilled water in depression B decreases, while the volume of salty solution in depression A increases. In part (d), candidates failed to account for the changes observed in the experiment, hence provided incorrect responses such as *I can account for diffusion process in the Irish potato, the Irish potato and salt make solution, water undergoes osmosis*. These candidates failed to understand that in depression B, the volume of distilled water decreases because it contains high water concentration than depression A.

Therefore, water moved from a region of high water concentration (depression B) to a region of low water concentration (depression A).

In part (e), some of the candidates interchanged the responses as they wrote *hypotonic solution* in depression A and *hypertonic solution* in depression B. Other candidates wrote incorrect terminologies such as *depression A turgidity* while *depression B flaccidity*. These candidates did not understand that the biological terminologies used to identify the concentration of the solution are depression A hypertonic solution, while depression B is hypotonic solution. In part (f), some of the candidates wrote the mechanisms of transport of materials in living things such as *diffusion* and *osmosis*. Other incorrect responses observed from candidates' scripts are *osmosis of plant roots and osmosis of plant leaves, photosynthesis and respiration*. These candidates were not aware of the osmotic activities, that osmosis enables the absorption of water from the soil into root system through the root hairs. Also, osmosis enables the movement of water molecules from one cell to an adjacent cell along xylem tissue to all parts of the plant, such as leaf and stem.

Likewise, in part (g), some of the candidates wrote different places such as *it is applied at home, it is applied at school, it is applied in hospitals* while others wrote different fields, such as *it is applied in agriculture, it is applied in biology and it is applied in nutrition*. In part (h), some candidates failed to determine the aim of the experiment. They gave incorrect responses such as *the aim of the experiment is to test irish potato, salt and water*. Other candidates wrote *the aim of the experiment is to experiment diffusion*, while others wrote *the aim of the experiment is to study irish potato in the laboratory, it is to observe the experiment on diffusion, transportation activities, absorption of water in Irish potato in order to show that it contain water*. They were not aware that the aim of the experiment was to investigate the process of osmosis in living cell/tissue/organisms. In part (i), some of the candidates, wrote *osmosis is water while diffusion is salt*. Others wrote *osmosis is the movement of particle from region with permeable concentration while diffusion is the particle of region from high concentration to low, osmosis involves water while diffusion involves gases*. These candidates had insufficient knowledge about the concept tested. They failed to understand that in osmosis, solvent molecules move, while in diffusion, solute particles move. Also, in osmosis, semi-permeable membrane is involved, while in diffusion no need

of semi-permeable membrane. Additionally, osmosis involves only solvent movement, while diffusion involves both solute and solvent. Extract 16.1 is a sample of the candidate's incorrect responses to question 1 paper 2B.

Q1	a/ the part labeled C represents membrane	
	b/ But C water as a membrane through which the water passes from hole A to hole B	
	c/ The salt from hole B moved to the water in hole A.	
	d/ the salt molecules from hole B moved from area of low concentration to hole A in the area of high concentration where there is water.	
	e/ Concentration in the hole A is the low concentration and hole B is the high concentration.	
	f/ i/ Transpiration ii/ Hydrotopism	
	g/ i/ Washing clothes ii/ Cooking	
	h/ The aim of the experiment is the determination as how does the water molecules move from area of low concentration to the area of high concentration.	
	i/ Osmosis, this is the movement from area of low concentration to the area of high molecules concentration through semipermeable membrane. While Diffusion this is the movement of molecules from low concentration to high concentration.	

Extract 16.1: Candidate's incorrect response to question 1 paper 2B

In Extract 16.1, the candidate wrote incorrect responses in all parts of the question. For example, the candidate mentioned *membrane* instead of selective permeable/ semi permeable membrane in part (a). He/she also wrote the uses of water such as *washing clothes* instead of application of knowledge osmosis in daily life. Also, the responses given in other parts were incorrect.

The analysis shows further that, 76,373 (15.67%) candidates scored from 7.5 to 25 marks. In this category, there were 68,380 (14.03%) candidates who scored from 7.5 to 16 marks. These candidates provided correct responses to some of the parts, hence failed to score all the marks. The analysis reveals that out of 7,999 (1.64%) candidates who scored from 16.5 to 25 marks, only 6 candidates provided correct responses in all the parts of the question, and therefore, scored 25 marks. This shows that the candidates had adequate knowledge and practical skills on osmosis. Extract 16.2 is a sample of the candidates' correct responses to question 1 paper 2B.

1.	a) Part C represented semi-permeable membrane.	
	b) Part C represents cell membrane with pores which allow small molecules to pass through while larger molecules can't pass.	
	It allows water molecules to pass through it but not soluble particles from the region of high water concentration to region of low water concentration.	
	c) HOLES	OBSERVATIONS
	i) In hole A contained table salts	The salt inside the hole A dissolved by distilled water to form salty solution. The volume of salty solution increased.
	ii) In hole B contained distilled water	The volume of distilled water in the hole B decreased.
	d) In the observations made in 1(c)	
	The volume of distilled water decreased in hole B because it had high concentration of water than in the hole A. This is because water moved by osmosis from the region of high concentration of water molecules (hole B) to the region with low water concentration (hole A).	

e)	Biological terms used for the concentrations in holes A and B were;
	> In hole A - Hypertonic solution
	> In hole B - Hypotonic solution
f)	Osmotic activities which take place in plants by nature are;
	1. The absorption of water by root from the soil through root hairs is possible by osmosis.
	2. The transportation of water molecules from one cell to the nearby cells to all plant parts in the xylem is possible by osmosis.
g)	The knowledge of Osmosis can be applied in daily life; in
	> Agriculture (crop plantation)
	Whereby farmers add fertilizers in the soil where as it is added in the soil it gains water by osmosis and dissolves for the plant growth.
ii)	Also the knowledge of Osmosis in daily life can be applied in preservation of foods for example; they put salt to foods such as meat to kill bacteria as they will lose water by Osmosis.
h)	The aim of the experiment was to determine the process of Osmosis in the living plant cell.
i)	Osmosis differ from diffusion in such a way that
	Osmosis involves the movement of water molecules through semi permeable membrane
	WHILE
	Diffusion involves the movement of the particles without semi permeable membrane

Extract 16.2: Candidate's correct response to question 1 paper 2B

In Extract 16.2, the candidate provided correct responses in all parts of the question, hence scored all the marks.

3.1.3 033/2C Biology 2C

The question had eight parts (a) - (h), carrying a total of 25 marks. In this question, the candidates were provided with stirring rod, delivery tube, test tube, Irish potato, scalpel, measuring cylinder and solutions in the beakers labeled by letters N₁ (mixture of distilled water and orange food colour), N₂ (mixture of distilled water and orange food colour), N₃ (distilled/rain/tap water), and N₄ (mixture of distilled water and table salt). They were required to follow the procedures as directed in (i)-(vii) to demonstrate the process of capillarity and osmosis experiments, and then answer the questions that follow.

- (i) Dip a delivery tube in the beaker containing solution N₁ and a stirring rod in the beaker containing solution N₂ until it reaches 5 cm deep while holding them careful to ensure that they do not touch the bottom of the beakers for 5 minutes.
- (ii) Remove the delivery tube and stirring rod from the beakers containing solution N₁ and N₂ after 5 minutes and observe what is happening.
- (iii) Peel the Irish potato to remove the outer cover and chip it to make four (4) small bars of about 4 cm long and 3 mm thick.
- (iv) Place two bars in a test tube which is half filled with water. Boil for 2 minutes and allow it to cool.
- (v) Place one boiled bar and one unboiled bar into the beaker containing solution N₃.
- (vi) Place one boiled bar and one unboiled bar into the beaker containing solution N₄.
- (vii) After 30 minutes remove the bars from solutions N₃ and N₄. Try to bend each bar and touch to feel its texture.

The questions asked were:

- (a) *What was your observation after 5 minutes when a delivering tube and stirring rod were deepened into solutions N₁ and N₂ in procedure (i)?*
- (b) *Account for observation made in procedure (i).*
- (c) *Which of the beakers N₁ and N₂ acted as a control of the capillarity experiment? Give reason to support your answer.*
- (d) *Which tissue found in plants can perform the same function as represented by delivery tube in this experiment?*

- (e) *How does the function of capillarity investigated in this experiment important for the survival of the plants?*
- (f) (i) *What was the texture of each bar after removing them from the solution N₃?*
 (ii) *Briefly explain the cause of each texture observation in (f) (i)*
- (g) (i) *What was the texture of each bar after removing them from the solution N₄?*
 (ii) *Briefly explain the cause of each texture observed in (g) (i).*
- (h) *Which of the bars in solutions N₃ and N₄ acted as a control of osmosis experiment? Give reason to support your answer.*
- (i) *Which of the solutions N₃ and N₄ had the following:*
 - (i) *higher concentration of water molecules?*
 - (ii) *higher concentration of solute molecules?*

The analysis of the candidates responses show that 204,563 (41.97%) candidates scored 0 marks as they provided incorrect responses in all the parts of the question. For example, in part (a), they wrote *the delivery tube and stirring rod is in solution N₁*. Other candidates wrote *solution N₁ and N₂ contain colour*. Others wrote *the delivery tube does not increase in the length in N₁ and solution in N₂ the stirring rod increase the length, the delivery tube changed color from colorless to orange and stirring rod remain colorless after five minutes*. These candidates were not aware that the observation made was that solution N₁ was raised in the delivery tube, but not the stirring rod. In part (b), candidates failed to account for the observation made, instead they provided incorrect responses such as *all delivery tubes had color, is the demonstration of capillarity process, the observation of stirring rod and delivering tube represent xylem and phloem in the plant that transport materials*. These candidates did not realize that, in the delivery tube, solution N₁ rose up because a narrow tube with lumen make possible for solution N₁ to rise up while for a stirring rod solution N₂ was not raised up because it gives negative results/the rod has no lumen to allow solution N₂ to pass through.

In part (c), the candidates failed to understand what a control experiment is, thus wrote incorrect responses such as *N₁ and N₂ are the control experiment*. Other candidates wrote *beaker act as a control of experiment, beaker acted as a control of the capillarity because the solution rose in a narrow tube*. In part (d), some of the candidates mentioned plant parts such as *leaves, roots and stem*. Others wrote animals tissues such as *blood, bone*

and *muscle*. There were also some of the candidates who wrote parts of a leaf such as *petiole*, *leaf veins* and *midrib*. These candidates were not aware that the tissue found in plants which performs the same function like delivery tube is the xylem. In part (e), some of the candidates wrote the importance of photosynthesis such as *capillarity helps the plant to manufacture its own food during photosynthesis also produces oxygen used by animals*. Other candidates wrote the function of phloem tissue in plants as *capillarity is important in plant for transport of food from the leaves to other parts of the plant*. In part (f) (i), some of the candidates provided incorrect responses on the texture as *smooth, unboiled bar become soft, unboiled bar is very strong, boiled bar is weak, the texture of unboiled bar is dry*, instead of unboiled bar became hard while the boiled bar remained with the same texture as before put in solution N₃. In part (f) (ii), some of the candidates responded incorrectly as *the texture was soft and not easy to break, the texture of boiled bar was soft because in the solution there is very low concentration that is hypertonic solution*. These candidates were not aware that the texture of the bars after removing from solution N₃ is that the unboiled bar became hard, while the boiled bar remained with the same texture as before put in solution N₃. The reasons were unboiled bar had live plant cells which gained water by osmosis/ water moved from beaker (high concentration of water) through semipermeable membrane to the cell of the bar with low concentration of water, hence the cell swelled/ became turgid. The boiled bar had dead plant cells, hence had limited osmosis process. In part (g) (i), some of the candidates wrote the texture of each bar is the texture of the solution N₃. In part (g) (ii), some of the candidate wrote the *texture is caused by boiling, because the solution contains colour*. Also, they gave incorrect reasons for the cause of changes in each bar given as *Irish potato contain water only, the boiled bar become soft due to absorption of water while boiled bar was hard due to loss of water*.

In part (h), some of the candidates failed to understand what a control experiment means, thus wrote incorrect responses such as *the control experiment is bar N₁, the control is the bar in solution N₃ and solution N₄*. These candidates did not recognize that boiled bars acts as control of the experiment in solution N₃ and N₄ because boiled bar had dead plant cells hence had limited osmosis. In part (i), the candidates incorrectly responded by writing solution N₄ is *higher concentration in solute molecules* (ii) *solution N₃ is higher concentration in water solution*. They were supposed

to understand that solution N₃ had higher concentration of water molecules while solution N₄ had higher concentration of solute molecules. Incorrect responses signify that the candidates had partial or no knowledge about Transport of Materials in Living Things. Extract 17.1 is a sample of the candidate's incorrect response to question 1 paper 2C.

01.	a) The solutions N ₁ and N ₂ arose and this show capilarity.	
	b) Observation in procedur(1) shows how capilarity is taking place.	
	c) Solution N ₁ used as a control of capilarity experiment.	
	d) Root hair tissue.	
	e) It is important because it helps plants for 1) Absorption of mineral salts in the soil. 2) Help in gaseous exchange in plants.	
	f) 1) The bar which inserted in solution N ₂ was smooth than that inserted in solution N ₁ .	
	2) In solution N ₂ because of the salt. and in solution N ₁ because of the solution itself.	
	g) 1) Boiled bar was smooth than unboiled one.	
	2) Because boiled one was killed by boiled.	
	h) Bar in solution N ₃ acted as control of osmosis, because of no reaction.	

Extract 17.1: Candidate's incorrect response to question 1 paper 2C

In Extract 17.1, the candidate wrote incorrect responses in all parts of the question. For example, he/she wrote *root hair tissue* instead of xylem in part (d). He/she also wrote the role of root hair that is *absorption of mineral salts*, instead of the role of capillarity. Also, the responses given in other parts were incorrect.

The analysis shows further that 76,373 (15.67%) candidates scored from 7.5 to 25 marks. In this category, there were 68,380 (14.03%) candidates who scored from 7.5 to 16 marks. These candidates provided correct

responses to some of the parts, hence failed to score all the marks. Furthermore, the analysis reveals that out of 7,993 (1.64%) candidates who scored from 16.5 to 25 marks, only few (6) candidates wrote correct responses in most part of the question, and therefore, scored 25 marks. This shows that the candidates had adequate knowledge about practical skills in osmosis. Extract 17.2 is a sample of the candidates' correct responses to question 1 paper 2C.

1.	a) When delivery tube were deepened into solution N_1 the solution started to rise through the delivery tube and when stirring rod were deeped into solution N_2 the solution remained the same	
	b) The level of solution N_1 was increased or the solution N_1 started to rise through the delivery tube due to capillarity where it is an ability of water or liquid to rise through a narrow tube since delivery tube is narrow tube. The solution N_2 did not rise through the stirring rod since it does not have lumen inside it therefore capillarity can not take place.	
	c) Beaker N_2 acted as a control experiment for capillarity since there was no any change which occured in the solution which is to rise up solution N_2 .	
	d) The plant tissue is Xylem tissue.	
	e) Capillarity is important for survival of the plants because it enables the movement of water molecules upward from the roots to the leaves by Xylem tissue hence they can manufacture their food through photosynthesis	

f) i)	The first bar or unboiled bar became hard and the second bar or boiled bar became the same as its original when they were removed in solution N_3 .
ii)	Unboiled bar had live plant cell which absorbed large amount of water through semi permeable membrane as solution had high concentration of water than solute it was hypotonic solution hence plant cell became turgid. - Boiled bar became the same because during boiling the potato bar the cells were killed therefore the movement of water molecules did not take place.
g) i)	The boiled bar remained the same with its texture as before put in solution N_4 while unboiled bar become soft.
ii)	The boiled bar became hard because it did not lose water molecules since when the bar was boiled the cell were killed hence osmosis did not take place and unboiled bar become soft because it lost large amount of water by osmosis through semi permeable membrane to the beaker with low concentration of water hence the vacuole shrunk and became plasmolysed.
h)	The boiled bar in solution N_3 and N_4 acted as a control experiment, because they remain the same after the experiment hence no changes which took place since their cell were killed through boiling and hence osmosis did not take place through them.
i) i)	Solution N_3 had higher concentration of water molecules.
ii)	Solution N_4 had higher concentration of solute molecules.

Extract 17.2: Candidate's correct response to question 1 paper 2C

In Extract 17.2, the candidate provided correct responses in all parts of the question, hence scored all the marks.

3.2 Question 2: Classification of Living Things

A total of 487,386 candidates attempted question 2 in all the three papers, A, B and C. The analysis shows that 235,846 (48.39%) candidates scored from 0 to 7 marks, out of which 57,045 (11.7%) scored 0 marks, 203,727 (41.80%) scored from 7.5 to 16 marks, whereas 47,813 (9.81%) scored from 16.5 to 25 marks. Figure 17 summarizes the candidates' performance in question 2 papers A, B and C.

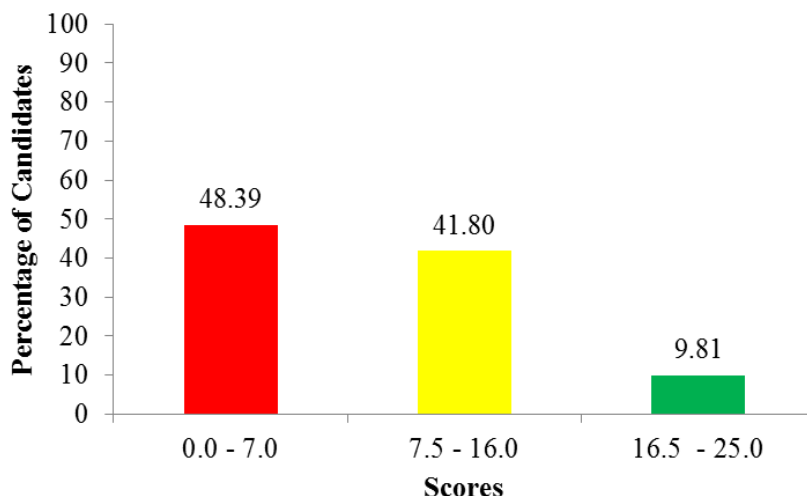


Figure 17: *Candidates' Performance in Question 2*

3.2.1 033/2A Biology 2A

The question had five parts (a) - (e), carrying a total of 25 marks. In this question, the candidates were provided with specimens D (bread mould), E (small pine branch) and F (earthworm), and they were required to study them carefully and answer the questions that follow.

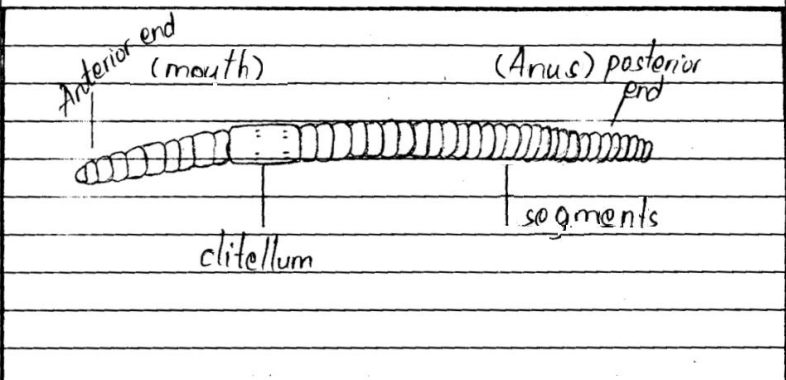
- (a)
 - (i) *What is the common name for each of the specimens D, E and F?*
 - (ii) *Why is it important to the scientists to classify specimens D, E and F to their lowest taxonomic groups? Give two reasons.*
- (b) *Classify each of the specimens D, E and F to the phylum/Division level.*
- (c) *Why are specimens D and F placed to the Phylum/Division you named in (b)? Give two reasons for each specimen.*
- (d) *What do the processing industries benefit from using the plants in which specimen E was taken? Give three benefits.*

- (e) (i) *Draw a well labeled diagram of the specimen F.*
- (iii) *State the habitat of the specimen F.*
- (iv) *What are the two advantages of specimen F to the farmer?*

The analysis of candidates' performance shows that half of the candidates 251540 (51.61%) scored from 7.5 to 25 marks. Therefore, the performance in this question was average for all alternative papers (A, B and C). For those who scored from 7.5 to 16 marks, they provided correct responses to some of the parts, hence failed to score all the marks. Further analysis reveals that out of 47,813 (9.81%) candidates who scored from 16.5 to 25 marks, only 25 candidates scored all the 25 marks. This indicates that the candidates had adequate knowledge about Classification of Living Things. Extract 18.1 is a sample of the candidates' correct responses to question 2 paper 2A.

2.		
01)	Common names for;	
	specimen D	- bread mould.
	specimen E	- pine leaf.
	specimen F	- earthworm.
20)ii.	Importances of classifying specimens D, E and F to their lowest taxonomic groups are:	
	a) Makes it easier to study organisms.	
	b) Enables scientists to know how organisms are related, and thus providing supportive evidence for evolution	
2b)		
	SPECIMEN	KINGDOM
	D	Fungi
		Zygomycota
	E	Plantae
		Coniferophyta
	F	Animalia
		Annelida

2c.	Specimen D is placed to the phylum zygomycota because:-
	i) They appear as white fluffy substance because of their hyphae, but they later on change to grey.
	ii) They grow on decaying food substances.
	Specimen F is placed to the phylum annelida because:-
	i) The presence of chaetae or bristles.
	ii) Metameric segmentation; they are segmented (their body walls and internal organs are segmented.)
2d.	i) The plants in which specimen E was taken contain chemical substances called resin which are a useful source of turpentine which is used in thinning paints.
	ii) The plants in which specimen F was taken act as is used in manufacturing of paper from wood pulp.
	iii) The plants in which specimen E was taken act as a source of timber which is used in making different industrial products. For example furniture.

2e)	
	A WELL LABELLED DIAGRAM OF THE SPECIMEN F
	
2e ii)	The habitat of specimen F is <u>in moist soil</u>
2e iii)	Advantages of the specimen F to the farmer
	<p>a) Improves soil drainage. Through the burrowing activity of the specimen F (earthworm), the soil is made loose and air spaces are formed, these spaces allow easy penetration of water to the soil deep down, and thus, improves soil drainage.</p> <p>b) Improves soil fertility. The specimen F (earthworm) can feed on dropped leaves and in the process decomposes them to form manure.</p>

Extract 18.1: Candidate's correct response to question 2 paper 2A

In Extract 18.1, the candidate provided correct responses in all the parts. This shows that the candidate had adequate knowledge of Classification of Living Things, and practical skills in identifying and classifying various organisms.

On the contrary, 48.39 candidates scored low marks (0 – 7). There were some of the candidates who provided correct responses in some of the question, hence scored from 1 to 7 marks. For 57,045 (11.70%) candidates who scored 0 marks, most of them provided incorrect responses in most parts of the question signifying lack or inadequate knowledge of Classification of living things.

For example, in part (a) (i), most of the candidates wrote the names of other organisms. For example, some of the candidates wrote *D -Bread*, *E - Plant* and *F - Worm*. Other candidates wrote, *yeast*, *mucor* and *mushroom*. There were also some candidates who wrote *moss*, *fern plant* and *worm*. In part (a) (ii), some of the candidates wrote the importance of each specimen to other organism contrary to the demand of the question which required them to provide importance of classifying the specimens to their lowest taxonomic group. For example, some candidates wrote *specimen D is used as a source of food to other living organisms*, *specimen F is used in biological studies* *specimen E is used to produce timber*.

In part (b), these candidates failed to classify the specimens to their respective Kingdoms and Phyla/Divisions. For example, some candidate classified specimen D to Kingdom *Animalia*, instead of Kingdom *Fungi*, specimen E to Division *Angiospermophyta*, instead of Division *Coniferophyta*, and specimen F to *Kingdom Fungi*, instead of Kingdom *Animalia*. Others correctly classified the specimens into their Phylum/Division without following the hierarchical order which starts from the highest rank Kingdom to the lowest rank Phylum/Division, hence loss of some marks. Also, there were other candidates who mentioned correct ranks, but misspelt them, thus loss of marks. In part (c), the candidates were required to provide distinctive features, but most of them gave general features. For example, some candidate wrote *specimen D is placed in the group because they are heterotrophic, they are multicellular*. *Specimen F is placed in the group because they feed on plants and they are heterotrophic*. In part (d), some of the candidates provided the economic importance of specimen E to other living organisms instead of farmers. For example, some candidates wrote *specimen E help to provide food to other organisms*, *specimen E is used to provide medicine*. In part (e) (i), most of the candidates drew the diagram of a roundworm instead of earthworm. Others drew the diagram of specimen D, Bread mould, while others drew the diagram of the specimens which were not part of the question, such as

grasshoppers fern plant and yeast. In part (e) (ii), these candidates failed to give the habitat of specimen F, responses like *F is on the land*, *specimen F live in cow dung* were observed in candidates' scripts. In part (e) (iii), the candidates gave the importance of specimen F to other living organisms, instead of providing the importance of specimen F to farmers. For example, one candidate wrote *specimen F is a source of food to other organism*, *specimen F is used in catching fish*. This shows that these candidates had inadequate knowledge about the tested concepts. Extract 18.2 is a sample of the candidates' incorrect responses to question 2 paper 2A.

2	D - Bread moles	
	E - Plant leaf	
	F - Round worm	
B	Specimen	Phylum / Division.
	D - Bread mole	Biomycoter
	E - Plant leaf	Zygomycoter
	F - Round worm	Arechnider
	Reasons:	
C	D - Bread mole - Are Small plant Can not been Seen verywell	
	- Are growing in dry areas	
	E - Plant leaf: Are the thin and taller leaves.	
	- Are growing in desert Area.	
D	- It Used In medicine	
	- Is the Social of Spw Employment in our Country	
	Importance	
	- Bread mole Is Importance because Its Used to decomposed the food	
	- Round worm Is Importance because Its Used In Supporting life of plant	

Extract 18.2: Candidate's incorrect response to question 2, paper 2A

In Extract 18.2, the candidate wrote incorrect responses in all parts of the question. For example, he/she identified specimen D, E and F as *bread mole*, *plant leaf* and *roundworm* instead of bread mould, pine leaf and earthworm. He/she incorrectly classified specimen D, E and F into Phylum/Division *Biomycoter*, *Zygomycoter* and *Arechnida* instead of Phylum/Division *Zygomycota*, *Coniferophyta* and *Annelida*.

3.2.2 033/2B Biology 2B

The question had four parts (a) - (d), carrying a total of 25 marks. In this question, the candidates were provided with specimens Q (centipede), R (honey bee), S (rat/mouse) and T (frog/toad). They were required to study them and then answer the following questions:

- (a) (i) *Identify each of the specimens Q, R, S and T by its common name.*
- (ii) *Why is it important for scientists to use the knowledge of classification in identification of the specimens instead of common names you used in 2(i)? Give two points*
- (b) (i) *Classify each of the specimens Q and R to the class level.*
- (ii) *Give three reasons for the specimens Q and R to be placed into different classes.*
- (c) *Why is the specimen R said to be economically important to human being while specimens S and Q are said to be detrimental? Give one point for each.*
- (d) *What are the two observable differences between the specimens S and T at class level?*

The analysis of candidates' responses shows that the candidates who performed well in this question provided correct responses in all the parts of the question. These candidates had adequate knowledge of identifying and classifying various organisms. Extract 19.1 is a sample of the candidates' correct response to question 2 paper 2B.

2a i	Specimen	Common name.
	Q	centipede
	R	honey bee
	S	rat
	T	frog

2a ii	<p>i/ Because it gives the scientists in all over the world the common knowledge and idea in identifying the organisms rather than using common names hence this reduces chances of confusions by giving them scientific names.</p> <p>ii/ It is easy to study organisms when they are classified even to identify them is easy as organisms of the same characteristics are put in one group example: mouse or rat and human beings have many corresponding characters hence they are grouped in one group of chordata and mammalia.</p>
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2b i.	<p>Specimen Q.</p> <p>Kingdom: Animalia</p> <p>Phylum: Arthropoda</p> <p>Class: Chilopoda.</p>
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2b i	<p>Specimen R</p> <p>Kingdom: Animalia</p> <p>Phylum: Arthropoda</p> <p>Class: Insecta.</p>
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2b ii	i/ Specimen Q is dorsal ventrally flattened with many segments	
	ii/ Specimen Q has one pair of legs in each segment	
	iii/ Specimen Q has poisonous claws.	
	i/ Specimen R has two pairs of wings.	
	ii/ Specimen R is divided into three parts.	
	iii/ Specimen R has three pairs of walking legs	
2c.	Specimen R is said to be economically important to human beings because it produces honey which is used in medication as medicine for human example treating burns and domestically honey is used as ingredient to add flavour in some type of food example cake.	
	Specimen Q is said to be detrimental to human beings as it attacks human beings with its poison claws and hence causes danger and health problem to human beings	
	Specimen S is said to be detrimental to human beings as it destroys food materials in granaries and other storage facilities and hence can lead to starvation and food shortage in the society.	
2d.	Observable differences of S from T.	
	Specimen S	Specimen T.
	i/ It has outer ear made up of pinna	It has no outer ear but ear drum can be seen
	ii/ It has skin covered with hair	It has moist skin with out hair.

Extract 19.1: Candidate's correct response to question 2 paper 2B

In Extract 19.1, the candidate provided correct responses in all parts of the question, which indicates adequate knowledge on identifying and classifying various organisms.

On the other hand, some of the candidates scored low marks (0 – 7). Some of the candidates gave correct responses to some parts, hence scored from 1 to 7 marks. For the 57,045 (11.70%) candidates who scored 0 marks, they provided incorrect responses in all parts of the question. For example, in part (a) (i), some of these candidates mentioned incorrect common names of specimens *Q*, *R*, *S* and *T* such as *Q* is a *worm* instead of *Centipede* and *R* is a *Housefly* instead of *Honeybee*, specimen *S* is a *Rabbit* instead of

Rat/Mouse. In (a) (ii), some of these candidates gave the advantages of the specimens instead of the importance of classifying organisms. Some of the incorrect responses provided were: *specimen Q is a source of food to other organisms*, *specimen R produces food to human being* and *specimen S is used in biological studies*.

In part (b) (i), some candidates failed to classify specimens into their respective ranks, while others wrote correct ranks but misspelt them. For instance, some of the candidates wrote the Phylum of specimen Q as *Anthopoda* instead of *Arthropoda*. Specimen R was incorrectly classified in Phylum *Nemtoda* instead of *Arthropoda*. Furthermore, some candidates interchanged the ranks. They classified specimen R in *Phylum Insecta* and Class *Arthropoda* instead of Phylum *Arthropoda* and Class *Insecta*. In part (b) (ii), Most of these candidates wrote the general features of Phylum *Arthropoda* instead of distinctive features of classes *Chilopoda* and *Insecta*, such as *they are multicellular*, *they have heterotrophic nutrition*, *they have exoskeleton* and *have many pair of legs*. Other candidates wrote the distinctive features of Class *Arachnida* as they wrote *they have bodies divided into two parts* and *they have four pairs of legs*, instead of the distinctive features of class *Insecta* and class *Chilopoda* in which specimen Q and R belong.

In part (c), some of the candidates incorrectly provided economic importance of specimen R to human being. For example, some candidate wrote *specimen R is used to add manure in the soils*. Also some candidates wrote *specimen S is used as meat* instead of giving detrimental effects of the specimens S and Q. These candidates were not aware that specimen S causes damage to crops and other man's properties. Also, it carries fleas which spread diseases to humans such as plague. In part (d), some candidates differentiated specimen S and T by using their habitat, as they wrote *specimen S live in damp areas while specimen T live in water*, *specimen S destroy human property while specimen T does not destroy human property*. Incorrect responses provided by the candidates signify lack of adequate knowledge of the practical skills of classifying organisms to different groups. Extract 19.2 is a sample of the candidates' incorrect response to question 2 paper 2B.

2	a) i) Q - Millipede	
	R - Housefly	
	S - Frog	
	T - Mouse	
	b) Q and R - Class Filicinophyta	
	R - Class Angiospermophyta	
	b) Q R	
	- Have segmented body - Have no segmented body	
	- Have jointed legs - Have no jointed legs	
	- Have eyes - Have no eyes	
	d) S - Have tail at class mammalia	
	T - Have hind limbs at class mammalia	
	c) Because specimen R it help for bite in the house	
	also and it help for gaseous exchange for human being	
	a) i) It help to gain different uses of specimens	
	because scientist to use the knowledge of classification also	
	it help to gain many uses of different specimen because	
	if you not knowledge of scientist also does not to gain	
	many uses of specimens	
	It help for experiments. This is the important for	
	scientist to use the knowledge because it help for experi	
	ments in the laboratory if you gain names of specimen	
	also it help for scientist to using experiment because	
	to gain names for experiments also this is the importa	
	nt for scientist to use knowledge of classification in ide	
	ntification of the specimens.	

Extract 19.2: Candidate's incorrect response to question 2 paper 2B

In Extract 19.2, the candidate wrote incorrect responses in all parts of the question. For example, he/she identified the specimens as Q - millipede R - housefly, S - frog and T - mouse, instead of centipede, honey bee/bee, rat/mouse/ and frog/toad in part (a). He/she also incorrectly wrote the classes of specimens Q and R, instead of classifying them hierarchically from Kingdom to Class. Also, the responses given in other parts were incorrect.

3.2.3 033/2C Biology 2C

The question had five parts (a) - (e), carrying a total of 25 marks. In this question, the candidates were provided with specimens A (mushroom), B (beetle), C (centipede) and D (millipede) and they were required to study them carefully and answer the following questions:

- (a) (i) *Identify each of the specimens A, B, C and D by its common name.*
- (ii) *Why scientists prefer binomial nomenclature in naming the organisms A, B, C and D instead of common names?*
- (b) (i) *Classify the specimen A to Phylum level.*
- (ii) *Give two benefits of the specimen A to man.*
- (c) *Classify each of the specimens C and D to class level.*
- (d) *Why are the specimens C and D placed in the same phylum but different classes?*
- (e) *What are the two benefits that specimen B has in the ecosystem?*

The analysis of candidates' responses shows that the 51.61 per cent of the candidates who scored from 16.5 – 25 marks provided correct responses in most parts of the question. This shows that the candidates had sufficient knowledge on identifying and classifying living things. Extract 20.1 is a sample of candidates' correct response to question 2 paper 2C.

2a/	i/	A - Mushroom.	
		B - Beetle.	
		C - Centipede.	
		D - Millipede.	
	ii/	Enables identification of organisms to be easier and the scientific names are universal thus can be used by scientists anywhere in the world.	
2b/	i/	SPECIMEN A	
		KINGDOM - Fungi.	
		PHYLUM - Basidiomycota.	
	ii/	Importance of Specimen A to man:	
	a/	Source of food.	
	b/	Decompose dead / decaying organic matter thus may increase soil fertility.	
2c/		SPECIMEN C	
		KINGDOM - Animalia.	
		PHYLUM - Arthropoda.	
		CLASS - Chilopoda.	

2c/	SPECIMEN D	
	KINGDOM: <u>Animalia</u> .	
	PHYLUM: <u>Arthropoda</u> .	
	CLASS: <u>Diplopoda</u> .	
2d/	Because the specimen have segmented bodies and jointed appendages.	
	differences causing them to be in different classes.	
	SPECIMEN C.	SPECIMEN D.
	i/ One pair of legs in each segment.	i/ Two pairs of legs in each segment.
	ii/ Has poisonous claws.	ii/ Has no poisonous claws.
	iii/ They are carnivores.	iii/ They are herbivores.
2e/	i/ Source of food to some organisms such as snakes.	
	ii/ Because they are scavengers feeding on decaying organic matter they help to clean the environment.	

Extract 20.1: Candidate's correct response to question 2 paper 2C

In Extract 20.1, the candidate provided correct responses in all parts of the question signifying adequate knowledge of identifying and classifying various organisms.

However, some of the candidates scored low marks (0 – 7). These candidates provided incorrect responses in some or all parts of the question. For example, in part (a) (i), some candidates mentioned incorrect common names to specimens A, B, C and D; some of the candidates identified specimen A as *Rhizopus* instead of *Mushroom*, B as *Black ant*, *spider* and *battle* instead of *Beetle*, C as *Scorpion* instead of *Centipede*, and D as *Caterpillar* instead of *Millipede*.

In part (a) (ii), some candidates defined binomial nomenclature as *the scientific naming of organisms where each is given two names, generic and specific names*. Other candidates provided the importance of studying biology such as *helps to understand ourselves better, biology help us to get different professionals*. There were other candidates who provided

examples of scientific names such as *Musca domestica*, *Panthera leo* and *Zea maize* instead of giving the reasons as to why binomial nomenclature is preferred by scientist. In part (b) (i), some of the candidates incorrectly classified specimen A to *Kingdom Plantae* and *Phylum Ascomycota* instead of *Kingdom Fungi*, and *Phylum Basidiomycota*. Other candidates provided correct rank, but misspelt them as they wrote *Basijomycotes* instead of *Basidiomycota*. In part (b) (ii), they wrote the benefits of other organisms such as *specimen A helps other plants to grow*, *specimen A is used as decoration*, *it is used to show tourism attraction* and *specimen A provides timbers*. Other candidates wrote the disadvantages instead of benefits, as *some are poisonous and it causes death to man*.

In part (c), some of the candidates incorrectly classified specimens C and D, and did not follow the hierarchical order. For example, some classified specimen C to *Phylum Nematoda* instead of *Arthropoda* and class *Insecta* instead of *Chilopoda*. Specimen D was classified to *Kingdom Fungi* instead of *Kingdom Animalia* and *Class Insecta* instead of *Class Diplopoda*. In part (d), these candidates provided incorrect reason for placing specimens C and D to their respective group. For example, some candidate listed general features of placing specimens C and D to phylum level such as *they are bilaterally symmetrical and they have an open circulatory system* instead of the distinctive features. Similarly, specimens C and D were placed into different classes for reasons such as *specimen C - have a compound eyes but D have simple eyes*, *all are small animals but different structure such as different legs*, *they are different in external and internal*, *millipede have hard skin while centipede have soft skin*. There were also other candidates who gave the distinctive features of the Class Arachnida instead of the distinctive features of Phylum Arthropoda, as they wrote: *specimens C and D have four pairs of legs*, *specimens C and D have two body parts*. In part (e), they wrote benefits of bees such as *source of income and produces honey* instead of the benefits of specimen B. Other incorrect responses observed from candidates scripts were *it gives plant carbon dioxide*, *it provides medicine*, *they are secondary producer as they are eaten by bird*, *it helps living organism to survive*, *it reduces number of producers*. This shows that candidates had inadequate knowledge on identifying and classifying different living organisms. Extract 20.2 is a sample of the candidate's incorrect responses to question 2 paper 2C.

2. You have been provided with specimens A, B, C and D. Study the specimens carefully and answer the following question.

Q. Identify each of specimens A, B, C and D by its common name.

Specimen	Common name
A	Mushroom
B	Bee
C	Millipede
D	Centipede

Q. Why do scientists prefer binomial nomenclature in naming the organism A, B, C and D. Instead of common names?

Because they want to know their common names and not the letter.

Q. Classify the specimen A to phylum.

Specimen	Phylum
Mushroom	Basidiomycota

Q. Give two benefits of the specimen A to man.

- It is the food for the human.
- It is got on the damp land.

Q3 Classify each of the specimens C and D to Class level

Specimen	KINGDOM	PHYLUM	CLASS
Millipede	Animal	Arthropoda	Chilopoda
Centipede	Animal	Arthropoda	Diplopoda

Q4 Why are the specimens C and D placed in the same phylum but different classes?

⇒ Because the centipede and millipede are so different cause of the legs the legs of centipede is few and the legs of millipede is many.

Q5 What are the two benefits that specimen B has in ecosystem.

- It's the work of waste supply
- It's habit in the damp land.

Extract 20.2: Candidate's incorrect response to question 2 paper 2C

In Extract 20.2, the candidate incorrectly identified the specimens B, C and D as *bee*, *millped* and *centped* instead of *beetle*, *centipede* and *millipede* in part (a). The candidate also misspelt the ranks of the specimens. For example, he/she wrote the phylum *Basidiomycot* instead of *Basidiomycota* in part (b) (i). However, the candidate correctly identified the common name of specimen A as *mushroom* and its benefit to man as *its the food for the human* in parts (a) (i) and (b) (ii).

4.0 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH TOPIC

A total of 17 topics were tested in the Biology subject examination paper 1 and paper 2. The analysis of the candidates' performance in the paper 1 which comprised 15 questions indicates that out of 17 topics tested, the topics of *Gaseous Exchange and Respiration*, *Introduction to Biology*, *Safety in Our Environment*, *Cell Structure and Organisation*, *Nutrition*,

Coordination, Growth, Classification of Living Things, Balance of Nature and Transport of Materials in Living Things had good performance of 76.18 per cent. These topics were examined in question 1 which involved multiple choice items. It was followed by the topic of *Introduction to Biology* which had performance of 69.21 per cent examined in question 15, which was an essay type question.

The topics with average performance were *Safety in Our Environment*, (62.96%), *Health and Immunity*, (55.82%), *Transport of Materials in Living Things* (47.81%) and *Genetics* (35.53%). These topics were examined in questions 3, 4, 2 and 11. Question 2 was matching items while questions 3, 4 and 11 were short answer questions.

The topics with weak performance were *Reproduction* (27.66%), *Coordination* (27.03%), *Movement* (14.67%), *Excretion* (13.65%), *Regulation* (11.60%), *Gaseous Exchange and Respiration* (9.58%), *Evolution* (8.83%) and *Nutrition* (7.87). These topics were examined in questions, 5, 13, 14, 8, 10, 9, 7, 12 and 6. Questions 5, 6, 7, 8, 9, 10 and 12 were short answer type while question 13 and 14 were essay type. Appendix I summarizes the candidates' performance in each topic in 033/1 Biology 1 CSEE 2021. In the 033/2 Biology 2 actual paper, the topic of *Classification of Living Things* had average performance of 51.61 per cent. However, the topic of *Transport of Materials in Living Things* had weak performance of 15.67 per cent.

The comparison of the candidates' performance in each topic in 033/1 Biology 1 CSEE 2020 and CSEE 2021 shows that, the performance has improved from average to good in the topic of *Introduction to Biology*, while those of *Safety in Our Environment* and *Transport of Materials in Living Things* have improved from weak to average. This implies that there were some efforts directed toward improving teaching and learning in Biology subject. On the other hand, the performance on the topics of *Health and Immunity* and *Genetics* maintained average performance. However, the topics of *Reproduction*, *Nutrition*, *Excretion*, *Coordination*, *Gaseous Exchange and Respiration* and *Regulation* maintained the weak performance. The comparison is summarized in Appendix II.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

The analysis of candidates' performance in the CSEE Biology examination 2021 paper 1 shows that, the questions which had good performance were 1 (76.18%) and 15 (69.21%). The questions which had average performance were 2 (47.81%), 3 (62.96%), 4 (55.82%), 11 (35.53%) and 13 (42.13%). However, the questions 5 (12.69%), 6 (7.87%), 7 (9.58%), 8 (14.67%), 9 (11.60%), 10 (13.65%), 12 (8.83%) and 14 (27.03%) had weak performance. In 033/2 Biology 2 question 1 had weak performance while question 2 had average performance.

Generally, the performance of the candidates in Biology subject CSEE 2021 was good because 67.21 per cent of the candidates passed. The analysis conducted on the candidates' responses indicated that, good performance to some candidates was attributed to factors such as sufficient knowledge of the tested concepts, good understanding of the questions' demands and good proficiency in the English language. However, weak performance to some candidates was due to failure of the candidates to understand the demands of the questions, insufficient or lack of knowledge on various concepts as well as poor command of English language which contributed to the difficulties in understanding the demands of the questions and providing clear explanations to the given concepts or terminologies.

5.2 Recommendations

Based on the observations made through the candidates' item response analysis report, the following are recommendations in order to maintain good performance in Biology subject:

- (a) Teachers and students are advised to read the Candidates' Item Response Analysis report (CIRA). This will enable them to find the factors which affect candidates' responses and take appropriate measures during classroom teaching and learning so as to improve the candidates' performance.
- (b) Teachers and students are urged to use English Language during the discussion of various topics in the class and in other extracurricular activities. This will improve students' writing skills and enable

them to understand what is taught in the classrooms as well as the questions' demand.

- (c) Teachers are advised to adhere to the teaching and learning strategies underlined in the Biology syllabus for better students' acquisition of knowledge in the poorly performed topics as follows:
 - (i) For the topic of *Nutrition*, teacher should provide charts/samples of fertilizers and plants pictures/photographs showing problems associated with nutrients availability. Then the teacher should guide the students in groups to observe, list the essential mineral elements in plant nutrition and discuss the roles, excess and deficiency symptoms of essential mineral elements. The teacher also should provide inorganic fertilizers, hand hoes, watering can, water, measuring tape charts/photographs showing healthy plants, plants with excess and deficiency symptoms of essential mineral elements. Then the teacher should guide students in groups to set up small plot field experiment to investigate effects of excess and deficiency supply of essential mineral elements in plants. Students should make progressive observations and record results, while the teacher should guide students on interpreting results of the experiments and come up with conclusions.
 - (ii) For the topic of *Evolution*, teacher should display photographs/pictures of fossils in the rock strata for students in groups to observe pictures or photographs and discuss the evidences of organic evolution. Then they should present their group tasks in plenary discussion and the teacher to guide them to summarize major points and make clarifications.
 - (iii) For the topic of *Gaseous Exchange and Respiration*, teacher should use chart/diagram on anaerobic and aerobic respiration to guide students in groups to discuss the differences between aerobic and anaerobic respiration. Then students should present their findings in plenary discussion and the teacher to make clarification and conclusion.

- (iv) For the topic of *Regulation*, students should discuss in groups the body reactions when the temperature of the surrounding is lower and when is higher than the body temperature. Then teacher should lead a class discussion on the structure of the skin in relation to temperature regulation (vasoconstriction and vasodilation). Students should observe models/charts/ photographs showing the section of the skin and pictures or diagrams showing the reaction of the skin under different conditions (hot and cold) and draw a labeled section of the skin showing vasoconstriction and vasodilation.
- (v) For the topic of *Excretion*, teacher should display a chart showing various plants and their waste products, samples of plant excretory products such as gums, alkaloids and latex. Then the teacher should lead students in groups to discuss the importance of excretory products from plants such as gum, alkaloids and latex, to summarize the major points and make conclusion.
- (vi) For the topic of *Movement*, teacher should provide model of human skeleton for students in groups to discuss the adaptation of the major components of the human skeleton. Also, the teacher should lead plenary discussion and guide students to summarize and record major points.
- (vii) For the topic of *Coordination*, teacher should guide students in groups to observe live or preserved specimen of the sense organs, models/pictures/ specimens showing different sense organs and discuss the role of each sense organ and its adaptive features. Then students should present their group task and the teacher to guide them to summarize major points and make clarification.
- (viii) For the topic of *Reproduction*, teacher should guide students to observe pictures showing various contraceptives and discuss in groups the factors affecting fertilization and present their group tasks for plenary discussion. Students should use guidelines, radio/video tapes, texts depicting cases of

sexuality and sexual behaviour tapes, pictures and photographs showing people with different sexual behaviour (responsible and irresponsible behaviour) to role play on responsible and irresponsible sexual behaviour. Then teacher should guide students to discuss responsible and irresponsible sexual behaviour, their impact on oneself, family and community as shown in the role play and make conclusions. Students should also tabulate the differences between responsible and irresponsible sexual behaviour.

- (ix) For the topic of *Transport of Materials in Living Things*, teacher should use Irish potatoes, sugar or table salt, water, heat source, petri dish or small trough, beaker, distilled water, pawpaw, perfume and air fresher to demonstrate simple experiments on osmosis, diffusion and mass flow. Subsequently, students in groups should carry out experiments on osmosis, diffusion and record their observations. Also the teacher should display chart/tables on differences between diffusion and osmosis and guide the students through questions and answers to outline differences between diffusion, osmosis and mass flow. The teacher also should lead students in groups to discuss the roles of osmosis, diffusion and mass flow in movement of materials in living organisms.

Appendix I: A summary of the Candidates' Performance Topic-wise in CSEE 2021

S/N	Topic			
		Question number	Percentage of Candidates With a Score of 30% or Above	Remarks
1.	Gaseous Exchange and Respiration, Introduction to Biology, Safety in Our Environment, Cell Structure and Organisation, Nutrition, Coordination, Growth, Classification of Living Things, Balance of Nature, Transport of Materials in Living Things, Health and Immunity, Reproduction, Movement, Regulation, Excretion, Genetics and Evolution.	1	76.18	Good
2.	Introduction to Biology	15	66.18	Good
3.	Safety in Our Environment	3	62.96	Average
4.	Health and Immunity	4	55.82	Average
5.	Transport of Materials in Living Things	2	47.81	Average
6.	Genetics	11	35.50	Average
7.	Reproduction	5	12.69	Weak
		13	42.63	Average
8.	Coordination	14	27.03	Weak
9.	Movement	8	14.67	Weak
10.	Excretion	10	13.65	Weak
11.	Regulation	9	11.60	Weak
12.	Gaseous Exchange and Respiration	7	9.58	Weak
13.	Evolution	12	8.83	Weak
14.	Nutrition	6	7.87	Weak

Appendix II: Comparison of the Candidates' Performance Topic-wise in CSEE 2020 and 2021

S N	Topic	CSEE 2020			CSEE 2021		
		Question number	Percentage of Candidates With a Score of 30% or Above	Remarks	Question number	Percentage of Candidates With a Score of 30% or Above	Remarks
1.	Introduction to Biology, Safety in Our Environment, Nutrition, Balance of Nature, Transport of Materials in Living Things, Regulation, Growth, Coordination, Genetics and Evolution.	1	65.1	Good	1	76.18	Good
2	Classification of Living Things	4	1.3	Weak			
3	Safety in Our Environment	3	23.8	Weak	3	62.96	Average
4	Movement	15	49.8	Average	8	14.67	Weak
5	Health and Immunity	13	40.7	Average	4	55.82	Average
6	Introduction to Biology	2	30.9	Average	15	66.18	Good
7	Reproduction	11	12.6	Weak	5 & 13	27.66	Weak
8	Genetics	12	39.2	Average	11	35.50	Average
9	Nutrition	6	21.4	Weak	6	7.87	Weak
10	Excretion	9	7.3	Weak	10	13.65	Weak
11	Coordination	8	15.2	Weak	14	27.03	Weak
12	Cell Structure and Organisation	10	10.3	Weak			
13	Gaseous Exchange and Respiration	9	6.9	Weak	7	9.58	Weak
14	Regulation	12	6.1	Weak	9	11.60	Weak
15	Transport of Materials in Living Things	6	22.7	Weak	2	47.81	Average
16	Evolution				12	8.83	Weak

