THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT ON THE DIPLOMA IN SECONDARY EDUCATION EXAMINATION (DSEE) 2023

BIOLOGY

THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF EDUCATION, SCIENCE AND TECHNOLOGY

NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT ON THE DIPLOMA IN SECONDARY EDUCATION EXAMINATION (DSEE) 2023

733 BIOLOGY

Published by:
National Examinations Council of Tanzania
P.O. Box 2624
Dar es Salaam, Tanzania.

TABLE OF CONTENTS

FOREWORD

The National Examinations Council of Tanzania is pleased to issue this report on Candidates' Item Response Analysis (CIRA) on the Diploma in Secondary Education Examinations for the year 2023 in the Biology subject. This report has been prepared to give feedback to all education stakeholders on how the candidates responded to the Biology examination questions.

Diploma in Secondary Education Examination (DSEE) measures the extent to which the teaching and learning objectives were attained for the period of two years of the course. Basically, candidates' responses to the questions show how the teaching and learning objectives were achieved.

The report highlights some of the factors which led to candidates' good or poor performance in the assesed topics. Factors which led to candidates' good performance include mastering various competences stipulated in the syllabus, understanding questions asked, good presentation skills and good laboratory skills. Moreover, the reasons that contributed to the weak performance on few topics include inability to understand the questions asked, lack of competences in the respective topics and poor presentation skills accompanied by poor mastery of the English language.

It is our hope that the feedback provided in this report will enable various education stakeholders and other concerned authorities to take appropriate measures and therefore improve the teaching and learning process which will ultimately raise performance in the future examinations.

The National Examinations Council of Tanzania would like to express sincere gratitude to all stakeholders who participated in different capacities in the preparation of this report.

Dr. Said A. Mohamed
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report analyses the performance of the candidates who sat for Biology subject on the Diploma in Secondary Education Examination (DSEE) in 2023. The questions intended to assess the candidates' competences in the Biology academic and pedagogy syllabus (2009) for Diploma in Secondary Education. A total of 717 candidates were registered for the Biology examination out of them 709 sat for and passed the examination. This indicates that the subject was well taught and understood. The candidates' performance in grades shows that, no candidate scored A, 47 scored B, 483 scored C, and 169 scored D grade. In comparison to year 2022, the performance in 2023 has increased by 0.58 per cent.

Analysis of the candidates' responses covers both 733/1 Biology 1 (Theory Paper) and 733/2 Biology 2 (Actual Practical Paper). Biology paper 1 consisted of (14) questions. The candidates were instructed to attempt all the questions in each section. The practical paper had two (2) alternative papers: 733/2 Biology 2A and 2B. Each alternative paper consisted of three compulsory questions: Question (1) carried 20 marks, and the rest carried 15 marks each. Thus, each paper had a total of 50 marks.

This analysis report focuses on assessing the quality of responses supplied by the candidates in responding to various questions. It also describes the misconceptions observed on candidates' responses and possible reasons for such misconceptions. Moreover, the report consists of five main sections, which are the introduction, analysis of the candidates' performance on each question in 733/1 Biology 1, analysis of the candidates' performance on each question in 733/2 Biology 2, analysis of candidate's performance in each topic and finally, the report presents the conclusion and recommendations.

Three parameters have been used to analyze performance in each question. The parameters are based on the percentage of candidates' performance in the given questions which are 0-39%, 40-69% and 70-100%. The performance group ranges are considered to be weak, average and good, respectively. The candidates who scored average and those who scored good performance were considered to pass the given question. Likewise, green, yellow and red colors have been used in charts to indicate good,

average and weak performance levels, respectively. On the other hand, charts, graphs as well as samples of good and poor responses have been provided in extracts to present the quality of responses given by the candidates in response to particular questions.

2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE ON EACH QUESTION IN 733/1 - BIOLOGY 1

This section analyses the performance of the candidates on each question in Sections A and B. Section A had 10 short-answer questions. Each question carried four (4) marks, making a total of 40 marks. Section B had four (4) essay type questions where each question carried 15 marks making a total of 60 marks.

2.1 SECTION A: Short Answer Questions

In this section, candidates were required to answer all questions. Each question carried four (4) marks as described in the previous sections of this report.

2.1.1 Question 1: Classification of Living Things

The question required the candidates to classify the following organisms from phylum/division to class level; (a) Moss (b) Crab, (c) Water lily (d) Amoeba.

The question was attempted by all candidates. The performance of candidates on this question was average since 381 (53.7%) candidates scored 2 to 4 marks. Figure 1 provides a summary of candidates' performance on this question.

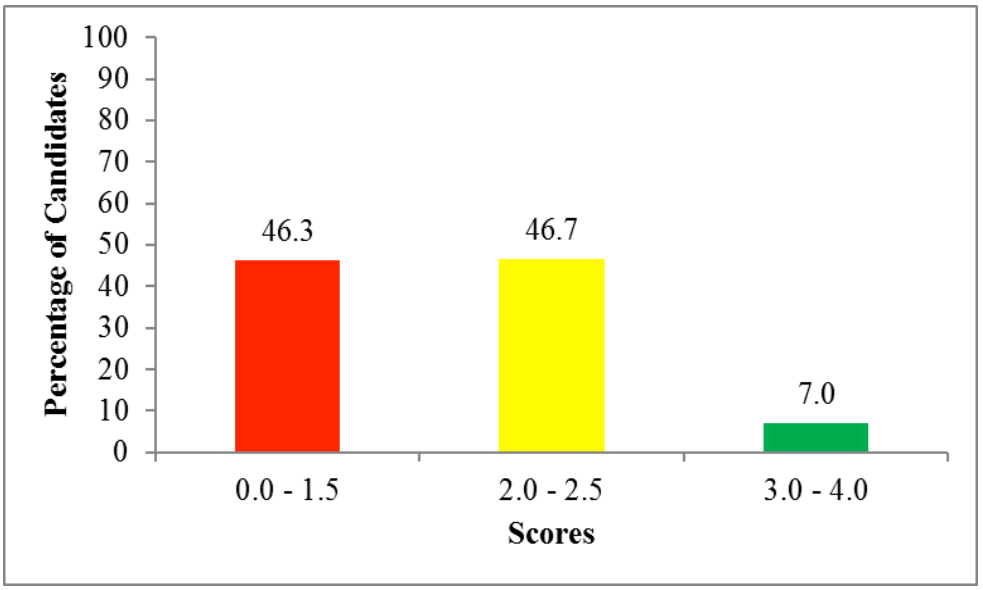


Figure 1: *Candidates' Performance on Question 1*

Figure 1 shows that 46.7 per cent of the candidates scored 2 to 2.5 marks and 46.3 per cent scored 0 to 1.5 marks. Only 7.0 per cent scored 3 to 4 marks.

Data analysis further indicates that 381 candidates who scored above the pass mark were able to classify correctly two or four of the organisms given in items (a) to (d). Their adequate knowledge of classifying organisms into their appropriate groups/taxa enabled them to give correct responses such as: (a) *Moss belongs to division Bryophyta and class Musci (b) Crab belongs to the phylum Arthropoda and a class of Crustacea, (c) Water lily belongs to division Angiospermophyta and class Monocotyledonae (d) Amoeba belongs to the phylum Protozoa and class Rhizopoda*. Such responses suggest that the candidates had adequate knowledge of the subtopic on the Major Groups of Living Things. Thus, they responded correctly to the question. Extract 1.1 is among the correct response to the question.

1	To classify the following organism from phylum to class level
a.	Moss
–	Phylum : Bryophyta
–	class : musci
b.	Crab
–	Phylum: Arthropoda
–	class: Crustacea
c.	Water lily
–	Phylum: Angiospermatophyta.
–	class: Monocotyledonae
d.	Amoeba
–	Phylum: Rhizopoda
–	class: Rhizopoda

Extract 1.1: A sample of a correct response to question 1.

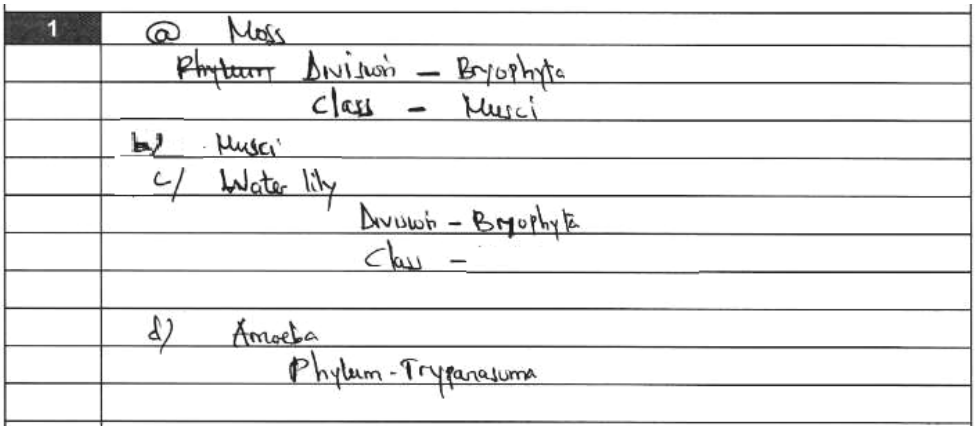
In Extract 1.1, the candidate correctly placed the organisms in their appropriate taxa. However, in part (d) the candidate failed to provide the correct answer of the class that the given organism belongs to.

In contrast, 46.3 per cent of the candidates scored 0 to 1.5 marks. They gave incorrect taxonomic groups to either all the organisms or got only one item correctly. For example, in part (a), some candidates classified moss as belonging to division Angiospermophyta and class Dicotyledonae. Other candidates classified the same specimen as belonging to Division Gymnospermophyta and class Monocotyledoneae.

In part (b), most candidates classified the crab as belonging to kingdom Fungi. For example, one candidate wrote: *Crab belongs to phylum Zygomycota and class Zygomycetes*. Another candidate wrote: *Crab belong to Phylum Annelida and class Arachinida*. Similarly, in part (c), some candidates classified water lily by explaining common uses of water. Others interchanged the taxa for crab in place of water lily.

Likewise, in part (d), most of them classified amoeba by adding the suffix "id" at the end of the name Amoeba. For example, one candidate wrote: *Amoeba belongs to phylum amoeboid and class Amoeboid*. These candidates failed to realize that classification is not about adding suffixes or prefixes to the names of the given organisms. Rather, it is about identification of different features which enable the organism to belong to a

specific taxon. This shows that these candidates had inadequate knowledge regarding systematic grouping of different organisms. Extract 1.2 provides a sample of an incorrect response from one of the candidates.



Extract 1.2: A sample of incorrect response to question 1.

In Extract 1.2, the candidate managed to position the organism in part (a) into appropriate taxa but the rest were misplaced and in part (b) they mentioned only the class of the moss plant. Consequently, they ended up scoring low marks.

2.1.2 Question 2: Biochemistry

The question required the candidates to validate the statement by giving two points that cells of cold-blooded animals have high proportion of unsaturated fatty acids than those of warm-blooded animals. The question was attempted by all candidates. The performance of candidates on this question was weak since 655 (92.4%) scored 0 to 1.5 marks. The candidates performed poorly on this question as compared to other questions in this examination. Figure 2 summarizes the candidates' performance on this question.

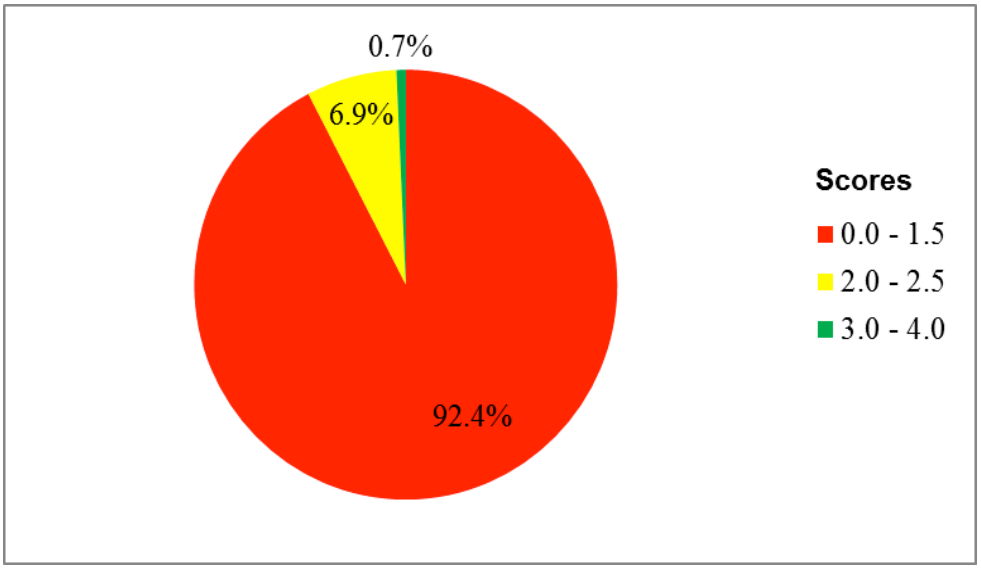
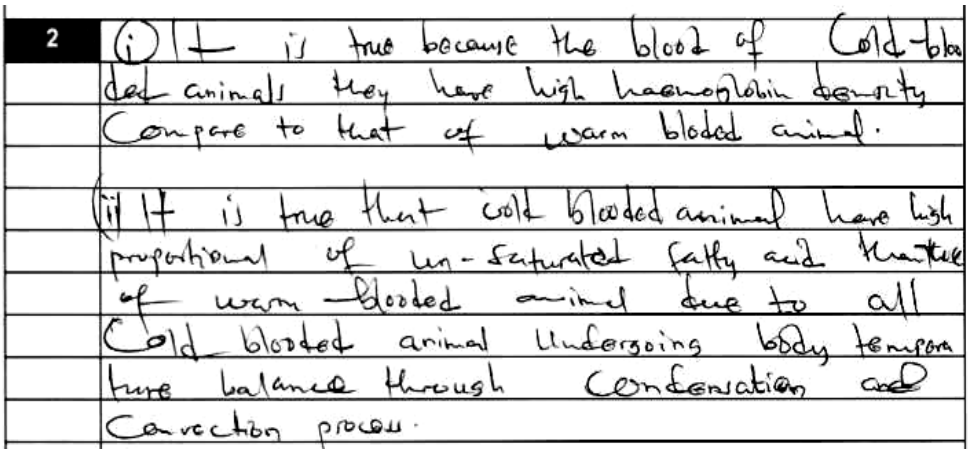


Figure 2: *Candidates' Performance on Question 2*

The data report shows that 6.9 per cent of the candidates scored 2 to 2.5 marks, 0.7 scored 3 to 4 marks and the remaining (92.4%) candidates scored 0 to 1.5 marks.

Poor performance on this question was attributed to inadequate knowledge of the concepts that related to lipids specifically un-saturated fatty acids. For example, some candidates gave the properties of animal cells and others explained the role of lipids in human body instead of explaining properties of unsaturated lipids at lower temperature. Moreover, some candidates explained the adaptation of organisms in cold and warm climates. For example, one of the candidates wrote: *organisms living in cold climate have hairs and large amount of adipose tissues.* Another candidate wrote: *Lipids are used for protecting vital organs*. Again, one candidate confused the use and property of lipids by writing *it provides heat in the body, have high boiling point, have high melting point.* Furthermore, another candidate wrote*: "helps them in buoyance, used for osmoregulation, require high amount of energy to break the cells and cells depend on weather.* These candidates failed to understand that lipids rich in un-saturated fatty acids have lower melting points and remain liquid at lower temperature. This helps the body temperature of a cold-blooded animal to remain at low temperature in cold environment. Also, unsaturated properties of fatty acids have influence on the fluidity of the membrane.

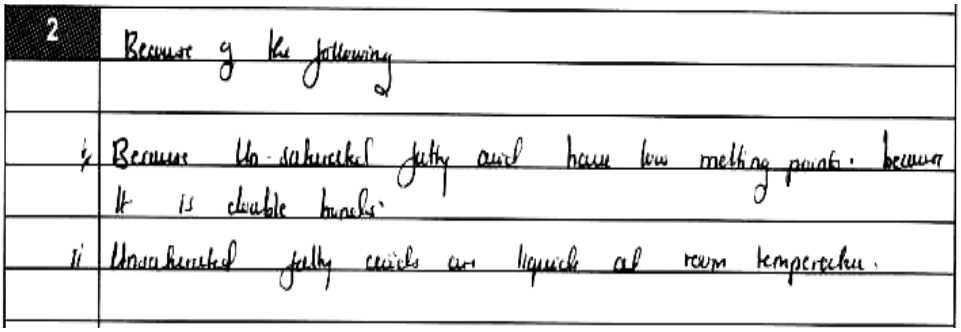
This is necessary for the lipids to maintain its functions such as constituents of plasma membrane. Such responses show that the candidates did not understand the concepts tested in this question. Extract 2.1 provides a sample of the incorrect responses by one of the candidates.



Extract 2.1: A sample of incorrect response to question 2.

In Extract 2.1, the candidate incorrectly explained the adaptation of organisms on oxygen uptake and characteristics of Poiklotherms and Homeotherms instead of giving reasons for the high proportion of unsaturated fatty acids to cold blooded animal cells.

Nevertheless, 54 (7.6%) candidates scored 2 to 4 marks in the same question. This indicates that such candidates responded correctly to the question. Moreover, the candidates who scored 3 to 4 marks had adequate knowledge about various aspects in relation to types and properties of lipids. For example, few candidates explained the properties of unsaturated fatty acids that suit in cells of cold-blooded organisms. Others explained *unsaturated fatty acids have lower melting point and liquid at room temperature"*. One candidate wrote*: Lipid is one of the main components of a cell membrane. The unsaturated property has an influence on moisture condition on cell membrane also is an important property for facilitating different functions of a cell.* This shows candidates are aware of some concepts related to what had been asked. Extract 2.2 is a sample of the correct response by one of the candidates.



Extract 2.2: A sample of correct response to question 2.

In Extract 2.2, the candidate correctly wrote two properties of unsaturated fatty acids that are common in cells of cold-blooded organisms. However, the candidate did not give details.

2.1.3 Question 3: Respiration

The question on this topic demanded the candidates to give four possible factors that affect Basal Metabolic Rate (BMR). The question was attempted by all candidates. The performance of candidates on this question was weak since 482 (68.0%) candidates scored 0 to 1.5 marks, as shown in Figure 3.

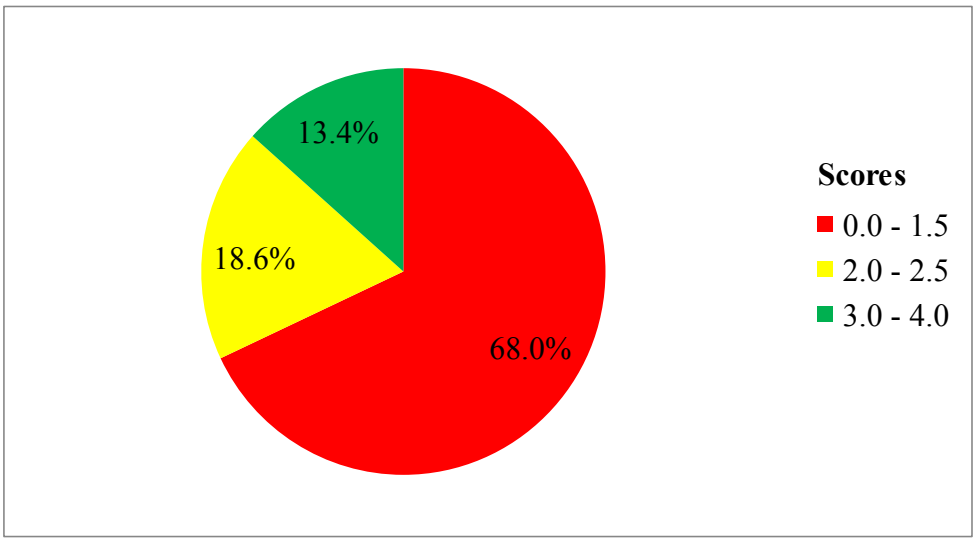
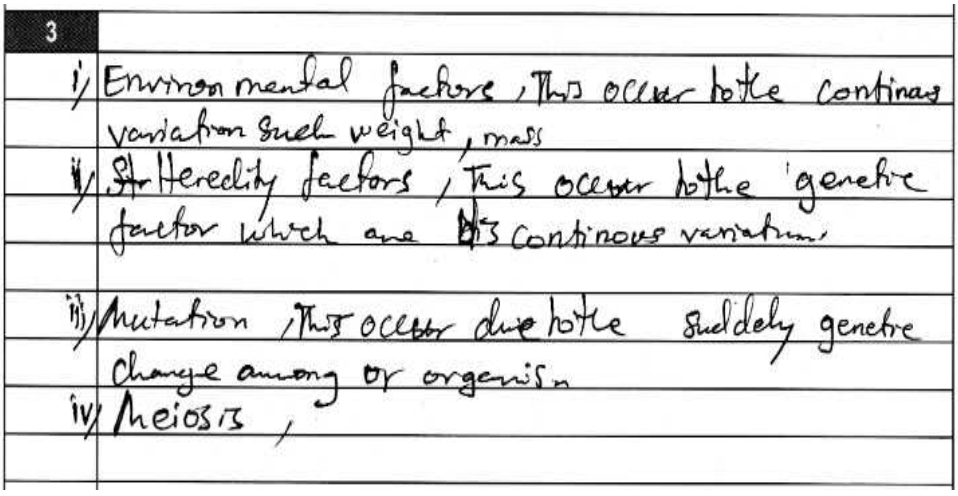


Figure 3: *Candidates' Performance on Question 3*

Based on data, 18.6 per cent of the candidates scored 2 to 2.5 marks, 13.4 per cent scored 3 to 4 marks and great number of candidates (68%) scored 0 to 1.5 marks.

The candidates who scored 0 to 1.5 marks lacked knowledge on various concepts related to aerobic respiration. For instance, some of the candidates explained factors for variation in energy among individuals *as caused by nature of activities they perform.* Other candidates related the problems of digestive system to the amount of energy an individual can produce. One candidate wrote: *variation in energy among individuals was due to routine activities of a person, time table of taking meals and nature of digestion.* Meanwhile, another candidate stated *energy is lost through heat and conversion of energy from one form to another.* Such responses suggest that the candidates had inadequate knowledge on the tested concept and also, they did not understand the question. Extract 3.1 is a sample of incorrect response.


3

i/ Environmental factors, This occur bothe continas variation such weight, mass

ii/ Heredity factors, This occur bothe 'genetic factor which are continous variation.

iii/ Mutation, This occur due bothe suddely genetic change among or organism

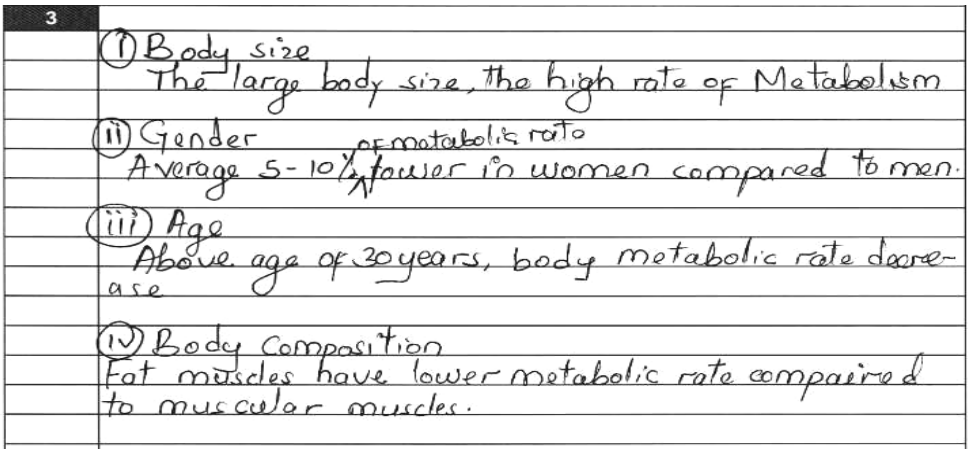
iv/ Meiosis,

Extract 3.1: A sample of incorrect response to question 3

In Extract 3.1, the candidate incorrectly explained causes for genetic variation among individuals instead of variation in energy.

Despite the great number of candidates scoring 0 to 1.5 marks, 227 candidates (32.0%) were able to give two to four responses correctly. Hence, they scored 2 to 4 marks. For example, one candidate wrote *Age of a person, sex, body composition, and body size.* Another candidate wrote*: health status, size of the body, age and sex.* As per marking scheme the

candidates were required to write possible causes for variations in energies among the two individuals as: *body composition, body sizes, age, hormone levels, health status of an individual climate of the body temperature among others*. The candidates' responses are not so much different from those of the marking scheme and this shows that the candidates were knowledgeable about various concepts of aerobic respiration particularly Bathal Metabolic Rate (BMR). Extract 3.2 presents a sample of the correct response.



Extract 3.2: A sample of a correct response to question 3.

In Extract 3.2, the candidates correctly explained causes of variation in energy between individuals. However, in (ii) the candidate wrote the term "gender" instead of "sex."

2.1.4 Question 4: Ecology

The question based on this topic required the candidates to explain the need for producers, consumers, detritivores and decomposers in the biotic component of an ecosystem. The question was attempted by all candidates. The candidates' performance on this question was average as 306 (43.2%) candidates scored 2 to 4 marks. Figure 4 provides the summary of candidates' performance on this question.

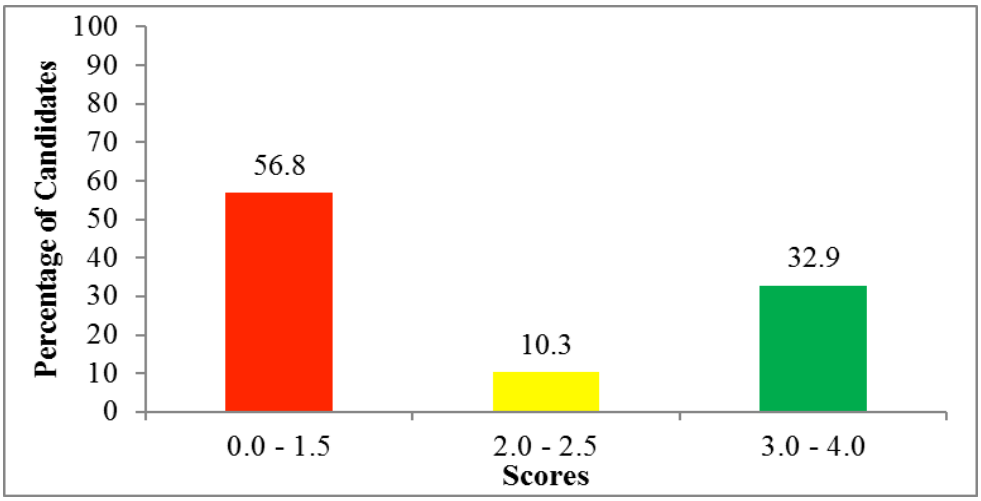
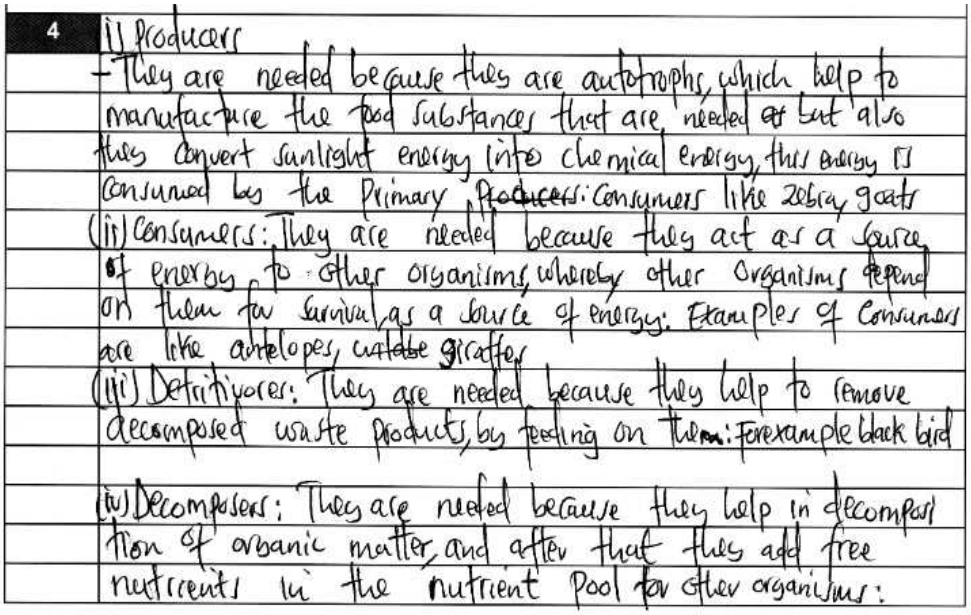


Figure 4: *Candidates' Performance on Question 4*

Figure 4 shows that 10.3 per cent scored 2 to 2.5 marks, 32.9 per cent scored 3 to 4 marks and 56.8 per cent scored 0 to 1.5 marks.

The analysis of candidates' responses shows that 43.2 per cent of the total candidates scored 2 to 4 marks of which only 84 candidates (11.8%) scored full marks allotted to this question. These candidates had adequate knowledge of various biotic components of an ecosystem. They gave two to four correct points on the need of producers, consumers, detritivores and decomposers in the biotic component of an ecosystem in-line with the marking scheme. For example, one candidate wrote: *Producers fix energy from the sun and store it in a complex organic compound. Consumers consist of heterotrophs which cannot produce their own food these can be grouped into primary consumers like herbivores and secondary consumers like lion and high-level consumers like human being. Detritivores feed on plant and animal remains and other dead matters like mites and decomposers these include microorganisms' chiefly bacteria and fungi*. Another candidate wrote: *Producers are source of energy to other organisms. Consumers depend on energy from producers as they cannot produce their own food, Detritivores are used to feed on plant and animal remains. Decomposers like bacteria are used to break down complex compounds of dead organisms.* Such responses suggest that the candidates had adequate knowledge of the need for producers, consumers, detritivores and decomposers in the biotic component of the ecosystem. Extract 4.1 presents a sample of correct response from one of the candidates.



Extract 4.1: A sample of correct response to question 4.

In Extract 4.1, the candidate explained clearly the need for each category in the ecosystem. Hence he/she obtained full marks allotted to this question.

Despite the average performance (43.2%) of the candidates on this question, 403 (56.8%) candidates scored 0 to 1.5 marks. These candidates lacked knowledge of the role of each category of organisms in the biotic component of an ecosystem. For instance, some candidates explained the general need of producers in an ecosystem without specifying the roles of each category of organisms as demanded in the question. Others, explained energy flow from the sun to the decomposers without specifying the need of each category of organisms in the biotic component of the ecosystem. Moreover, some explained the role of maintaining ecosystem for the survival of different organisms. Most candidates wrote: *ecosystem is maintained when producers are in large number so as to fix light energy into complex large organic compounds.* Specifically, one candidate wrote: *Producers, Consumers, Detritivores and Decomposers are important in the ecosystem.* Moreover, another candidate explained: *Producers first stage, consumer is the next stage, detritivores is the third stage while Decomposer is the fourth and last stage.* Such responses suggest that the candidates did not understand the question. Extract 4.2 is a sample of incorrect response from one candidate.

4	Producer, consumers, decomposers and decomposes are needed in the biotic component in order to have the balance in nature - The organisms are depending to each other

Extract 4.2: A sample of incorrect response to question 4.

In Extract 4.2, the candidate explained the general need of all organisms in the biotic component of the ecosystem at par instead of explaining the need of each category in the ecosystem. Consequently, the candidate ended up getting no marks.

2.1.5 Question 5: Body Health and Immunity

This question required the candidates to explain the importance of providing care and support to people living with HIV/AIDS infections. The question was attempted by all candidates. The general perfomance on this question was good because 89.9 per cent of the candidates scored 2 to 4 marks. Figure 5 gives the summary of the candidates' performance on this question.

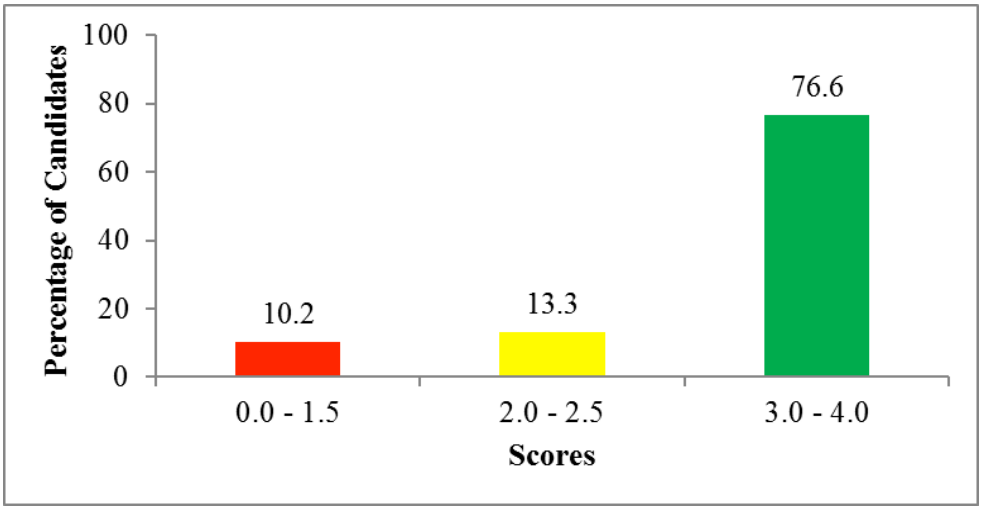
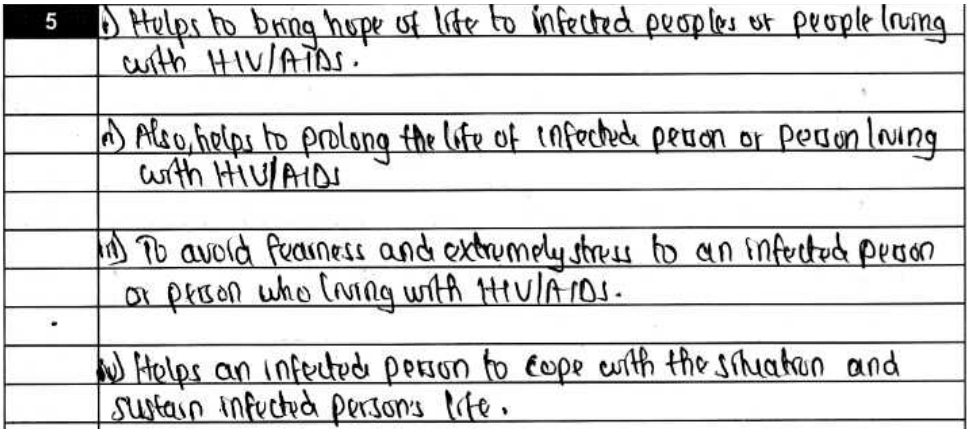


Figure 5: *Candidates' Performance on Question 5*

Figure 5 indicates that 13.3% of the total candidates scored 2 to 2.5 marks, 76.6% scored 3 to 4 marks and only 10.2 % failed by scoring 0 to 1.5 marks.

The candidates who scored 2 to 4 marks had sufficient knowledge specifically of body health and immunity. The marking scheme required the candidates to write the importance of providing care and support to people living with HIV/AIDS *bring hope to patient, enhance life span, make them feel un-isolated, promote their ability to involve in economic activities.* Other candidates wrote, *it helps patient to live longer, reduce risk of infection from other diseases, and reduce fear to death*. Moreover, one candidate wrote *patient to achieve goal, help patient to build high self-esteem among others.* Another candidate wrote *it reduces stress among victims, helps them to live peacefully and comfortably, promotes cooperation and love and promote harmony in the society.* Of all answers provided, it shows that these candidates had skills on providing care and support to people living with HIV/AIDS infections. Extract 5.1 is a sample of correct response to question 5.


5

i) Helps to bring hope of life to infected peoples or people living with HIV/AIDS.

ii) Also, helps to prolong the life of infected person or person living with HIV/AIDS

iii) To avoid fearness and extremely stress to an infected person or person who living with HIV/AIDS.

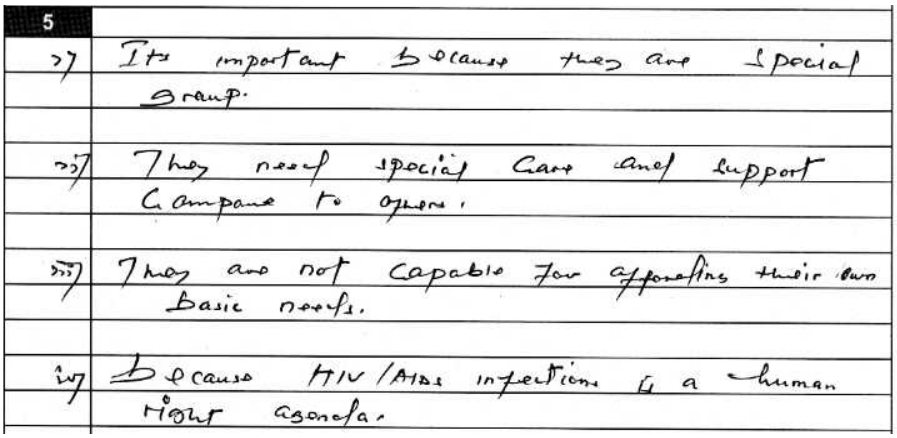
iv) Helps an infected person to cope with the situation and sustain infected persons life.

Extract 5.1: A sample of correct response to question 5.

In Extract 5.1, the candidate explained clearly the importance of providing care and support to people living with HIV/AIDS infections.

Despite the good performance on this question a few candidates (10.2%) scored 0 to 1.5 marks. Most of these candidates explained issues to be done by people living with HIV/AIDS instead of what has to be done by

individuals or society at large to help these people. For example, one candidate wrote *avoid un-safe sex*. Others, explained human rights to people living with HIV/AIDS. Moreover, some candidates explained roles of guidance and counselling sessions before diagnosing the status of people with HIV/AIDS. For example, one candidate wrote *people living with HIV/AIDS have to be counselled regularly, have to involve on physical exercises*, *have to go to clinic several times.* Moreover, another candidate wrote; *these people are not able to fetch for their own basic need, human right agenda consider wellbeing of these people, this is a special group that need more attention.* Such responses act as evidence that the candidates did not understand the question. Extract 5.2 is a sample of incorrect response from one of the candidates.


5

i) Its important because they are special group.

ii) They need special care and support Compare to others.

iii) They are not capable for afforeding their own basic needs.

iv) Because HIV/AIDS infections is a human right agenda.

Extract 5.2: A sample of the incorrect response to question 5.

In Extract 5.2, the candidate explained the nature of people living with HIV/AIDS and the way the society interpret them instead of explaining the importance of providing care and support to this category of people.

2.1.6 Question 6: Analysis of O-Level Biology Curriculum Materials

The question based on this topic required the candidates to explain four necessities of teacher's guide to student teachers during Block Teaching Practice (BTP). The question was attempted by all candidates. The general performance on this question was very good since 93.7 per cent of all candidates scored 2 to 4 marks. Figure 6 shows the performance of candidates on Question 6.

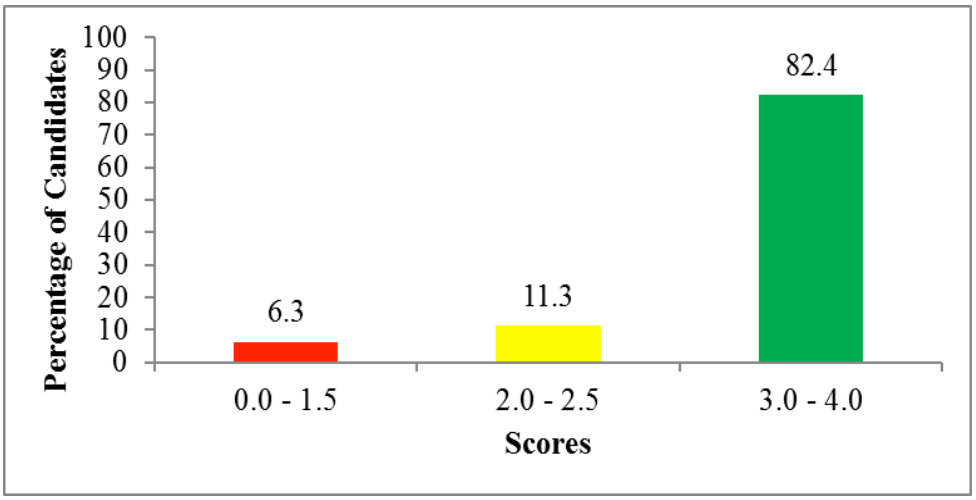
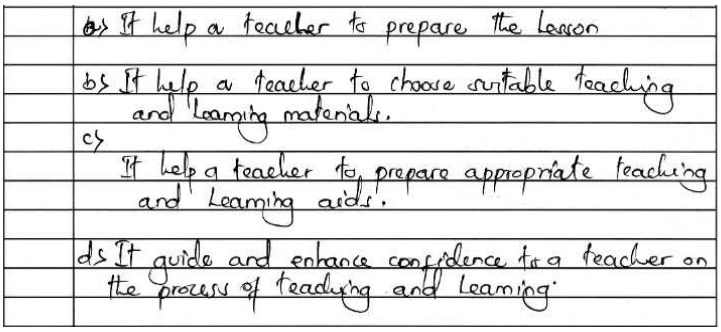


Figure 6: *Candidates' Performance on Question 6*

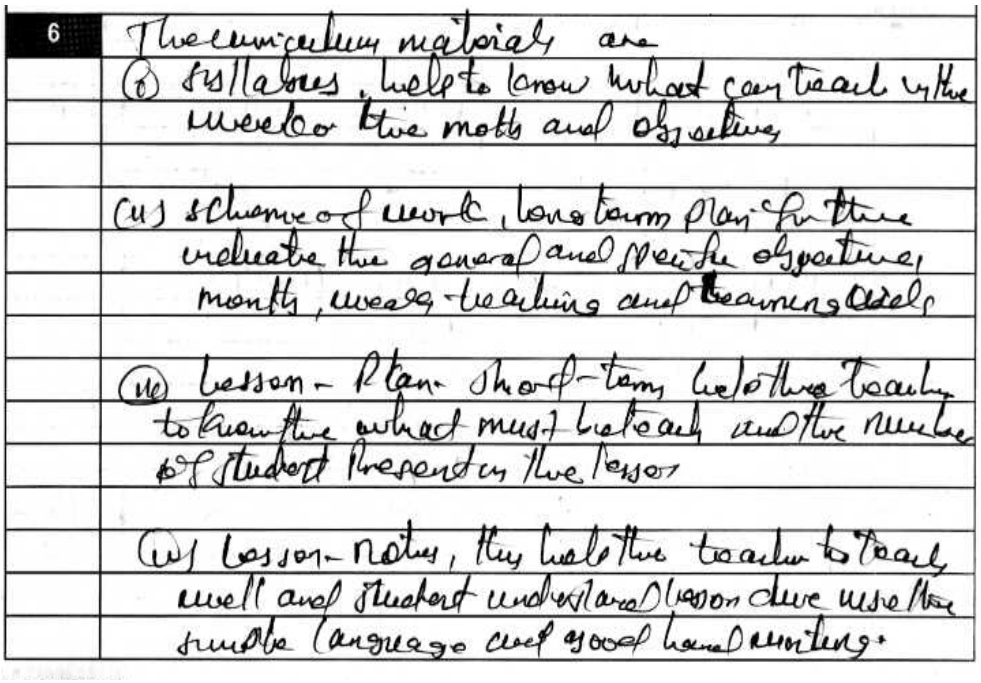
Figure 6 shows that 11.3 per cent of the candidates scored 2 to 2.5 marks, 82.4 per cent scored 3 to 4 marks and 6.3 per cent scored 0 to 1.5 marks. Data analysis shows that majority of the candidates (93.7%) gave two to four points thus scored 2 to 4 marks. This group correctly explained necessities of teacher's guide to student teachers during Block Teaching Practice (BTP). In responding to this question, one candidate wrote *it contains specific teaching and learning objectives, teaching and learning resources.* Another candidate explained as *it guides reference materials to be used, suggests assessment procedures for learners, guides on what teachers has to do while in the class and guides on what students has to do while in the class.* Such responses show that the candidates had sufficient knowledge of the concept asked. Extract 6.1 provides a sample of correct response from one of the candidates.



Extract 6.1: A sample of the correct response to question 6.

In Extract 6.1, the candidate explained four aspects that show the necessity of the teacher's guide clearly.

Conversely, 6.3 per cent of the candidates provided incorrect points to most parts of the question. For example, some candidates explained the role of a teacher's guide similar to textbooks. Others, interchanged the role of teacher's guide with that of a syllabus. Furthermore, some candidates explained teachers guide as a document that contains questions and answers from different topics. Specifically, one of the candidates wrote: *teachers guide can be used in the absence of textbooks, can be used as lesson plan, can be used to guide teaching on difficult topics.* Another candidate wrote*: contains additional information to supplement textbooks, help teachers to guide on the use of syllabus*. Such responses indicate that the candidates had inadequate knowledge on curriculum materials specifically the teacher's guide. Extract 6.2 contains a sample of incorrect response.


6

The curriculum materials are

(i) Syllabus, help to know what can teach in the week or the month and objectives

(ii) Scheme of work, long term plan further underline the general and specific objectives, months, weeks, teaching and learning aids

(iii) Lesson Plan short term, help the teacher to know the what must be teach and the number of student present in the lesson

(iv) Lesson notes, this help the teacher to teach well and student understand lesson clear use the simple language and good handwriting.

Extract 6.2: A sample of the incorrect response to question 6.

In Extract 6.2, the candidate explained the importance of syllabus, lesson plan and lesson notes as shown in (i), (iii) and (iv) respectively and in item

(ii) the candidate mentioned the components of a scheme of work instead of the importance of a teachers' guide. This shows that the candidates did not understand the question.

2.1.7 Question 7: Fundamentals of Teaching and Learning Biology

This question required the candidates to explain strategies to be used to promote students' active participation in learning. The question was attempted by all candidates. The general performance on this question was average since 64.2% of the total candidates scored 2 to 4 marks. Figure 7 shows the performance of the candidates on this question.

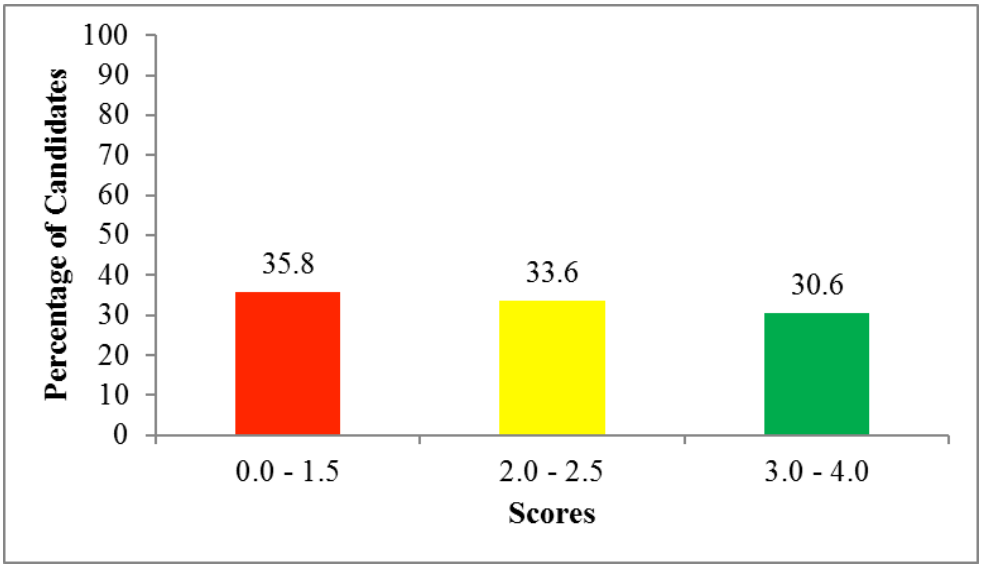
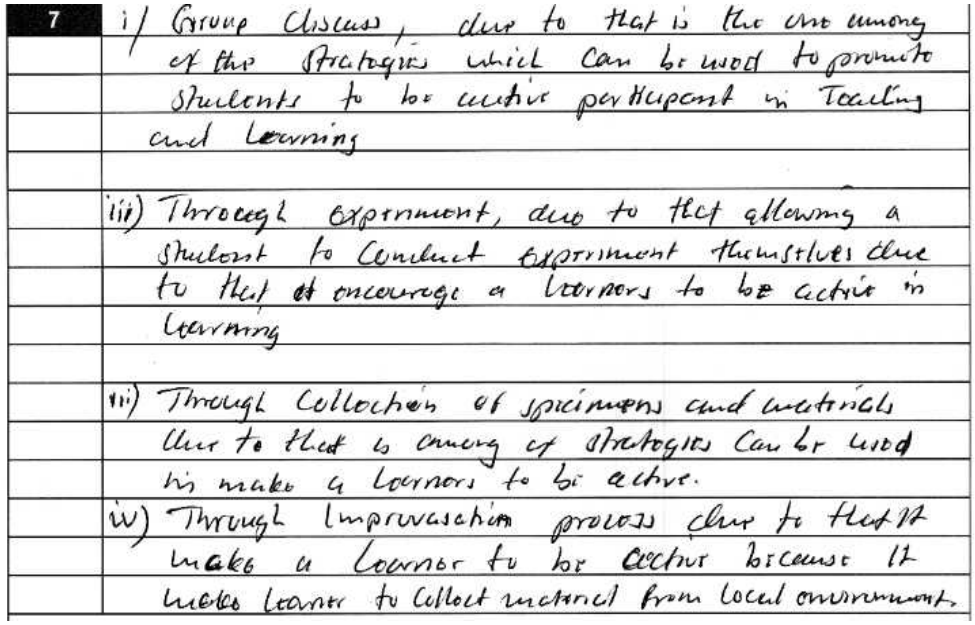


Figure 7: *Candidates' Performance on Question 7*

Based on Figure 7, 33.6 per cent of the candidates scored 2 to 2.5 marks, 30.6 per cent scored 3 to 4 marks and 35.8 per cent candidates scored 0 to 1.5 marks.

The analysis shows that the candidates who scored 2 to 4 marks had adequate knowledge of the concepts tested. Therefore, they correctly explained the strategies that can promote students' active participation in learning. According to the marking scheme candidates were required to write: *involve learners in collection of Biology specimens and materials, developing and improvisation of Biology teaching and learning aids, encouraging and supporting all students in learning.* Others, included *assigning students'*

activities which will involve them in observation of a biological phenomenon, recording, sketching and interpretation of phenomenon. Some candidates wrote: *use of activity-based assignments, use study tour that will involve report writing, involve students in preparation of teaching and learning aids, encourage students to work as a team.* Specifically, one candidate wrote *through collection of specimen motivation and reinforcement, practical activities that will enable them to make observation".* Such responses suggest that these candidates were aware of and had knowledge of the tested concept. Extract 7.1 serves as a sample of the correct response from a candidate.


7

i/ Group Discuss, due to that is the one among of the Strategies which can be used to promote Students to be active participant in Teaching and Learning

iii) Through experiment, due to that allowing a Student to Conduct experiment themselves due to that it encourage a Learners to be active in Learning

iii) Through Collection of specimens and materials due to that is among of Strategies Can be used in make a Learners to be active.

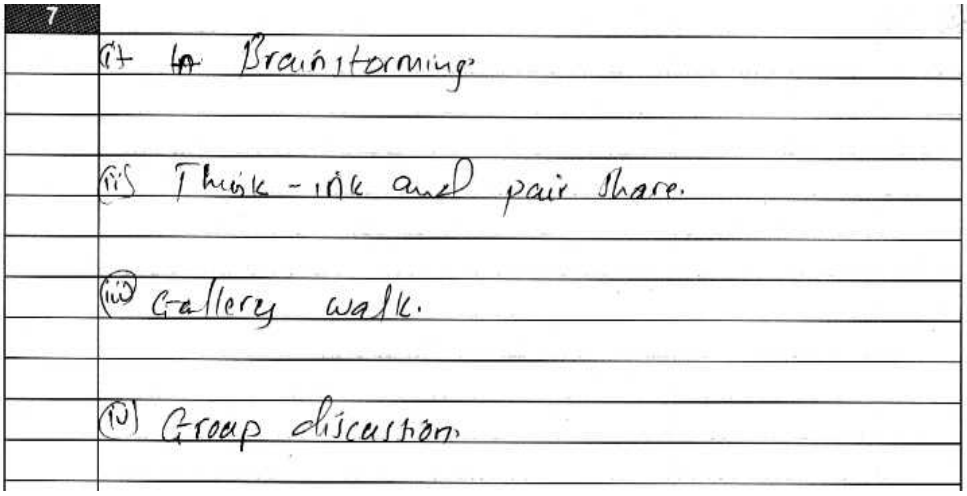
iv) Through Improvisation process due to that it make a Learner to be active because it helps learner to collect material from local environment.

Extract 7.1: A sample of the correct response to question 7.

In Extract 7.1, the candidate explained clearly the strategies to be used to promote active participation in learning as the question asked.

Despite the good performance of 64.2 per cent on this question, 35.8 per cent of the candidates failed to provide correct answers to most parts of the question. This implies that candidates had inadequate skills relating to the concepts tested. For example, most candidates wrote about how teachers should arrange their classes during sessions. Others, confused between the teaching techniques and strategies, and yet others used the terms teaching methods and strategies interchangeably. Moreover, one candidate explained the security of the teaching environment as a *means to promote active*

participation of learners. Another candidate wrote *learning must be conducive.* Another candidate wrote: *learning environment has to be calm, clean, and productive*. Extract 7.2 presents a sample of incorrect response from one of the candidates.



Extract 7.2: A sample of incorrect response to question 7.

In Extract 7.2, the candidate mentioned different teaching and learning techniques instead of explaining the strategies that can enhance environment for active participation of learners during teaching and learning process.

2.1.8 Question 8: Basic Biology Laboratory Skills

The question based on based on this topic required the candidates to explain ways used to facilitate practical session on dissection of a cockroach in a school where there are no laboratory facilities. The question was attempted by all candidates. The general performance on this question was good since 79.1% of the total candidates scored 2 to 4 marks. Figure 8 shows the performance of the candidates on question 8.

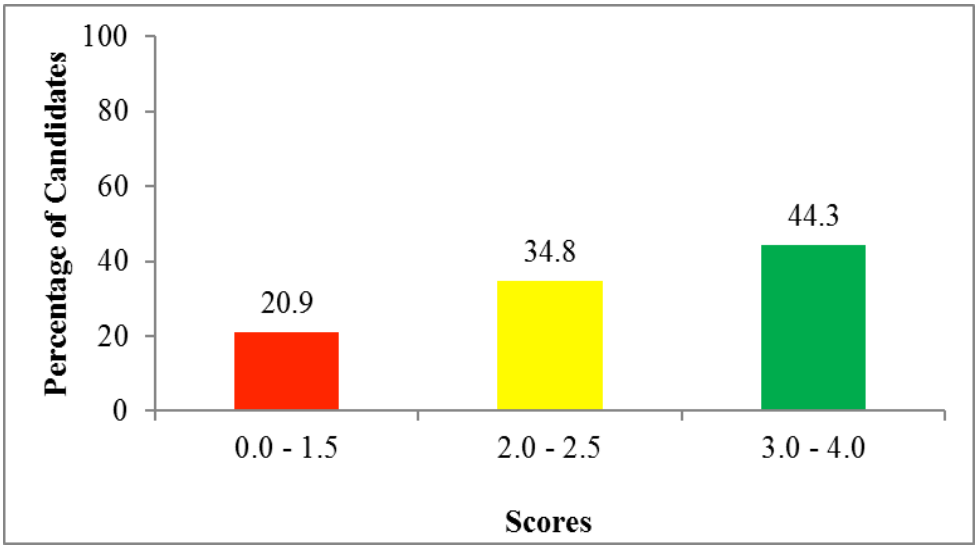


Figure 8: *Candidates' Performance on Question 8*

Figure 8 shows that 34.8 per cent of the candidates scored 2 to 2.5 marks, 44.3 per cent scored 3 to 4 marks and 20.9 per cent scored from 0 to 1.5 marks.

The figure shows that majority of the candidates (79.1%) scored 2 to 4 marks. These candidates gave two to four correct points on the ways to facilitate a practical session on the dissection of a cockroach in a school where there are no laboratory facilities in line with the marking scheme. As per marking scheme, the candidates were required to write: *instructing students to collect specimens, modify classroom to suit laboratory setting, use locally available materials such as boxes, improvised water bottles, razorblades and thorns instead of pins*. *Also, controlling number of students entering the room, observing safety precautions, and the use of ICT facilities to demonstrate procedures for undergoing dissection of Cockroach*. Another candidate wrote: *create dissection tray by using boxes, use bee wax and plate to create a tray, encourage student to catch their own cockroaches from their local environment, use razor blade for dissection.* Others wrote, *collect specimens, make sure the class has enough place for student to do practical*. Specifically, one candidate wrote: *design a classroom that mimic a science laboratory, tell students to collect cockroaches, use sharp razorblades for dissection, use disposed bottles to hold water for clearness during dissection.* These responses

suggest that the candidate had knowledge on matters related to practical facilitation as the question demand. Extract 8.1 represents correct response to question 8.

8 • encourage the student to catch the cockroach and bring it at school.

• To creates a dissecting kit by using local material.

- This is like wax from handle great at least four dissecting tray.

• Use razorblador and pair of scisors to show demonstration on how to dissect cockroach.

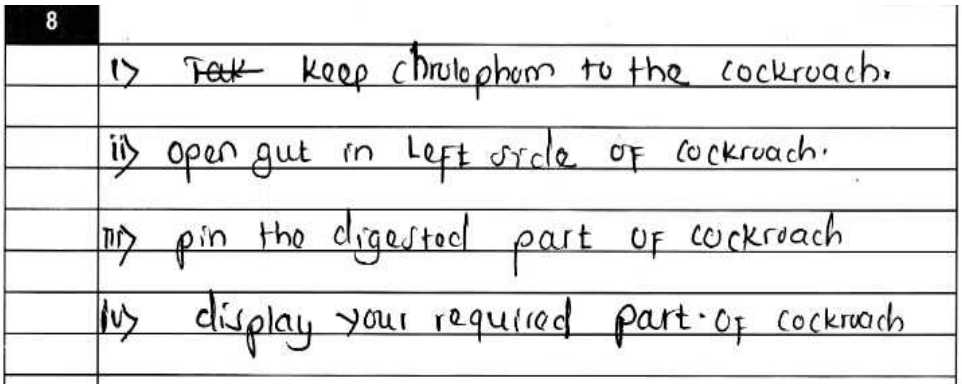
• Allow student to sit in groups with dissecting tray. Form at least four with six members in each group.

Extract 8.1: A sample of correct response to Question 8.

In Extract 8.1, the candidate correctly wrote three points on the facilitation of a practical session to secondary school where no laboratory facilities are present. However, in one point he/she failed to provide the convincing response.

Despite the good performance of 79.1 per cent on this question, 20.9 per cent of candidates failed to provide all four responses correctly. This shows that these candidates failed to grasp what was required to respond. Some candidates advised the school administration in case there are no laboratory facilities instead of giving points as per question. For example, one candidate wrote *the session could not be achieved in the absence of laboratory facilities*. Others suggested the use of books and dissection guides to explain procedures for dissecting a cockroach. Specifically, one candidate wrote: *Tell students to observe diagrams from books, explain about different systems using books, draw some diagrams portraying Cockroach on chalk board.* Another candidate wrote*: Teach students*

alternative to practical, use good diagrams and pictures, tell students to buy some laboratory facilities like scissors. Extract 8.2 shows a sample of incorrect response to question 8.



Extract 8.2: A sample of incorrect response to Question 8.

In Extract 8.2, the candidate outlined the procedures to follow while dissecting a cockroach instead of explaining how dissection of a cockroach can be achieved in a school setting without laboratory facilities. Consequently, the candidate ended up with losing all the marks.

2.1.9 Question 9: Fundamentals of Teaching and Learning Biology

The question required the candidates to explain four limitations of using real objects as best media in actual biology classroom. The question was attempted by all candidates. The general performance on this question was good since 76.6% of the total candidates scored 2 to 4 marks correctly. Figure 9 shows the performance of the candidates on this question.

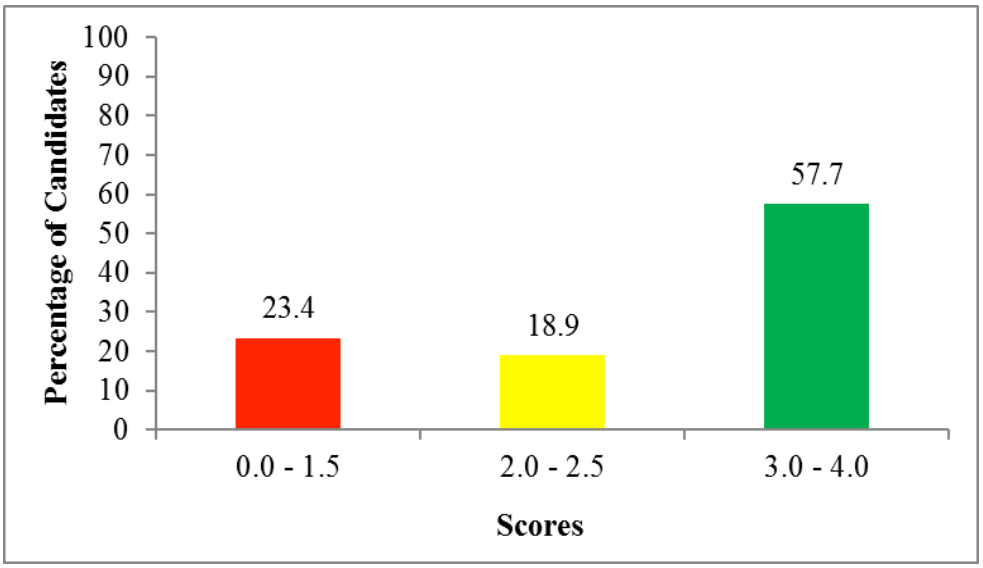
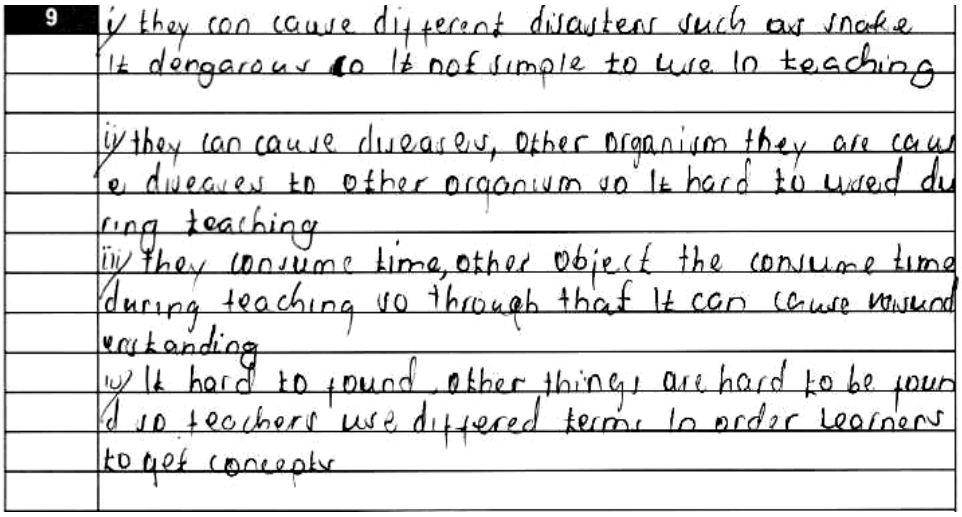


Figure 9: *Candidates' Performance on Question 9*

The Figure 9 shows that 76.6 per cent of the candidates scored 2 to 4 marks. Of these 18.9 per cent scored 2 to 2.5 marks, 57.7 per cent scored 3 to 4 marks and 23.4 per cent scored 0 to 1.5 marks.

Further analysis indicates that the candidates who scored 2 to 4 marks had adequate knowledge of the assessed concepts. The candidates correctly gave the limitations of applying real objects in actual Biology classrooms. Some of the correct responses included *some live animals can scare students, others are too big to bring into classrooms, some are too small to be seen by necked eyes, finding and collecting them is tedious work, others are dangerous and harmful to handle*. Some candidates wrote: *some are not portable to be taken into classroom setting, others are dangerous to students, it is costly and time consuming and some are poisonous*. Others wrote: *Ethically some specimens are not allowed to be taken live in the classroom setting, it is difficult to access some specimens in our local environment, great care is needed during manipulation in a live class.* Specifically, one candidate explained *some real objects can cause disease, others demand large space for them to be observed, yet others are disastrous when brought in the class for example snake and it is time consuming to find them.* From such responses it is worth to recommend that the candidate clearly understood the question. Extract 9.1 presents a sample of correct response provided by one of the candidates.

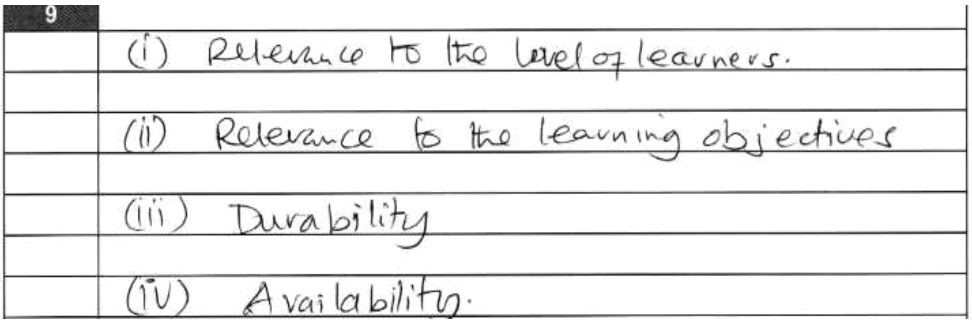


Extract 9.1: A sample of correct response to question 9.

In Extract 9.1, the candidate correctly explained the limitations of using real objects in actual Biology classrooms. However, some errors in the English language were observed in some sentences.

Further analysis shows that candidates who scored 0 to 1.5 marks had inadequate knowledge or misunderstanding of the concept assessed. For example, one candidate explained *as it is totally bad to use real objects as it discourages students learning.* Another, wrote *the government is not taking charge to facilitate the use of real objects hence it is difficult to implement.* Moreover, some candidates explained that teachers are not competent enough to use real objects in Biology classrooms. Others, explained real objects *as a teaching aid that can be drawn on manila or blackboard.* Another category of candidates' responses included the characteristics of teaching and learning aids. For example, one candidate wrote: *real objects are not appropriate to the subject matter, most of them are not appropriate to learners and real objects are not well constructed.* Another candidate explained *real objects do not reflect level of learners, it can discourage on the use of teaching and learning aids, when teaching aids are many in the classroom can create confusion to students.* Similarly, another candidate wrote: *real objects are durable, attractive and relevant to level of learners, less cost full.* Such responses indicate that the candidates

did not understand the question. Extract 9.2 represents a sample of incorrect response provided by one of the candidates.

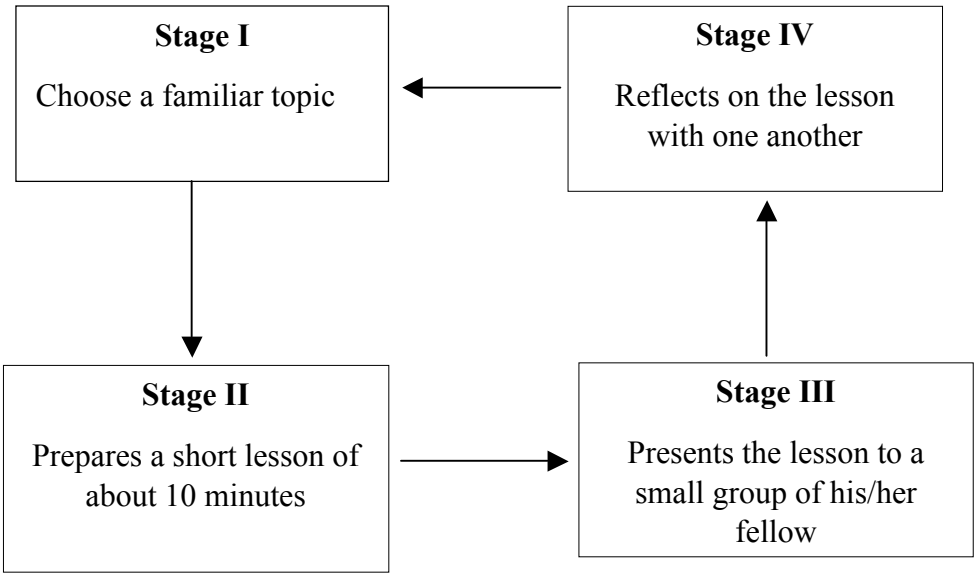


Extract 9.2: A sample of incorrect response to question 9.

In Extract 9.2, the candidate mentioned the characteristics of teaching and learning aids instead of limitations of using real objects in actual biology classrooms.

2.1.10 Question 10: Planning and Preparation for Teaching

In this question, the candidates were required to observe the figure and then answer the questions asked.



Questions

(a) Which concept in teaching does the figure represent?

(b) Identify two curriculum materials required for the student teacher to carry out in stage II.

(c) How important are the activities at stage IV to the student teacher? Give two points.

The question was attempted by all candidates. The candidates' performance on this question was good since 93.4 percent of the candidates scored 2 to 4 marks, as shown in Figure 10.

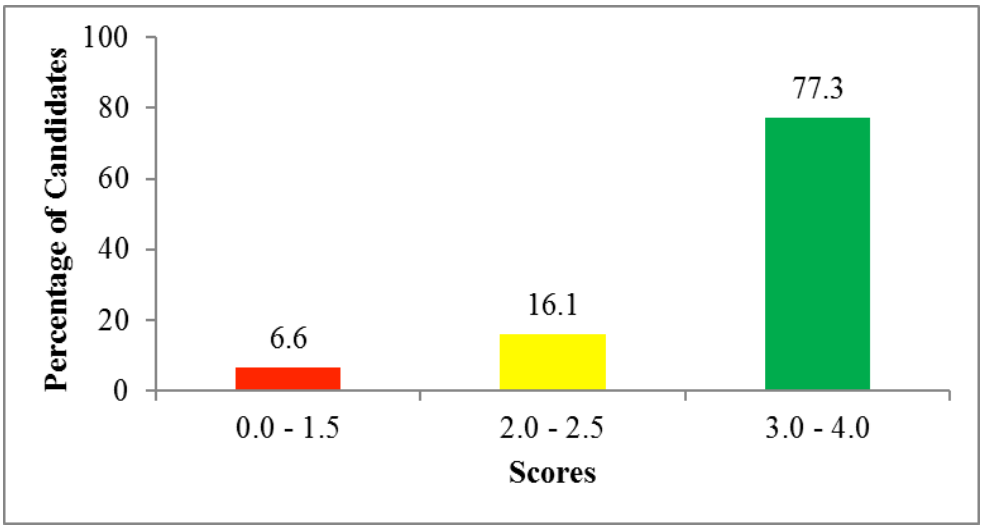
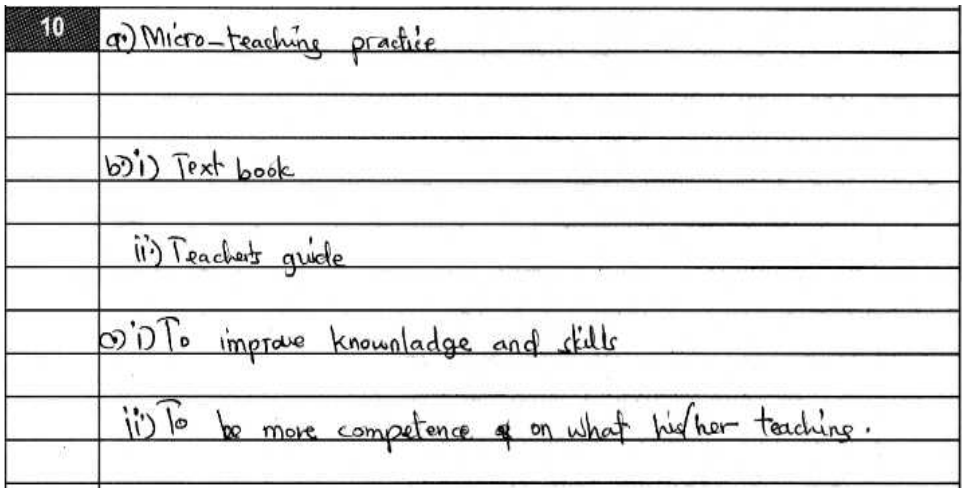


Figure 10: Candidates' performance on Question 10

Data analysis from Figure 10 show that, 93.4 per cent of the candidates scored 2 to 4 marks of whom 16.2 per cent scored 2 to 2.5 marks, 77.3 scored 3 to 4 marks and 16.2 per cent scored 0 to 1.5 marks.

Statistics show that candidates who had scored 2 to 4 marks (93.4%) had adequate knowledge of the assessed concepts. For example, in part (a), one candidate named the concept as *microteaching*. Some explained the concept as a process of conducting a class for a small group of students in a short period of time. This is intended to enhance the skills of teachers.

Similarly, in part (b), the candidates gave correct responses such as *teachers' guide, teachers' manual, syllabus, textbooks, reference books among others.* In part (c), the candidates explained the importance of reflection to student teachers as: *enable students to get feedback on how the lesson was presented, enable student to identify areas of strength and weakness for future improvement.* Others wrote: *enables a student teacher to grow professionally, learn real classroom practice and promote areas of strength due to inputs given by observers*. Extract 10.1 provides a sample of correct response to this question.

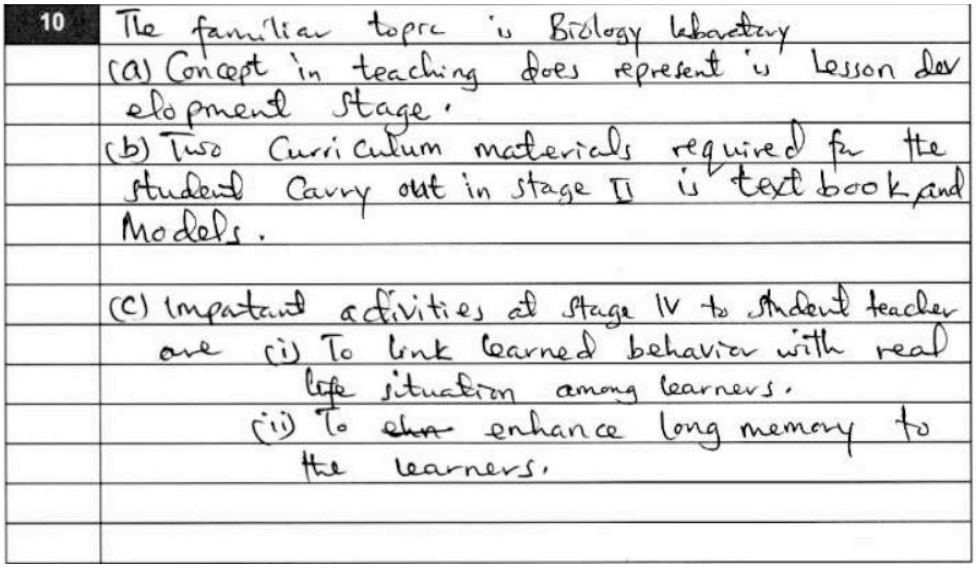


Extract 10.1: A sample of the correct response to question 10.

Extract 10.1, is a sample response from the candidate who carefully studied the figure and answered respective questions correctly.

Despite the good performance of candidates on this question, 6.6 per cent of the candidates scored 0 to 1.5 marks. Some candidates got only one point correctly while others failed all points in the question. One candidate explained some components of the lesson plan like *general objectives, teaching resources, teaching and learning strategies* and alike. Others explained stages as means that a teacher can use in case there is a small number of students in a class. Moreover, some candidates explained the stages as procedures that a teacher can use to make student understand a particular concept in detail. Specifically, one candidate wrote (a) *preparation for teaching,* in part (b) *manila and flip chart* and in part (c) *to increase interaction with students and to increase communication* which

were incorrect responses. Moreover, another candidate further included incorrect responses such as: in part (a) *lesson plan, planning for teaching and participatory teaching,* in part (b) *school calendar, notebook, chalks, marker pens among others*. In part (c) *enable teachers to know well his/her students, to perform task effectively, to communicate well with students*. Such responses provide no clue to what was required in the question. Extract 10.2 gives a sample of incorrect response to the question.


10
The familiar topic is Biology laboratory
(a) Concept in teaching does represent is lesson development stage.
(b) Two Curriculum materials required for the student Carry out in stage II is text book and Models.
(c) Impatant activities at stage IV to Student teacher are (i) To link learned behavior with real life situation among learners.
(ii) To ~~chu~~ enhance long memory to the learners.

Extract 10.2: A sample of the incorrect response to question 10.

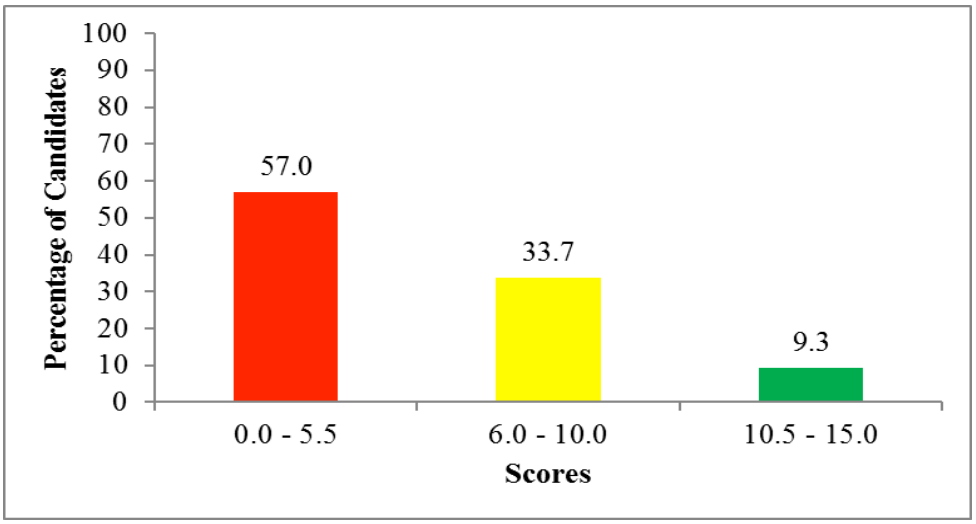
In Extract 10.2, the candidate failed to provide correct answers to all items except part (b) where the candidate scored only one correct point i.e. textbook.

2.2 Section B: Essay Type Questions

This section consisted of 4 essay type questions. The candidates were required to answer all questions. Each question carried 15 marks, making a total of 60 marks. The questions comprised both academic and pedagogy syllabus. The analysis of these questions is shown in subsequent sections.

2.2.1 Question 11: Genetics

The candidates were requested to explain in six points the contribution of Biotechnology towards industrial economic development in Tanzania. The question was attempted by all candidates. The candidates' performance on this question was average since 43.0 per cent of the candidates scored 6 to



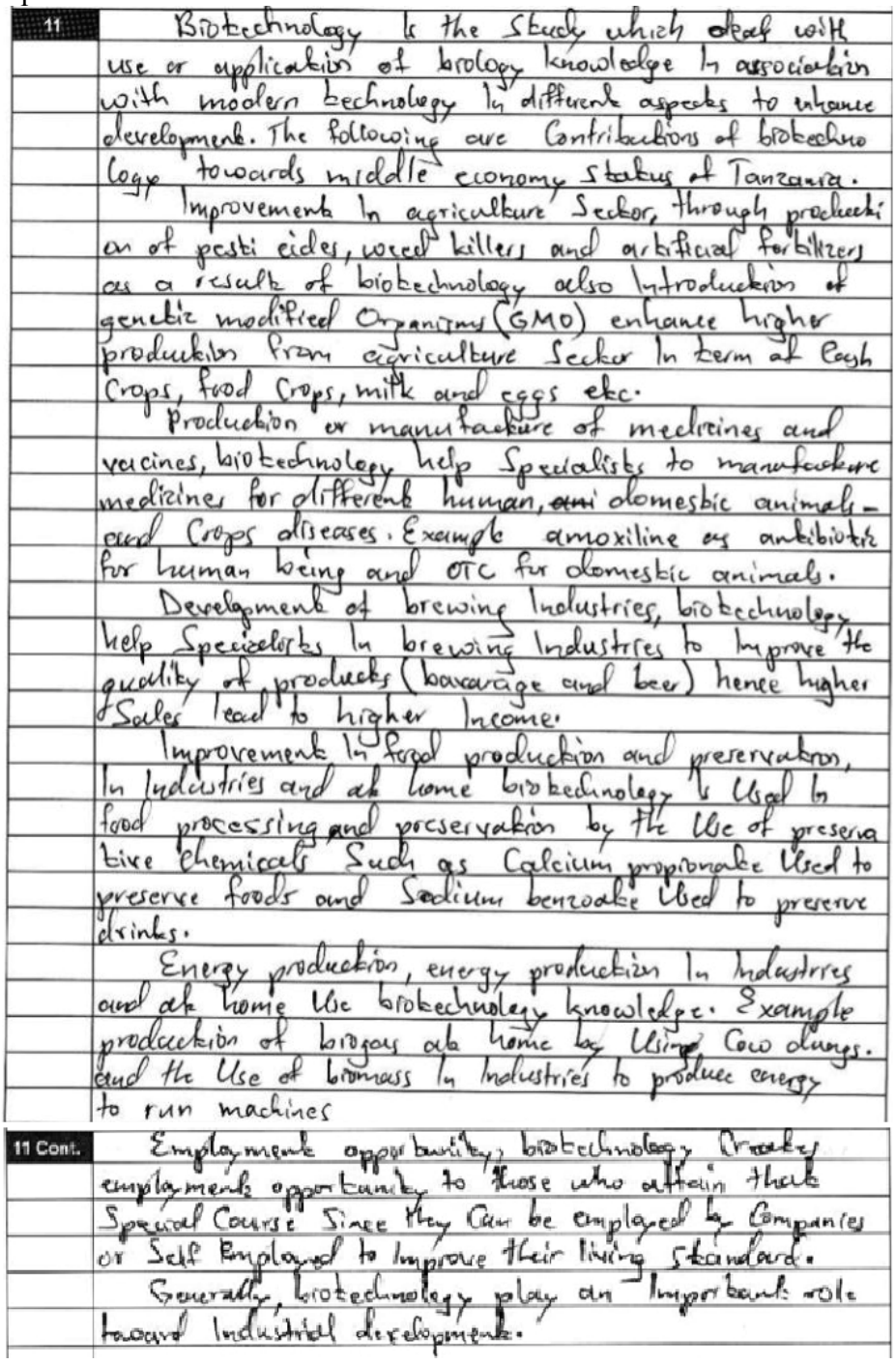
15 marks. Figure 11 shows the performance of the candidates on this question.

Figure 11: Candidates' performance on Question 11

The analysis from Figure 11 shows further that 33.7 per cent of the candidates scored 6 to 10 marks, 9.3 scored 10.5 to 15 marks and 57.0 scored 0 to 5.5 marks. Interestingly only 10 candidates (1.4%) scored all 15 marks allotted to this question.

The analysis of candidates' responses indicates that the candidates with performance of 6 to 15 marks were able to write correct responses such as: *Biotechnology is used in industries related to*; *food processing, agriculture, waste treatment facilities, fermentation, fuel and energy, chemicals, mineral extraction, medicine among others*. Specifically, one of the candidates wrote: *can be used in vaccines, brewing, agriculture, and baking industries. Moreover, can be used in waste disposal facilities.* Another candidate explained *biotechnology can be used in industries related to hybridization of species, bread making, genetic engineering, fermentation, and pharmaceuticals.* Such responses suggest that the candidate had adequate knowledge of the subtopic of application of

genetics. Extract 11.1 contains a sample of the correct response to this question.


11

Biotechnology is the Study which deal with use or application of biology knowledge in association with modern technology in different aspects to enhance development. The following are Contributions of biotechnology towards middle economy Status of Tanzania.

Improvement in agriculture Sector, through production of pesticides, weed killers and artificial fertilizers as a result of biotechnology also Introduction of genetic modified Organisms (GMO) enhance higher production from agriculture Sector in term of Cash Crops, food Crops, milk and eggs etc.

Production or manufacture of medicines and vaccines, biotechnology help Specialists to manufacture medicines for different human, ~~and~~ domestic animals-and Crops diseases. Example amoxiline as antibiotic for human being and OTC for domestic animals.

Development of brewing Industries, biotechnology help Specialists in brewing Industries to improve the quality of products (baverage and beer) hence higher Sales lead to higher Income.

Improvement in food production and preservation, In Industries and at home biotechnology is Used in food processing and preservation by the Use of preservative chemicals Such as Calcium propionate Used to preserve foods and Sodium benzoate Used to preserve drinks.

Energy production, energy production in Industries and at home Use biotechnology knowledge. Example production of biogas at home by Using Cow dungs. and the Use of biomass in Industries to produce energy to run machines

11 Cont.

Employment opportunity, biotechnology Create employment opportunity to those who attain their Special Course Since they Can be employed by Companies or Self Employed to improve their living Standard.

Generally, biotechnology play an Important role toward Industrial development.

Extract 11.1: A sample of correct response to question 11.

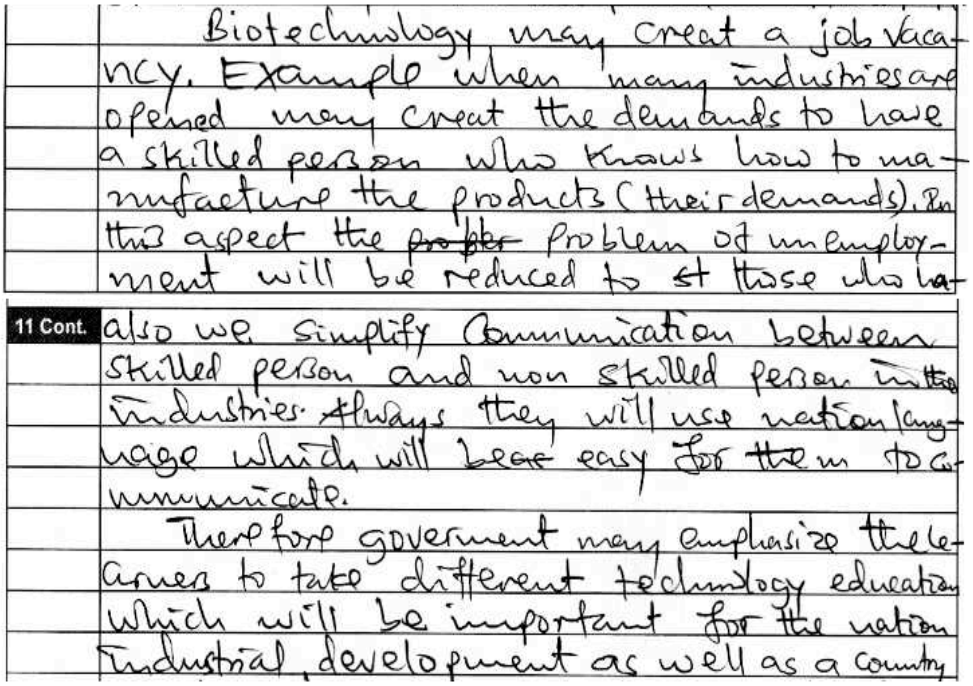
In Extract 11.1, the candidate correctly explained several points regarding the contribution of biotechnology to the development of industrial economy in Tanzania. However, the candidates had made weak points in the introduction and the conclusion.

Despite 43 per cent of the candidates to have good performance, further analysis reveals that 57 per cent of the candidates failed to provide convincing points that contribute to biotechnology development in industrial economy in Tanzania. For example, some of them wrote: *It is a source of income, provides employment, promotes development of infrastructures, source of knowledge and increase rate transportation*. Another candidate explained as: *Biotechnology improves technology, improves development of other industries, develops communication, to increase number of innovators, help in sharing of resources.* Such responses act as the evidence that these candidates did not understand the question. Extract 11.1 provides a sample of incorrect response commenting on this evidence.

11 Biotechnology refers to the science that used to identify different technology which may be applied in the biological field. The following are the contribution of biotechnology to the industrial economy.

It lead to production of various experties. These experties may be employed in different research centres which can help the society on identify the different ~~ideas~~ diseases which affect their animals and plants and they will help them to find the specific drugs which can be able to treat them and finally we increase the production.

Biotechnology may help to maintain the health of peoples. For example when different council ~~administer like NEMA~~ administer the type of food and fluid to consider the content which used to make and to see if it is possible to be used by the people. And if there are content which must not be used by the people they hinder Its spreading to the society as product hence they solve the problem of the people.


Biotechnology may creat a job vacancy. Example when many industries are opened may creat the demands to have a skilled person who knows how to manufacture the products (their demands). By this aspect the ~~proper~~ problem of unemployment will be reduced to ~~at~~ those who la-

11 Cont. also we simplify Communication between skilled person and non skilled person in the industries. Always they will use national language which will ~~be~~ easy for them to communicate.

Therefore goverment may emphasize the learners to take different technology education which will be important for the nation Industrial development as well as a country

Extract 11.2: A sample of the incorrect response to question 11.

In this Extract, the candidate explained irrelevant points *like production of expertize, simplify communication between skilled and non-skilled*. These points are not correlated at all with the question.

2.2.2 Question 12: Classification of Living Things

This question required the candidates to justify six aspects showing beneficial and detrimental economic importance of bacteria to human and other organisms. The data shows that all candidates attempted this question. The general performance on this question was good since 96.1% of all the candidates scored 6 to 15 marks. Figure 12 summarizes the candidates' performance on Question 12.

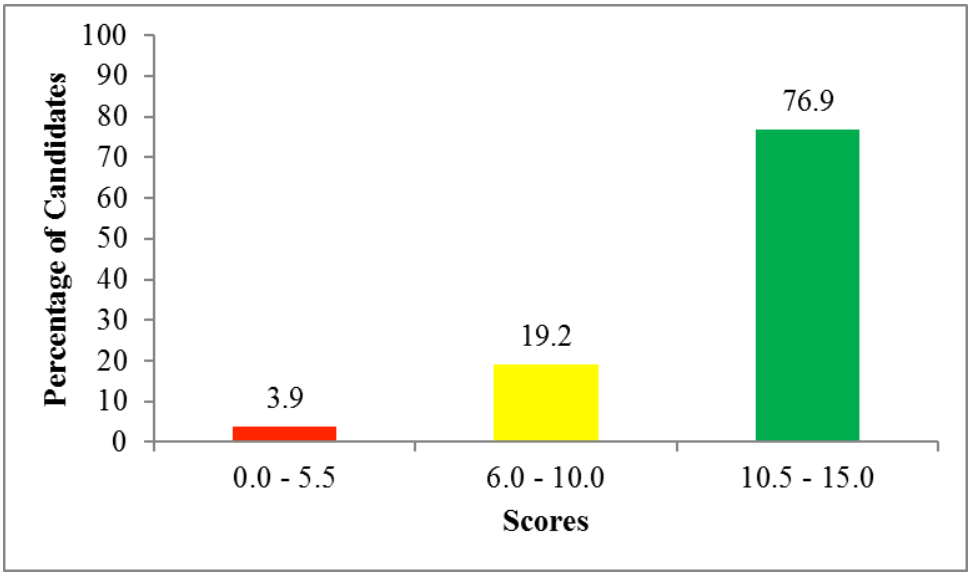
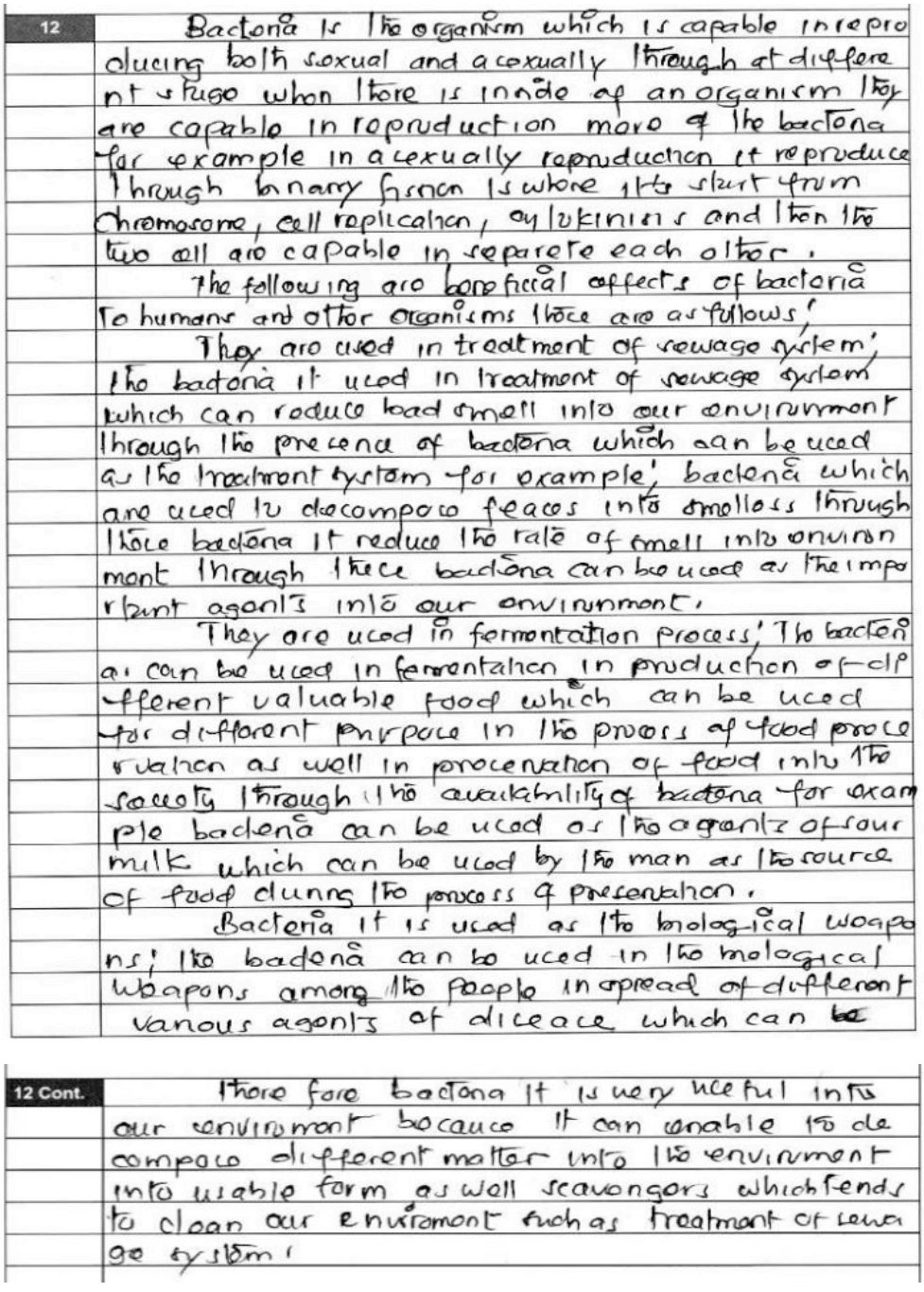


Figure 12: Candidates' performance on Question 12

The analysis from this figure shows that within good performance, 19.2 per cent of the candidates scored 6 to 10 marks, 76.9 per cent scored 10.5 to 15 marks and 3.9 per cent scored 0 to 5.5 marks.

The analysis shows further that 76.9 per cent of the candidates who scored higher than the rest had adequate skills in the concepts of major groups of living things. Consequently, they correctly explained the beneficial and detrimental economic importance of bacteria to human beings and other organisms. For example, most candidates wrote: *used in manufacture of dairy products, decomposition of organic matters nitrogen fixation and nitrification in soil, medical application and biological control.* Some candidates wrote: *bacteria are used in vaccines making industries, decomposition of organic matter, improvement of soil fertility, biological research, brewing industries.* Specifically, one of the candidates wrote: *have mutual relationship with ruminants' digestive system, used for nitrogen fixation in legumes, can be used as biological weapon, can cause health related problems can be used in brewing and fermentation industries*. Extract 12.1 gives a sample of correct response to the question among several others.



12

Bacteria is the organism which is capable in reproducing both sexual and asexually through at different stage when there is inside of an organism they are capable in reproduction more of the bacteria for example in asexually reproduction it reproduce through binary fission is where it's start from chromosome, cell replication, cytokinesis and then the two cell are capable in seperate each other.

The following are beneficial effects of bacteria to humans and other organisms there are as follows;

They are used in treatment of sewage system, the bacteria it used in treatment of sewage system which can reduce bad smell into our environment through the presence of bacteria which can be used as the treatment system for example, bacteria which are used to decompose feaces into smelless through there bacteria it reduce the rate of smell into environment through there bacteria can be used as the important agents into our environment.

They are used in fermentation process, The bacteria is can be used in fermentation in production of different valuable food which can be used for different purpose in the process of food production as well in preservation of food into the society through the availability of bacteria for example bacteria can be used as the agents of sour milk which can be used by the man as the source of food during the process of preservation.

Bacteria it is used as the biological weapons; the bacteria can be used in the biological weapons among the people in spread of different various agents of disease which can be

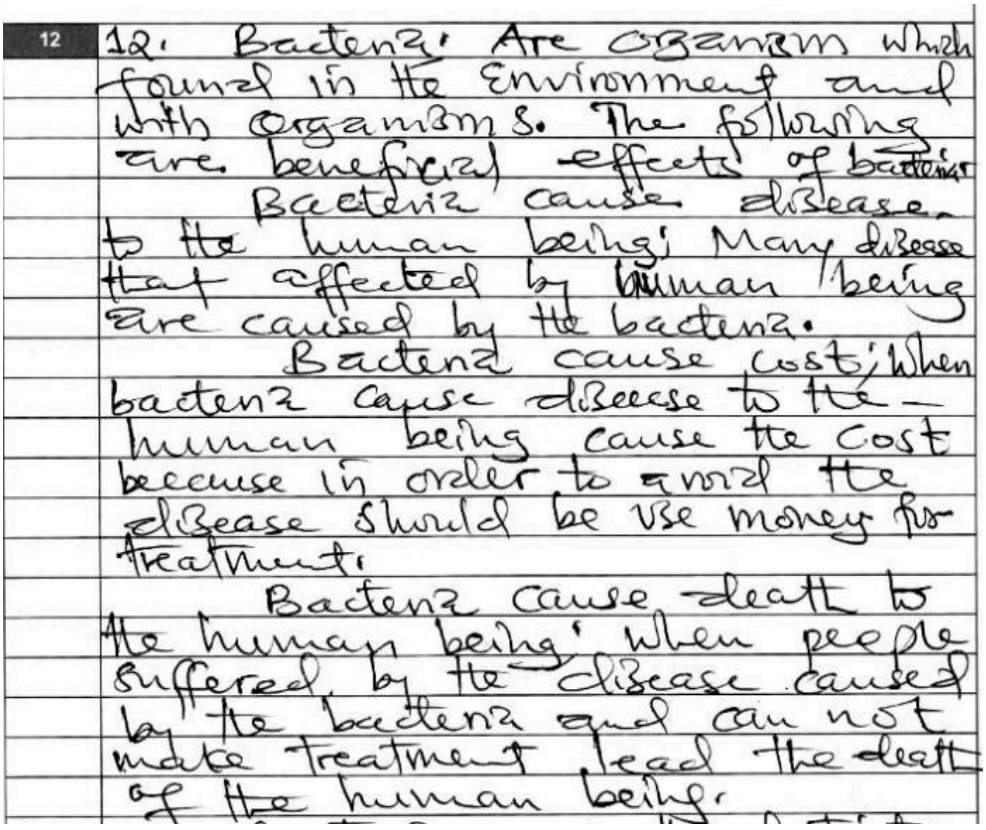
12 Cont.

therefore bacteria it is very useful into our environment because it can enable to decompose different matter into the environment into usable form as well scavengers which tends to clean our enviroment such as treatment of sewage system.

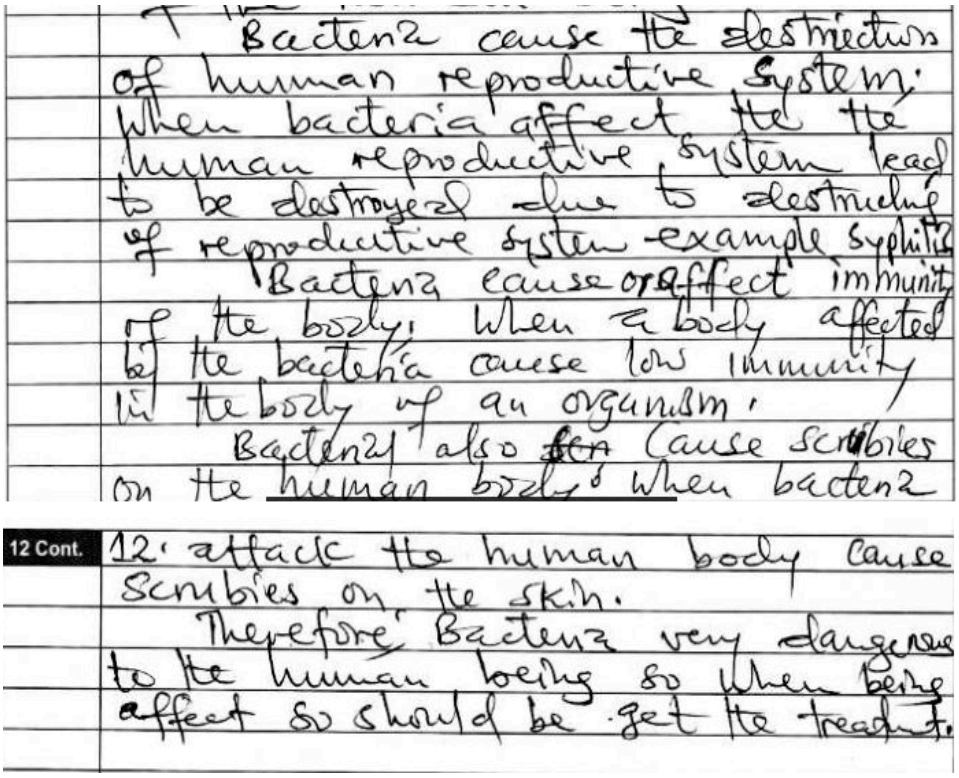
Extract 12.1: A sample of the correct response to question 12.

In Extract 12.1, the candidate explained clearly the advantages of bacteria to human and other organisms.

Despite the good performance of the candidates on this question, a few candidates (3.9%) scored 0 to 5.5 marks. They failed to exhaust the points as per the requirement of the question. Their performance indicated that they had poor skills in the importance of bacteria to human and other organisms thus, their responses were characterized by lack of clarity and poor English language. For example, some candidates responded *bacteria are used as source of food, are used as source of income, are used to promote diseases.* One candidate wrote: *bacteria are found in dirty places, they produce chemicals, they work similar to viruses, can be used as source of food to some animals, they live mutually with other organisms.* Others wrote*: bacteria is a group of organisms that is independent of other groups.* Such responses act as an evidence that these candidates had inadequate knowledge of the concepts on major groups of living things as they gave irrelevant and general responses. Extract 12.2 presents a sample of incorrect response of one candidate to this question.


12

12. Bacteria: Are organism which found in the environment and with organism's. The following are beneficial effects of bacteria
Bacteria cause disease to the human being; Many disease that affected by human being are caused by the bacteria.
Bacteria cause cost; When bacteria cause disease to the human being cause the cost because in order to avoid the disease should be use money for treatment.
Bacteria cause death to the human being; when people suffered by the disease caused by the bacteria and can not make treatment lead the death of the human being.



Extract 12.2: A sample of incorrect response to question 12.

In Extract 12.2, the candidate incorrectly explained non-beneficial aspects of bacteria rather than the beneficial aspects.

2.2.3 Question 13: Basic Biology Laboratory Skills

The question based on this topic required the candidates to develop six safety precaution measures that a student should follow to reduce accidents during practical session on food test. All candidates attempted this question. The general performance on this question was good since 98.7 per cent of the candidates scored 6 to 15 marks. This question has good performance as compared to other questions on this examination. Figure 13 shows the performance of the candidates on Question 13.

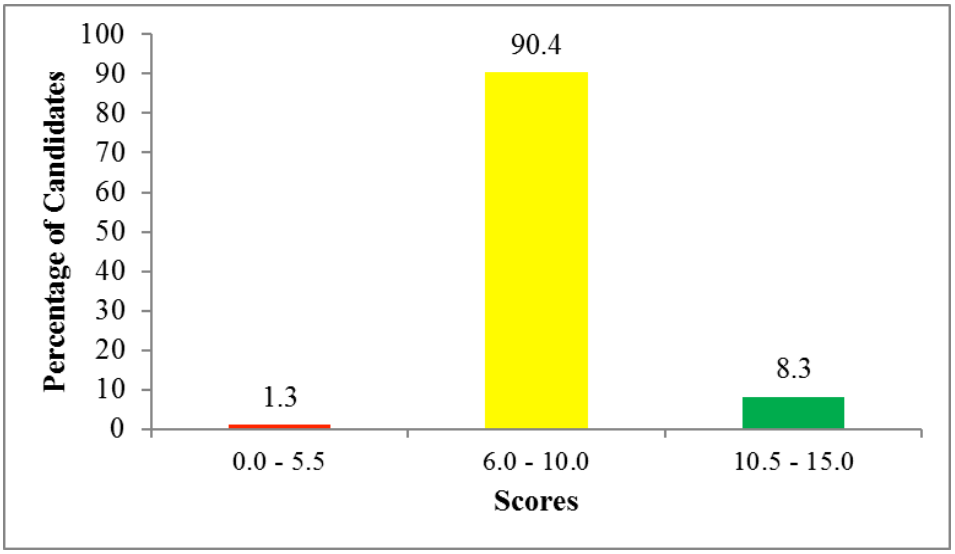
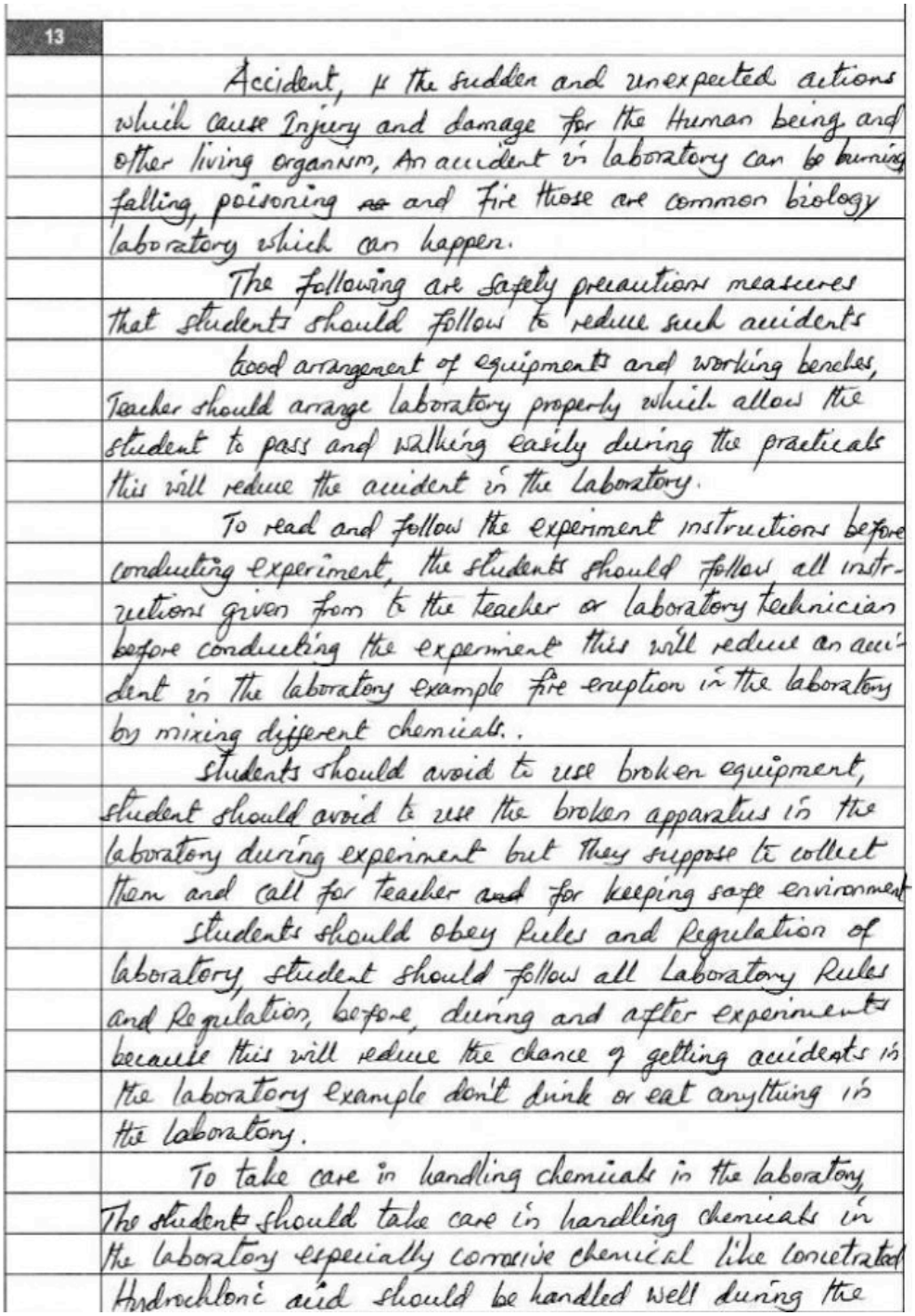


Figure 13: Candidates' performance on Question 13

Data analysis from this figure shows that 90.4 per cent of the candidates scored 6 to 10 marks and 8.3 per cent scored 10.5 to 15 marks. Likewise, 1.3 per cent of the candidates scored 0 to 5.5 marks indicating that they missed the correct answer of the question.

The analysis also indicates that the candidates who passed this question were able to describe the precautions like*: bench reagents should be handled with care, droppers should not be contaminated, in case sharp tools are used for peeling food stuffs avoid cuts, avoid eating or testing anything during experiments, students should be well instructed before practical sessions.* One candidate wrote: *Wear laboratory coats during the session, wear eyeglasses or point away test tubes from your eyes and people during heating and first aid kit should be around in case of any accident*. Specifically, one candidate explained: *use of test tube holder during heating, wearing of gloves and laboratory coat, provision of necessary instructions before session, students should avoid the use of broken apparatuses, student should wash hands using soap before and after the session.* Another candidate explained: *chemicals to be used has to be well arranged and organized, handle chemicals and apparatuses with care to avoid injuries, communicate with students before commencement of practical session, every student should have enough*

space to avoid accidents. Such responses suggest that the candidate had knowledge of the laboratory rules and procedures as per practical activity. Extract 13.1 serves as a sample of correct answer to question 13.



13

Accident, is the sudden and unexpected actions which cause Injury and damage for the Human being and other living organism, An accident in laboratory can be burning falling, poisoning ~~as~~ and Fire those are common biology laboratory which can happen.

The following are safety precautions measures that students should follow to reduce such accidents

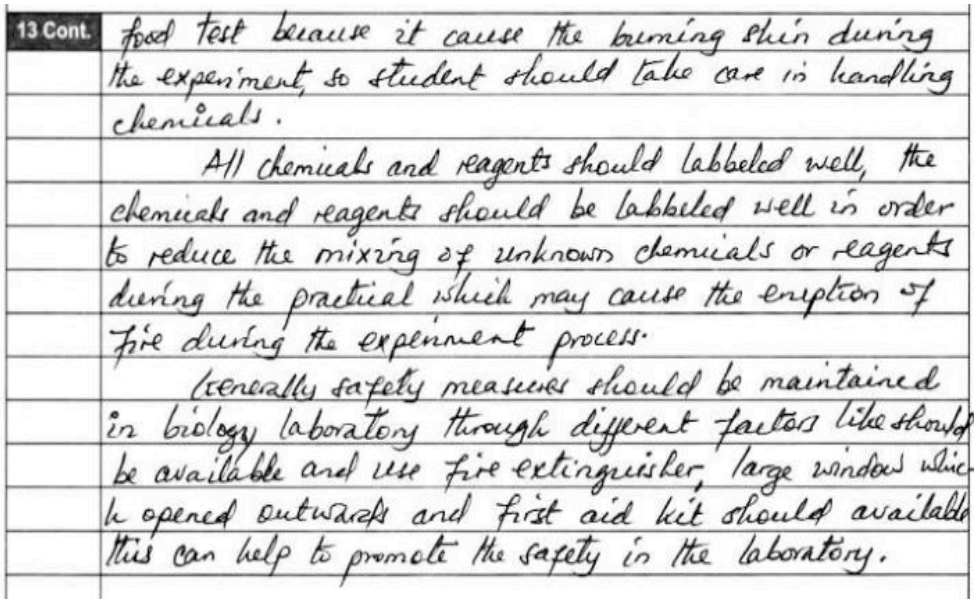
Good arrangenent of equipments and working benches, Teacher should arrange laboratory properly which allow the student to pass and walking easily during the practicals this will reduce the accident in the Laboratory.

To read and follow the experiment instructions before conducting experiment, the students should follow all instructions given from to the teacher or laboratory technician before conducting the experiment this will reduce an accident in the laboratory example fire eruption in the laboratory by mixing different chemicals..

Students should avoid to use broken equipment, student should avoid to use the broken apparatus in the laboratory during experiment but they suppose to collect them and call for teacher ~~and~~ for keeping safe environment

Students should obey Rules and Regulation of laboratory, student should follow all Laboratory Rules and Regulation, before, during and after experiments because this will reduce the chance of getting accidents in the laboratory example don't drink or eat anything in the laboratory.

To take care in handling chemicals in the laboratory The students should take care in handling chemicals in the laboratory especially corrosive chemical like concetrated Hydrochloric acid should be handled well during the



Extract 13.1: A sample of correct response to question 13.

In this extract the candidate explained correctly safe precautious measures to be adhered to during practical sessions.

Further analysis shows that the candidates who failed this question had limited knowledge of the laboratory safety hence they presented both relevant and irrelevant points. One candidate explained the general laboratory rules without considering specific rules that can govern food test practical like: *Don't make noise in the laboratory*, *don't enter in the laboratory without permission*. Other candidates explained laboratory layout. Moreover, a few candidates explained procedures on how to use concentrated acids during food test experiments. However, it is known that the acids used in food tests are diluted. For example, one of the candidates provided incorrect points such as: *laboratory for conducting food test should possess large windows, water system, gas systems, electric system, good benches and preparation room.* Another candidate wrote: *avoid sharing chemicals, never use all sources of heat, do not fell down, rules and regulation should be displayed to every student and clean the laboratory flow with soap.* Yet, another candidate wrote*: during practical session students should be in groups of three, each student should have his/her own source of heat*. Extract 13.2 contains a sample of incorrect response to the question.

13

Accidents; Are problems or actions that occured in a laboratory or anywhere in which a people made concentrate on it. Forexample accidents that occured in the laboratory includes, falling, electric shock and ~~fa~~ cuts and chocking.

The following are the safety precaution measures that students should follow to reduce such accident during food test session. as following.

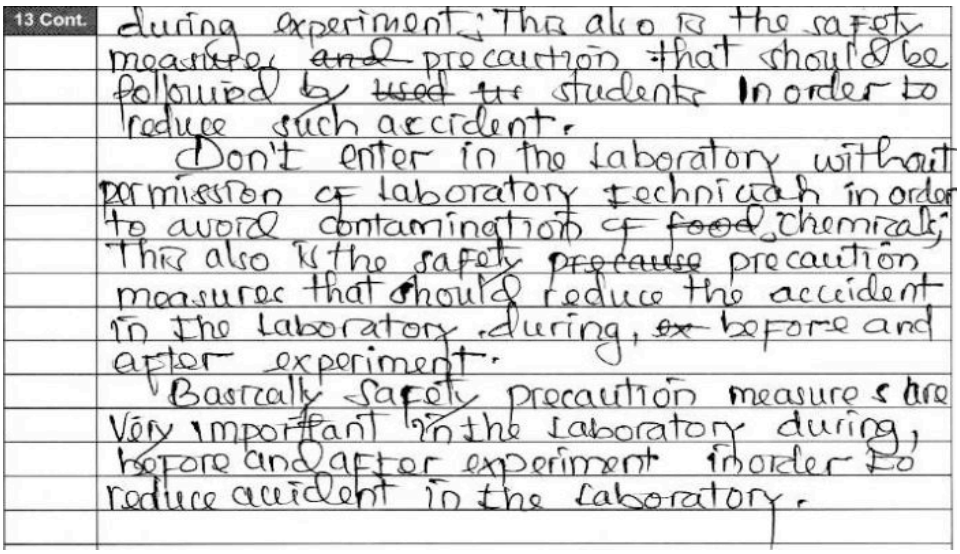
Do not eat anything in the laboratory forexample food samples such as Milk, Fruits and other samples; Inorder to avoid accident in the laboratory because those food substances are ~~contain~~ preserved with chemicals.

Do not drink anything in the laboratory before, the after and during the experiment because in the laboratory, the drinks are preserved with chemicals and are not for eating it is just for experiment only. for example Milk.

Dont use the broken apparatus in the laboratory because it cause cuts and stretches; it is not allowed to use those apparatus such as test tubes, beakes and other apparatus.

Dont play in the laboratory to avoid falling; The also is the safe measures and precaution that help the student to ~~pe~~ perform the experiment safely and reduce the accident in the laboratory.

Don't make noise in the laboratory



Extract 13.2: A sample of incorrect response to question 13.

In this extract with incorrect responses, the candidate explained general laboratory rules instead of the precautious measures to consider so as to reduce accidents.

2.2.4 Question 14: Assessment in Biology

The question from this topic required the candidates to prepare an observation checklist with seven points to observe during assessment of the biology practical, which require the students to dissect a cockroach and display its digestive system. All candidates attempted this question. The general performance on this question was weak since 20.4 per cent of the candidates scored 6 to 15marks. Figure 14 shows the performance of the candidates on Question 14.

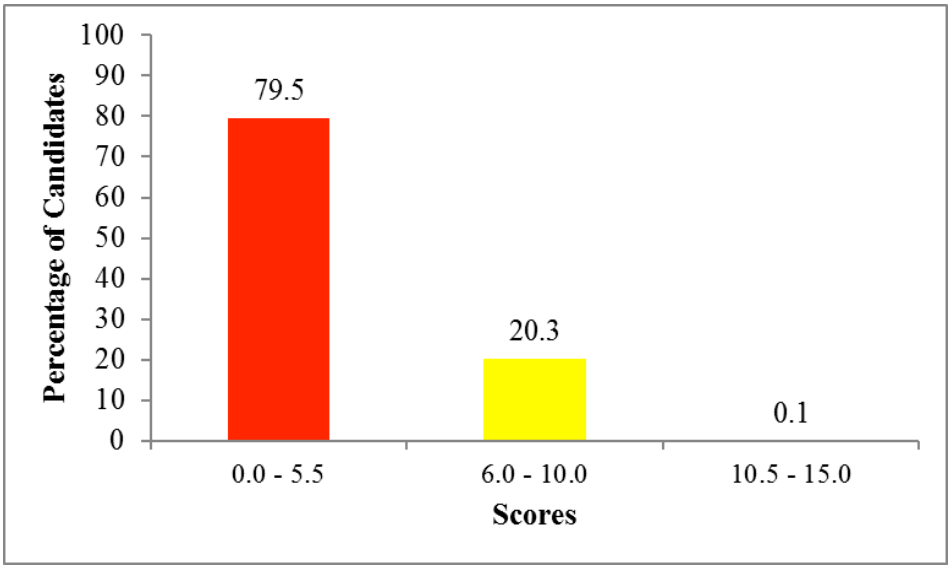
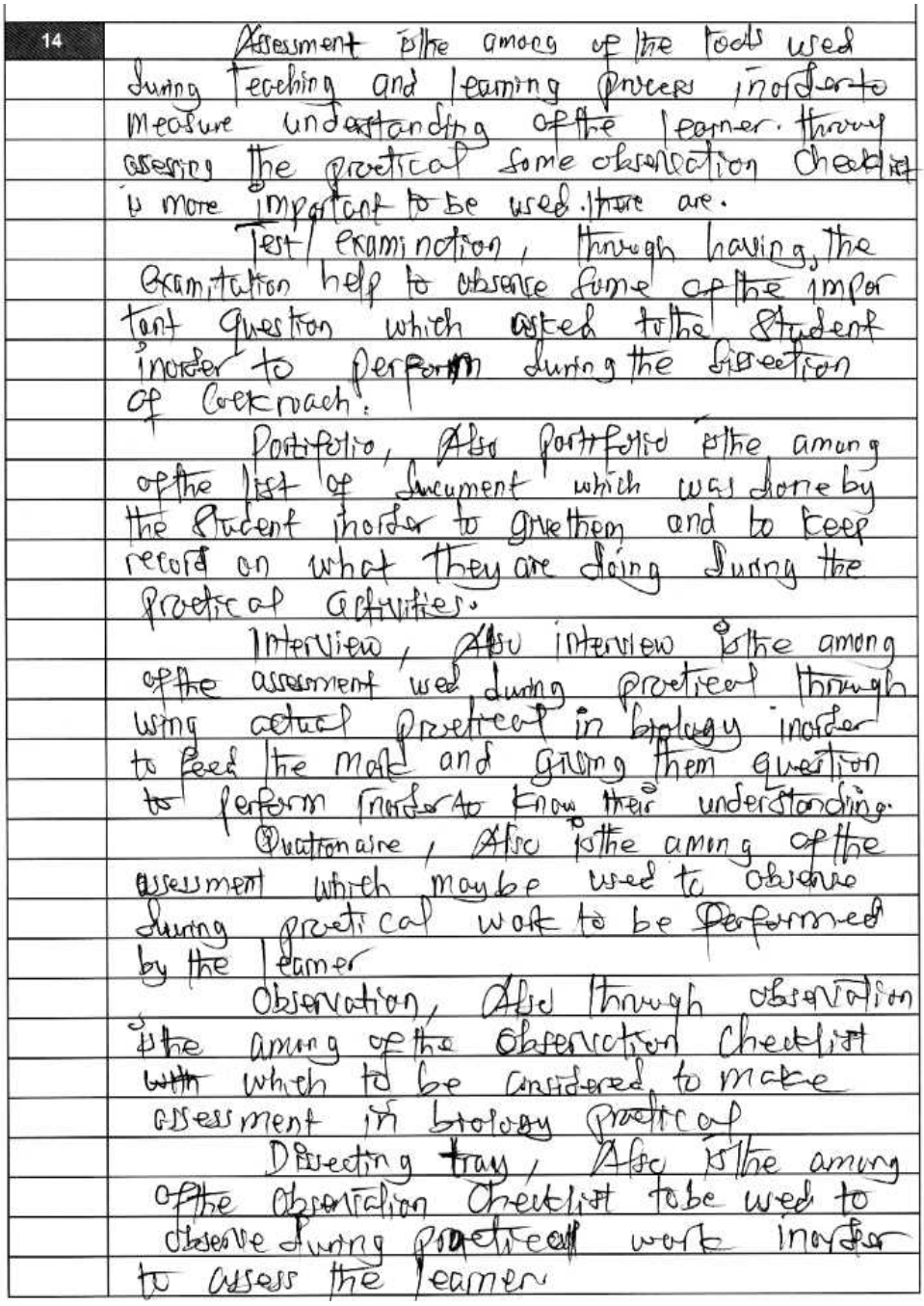


Figure 14: Candidates' performance on Question 14

The histogram in Figure 14 shows that among the well performing candidates 20.3 per cent scored 6 to 10 marks and 0.1 per cent scored 10.5 to 15 marks. The rest of the candidates (79.5%) scored poorly (0 to 5.5 marks).

The data further shows that the candidates who failed (79.5%) provided irrelevant or fewer points as per the requirement of the question. Most candidates explained parts of the cockroach's digestive system instead of providing observational checklist that will guide a teacher during assessment of dissection. Another candidate explained ways that a teacher can employ to observe students while they are executing practical session in the laboratory. One candidate, mentioned different assessment tools that a teacher can use to assess students during the practical sessions like: *interview, observation, tests, examinations, portfolios, checklist, among others*. Moreover, a few candidates mentioned preliminary stages used before a cockroach is dissected. One candidate wrote: *Removal of the wings and antennae, pinning of the specimen dorsal-ventrally.* Another candidate wrote: *Making the specimen unconscious, remove all legs, remove the outer skin, place the specimen at the center of the tray, measure the size of dissected specimen.* Specifically, one of the candidates wrote: *Observe the ability of students to remove legs, ability to start dissection, display the digestive system, ability to use water in the*

bottle. Such responses revealed that the candidate did not understand the question. Extract 14.1 gives a sample of incorrect response to the question.


14

Assessment is the among of the tools used during Teaching and learning process, inorder to measure understanding of the learner. Throug assessing the practical some observation Checklist is more important to be used. There are.

Test/ examination, Through having, the Examination help to observe some of the important Question which asked to the Student inorder to perform during the dissection of Cockroach.

Portifolio, Also portfolio is the among of the list of document which was done by the Student inorder to give them and to keep record on what they are doing during the practical activities.

Interview, Also interview is the among of the assessment wed during practical through wing actual practical in biology inorder to feed the mark and giving them question to perform inorder to know their understanding.

Questionaire, Also is the among of the assessment which maybe used to observe during practical work to be performed by the learner

Observation, Also through observation is the among of the Observation Checklist with which to be considered to make assessment in biology practical

Directing tray, Also is the among of the Observation Checklist to be wed to observe during practical work inorder to assess the learner.

Extract 14.1: A sample of incorrect response to the question 14.

In Extract 14.1, the candidate explained different tools that can be used in assessing student academic progress instead of explaining the observation checklist that can be used during the assessment of a student performing a practical of dissecting a cockroach.

On the other hand, a few candidates (20.4%) who scored 6 to 15 marks explained correctly the observational checklist that can guide a teacher during assessment of students performing the dissection of a cockroach. Some candidates in this group wrote: *Opening of the specimen to display the digestive system, undamaged organs, cleanliness of the dissection, relationship between dissection and drawing, magnification of the drawing, caption and labeling*. Others wrote: *Placement of debris in a dissection tray, orientation of the dissection, relationship between dissection and diagram, size of the drawing, heading of the drawing, pinning of the specimen* among others. Specifically, one of the candidates wrote: *Magnification of the drawn specimen should be clear, display and orientation should be inline with instructions given, neatness of the dissection, drawing and dissection displayed should be in harmony.* Another candidate wrote*: Procedures for cutting the specimen, labeling of the parts, magnification of the drawn specimen, caption of the specimen, size of the drawn diagram and use of arrows while labeling.* Such responses suggest that the candidate interpreted the question accordingly hence complied with instructions as shown in Extract 14.2 of the sample of correct response to the question.

14

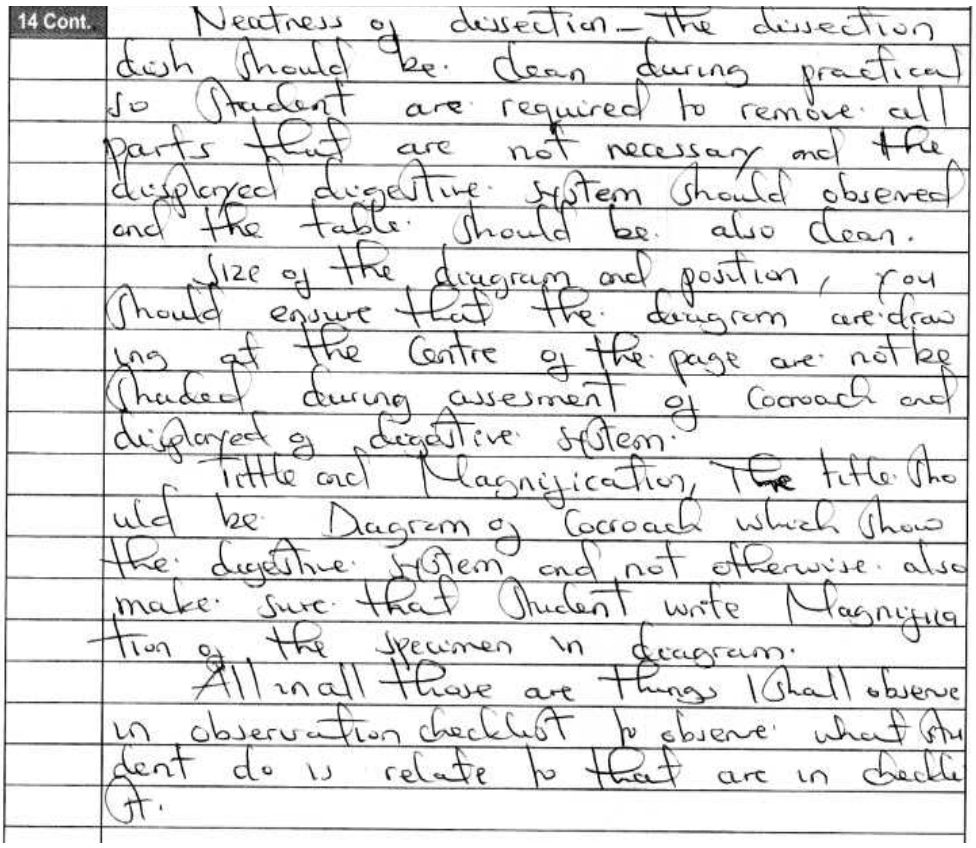
Checklist - is the printed material that used during practical assesment in the laboratory Concerning digestion dissection of the specimen. The following are the an observational checklist during assesment of practical Concern digestive system of cockroach.

Side of displayed organ, Here you have to look on the side of displayed organ that a Student are required to display during your assesment if it is right or left you should observe this

Relation of diagram with specimen, Here in your checklist is where you look if the drawing of the specimen is related to the specimen that Student dissect it if it is Cockroach you should look if Student drao Cockroach or what you should able to observe it.

Labelled part, You should Look if Student label the part that are responsible to labelled if it is digestive part also labelled should Contain digestive part and not other.

Damage of the specimen organ, You should look if Student not damage part organ of the specimen that are required to dissect it a checklist contain this part during assesment in practical in order to ensure that the Student do that they suppused to do during practical work.


14 Cont.

Neatness of dissection – The dissection dish should be clean during practical so student are required to remove all parts that are not necessary and the displayed digestive system should observed and the table should be also clean.

Size of the diagram and position, you should ensure that the diagram are drawing at the centre of the page are not be shaded during assesment of cockroach and displayed of digestive system.

Title and Magnification, The title should be Diagram of cockroach which show the digestive system and not otherwise also make sure that student write Magnification of the specimen in diagram.

All in all those are things I shall observe in observation checklist to observe what student do is relate to that are in checklist.

Extract 14.2: A sample of correct response to the question 14.

In this extract, the candidate explained clearly the points on the observation checklist to observe during the assessment of a practical session.

3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE ON EACH QUESTION IN 733/2 - BIOLOGY 2

The paper consisted of two alternative practical papers, namely 733/2A (Biology 2A) and 733/2B (Biology 2B). Each paper had three questions which were set from three topics as follows: Question 1 came from Basic Biology Laboratory Skills, Question 2 came from Biochemistry and Question 3 came from Classification of Living Things. The candidates were required to attempt all the questions in the paper. The analysis of candidates' responses to each question in both papers is discussed in the following sections.

3.1 Question 1: Basic Biology Laboratory Skills

In the question based on this topic, a candidate was required to dissect the given specimen and answer the questions that followed. The question of that nature was attempted by all candidates in both papers. The general performance on this question was good since 638 (90%) candidates scored 8 to 20 marks and only 71 (10%) candidates scored 0 to 7.5 marks. Figure 15 shows the performance of the candidates on question 1 in paper 2A and 2B.

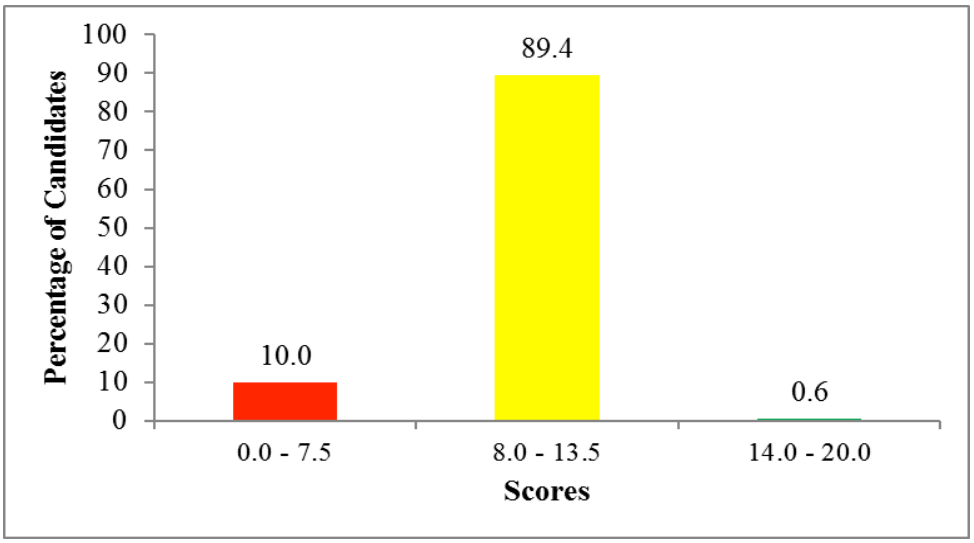


Figure 15: Candidates' Performance on Question 1 in paper 2A and 2B

Data analysis shows that 0.6 per cent of the candidates scored 14 to 20. On the other hand, 89.4 per cent scored 8 to 13.5 and only 10 per cent scored from 0 to 7.5 marks. The analysis of candidates' responses to question 1 in each paper is given as follows:

3.1.1 733/2A Biology 2A

The question 1 required the candidates to dissect the provided specimen M (a male or female frog/toad) in the usual way and display the digestive system. Candidates were supposed to deflect the alimentary canal to the left-hand side of the specimen and respond to the following questions: -

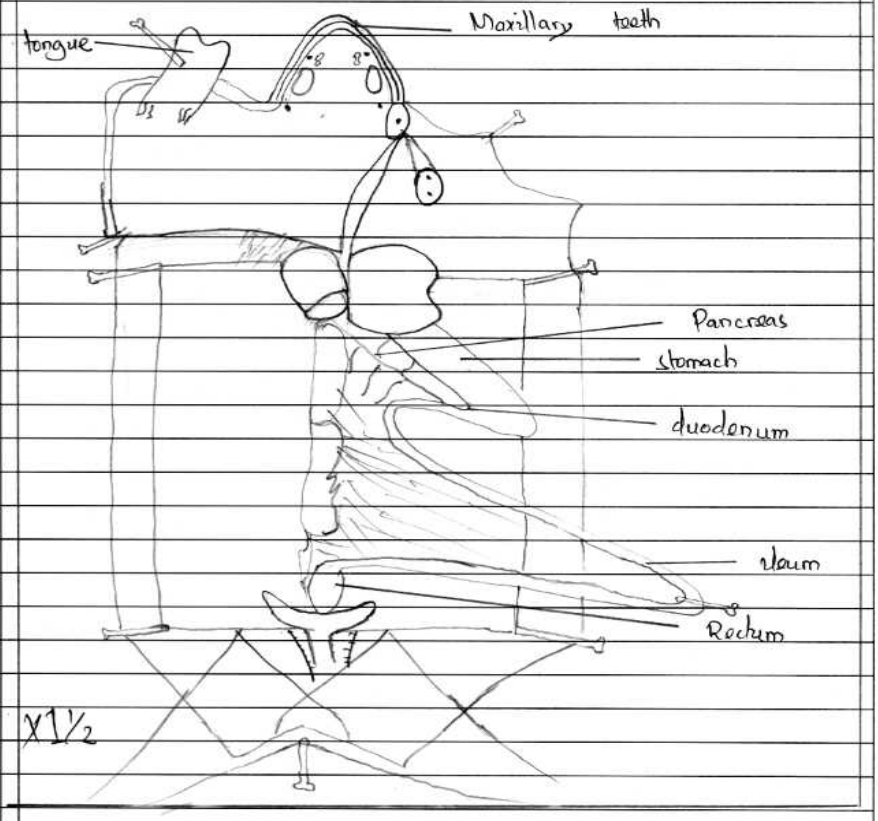
(a) Draw a diagram of the dissected specimen M and label seven parts concerned with digestion.

(b) Which precautions did you take when opening the inner skin? Give two points.

The results show that 90 per cent of the candidates scored 8 to 20 marks. Their good performance was due to their adequate knowledge of the tested concepts and good biology laboratory skills. In part (a), the candidates correctly drew large, neat diagrams showing parts of the frog/toad digestive system. The caption and magnification were shown in the required places of the diagram. Most of them demonstrated to have adhered to the principles of drawing biological diagrams such as drawing using a sharp pencil, using a pencil in arrowing, avoiding shadowing, labelling by non-arrowed lines, drawing large and neat diagrams, stating the caption and magnification and avoiding putting lines which cross to each other. They correctly labelled the parts that are associated with the digestive system such as the tongue, vomerine teeth or maxillary teeth, oesophagus, stomach, liver, gall bladder, pancreas, ileum, and rectum. Their responses show that the candidate had adequate knowledge of the digestive system of a toad/frog. In part (b), the candidate correctly identified the main precautions to be taken when opening the inner skin including tightening the ventral abdominal vein at two points before cutting it to prevent bleeding and secondly cutting the skin only superficially to avoid damaging the visceral organs. This shows that the candidate had good knowledge and skills of dissection of small animals particularly frog/toad. Extract 15.1 presents a sample of a correct response to question 1 in paper 2A.

1 a)

A DIAGRAM OF DISSECTED SPECIMEN SHOWING THE DIGESTIVE SYSTEM



1 Cont. (b) The precautions when opening the inner skin

i/ Tie blood muscle in two position.
This inorder to avoid flow of blood during dissection.

ii/ Cut vertically first to the specimen inorder to avoid to destroy the inner part of the specimen

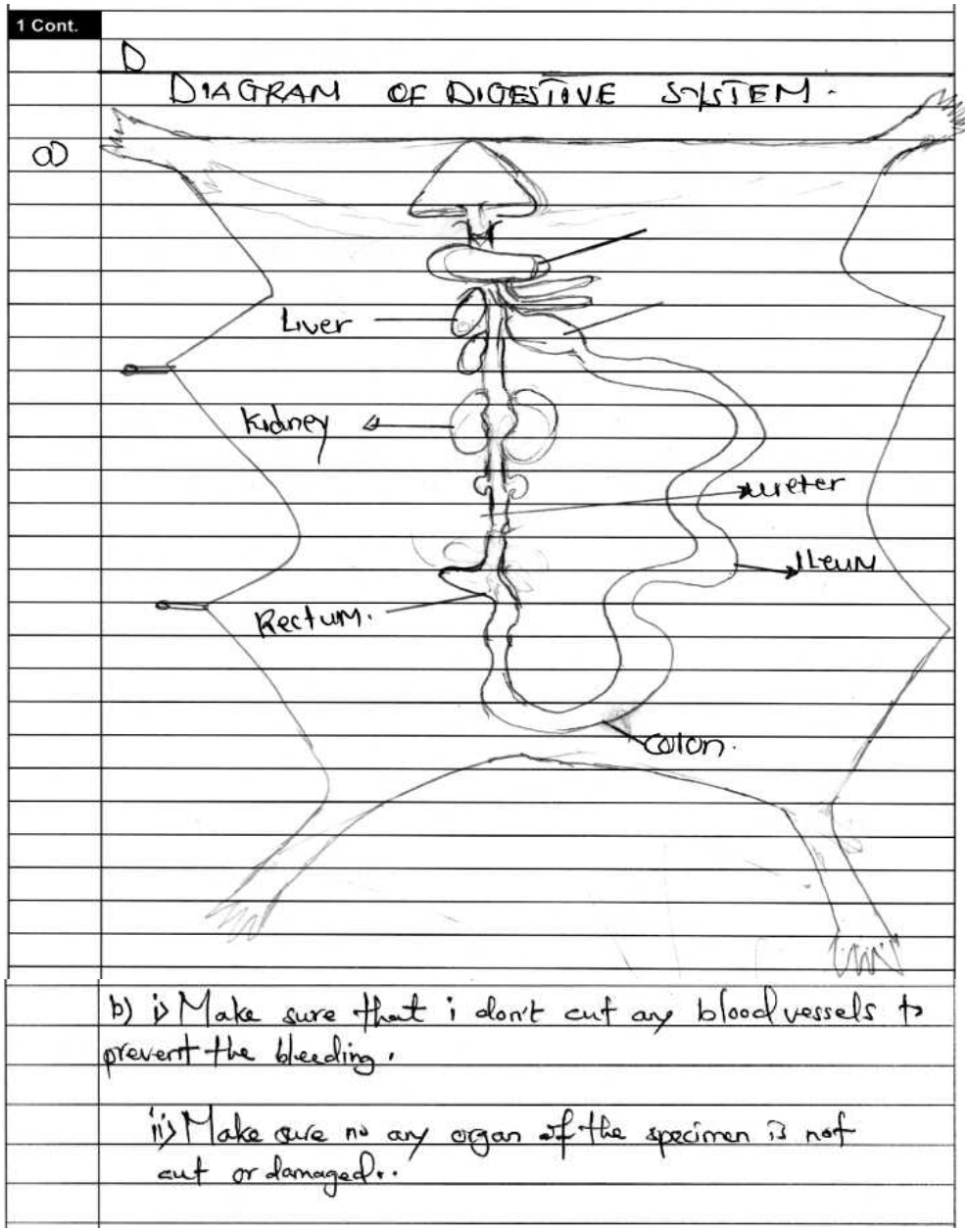
Because in the inner skin there are different systems such as digestive system, reproductive system also excretory system.

Extract 15.1: A sample of correct response to question 1 in paper 2A.

In Extract 15.1, the candidate correctly drew a well labelled diagram of a dissected toad/frog. The parts associated with the digestive system were correctly labelled, provided the title, caption and magnification and stated the precautions when opening the inner skin. However, in point (b) (i) the candidate used the term "blood muscle" instead of "blood vessel" and also in point (b) (ii), the candidate used the term "vertically" instead of "superficially" due to lack of proper vocabularies to describe specific concepts. These responses show that the candidates were knowledgeable about the conditions to be followed in dissecting a frog/toad drawing biological diagrams as well as the digestive system of a frog/toad.

Despite the good performance on this question, candidates who scored 0 to 7.5 marks, failed to provide correct responses to most parts of the questions. This shows that they had inadequate knowledge of the tested concepts. For example, in responding to part (a), most of the candidates dissected specimen M (male or female toad/frog) but their drawings had some incorrect labelling which led them to score low marks. Some of the candidates labelled correctly some parts of the reproductive system such as ovisac, oviduct and ovary. Moreover, some of the candidates labelled some parts of the excretory system including the lungs, kidney, ureter and urinary bladder which are not associated with the required digestive system of the given specimen M. These responses suggest that the candidates did not understand the demands of the question. Some candidates drew diagrams which were not well defined as such whether it was a diagram of the dissected frog/toad or rat/mouse. This could have been contributed by poor competence in drawings, poor preparation or poor practice in drawing the dissected specimens. This led them to score low marks. In part (b), most of the candidates gave one correct precaution which is commonly known particularly on tightening the ventral abdominal vein at two points before cutting it to prevent bleeding but most of them failed to point out the aspect of being careful in cutting the inner skin to avoid distraction of the inner delicate organs. This shows that they were not aware of this precaution. Some used improper technical language/ vocabularies showing that language was a barrier in attempting this question. Also, some candidates failed to draw diagrams of the dissected frog/toad and others failed to put a caption and magnification or stating them or the title incorrectly. This also shows that they lacked skills in drawing the dissected specimens leading to

score very low marks in this question. Extract 15.2 shows a sample of an incorrect response to question 1 in paper 2A as given by one candidate.



Extract 15.2: A sample of incorrect response to question 1 in paper 2A.

In Extract 15.2, the candidate drew a diagram showing a well displayed digestive system of frog/toad but the drawn diagram had labels of a kidney

and a ureter which were not parts of digestive system. Also, the cutting edge of the inner and outer skin was blunt. The drawing could not appear smart as expected based on principles of drawing biological diagrams. Some organs were left unlabelled although there were arrows pointing to them. This shows that the candidate did not understand the question and also had low knowledge of the internal organs of a frog/toad. In responding to part (b), the candidate identified two precautions to be taken during opening the inner skin by writing: (i) *make sure that I don't cut any blood vessels to prevent the bleeding* (ii) *make sure make sure no any organ of the specimen is not cut or damaged.* This shows that, the candidate was poor in grammar as shown in (i) and the use of double negation in (ii). Also, the candidate wrote a title without specifying the specimen. This was caused by insufficiency of knowledge about the principles of writing the title of a biological drawing.

3.1.2 733/2B Biology 2B

Question number 1 in this paper required a candidate to dissect the provided specimen B (a male or female rat/ mouse/guinea pig) in the usual way to display the digestive system and respond to the following questions:

(a) Draw a diagram of a dissected specimen B and label six parts that forms the digestive system.

(b) Carefully observe the dissected specimen B by using hand lens and identify the structure that carry out each of the following functions:

(i) Transfer of food from mouth to the stomach

(ii) Production of ptyalin enzyme

(iii)Secretion of bile.

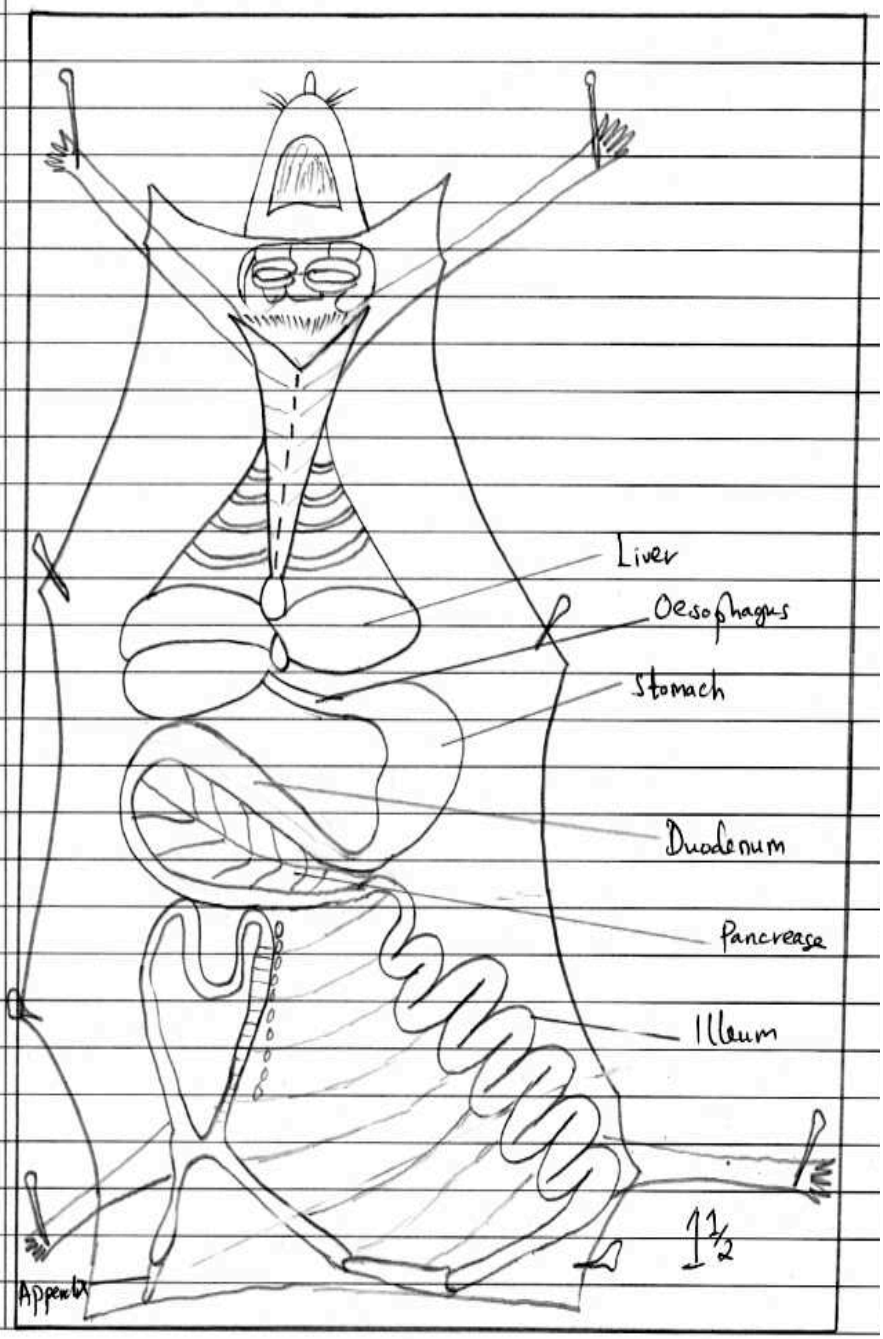
(c) Does specimen B have a gall bladder or not? Give a reason for your response.

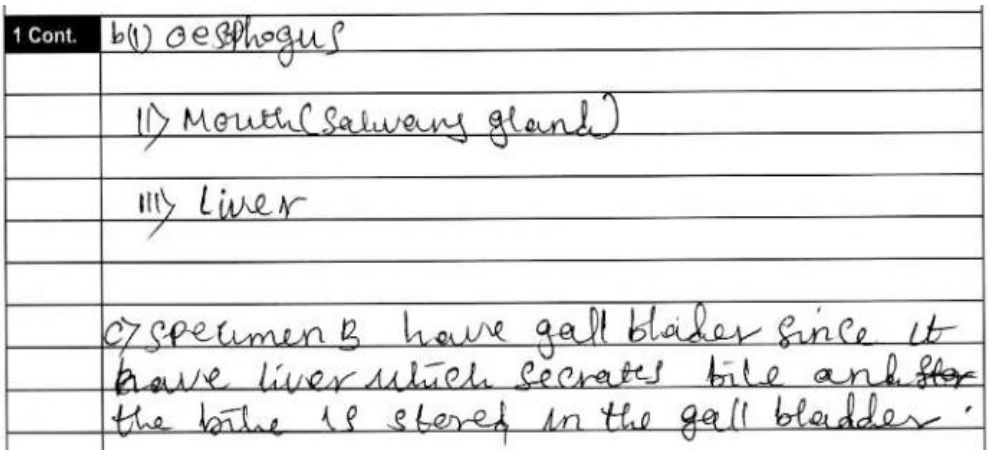
Analysis shows that 90 per cent of the candidates scored 8 to 20 marks. In part (a), they managed to draw large, neat and well-labelled diagrams of specimen B showing a well displayed digestive system with title, captions and magnification, signifying that they understood the rules of presenting biological drawings. The candidates correctly labelled the parts associated with the digestive system such as *stomach, oesophagus. pancreas, jejunum,*

ileum, bile duct, duodenum, pancreatic duct, rectum, colon, caecum, and *appendix*. Most candidates correctly labelled from six to ten parts of the system, indicating their good knowledge and skills in identifying parts of the digestive system of mammals such as rat/mouse or guinea pig. Furthermore, in part (b) (i), most of the candidates correctly identified oesophagus to be responsible for transfer of food from the mouth to the stomach (ii) mouth to be responsible for production of ptyalin enzyme (Salivary amylase) and (iii) liver being responsible for secretion of bile. All these signify that the candidates had good knowledge of nutrition in animals particularly parts of the digestive system and its accessory glands. Moreover, in part (c), some candidates had identified that specimen B lacks gall bladder because the organism tends to consume a very small amount of food (meal) per day thus there was no necessity of having large amount of bile to digest a big meal. This shows that the candidates had enough knowledge of the role of bile in the digestion of food in animals. Extract 16.1 shows a sample of correct response to question 1 in paper 2B.

.

1 @ A DIAGRAM OF A DISECTED SPECIMEN B (RAT) SHOWING DIGESTIVE SYSTEM.





Extract 16.1: A sample of correct responses to question 1 in paper 2B.

In this extract, the candidate drew the digestive system of the dissected specimen B and correctly labelled six (6) main parts associated with digestion. He/she was competent in drawing and labelling biological diagrams and also understood the digestive system of mammals.

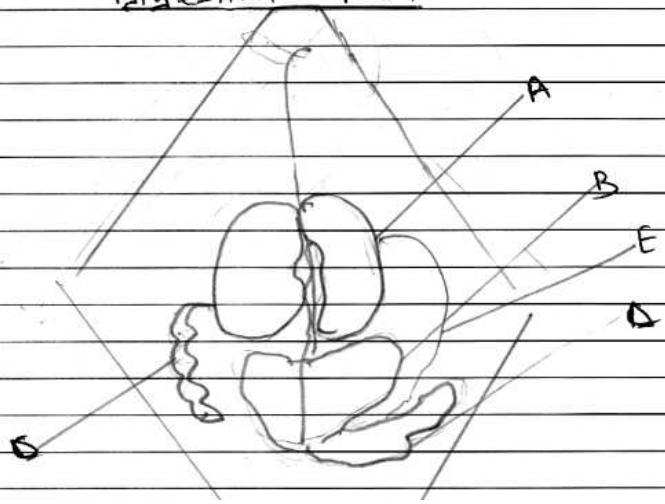
Likewise, in part (b), the candidate wrote correctly specific structures according to their functions. For example, in item (i), the candidate wrote *oesophagus* as a structure for the transfer of food from the mouth to the stomach. In item (ii), the candidate wrote mouth as the structure responsible for production of ptyalin enzyme and in item (iii), the candidate wrote liver as the structure for secretion of bile. However, in part (c), the candidate responded incorrectly by showing that specimen B has gall bladder since it has a liver which secretes bile and the bile is stored in the gall bladder. This response shows that the candidate was not aware that specimen B does not need to eat large amount of meal in a day and so the gall bladder was unnecessary for it.

Nevertheless, the candidates who scored 0 - 7.5 marks failed to provide correct responses to some parts of the question. For example, in part (a), the candidates failed to draw neat diagrams of a male or female rat/mouse/guinea pig, showing its digestive system. Moreover, some candidates failed even to provide labelling for the sketch diagrams they drew showing that they were not aware of the principles of drawing biological diagrams and also they had poor knowledge and skills in identifying parts of the digestive system in small mammals particularly rats,

mice or guinea pigs. Other candidates labelled organs that were not part of the digestive system such as kidneys, lungs, testes, urinary bladder and heart. Other candidates labelled the external parts of the rat like nail, fore and hind leg and eye and nostrils. These responses show that they did not understand of the question. Some identified correct parts but interchanged them, while others labelled less than six digestive parts in the diagram. In part (b), most of them failed to score full marks because they were able to identify either one or two among the three parts. For example, one candidate identified correctly the parts responsible for transfer of food from the mouth to stomach, production of ptyalin and secretion of bile to the gut, mouth and gall bladder respectively. Hence, the candidate scored marks only in one part. Other candidates failed to recognize that ptyalin is an alternative name for salivary amylase. For example, one candidate wrote *esophagus, ileum and liver* respectively signifying that there are confusions between ptyalin and erepsin enzyme which is secreted by the intestinal grands of the ileum. Other candidates responded to only one part of the question and skipped the other. For example, one candidate responded only to part (i) as oesophagus. Also, some candidates left all the parts as open blanks showing that they had inadequate knowledge of parts of the digestive system of mammals. In part (c), most candidates responded incorrectly to the question. For example, one candidate responded as *yes, the specimen has a gall bladder* and went far by giving wrong reason that *because it consumes a lot of lipids per day*. Another candidate argued that *yes because it secretes bile.* Those responses show that candidates were not aware that, bile is stored in animals who eat large amount of meals in a day. Extract 16.2 provides a sample of incorrect response to question 1 in paper 2B.

1

Diagram of Specimen M showing Digestion Part



1 Cont.

b) i) The part called Oesophagus are used to transfer the food from the Mouth up to the Stomach.

ii) Thep part called Pancreas are used to

ii) The part called Duodenum are used to produce the ptyalin enzyme for the purpose of breaking down of food.

iii) The part called pancreas are used to produce the bile which are used to neutralize the acidic chyme.

c) Yes; The specimen "B" have a gall bladder

Reason.

i) The pancreaso are used to produce the bile that are used to neutralize the chyme and also are used to hydrolyze the harmfull substances into harmells this process called Detoxification.

Extract 16.2: A sample of incorrect response to question 1 in paper 2B.

In this extract, the candidate dissected specimen B but incorrectly displayed the digestive system due to improper drawing with respect to the system asked. The labelling was indicated with letters instead of names and there is no key for the letters. Moreover, he/she did not write the magnification of the diagram. This shows that the candidate lacked knowledge in the laboratory skills and principles to be adhered to in the dissection and labelling of biological diagrams. In part (b), the candidate scored correctly only in (i) by writing that *oesophagus* is responsible for transfer of food from the mouth to the stomach but in parts (ii) and (iii) the responses were *duodenum secretes ptyalin enzyme and pancreas secretes bile* of which were both wrong answers. Also, in part (c), the candidate responded that *specimen B have gall bladder and justified that because it is used to neutralize the acidic chyme* which was also incorrect. These responses show that the candidate had insufficient knowledge on the digestive system of small mammals like mice/rat and not aware that bile is stored in animals who eat large amount of meal in a day.

3.2 Question 2: Biochemistry

The question, in 2A required the candidates to carry out a biochemical test to identify food substances contained in the given solution R using the provided reagents and then answering the questions that followed. But in 2B, the candidate was provided with specimen **D** and was required to carry out an experiment following the given procedures.

The question was attempted by all candidates. The data shows that the general performance on this question was good because 687 candidates (96.9%) scored 6 to 15 marks and only 22 candidates (3.1%) scored 0 to 5.5. Figure 16 shows the performance of candidates on question 2 in both papers, 2A and 2B.

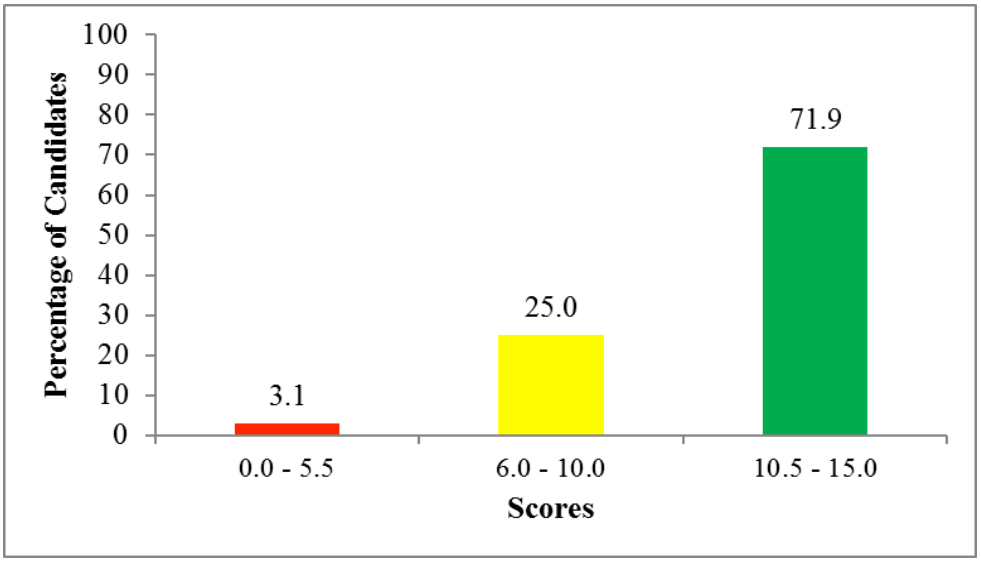


Figure 16: *Candidates' Performance on Question 2 in paper 2A and 2B*

The data shows that 71.9 per cent of the candidates scored 10.5 to 15 marks, 25 per cent scored 6 to 10 and 3.1 per cent scored 0 to 5.5 marks. The analysis of candidates' responses to question 2 in each paper is as follows:

3.2.1 733/2A Biology 2A

In this question candidates were provided with solution R and required to answer the following questions:

(a) Using the provided reagents, carry out the biochemical test to identify food substances contained in solution R. Tabulate your result as shown in the following table: -

Food Tested	***Procedure***	***Observation***	***Inference***

*(b) State the role of each of the food substances identified in solution **R** to human body.*

*(c) Why was heat required during the testing of food substance identified in solution **R**?*

The analysis from the candidates' responses shows that the candidates who scored 6 to 15 marks in paper 2B for question number 2 gave correct responses to most parts of the question. This indicates that the candidates had adequate knowledge of the topic, skills tested and principles of conducting scientific practicals involving main sense organs. In part (a), they correctly identified the food substance(s) contained in solution R by tabulating their results as required in the question. They explained the correct procedures for investigation of each food substances. They also used specific and measurable quantity of food sample solutions and reagents in each type of the food tested. Consequently, they obtained the correct observations and drew the correct inferences as can be seen in the marking scheme as follows:

Food Test.	***Procedure***	***Observation***	***Inference***
Starch	*To $2cm^3$ of solutions **R** in the test tubes, two (2) drops of Iodine solution were added and the content was gently shaken.*	*Solution **R** was retained with the brown colour of the reagent.*	*Starch was absent in solution **R**.*
Reducing sugar	*To 2 cm^3 of solutions **R** in the test tubes, $2cm^3$ of Benedict's solution was added and the content was boiled.*	*Solution **R** in the test tube turned into a series of colour from blue, green, yellow, orange to brick red precipitate.*	*Reducing sugar was present in solution **R**.*
Protein	*To $2cm^3$ of solutions **R** in the test tubes, $2cm^3$ of dilute NaOH solution was added followed by 2 drops of 1% $CuSO_4$ solution while shaking.*	*Solution **R** in the test tube turned into purple/violet coloration.*	*Protein was present in solution **R**.*
Lipid	*To $2cm^3$ of solutions **R** in the test tube, 3 drops of Sudan III solution was added and the content was vigorously shaken left to settle for 2 minutes.*	*Solution **R** in the test tube formed a red ring at the top surface of the solution.*	*Lipid was present in solution **R**.*

Most of the candidates wrote the correct procedures, observations and inferences, suggesting that they had adequate knowledge of how to write a good experiment report which led them to score high marks. Likewise, in part (b), the candidates correctly identified the role of each food substances identified from solution R including reducing sugar for energy production/release, lipids for insulation and energy release during cellular respiration and protein being responsible for various functions including growth, repair of worn-out cells and tissues, acting as structural materials like keratin in hair, nails, horns and hooves. Also, protein can aid in body defence like antibodies and transportation of materials like haemoglobin for transportation of Oxygen. All these indicate that the candidates had good understanding of the concept of biochemistry, especially the role of food substances in the body of living organism specifically animals. Moreover, in part (c), The candidate stated the reasons for applying heat when testing reducing sugar as *it was responsible for conversion /reduction of blue copper II contained in Benedict`s solution to brick red precipitate of copper I oxide by speeding the rate of reaction*. This indicates that the candidates had knowledge of factors affecting the rate of reaction. Extract 17.1 shows a sample of the correct response to question 2 in paper 2A.

2	BIOCHEMICAL FOOD TEST FOR FOOD SOLUTION R.			
	FOOD TEST(S)	PROCEDURE	OBSERVATION	INFERENCE.
a)	STARCH.	To 2cm³ of food solution R, 2 drops of iodine solution were added and the content were left to settle for 2 minutes.	Food solution R in the test tube retained the violet colour of the reagent	Starch absent in food solution R
	REDUCING SUGAR	To 2cm³ of food solution R in the test tube, 2cm³ of benedict solution were added and the content were gently boiled	Food solution R in the test tube turned into series of colour, blue, green yellow up to orange.	Reducing sugar present in food solution R.
	NON-REDUCING SUGAR.	To 2cm³ of food solution R in the test Tube, 2cm³ of dil. HCl were added and the content were boiled and allowed to cool. After cooling 2cm³ of dil NaOH were added followed by 2cm³ of benedict solution then the content were boiled.	Food solution R in the test tube turned into series of colour from blue, green, yellow then orange	Non-reducing sugar present in food solution R.

2 Cont.

	FOOD TESTED	PROCEDURE	OBSERVATION	INFERENCE
a)	PROTEIN	To 2cm³ of food solution R in test tube, 2cm³ of dil NaOH were added then 3 drops of 1% $CuSO_4$ were added while shaking.	Food solution R in the test tube turned into purple colouration	Protein present in food solution R.
	LIPID	To 2cm³ of food solution R in the test tube, 2 drops of sudan(III) were added - and the content were left to settle for 2 minutes.	Food solution R in the test tube formed a red ring on the surface of the solution	Lipid present in food solution R.

b) ① Reducing sugar and non-reducing sugar
- Are responsible for provision of energy in the body of an organism

② Protein
- Used to support growth
- Repairing of cells.
- Production of hormones and enzymes

2 Cont.

b) (iii) Lipid
- Used for insulation
- Protection of vital organs
- Used as respiratory substrate

c) Heat was required inorder to increase the rate of chemical reaction in food solution R, as the rate of reaction depends on temperature.

Extract 17.1: A sample of correct response to question 2 in paper 2A.

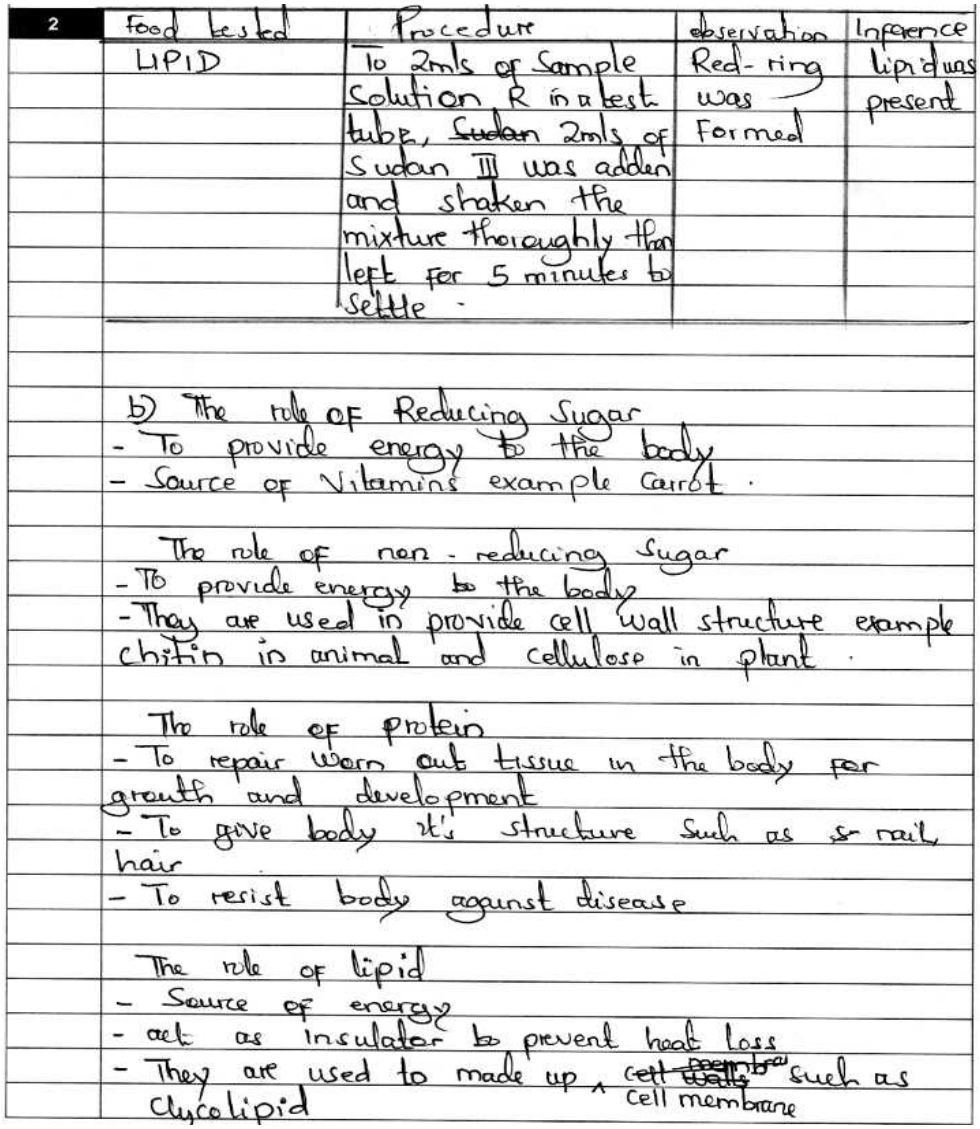
In Extract 17.1, the candidate adhered to all the requirements of the question. For example, in part (a), he/she clearly tabulated showing the

food tested, procedures involved, observations and inference for each food tested. The candidate presented the unit of measurement for each food solution tested and the time limit before observing the changes for deducing presence or absence of a given class of food. This shows that the candidate mastered the principles of food testing and report writing. In part (b), the candidate pointed out the main role of each identified class of food and much more in part (c) the candidate justified the reasons for applying heat when testing reducing sugar *that was to increase the rate of reaction.* All these signify that the candidate had enough knowledge and skills in types of chemical reactions and factors affecting them.

In contrast, the candidates who scored 0 to 5.5 marks provided most incorrect responses, especially on the procedures, observations and inferences. For example, in part (a), one candidate wrote the procedures for testing starch as *to 2 cm^3 of solutions R in the test tubes, 2 drops of iodine solution were added and the content were boiled and left to settle for two (2) minutes.* In addition, the testing of reducing sugar, another candidate wrote that *to 2 mls of solutions R in the test tube, equal amount 1% Copper (II) Sulphate solution was added and the mixture was boiled for 2 minutes while shacking***.** The two procedures were wrong since testing of starch with iodine does not involve boiling whereas the testing of reducing sugar involves the use of Benedict solution and not Copper (II) Sulphate.

Moreover, another candidate in testing for reducing sugar wrote: *to 2 cm^3 of solutions R, 2 cm^3 of Sudan III solution was added and the content were left to settle.* In this area, the candidate confused the reagents for testing various food substances since Sudan III is used to test lipid and not reducing sugar. Another candidate wrote: *in testing for reducing sugar, Hydrochloric acid* was *added followed by Sodium hydroxide and Benedict solution*. Apart from this observation, some candidates did not indicate specific quantities of the reagents used in each procedure and the time interval for certain reactions or activities. All of these show that the candidates have a missing concept for the main procedures, the reagents to be used and the conditions necessary in carrying out the biochemical tests of various classes of foods. Also, in part (b), some candidates mentioned the elements which make up carbohydrates such as hydrogen, oxygen, and carbon*,* instead of food

substances contained in the sample showing that they did not understand the question. On the other hand, in the same part, most candidates failed to specify the role of each class of food identified. Instead, they mentioned the role of food in the body generally. This shows that they did not understand the question. For example, one candidate wrote that the role of the food identified in solution R is *for growth and repair, body insulation and energy release* which was correct but not specific. Such responses suggest that the candidates had partial knowledge and skills in the roles of a specific food substance in human bodies. Other candidates wrote the functions of starch, which was not in the solution R. These candidates either did not understand the question or did not conduct the starch test. Specifically, one candidate wrote: *The end product of starch is maltose, that of protein is peptides.* This also did not understand the question. Yet other candidates provided correct answers but interchanged them. Such responses indicate that they had inadequate knowledge of the tested concepts and some other candidates did not understand the question. In part (c), a few candidates failed to state the role of heat in testing reducing sugar. For example, one candidate wrote: *The role of heat in testing reducing sugar is to break down the glycosidic bond for benedict solution to enter* and another candidate wrote: *To break down disaccharides to monosaccharides* showing that they have low knowledge of the roles of various conditions applied in a certain food test experiment. Extract 17.2 shows a sample of incorrect response to question 2 in paper 2A.



2	Food tested	Procedure	observation	Inference
	LIPID	To 2mls of Sample Solution R in a test tube, ~~Sudan~~ 2mls of Sudan III was added and shaken the mixture thoroughly then left for 5 minutes to settle.	Red-ring was Formed	lipid was present

b) The role of Reducing Sugar
- To provide energy to the body
- Source of Vitamins example Carrot.

The role of non-reducing Sugar
- To provide energy to the body
- They are used in provide cell wall structure example chitin in animal and cellulose in plant.

The role of protein
- To repair worn out tissue in the body for growth and development
- To give body it's structure Such as nail, hair
- To resist body against disease

The role of lipid
- Source of energy
- act as insulator to prevent heat loss
- They are used to made up ~~cell wall~~ cell membrane such as Glycolipid

Extract 17.2: A sample of incorrect response to question 2 in paper 2A.

In this extract, the candidate scored low marks due to lack of skills on food testing. Also, in his/her report, the candidate presented the test for lipid only instead of including all other food substances asked like starch, protein and reducing sugar. For example, in part (b), the candidate gave the role of non-reducing sugar which was not present in solution R, showing he/she had no knowledge and skills in observation and report writing for food test experiments. Part (c) was completely skipped by the candidate.

3.2.2 733/2B Biology 2B

In the question, the candidate was provided with specimen D and was required to carry out an experiment using the following procedures:

Procedures

(a) Cut the specimen D into two halves.
(b) Place one half into a mortar and grind using pestle to make a paste
(c) Place the paste into the test tube and label it as test tube X.
(d) Place the other half into another test tube and label it as test tube Y
(e) Add 2mls of 2% H_2O_2 solution into each of the test tube X and Y and note the changes.
(f) Take a wooden splint and test the evolution of gas in each of the test tubes. Record your observation.

Questions

(a) (i) What was the aim of this experiment?
(ii) Which test tube acted as a control experiment?

(b) Why was specimen D grounded?

(c) (i) What did you observe after adding 2% hydrogen peroxide solution into each of the test tube X and Y? Give reason for each observation.
(ii) Suggest the name of the substance contained in specimen D which was responsible for the changes noted in one of the test tubes in procedure(e).
(iii) Write the chemical equation for the reaction which occurred after adding 2 % of hydrogen peroxide solution which caused the observed changes in one of the test tube in procedure (e).

(d) Name the gas evolved in this experiment. Give reasons for your answer.

(e) What deductions can be made in this experiment? Give two points.

Analysis from the candidates' responses reveals that the candidates who scored 6 to 15 marks managed to provide correct responses to many parts of

the question, indicating that they had adequate knowledge of biochemistry and biology laboratory skills. For example, in part 2 (a) (i), most of the candidates correctly stated that the aim of this experiment was to investigate an enzyme activity while in 2 (a) (ii), they identified that *the test* tube which acted as a control was test tube X showing that they had adequate knowledge of experimental and control parts of the experiment and the aim of this experiment. In part (b), the candidates correctly stated the reason for grinding specimen D that was to increase the surface area of the substrate in order to increase the rate of reaction. This also shows that the candidates had enough knowledge on the factors affecting the rate of enzyme-controlled reaction such as enzyme concentration which is increased by increasing the surface area of the substrate. In part (c) (i), the candidates correctly stated the observation made after addition of 2% hydrogen peroxide solution into each of the respective test tubes X and Y. They also stated the reason behind for each observation that occurred for each test tube. That means in test tube X, there was evolution of strong effervescence which appeared as bubbles of air because in the grounded specimen D, more catalase enzymes were exposed to 2% hydrogen peroxide leading to high rate of reaction which was indicated by high production of effervescence. On the other hand, in the test tube Y, there was less evolution of effervescence. That was because in the ungrounded specimen D, a few catalase enzymes were exposed causing low rate of reaction which was indicated by low production of effervescence.

In part 2 (c) (ii), the candidates identified the name of the substance contained in the specimen D which was responsible for the changes noted in this experiment as catalase enzyme showing that they had a clear understanding of the concept of enzymology. Moreover, in 2 (c) (iii), the candidate wrote the chemical equation for the reaction which occurred after adding 2% of hydrogen peroxide solution as follows:

$$2H_2O_2 \xrightarrow{\text{Catalase}} 2H_2O + O_2$$

In part 2 (d), the candidates identified that the gas evolved is oxygen with reasons that the gas relit a glowing wooden splint in test tube X. This shows that the candidates had knowledge of the decomposition of hydrogen peroxide and the test for oxygen gas. In part 2 (e) based on this experiment the candidates deduced that enzyme activity depends on their

concentrations. The higher the concentration of enzymes, the higher the rate of reaction and vice versa. This explains why there was more effervescence in test tube X than Y. Such good answers show that the candidates had knowledge on the factors affecting enzyme-controlled reaction. Extract 18.1 shows a sample of correct response to question 2 in paper 2B.

2

A.

(i) Aim of experiment

The Aim is to investigate the effect of Surface area on enzyme action.

(ii) Test tube X acted as a Control experiment.

B. Specimen D was grounded - In order to increase surface area for the enzyme reaction to take place faster or More quickly.

C.

(i) Procedure	Test tube Observation	(ii) Reason.
Adding 2ml of 2% H_2O_2 Solution in each of the test tube X and Y.	In test tube X there was high formation of effervescence	This was due to Large surface area of the specimen D that lead to catalase enzyme to speed up the rate of reaction.

2 Cont.

c. i, In test tube Y

Observation.

- There was low formation of effervescence due to small surface area that lead to slower the action of catalase enzyme in specimen D.

Reason.

- Small surface area that lead to slower the action of catalase enzyme in specimen D.

ii. Catalase enzyme was the substance that was responsible for the changes that noticed in the test tube X and Y.

iii.

$$2H_2O_2 \xrightarrow[\text{In specimen D}]{\text{Catalase enzyme}} 2H_2O + O_2$$

2 Cont.

D. The gas evolved is Oxygen gas.

- This is because of continuation of growing / burning of the wooden splint.
- The gas supported combustion.

E. The experiment validates the statement that show the effect of surface area on enzyme activity. Since in the test tube X there was high formation of effervescence due to large surface area that lead to the catalase enzyme to speed up the rate of reaction but in test tube Y there was low formation of effervescence due to small surface area that lead to slower the surface area for enzyme reaction to take place.

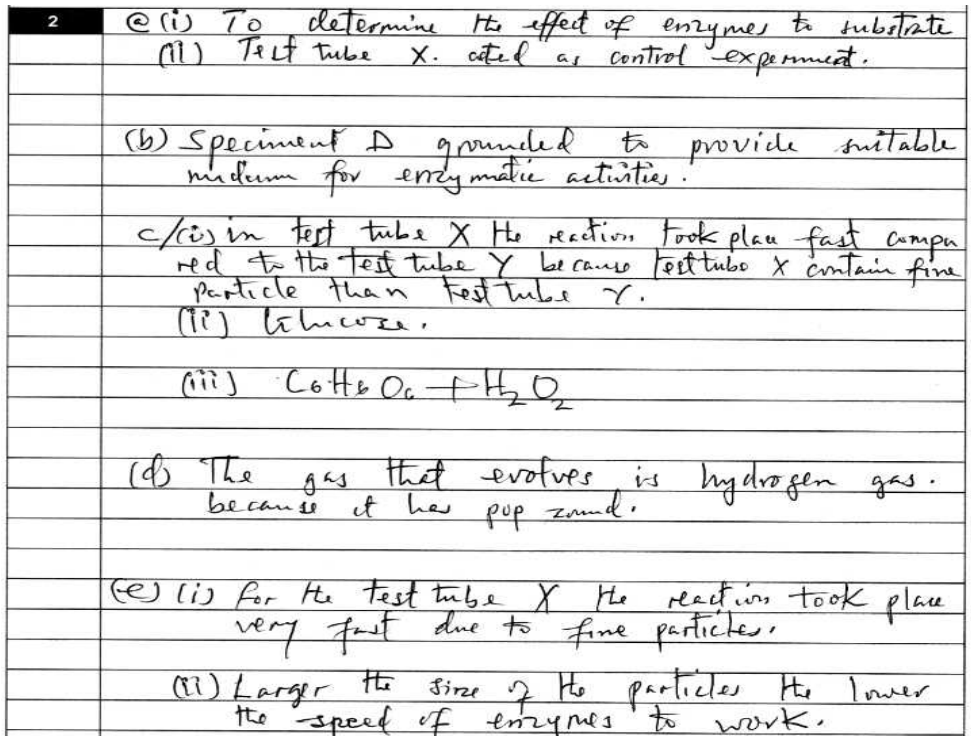
Therefore Large surface area speeds up the rate of enzyme reaction.

Extract 18.1: A sample of correct response to question 2 in paper 2B.

In Extract 18.1, the candidate correctly stated the aim of the experiment in part (i). Moreover, he/she correctly identified the test tube used as a control experiment in part (ii). Likewise, in part (b), the candidate gave the correct reason for grinding the specimen D. Moreover, in part (c) (i), he/she gave the correct observation and the reason after adding 2% hydrogen peroxide solution into each of test tubes X and Y was given. In part (c) (ii), the candidate also suggested the name of the substance contained in specimen D, which was responsible for the changes noted, in procedure (e). Similarly, the correct balanced chemical equation was presented for the reaction which occurred after adding 2% of hydrogen peroxide solution to test tubes. In part (d), the candidate named correctly the gas evolved from this experiment and gave the reason. In part (e), the candidate gave correct deduction from the experiment. All this shows that the candidate had enough knowledge and skills in biochemistry especially enzymology.

In contrast, analysis shows that candidates who scored 0 to 5.5 marks provided incorrect responses to most parts of the question. For example, in part (a) (i), some of the candidates wrote the aim of experiment was *to* determine factors effecting enzyme activity and others said to investigate the rate of enzyme activity. Their responses indicate that they are not aware of the aim of the experiment. In (a) (ii), some candidates identified the test tube Y as a control experiment while test tube X was the correct one. This response shows that candidates do not understand the differences between experimental and control parts of an experiment. In part (b), some candidates wrote that the aim of grinding specimen D was to facilitate reaction while others wrote for easy penetration of 2 % hydrogen peroxide. All these responses showed that they had low knowledge of how enzyme concentration affects the rate of enzyme-controlled reaction. In part (c) (i), they wrote incorrect observations after adding 2% hydrogen peroxide solution into each of the test tubes X and Y. For example, some candidates wrote in test tube X there was evolution of more bubbles instead of effervescence and other candidates wrote more detergents were produced in test tube X than Y. One candidate wrote that more effervescence was evolved in test tube X than Y due to more reaction caused by specimen D. Their reasoning indicated that they were not aware of the reaction occurring in the test tubes and some lacked proper scientific vocabularies to explain the observations. In part c (ii), a few candidates failed to give the

actual name of the enzymes. Some said that the name of the substance present in specimen D was protein. Others wrote the general term as enzyme without specifying the exact name of the enzyme. This indicates that they were not aware of catalase enzyme and its function in the liver. In part c (ii) most of the candidate failed to write a chemical reaction for the reaction occurred after adding 2% hydrogen peroxide. A few candidates attempted to write it but it was not balanced. All these show that the candidates had limited knowledge of the principles of writing chemical equations. In part (d), most candidates identified the types of the gas evolved but failed to justify it and some candidates failed to use the term relight a glowing wooden splint in explaining the observation. For example, one candidate wrote that *the gas evolved was an oxygen because when it reacts with effervescence, burning start* and another one wrote *when wooden splint is placed on the test tube X fire is produced,* showing that they did not know how the oxygen gas is confirmed through experiments. Very few candidates failed to name the gas evolved from the experiment. One candidate wrote carbon dioxide and others wrote carbon monoxide. These candidates are not familiar with the decomposition of hydrogen peroxide under catalase enzyme. In part (e), most of the candidates failed to deduce that the rate of enzyme reaction depends on its concentration. For example, one candidate deduced that *test tube X have more enzyme than test tube Y* and other candidates wrote that, *from the experiment it can be concluded that grinding specimen D cause more bubbles than non-grinded one.* This shows that the candidates in this category were not aware that grinding a substrate increases the surface area for enzymic reaction. Extract 18.2 shows a sample of incorrect response to question 2 in Paper 2B.



Extract 18.2: A sample of incorrect response to question 2 in Paper 2B.

In Extract 18.2, the candidate scored poorly because in part a (i) the candidate failed to understand the aim of the experiment. The candidate pointed out that the aim of the experiment was *to determine the effects of enzymes to substrate* while it was to investigate the enzyme activity. In part (b), the candidate failed to give reasons for grinding specimen D. The candidate wrote: *To provide suitable medium for enzymatic reaction* instead of increasing surface area of the substrate in order to increase the rate of reaction. In part (c) (i), the candidate failed to justify the observation by writing*: Test tube X contain fine particles than test tube Y* which was incorrect. Also, in part (c) (ii), the candidate failed to identify the substance contained in the specimen by writing *glucose* while it was catalase enzyme. Moreover, in part c (iii) the candidate also failed to write the correct balanced chemical equation for the reaction occurring in the test tube X after adding 2 % of hydrogen peroxide solution.

The candidate wrote $C_6H_6O_6 + H_2O_2$ while the correct equation is $2H_2O_2 \xrightarrow{\text{Catalase}} 2H_2O + O_2$

In part (d), the candidate failed to identify the gas that was evolved after the reaction and wrote hydrogen with the reason which was not based on observation. For instance, *the gas gave a pop sound*. The correct response was oxygen gas since it re-light a glowing splint. Not only that but also in part (e), the candidate failed to provide vivid deductions based on the experiment conducted. All these show that the candidate missed several skills in Biology practicals particularly enzymology.

3.3 Question 3: Classification of Living Things

In this question, the candidates were given various specimens for identification and then required to answer the questions that followed. The question was attempted by all candidates. The general performance on this question was good since 601 candidates (84.8%) scored 6 to 15 marks and only 198 candidates (15.2%) scored 0 to 5.5 marks. Figure 17 shows the performance of the candidates on question 3 in both papers, 2A and 2B.

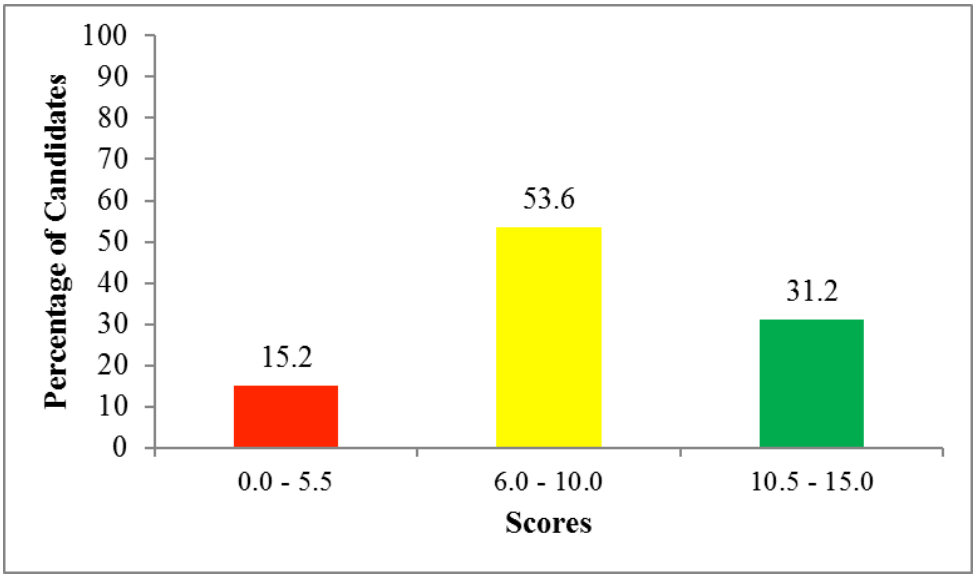


Figure 17: Candidates' Performance on Question 3 in Paper 2A and 2B

The data shows that 31.2 per cent of the candidates scored 10.5 to 15 marks, 53.6 per cent of the candidates scored 6 to 10 and 15.2 per cent scored 0 to 5.5 marks. The analysis of candidates' responses to question 3 in each paper given as follows:

3.3.1 733/2A BIOLOGY 2A

In the question asked, the candidates were provided with specimens A (Sisal plant), B (Tilapia scale) and C (Groundnut seedling) and then required them to observe them and answer the following questions:

(a) (i) What are observable features used to place specimen A into its respective kingdom? Give two points.

(ii) In what ways is specimen A is successfully adopted to its habitat? Give three points.

(iii) How is specimen A important for industrial development. Give three points

(b) (i) Identify the name of the organism from which specimen B was taken.

(ii) How is the specimen B important to the organism from which it was taken? Give two points.

(c) What are the observable features used to place specimen C into its respective class? Give three points.

Analysis shows that the candidates who scored 6 to 15 marks on question 3 in paper 2A wrote correct responses in most parts of the question. In part (a) (i), these candidates correctly identified the observable features used to place specimen A into its respective Kingdom (Plantae) including possessing green leaves for capturing light energy during photosynthesis and its body being divided into roots, stem and leaves. In part (a)(ii), the candidates identified the features that enabled specimen A to successfully adapt to its habitat such as having leaves which store water for survival during drought and preventing excessive loss of water through transpiration, possession of narrow leaves which reduce the surface area when exposed to sunlight to reduce the rate of transpiration and leaves having thorny endings/tips which prevent herbivores from consuming them.

Moreover, in (a) (iii), the candidates had pointed out ways in which specimen A is important for industrial development such as being used in making carpets, strings/ropes and sacks/sisal bags showing that they had knowledge of the application/use of various plants in our daily life and improvement of life standard of human beings through industrial processing.

In part (b) (i), they responded correctly by identifying the organism from which specimen B was taken such as Tilapia fish. Such correct responses show that the candidates had adequate knowledge of the structures and parts of various organisms in the Kingdom Animalia. Also, in (b) (ii), they described the main ways in which specimen B is important to the organism from which it was taken such as protecting the internal delicate parts and their arrangement in the body of an organism reduces the resistance of water current during swimming. All these indicate that the candidates understood the classification of organisms particularly on adaptation of those organisms to their ecological habitats. Similarly, in part (c), most of the candidates wrote distinctive features of specimen C (groundnut seedling) which were used to place it into its respective class (dicotyledonous). The features included having tap root system, leaves with network venation, possessing leaf petioles and difference appearance between upper and lower side of the leaves. These responses show that the candidates have an understanding of observable features of a dicot plant. Extract 19.1 shows a sample of correct response to question 3 in paper 2A.

3 a) i) They are autotrophs This means they have ability to manufacture their own food through having leaves.

ii) They have leaves which responsible for capturing Sunlight energy for manufacturing its own food.

ii) They have roots which anchorage to the soil for taking Mineralsalts and water in the soil.

ii) a) They germinate through vegetative propagation which ensure their survival. (bulbils of sisal)

b) They have thorn which act as a defensive mechanisms to organism which want to feed from it.

c) They have roots which anchorage in the soil and take minerals and water from the soil.

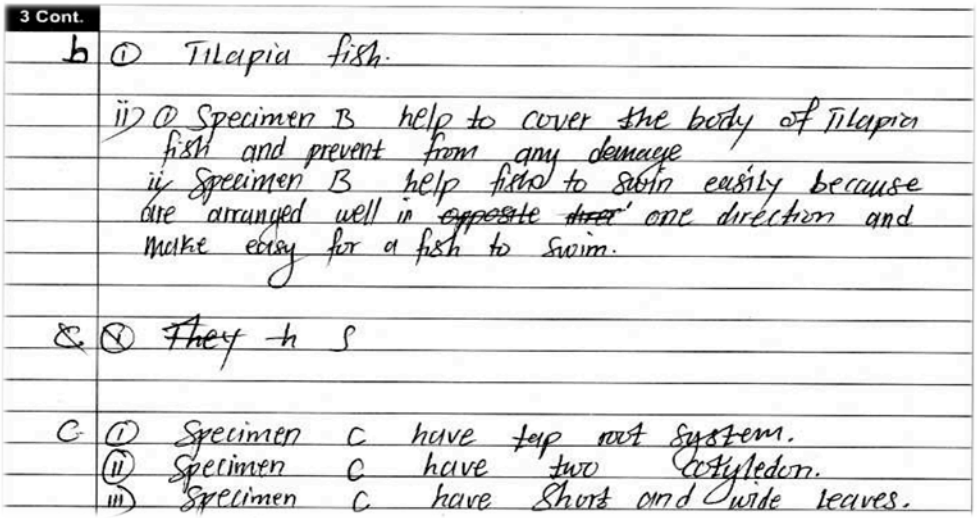
d) They have thick cuticle which reduce the water loss from the plant.

e) They have green pigment (leaf) which trap the sun ligh during Synthesis of food. (They have ability to manufacture their own food)

iii) a) Specimen A help to be used as raw material for manufacturing of a ropes and threads.

b) Specimen A help to be used as raw material for manufacturing of a Plastic bags

c) Specimen A help to be used as raw material for manufacturing of a clothes.

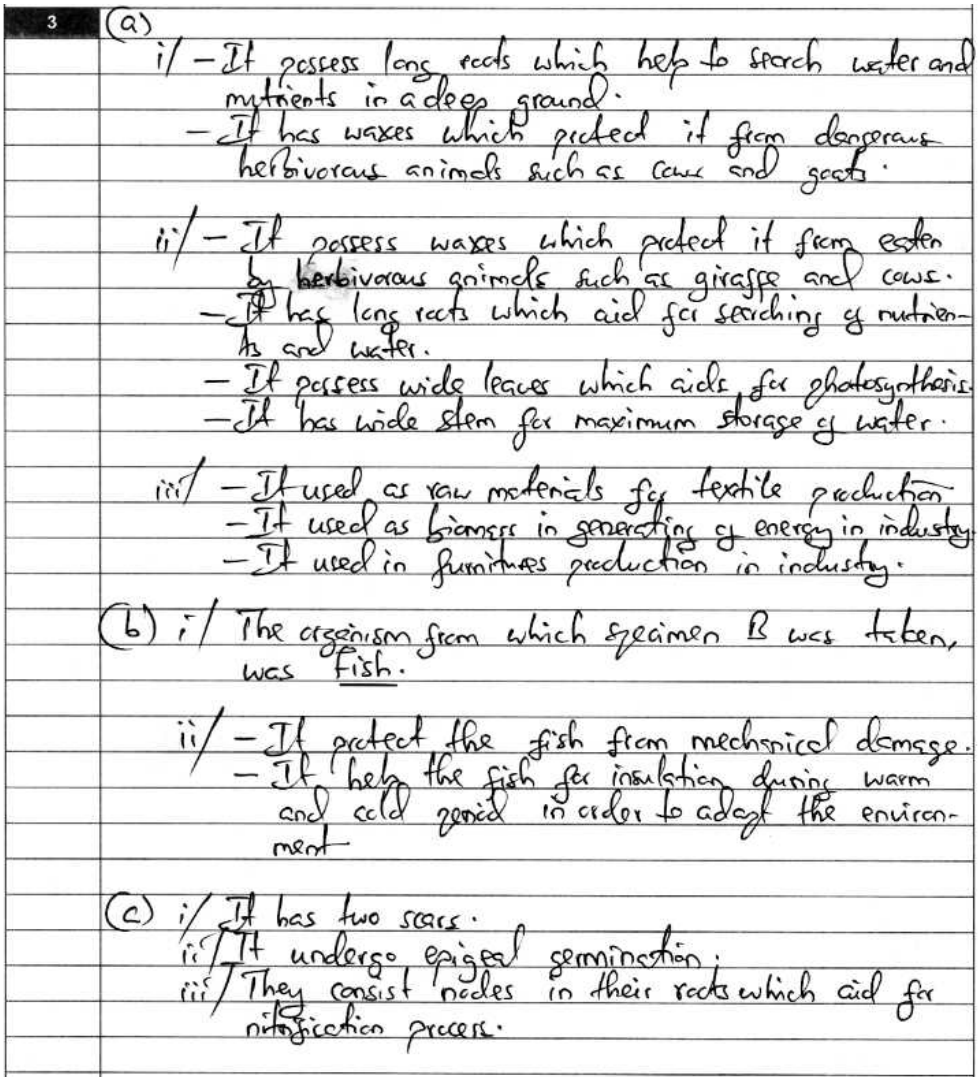


Extract 19.1: A sample of correct response to question 3 in paper 2A.

The extract shows that the candidate correctly wrote the observable features used to place specimen A into its respective kingdom since he/she gave the features which help specimen A to adapt successfully in its habitat. The candidate stated the way in which specimen A is important for industrial development. The candidate also identified the organism from which specimen B was taken and stated the way specimen B is important to the organism from where it was taken. Furthermore, the candidate pointed out the main features used to place specimen C into its respective class. All of these show that the candidate had good knowledge and skills in guideline and principles of classifying organisms and the importance of various organisms to human beings and adaptation to their habitats.

On the contrary, the candidates who scored 0 to 5.5 marks provided incorrect responses to almost all parts of the question, signifying that they lacked knowledge about the characteristic features of the specimens. For example, in part (a) (i), most of the candidates stated features of monocots or dicots. For example, one candidate wrote *presence of fibrous roots and having narrow and long leaves.* Another candidate wrote that *specimen A has spine/needles for defence* as the reasons for placing it into the kingdom plantae, which was not correct. This indicates that the candidates were unaware of the observable features of any member of the kingdom Plantae. Therefore, they failed to identify the observable features which place specimen A (sisal plant) into its respective kingdom. In part (a) (ii), most of

the candidate failed to identify the features that enabled specimen A to successfully adapt to its habitat. For example, one candidate wrote: *the specimen A have vascular tissues xylem and phloem* but with no justification and another one wrote: *the specimen bear flower* and other candidates left it as an open blank. Some candidates failed to explain how the specimen can be utilized in industrial processing in part (a) (iii). For example, one candidate wrote *that specimen A is planted near the industry for decoration* and another one wrote: *it is mostly destroyed during construction of industries* showing that they lacked knowledge of the application/use of various plants in our daily life or they did not understand the question. In part (b) (i), some candidates gave the general term *fish* instead of tilapia fish and others wrote *reptilian* while others stated *as snakes*. Furthermore, in (b) (ii), some candidate failed to describe the main ways in which specimen B is important to the organism from which it was taken. For example, one candidate wrote that *specimen B helps in swimming* without specifying how far specimen B is useful during swimming. Also, other candidates responded: *it is for defense* in steady of writing *for protecting the internal delicate parts.* All these, indicate that the candidates lacked correct understanding of how to describe an adaptation of living organisms. In part (c), some of the candidates gave general features instead of distinctive features of specimen C which were used to place it in its respective class (Dicotyledonae). One candidate wrote: It *have roots for absorption of water, leaves for photosynthesis and presence of spine for defense.* This shows that the candidate had misconception or low knowledge of the distinctive features of the class dicotyledonae. Extract 19.2 shows a sample of incorrect response to question 3 in paper 2A.


3 (a)
i/ – It possess long roots which help to search water and nutrients in a deep ground.
– It has waxes which protect it from dangerous herbivorous animals such as cows and goats.
ii/ – It possess waxes which protect it from eaten by herbivorous animals such as giraffe and cows.
– It has long roots which aid for searching of nutrients and water.
– It possess wide leaves which aids for photosynthesis.
– It has wide stem for maximum storage of water.
iii/ – It used as raw materials for textile production
– It used as biomass in generating of energy in industry.
– It used in furnitures production in industry.
(b) i/ The organism from which specimen B was taken, was fish.
ii/ – It protect the fish from mechanical damage.
– It help the fish for insulation during warm and cold period in order to adapt the environment
(c) i/ It has two seeds.
ii/ It undergo epigeal germination.
iii/ They consist nodes in their roots which aid for nitrification process.

Extract 19.2: A sample of incorrect response to question 3 in paper 2A.

In Extract 19.2, the candidate wrote observable features used to place specimen A in its respective kingdom as *it has wax which protect it from dangerous herbivorous animals like cows and goats* in part (a) (i) of the question which is not a feature that characterizes kingdom plantae. The candidate failed in part (b), to identify the organism from which specimen B was taken but did not specify the kind of fish. The candidate gave the wrong ways used in placing specimen A into successfully adapt to its habitat. The candidate wrote the ways that included: *it possess wax which protect from eaten by herbivorous animals like giraffe and cows, it has long roots which aids for searching of nutrients and water, it possess wide*

leaves which aids for photosynthesis and it has wide stem for storage of water, which were not true. Moreover, the candidate failed to state the way specimen B is important to the organism from which it was taken showing that he/she was incompetent in the functions of various structures and of living organisms. Furthermore, the candidate failed to point out the main features used to place specimen C into its respective class. All of these show that the candidate has poor knowledge and skills in classification of living things and benefits of various organisms to human beings.

3.3.2 733/2B BIOLOGY 2B

In the question, the candidates were provided with specimens A (Fern plant), F (Animal skin), C (Butterfly), G (Grasshopper) and E (Beetles). They were required to observe them carefully and answer the following questions:

(a) *What are the observable features shared by specimen C and E? Give five points.*

(b) *How is specimen F important for industrial development? Give four points.*

(c) *Observe the lower surface of the specimen A and answer the following questions.*
(i)Identify the structures found on the lower side.
(ii)What is the function of the structure identified in (c)(i)?

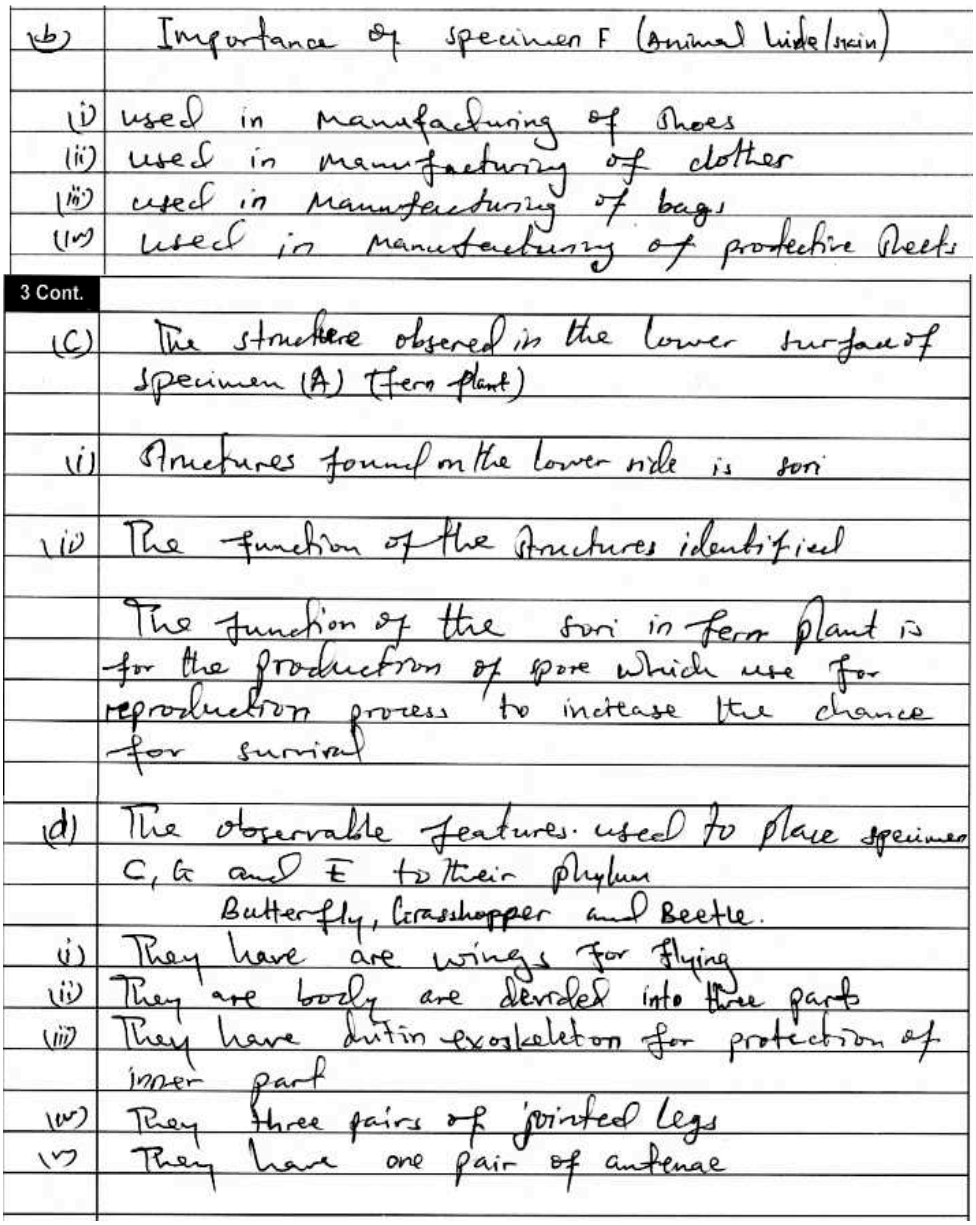
(d) *What are the observable features used to place specimen C, G and E to their phylum? Give three points.*

The analysis from the candidate responses show that most of the candidates who scored 6 to 15 marks on this question for paper 2B provided correct responses in all or most parts of the question. In part (a), these candidates correctly identified the observable features shared by specimen C and E such as *both having one pair of antennae, three pairs of walking legs, two pairs of wings, one pair of compound eyes and both having three body parts head, thorax and abdomen.* This shows that the candidates have reasonable knowledge and skills of identifying distinctive

features of various organisms in the Kingdom Animalia and class insecta in particular.

In part (b), the candidates have analyzed the importance of specimen F included industrial development such as making shoes, bags, balls, mattress and making clothes showing that they understand the economic importance of a various specimens and their products and how they can act as a raw material in industrial processing leading to industrial development. For the case of part (c) (i), the candidates identified the structures observed for specimen A to be *sori (sorus)* as a cluster of sporangia and in part (c) (ii), they stated the function of the structures identified in (c) (i) as being used in production of spores for asexual reproduction. Such correct responses show that the candidate was knowledgeable about the plant specimen and had observation skills to identify various parts of it and being able to state the roles of different parts of the plant. Moreover, the candidates responded correctly in part (d) (iii) of the question since they managed to point out the features used to place specimen C (Butterfly), G (Grasshopper) and E (Beetles) into their respective phylum of Arthropoda due to their bodies being covered by an exoskeleton and having jointed appendages and possessing segmented bodies. Such good answers show that the candidates had enough knowledge on the distinctive features used to classify organisms into their phyla. Extract 20.1 shows a sample of correct response to question 3 in paper 2B.

3	Specimen provided
	A Fern plant
	F Animal like
	C Butterfly
	G grasshopper
	E Beetle
(a)	Observable features shared by specimen C and E
(i)	They body are divided into three part which are head, thorax and abdomen
(ii)	They have an wings for flying
(iii)	They have a antenae
(iv)	They are exoskeleton
(v)	They have three pair of legs


(b) Importance of specimen F (Animal hide/skin)

(i) used in manufacturing of shoes
(ii) used in manufacturing of clother
(iii) used in manufacturing of bags
(iv) used in manufacturing of protective sheets

3 Cont.

(c) The structure observed in the lower surface of specimen (A) (Fern plant)

(i) Structures found on the lower side is sori

(ii) The function of the structures identified

The function of the sori in fern plant is for the production of spore which use for reproduction process to increase the chance for survival

(d) The observable features used to place specimen C, G and E to their phylum
Butterfly, Grasshopper and Beetle.

(i) They have are wings for flying
(ii) They are body are devided into three parts
(iii) They have chitin exoskeleton for protection of inner part
(iv) They three pairs of jointed legs
(v) They have one pair of antenae

Extract 20.1: A sample of correct response to question 3 in paper 2B.

In Extract 20.1, the candidate correctly wrote the features shared by specimen C and E with reasons. Also, the candidate stated the importance of specimen F for industrial development. The candidate has identified correctly the structures found in the lower side of the specimen A and specified their role in the plant. The candidate in part (d) has outlined the main features used to place specimen C, G and E into their phyla correctly

with the exception of the first and second points which were specifically for their class.

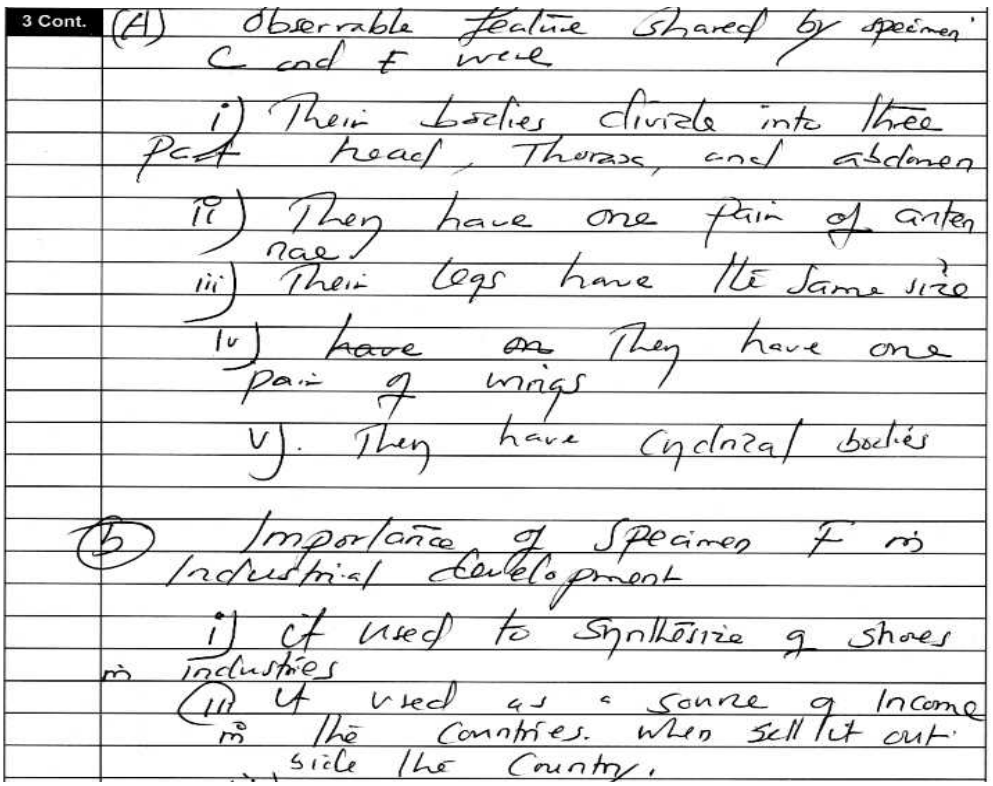
However, the candidates who scored 0 to 5.5 marks provided incorrect responses to all or some parts of the question. For instance, in part (a), some of them incorrectly identified the observable features shared by specimen C and E. For example, one candidate wrote only three points as *both have segmented body, their body is covered by exoskeleton and both of them have jointed appendages*. Another candidate wrote that *both have nervous system, heterotrophic mode of nutrition, undergoes locomotion and reproduce sexually.* These features are not observable to a dead organism thus the candidates did not understand the meaning of the term observable features.

Part (b) of the question shows that, most of the candidates failed to recognize the specimen F as a representative of an animal skin and hence failed to give importance of specimen F to the industrial development. For example, one candidate wrote that *it is used to increase beef as it is a source of meat, it improves dairy (milk) industries as it produces milk and helps in manure production via urine.* Another candidate wrote *it is used in biological studies research, used as specimen in biology practical, as medicine/ for treatment like covering the burnt wound.* All these show that the candidates failed to link the knowledge about the role of animal products in daily application including industrial processing leading to industrial development. Instead, they wrote the role of the organism from which specimen F was taken. These candidates also did not know the meaning of the term "specimen" which could be an organism or part of an organism.

For the case of part (c) (i) of this question, some candidates failed to identify the structures observed on the underside of specimen A to be sori. For example, some candidates identified the structures as sporangium, rhizoid, archegonium and others mentioned flowers. Such responses show that the candidates had insufficient knowledge about the structure of organisms in Kingdom Plantae, specifically those of the fern plant. Also, in part (c) (ii), some candidates failed to state the function of the structures identified in (c) (i) as being used in production of spores for asexual reproduction. For example, one candidate wrote: *it is used in storage of*

sporangium. Another candidate wrote: *for absorption of water,* another wrote *for sexual reproduction,* also another *candidate wrote for fertilization,* showing that they had misconception on the exact role of the structure identified (sori).

Furthermore, part (d) (iii) shows that some candidates failed to point out the features used to place specimen C, G and E into their phylum (phylum Arthropoda). Most of them wrote the distinctive features they shared in their class but not their phylum. For example, one candidate wrote: *All have one pair of antennae for sensation, three pairs of walking legs, two pairs of wings, one pair of compound eyes and all have three body parts head, thorax and abdomen.* Another candidate wrote: *The specimens belongs to this phylum due to possession of antennae, compound eyes, and possession of three body parts.* Such responses indicate that the candidates confused between the distinctive features of phylum Arthropoda and those of the class Insecta. Extract 20.2 shows a sample of a candidate's incorrect response to question 3 in paper 2B.


3 Cont.

(A) Observable feature shared by specimen C and E were

i) Their bodies divide into three part head, Thorax, and abdomen

ii) They have one pair of antenna

iii) Their legs have the same size

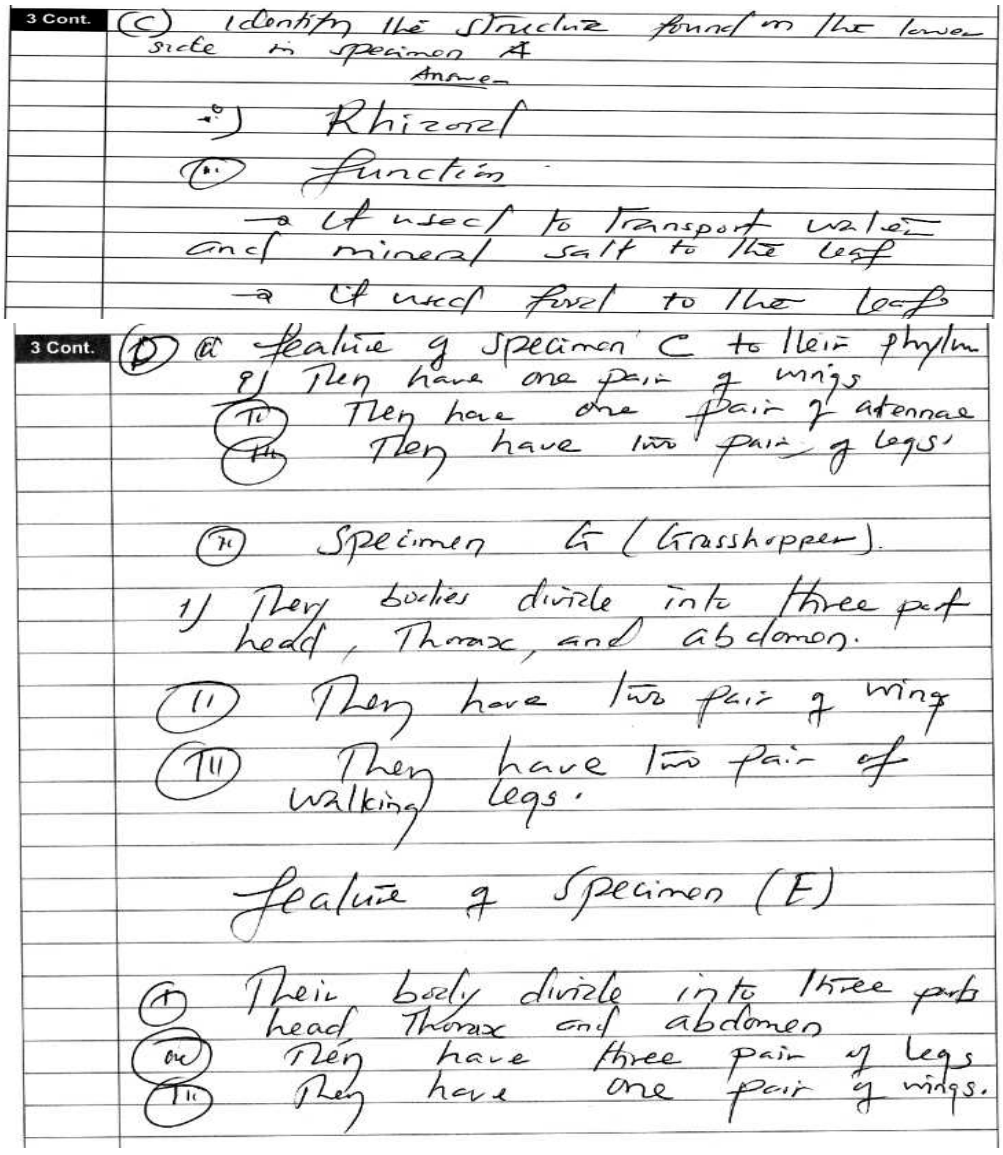
iv) have ~~or~~ They have one pair of wings

v) They have cylindral bodies

(b) Importance of Specimen F in Industrial development

i) It used to synthesize of shoes in industries

ii) It used as a source of Income in the countries. when sell it outside the country.


3 Cont.

(c) Identify the structure found on the lower side in specimen A

Answer

(i) Rhizoid

(ii) function

→ It used to transport water and mineral salt to the leaf

→ It used first to the leafs

3 Cont.

(d) (i) feature of specimen C to their phylum

i) They have one pair of wings

ii) They have one pair of atennae

iii) They have two pair of legs'

(ii) Specimen G (Grasshopper).

i) They bodies divide into three part head, Thorax, and abdomen.

ii) They have two pair of wing

iii) They have two pair of walking legs.

feature of specimen (E)

i) Their body divide into three parts head, Thorax and abdomen

ii) They have three pair of legs

iii) They have one pair of wings.

Extract 20.2: A sample of incorrect response to question 3 in paper 2B.

In this extract, the candidate scored correctly only two (2) points in part (a) and one point in part (b) and missed the rest. For example, the response for parts (a) (iii), (iv) and in part (b) (ii) were wrong with respect to the context of the question. Also, in part (c) (i), the candidate failed to identify the structure found on the lower side of specimen A by writing it as rhizoid. Lastly, in part (d) (ii), the candidate failed to analyse the features used to place specimens C, G and E into their phylum, instead of analysing the features used to place them into the same class. This shows that the

candidate had poor knowledge of the characteristic features of phyla in the Kingdom Animalia specifically phylum Arthropoda and also they did not understand the question in part (d).

4.0 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH TOPIC

In paper 1, eleven topics were assessed in the Biology examination for year 2023. The data analysis shows that the candidates demonstrated good performance in the topics on *Analysis of the O-Level Biology Curriculum Materials* (93.7%), *Planning and Preparation for Teaching* (93.4%), *Body health and Immunity* (89.9%), *Basic Biology Laboratory Skills* (88.9%), *Classification of Living Things* (74.9%) and *Fundamentals of Teaching and Learning of Biology* (70.4%). The candidates attained average performance on the topics of *Ecology* (43.2%) and *Genetics* (43%). Moreover, they demonstrated weak performance in the topics on *Respiration* (32%), *Assessment in Biology* (20.4%) and *Biochemistry* (7.6%). A summary of the candidates' performance per each topic in 733/1 is summarized in Appendix I.

Paper 2 (practical paper 2A and 2B) comprised 3 topics which were examined in 3 questions. The candidates demonstrated good performance in *Biochemistry* (96.9%), *Basic Biology Laboratory Skills* (90.0%) and *Classification of Living Things* (84.8%). The candidates' performance on each topic in 733/2 Biology 2 is summarized in Appendix II.

Considering the candidates' performance in the years 2022 and 2023 per topic, analysis shows that there is improvement in the performance in 2023 since candidates performed well in the six topics, average in two topics, and failed in three topics. Unlike in year 2022, candidates performed well in five topics, and got average and weak performance in three topics respectively. However, tutors are encouraged to design better methods for teaching the topics which the candidates have demonstrated to perform average or even failed completely in answering particular questions. This will help further improvement to the future candidates and produce more competent teachers in all topics to be taught in secondary schools.

5.0 CONCLUSION

The analysis on the Biology examination 2023 displays that the performance of the candidates was good since a total of 709 candidates (100%) passed the examination. In Biology paper 1, the candidates had good performance in question number 13 (98.7%), 12 (96.1%), 6 (93.7%), 10 (93.4%), 5 (89.9%), 8 (79.1%) and 9 (76.6%) because of adequate knowledge on the subject matter tested. The candidates attained an average performance in question number 7 (64.2%), 1 (53.7%), 4 (43.2%), 11 (43) because they were not competent on the tested topics. Moreover, they attained weak performance in question number 3 (32%), 14 (20.4%) and 2 (7.6%).

In Biology paper 2, the candidates had good performance in all three questions as follows; question 2 (96.9%), 1 (90%) and 3 (84.8%). From these observations, it is obvious that candidates performed better in practical than in theory. This is due to the fact that practical requires the candidate to do activities concerning with the tasks given and by doing so they understand the concepts taught.

6.0 RECOMMENDATIONS

Generally, the candidates' performance in this examination was good. For improving the performance of the candidates in the coming examinations the following are the measures recommended:

(a) Tutors should engage student teachers to get involved in activities that will allow one to one conversation such as debates, reading and speaking English all the time of their stay at the college. This will improve their proficiency in the language which seemed to hinder performance.

(b) Tutors should use simulated teaching and learning aids, pictures and models during teaching the concepts of lipids and cell membrane so as to instill more understanding on saturated and unsaturated fatty acids. During the session, students should be given enough time for discussion on issues related to the topic and given conclusion by their

tutors. This is recommended because some candidates lacked mastery of basic concepts.

(c) Tutors should engage student teachers in more practical activities in investigating the products of aerobic respiration through group discussion, plenary presentation and other possible ways so as to improve their competence in respective concepts.

(d) In teaching the topic of Assessment particularly the concept of "assessing Biology practicals," student teachers should be given flip charts, marker pens, masking tapes and Biology practical manual then be guided to construct an assessment tool to be used to assess practicals carried by students at school. This will help them to understand the key points to note during assessing practical work.

(e) All education stakeholders should make sure that all important facilities such as the library and internet resources are available at schools/colleges. This will help the candidates to have access to a variety of resources. These will ultimately improve candidates' knowledge and skills ultimately, performance will improve.

Appendix I

Summary of the Candidates' Performance per Topic in Paper 1, DSEE 2023

S/N.	Topic	Question Number	Percentage of the Candidates with Scores of 40% or Above	Average Performance Per Topic (%)	Remarks
1.	Analysis of O-level Biology Curriculum Materials	6	93.7	93.7	Good
2.	Planning and Preparation for Teaching	10	93.4	93.4	Good
3.	Body Health and Immunity	5	89.9	89.9	Good
4.	Basic Biology Laboratory Skills	8	79.1	88.9	Good
		13	98.7		
5.	Classification of Living Things	1	53.7	74.9	Good
		12	96.1		
6.	Fundamentals of Teaching and Learning Biology	7	64.2	70.4	Good
		9	76.6		
7.	Ecology	4	43.2	43.2	Average
8.	Genetics	11	43	43	Average
9.	Respiration	3	32	32	Weak
10.	Assessment in Biology	14	20.4	20.4	Weak
11	Biochemistry	2	7.6	7.6	Weak

Appendix II

Summary of the Candidates' Performance per Topic in Paper 2 DSEE 2023

SN.	Topic	Question number	Percentage of the Candidates with Scores of 40% or Above	Remarks
1.	Biochemistry	2	96.9	Good
2.	Basic Biology Laboratory skills	1	90	Good
3.	Classification of Living Things	3	84.8	Good