



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) 2021**

**BIOLOGY**



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**733 BIOLOGY**

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

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## 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 Examination (DSEE), 2021. This report has been prepared to provide feedback to educational administrators, college principals, tutors, student teachers and other education stakeholders on the performance of the candidates who sat for the Biology examination. Particularly, the report intends to show the strengths and weaknesses of the candidates who sat for this examination.

Diploma in Secondary Education Examinations measure the effectiveness and efficiency of the educational system in general and educational delivery in particular. Basically, the candidates' responses to the examination questions show whether the teaching and learning objectives were achieved in the classroom. It also shows the extent to which Biology learning competencies were attained in Diploma in Secondary Education course.

The report highlights factors that contributed to the good performance of the candidates on most topics. The factors include good mastery of the competencies stipulated in the syllabus, ability to interpret the demands of the questions, good presentation skills, accompanied by their mastery of the English language and good laboratory skills. Likewise, the report highlights factors that contributed to the weak performance on a few topics. The factors include lack of competencies in the subject content, inability to interpret the questions and poor presentation skills, accompanied by poor mastery of the English language.

The feedback provided in this report is expected to enable education stakeholders to take appropriate measures to improve the teaching and learning of this subject. This will eventually improve the candidates' performance in the future examinations.

Finally, the National Examinations Council of Tanzania is grateful to the examination officers and all other stakeholders who, in their various capacities, provided valuable assistance in the preparation of this report.



Dr Charles E. Msonde  
**EXECUTIVE SECRETARY**

## 1.0 INTRODUCTION

This report analyses the performance of the candidates who sat for the Biology Diploma in Secondary Education Examination in 2021. The questions intended to measure the candidates' competences in the 2009 Biology academic and pedagogy syllabus for diploma in secondary education. A total of 651 candidates were registered for the national examination. Among them, 645 sat for the examination, whereby 638 (99.69%) passed and 2 (0.31%) failed. This implies that the general performance in this subject was good. This performance has decreased by 0.19 per cent when compared to the 2020 Biology examination, where 829 (99.88%) candidates passed.

The report analyzes the candidates' responses in 733/1 Biology 1 (Theory Paper) and 733/2 Biology 2 (Actual Practical Paper). The theory paper consisted of sixteen questions, divided into Sections A, B and C. Section A had 10 short-answer questions; each question carried four (4) marks, making a total of 40 marks. Sections B and C had three (3) essay type questions. The candidates were required to attempt two (2) questions in each section. Each question carried 15 marks. The practical paper had two (2) alternative papers: 733/2 Biology 2A and 2B. Each alternative paper consisted of three (3) questions: Question one (1) carried 20 marks, and the rest carried 15 marks each, making a total of 50 marks.

In this report, performance on a question was considered to be *good*, *average* or *weak* if the percentage of the candidates who scored 40 percent or more of the marks allocated to the question falls within the range of 70 to 100, 40 to 69, and 0 to 39, respectively. In addition, green, yellow and red colours have been used in charts to indicate good, average and weak performance levels, respectively.

The following section of this report analyzes the performance of the candidates on each question by describing the demands of the questions and the candidates' responses. It also highlights the misconceptions observed on the candidates' responses and possible reasons for the observed misconceptions. Samples of the candidates' responses are inserted as extracts to illustrate correct and incorrect responses. In addition, charts and graphs are used to illustrate the candidates' performance on each question.

Generally, 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 on each topic, conclusion and recommendations.

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

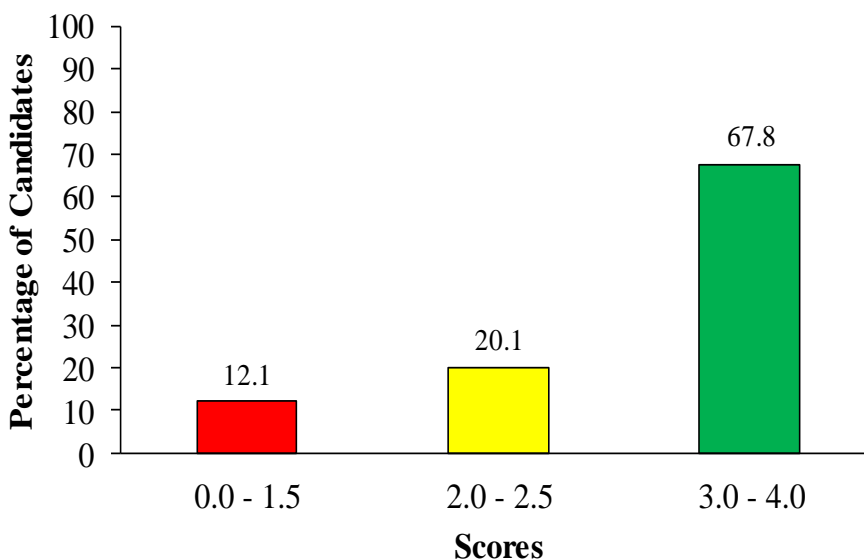
This section analyses the performance of the candidates on each question and item in Sections A, B and C.

### 2.1 SECTION A: Short-Answer Questions

The section consisted of 10 short-answer questions from both academic and pedagogy topics. Each question carried four (4) marks. The candidates were instructed to answer all the questions in this section.

#### 2.1.1 Question 1: Respiration

This question required the candidates to give the meaning of the terms (a) Basal Metabolic Rate (B.M.R), (b) Respiratory quotient, (c) Glycolysis and (d) Fermentation as used in respiration. The question was attempted by all 645 (100%) candidates. The performance of candidates on this question was good since 567 (87.9%) scored from 2 to 4 marks, as shown in Figure 1.



**Figure 1:** *Candidates' performance on Question 1*

Figure 1 shows that 437 (67.8%) candidates scored from 3 to 4; 130 (20.1%) candidates scored from 2 to 2.5; and 78 (12.1%) candidates scored from 0 to 1.5 marks.

Analysis indicates that 567 (87.9%) candidates who scored from 2 to 4 of the total marks allotted to this question. These candidates gave the correct meanings of two or four terms asked. Their adequate knowledge of the concepts asked enabled them to give correct responses such as (a) *B.M.R is the minimum amount of energy that is used when an organism is at total rest*, (b) *Respiratory quotient is the ratio between carbon dioxide evolved to oxygen used per unit time by an organism*, (c) *Glycolysis is a step by step break down of glucose molecule to release energy under the influence of enzyme to produce little amount of energy and pyruvic acid* (d) *Fermentation is the process which occurs in the absence of oxygen where pyruvate formed during glycolysis is converted to yield either ethanol in plants or lactate in animals*. Such responses suggest that the candidates were knowledgeable about the subtopic of aerobic and anaerobic respiration. Thus, they correctly responded to the question. Extract 1.1 is a sample of the correct responses to the question.

01. (a) Basal Metabolic Rate (B.M.R)
Is the minimum energy required to perform vital functions of organ and respiration of the organisms at resting.
(b) Respiratory quotient.
is the ratio between Carbon dioxide produced to the oxygen used.
Respiration quotient (RQ) = $\frac{\text{CO}_2 \text{ produced}}{\text{O}_2 \text{ used}}$
(c) Glycolysis
Is the process of breaking down glucose molecule into two molecules of pyruvic acid.
(d) Fermentation:
is the process of break down food substrate in absence of oxygen to form alcohol and lactic acid.

**Extract 1.1:** A sample of the correct responses to Question 1

In contrast, 78 (12.1%) candidates scored from 0 to 1.5 marks. They gave incorrect meanings to either all the terms or only one item. For example, in part (a), some of the candidates wrote the meaning of B.M.R as respiration, such as *B.M.R is a process where glucose is broken down to release energy*. Others wrote the meaning of B.M.R as death, such as *B.M.R is a situation where by body activities stop*.

In part (b), most candidates made a relationship between breakdown of substrate to breathing (taking air in and out). For example, one candidate wrote: *respiratory quotient is the ratio between oxygen taken in to carbondioxide given out*. Similarly, in part (c), some candidates wrote the meaning of glycolysis as *a cycle occuring in the body to balance systems*. Others interchanged the meaning of glycolysis in the place of fermentation.

Likewise in part (d), most of them gave the meaning of fermentation as aerobic respiration. For example, one candidate wrote: *Fermentation is a process where glucose is broken down in the presence of oxygen to release energy*. These candidates failed to realize that fermentation is a process which occurs in the absence of oxygen to form lactic acid and alcohol in animals and plants, respectively. This shows that these candidates had inadequate knowledge of the concepts tested. Extract 1.2 shows a sample of the incorrect responses from one of the candidates.

1.	a). Basal Metabolic Rate; This is the metabolic process through which the materials regulated to its rate of functioning
	b). Respiratory quotient; This is the constancy amount of respiration process.
	c). Glycolysis; This is the process of manufacturing sugar through metabolic process.
	d). Fermentation; This is the method used to manufacture alcohol.

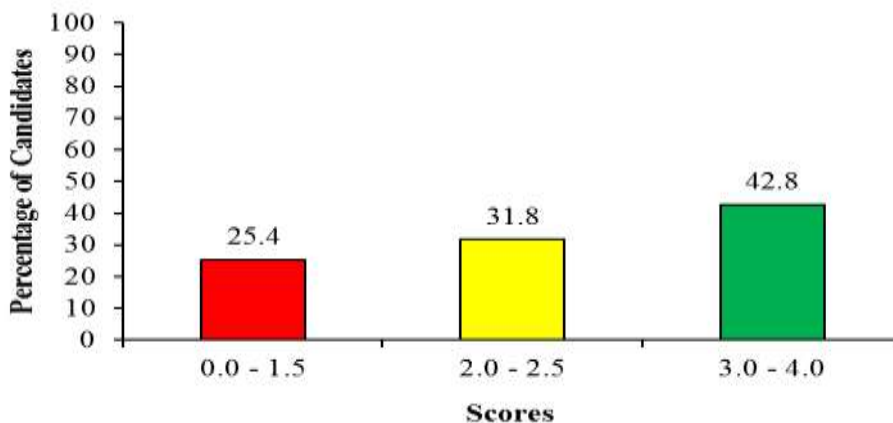
**Extract 1.2:** A sample of the incorrect responses to Question 1

In Extract 1.2 the candidate wrote incorrect meaning of the asked terms. He/she failed to realize that the term “lysis” in glycolysis implies breaking down and not manufacturing.

### 2.1.2 Question 2: Classification of Living Things

This question had two parts, (a) and (b). In part (a), the candidates were required to give the importance of biological keys in classification and in

part (b), they were required to state three significance of scientific naming of organisms. The question was attempted by 645 (100%) candidates. The performance of candidates on this question was good since 481 (74.6%) scored from 2 to 4 marks, as shown in Figure 1.



**Figure 2:** Candidates' performance on Question 2

Data show that 276 (42.8%) candidates scored from 3 to 4 marks; 205 (31.8%) scored from 2 to 2.5; and 164 (25.4%) scored from 0 to 1.5 marks.

Analysis indicates that 481 (74.6%) candidates scored from 2 to 4 marks. These had adequate knowledge of the tested concepts. For example, in part (a), the candidates gave the importance of biological keys in classification. Some of correct responses were *biological key is a tool that facilitate scientists during classification of living organisms, is a tool that can be used to assist taxonomists in classification of organisms*. Such responses show that the candidates had adequate knowledge of the tested concept.

Similarly, in part (b), the candidates gave correct responses such as *scientific naming of organisms make the name of an organism to be known in the same way all over the world, organisms' name sound uniformly binomial, simplifies studying of biology, scientific naming simplifies communication among biologists and ensures consistent understanding of organisms among biologists*. Extract 2 is a sample of the correct responses to the question.

2. (a) It help to identify unknown organisms during classification by considering physical features	
(i) It help the biologist to group living organisms easy in their respective taxa related to the physical features of the organism.	
(b) (i) It makes easy for biologist to have the same findings worldwide.	
(ii) It reduce and prevent confusion since the name assigned is universally known.	
(iii) It makes easy to study living things worldwide by using scientific names.	

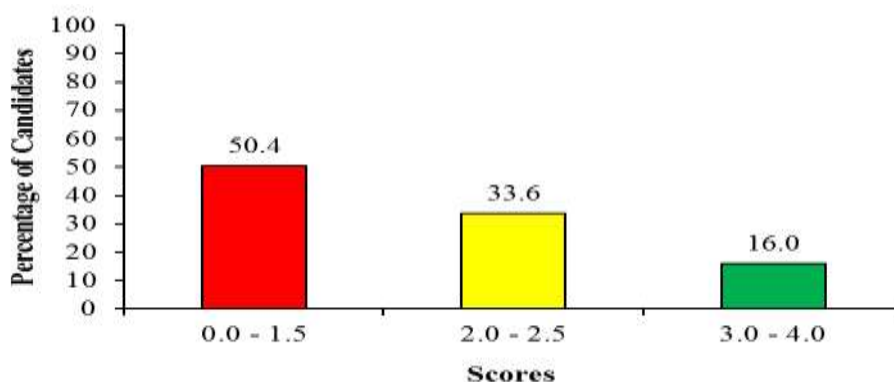
**Extract 2:** A sample of a good response to Question 2

Besides, 164 (25%) candidates scored from 0 to 1.5 marks. In part (a), some candidates did not understand the demand of the question. They had a misconception about the term “Key”. Therefore, they wrote about the lock and key theory of the reaction between enzyme and substrate. Other candidates defined the term “biological key” as a normal key used for opening doors and windows. Specifically, one candidate wrote: *Biological keys guide biologists to open up their mind in studying organisms*. Moreover, another candidate explained biological keys as a teaching aid, such as *biological keys is a tool that can help a teacher during teaching*. Such responses led to scoring low marks.

Similarly, in responding to part (b), some of the candidates wrote about advantages of the artificial system of classificaton, instead of importance of scientific naming. For example, one candidate wrote: *helps to understand observable features, helps to know features of organisms and helps to classify organisms*. Another candidates wrote: *it shows the procedure to differentiate organisms, it simplifies teaching, it facilitates determination of characteristics of organisms and it enables showing of distinctive features*. Similary, one candidate wrote: *scientific naming helps in separating them from non-living organisms, it helps to identify the difference between plants and animals and it promotes collegiality among Biologists*. Such responses show that the candidates had inadequate knowledge of the concept tested.

### 2.1.3 Question 3: Biochemistry

This question had two parts, (a) and (b). In part (a), the candidates were required to explain the way enzymes speed up the rate of reaction. In part (b), the candidates were required to describe the effect of substrate concentration on the rate of an enzyme-controlled reaction. The question was attempted by 645 (100%) candidates. The performance of candidates on this question was average as 320 (49.6%) scored from 2 to 4 marks, as shown in Figure 3.



**Figure 3:** Candidates' performance on Question 3

Analysis shows that 103 (16.0%) candidates scored from 3 to 4; 217 (33.6%) candidates scored from 2 to 2.5; and 325 (50.4%) candidates scored from 0 to 1.5 marks.

Further analysis shows that 320 (49.6%) candidates scored from 2 to 4 marks. These candidates had adequate knowledge of the concepts tested. They identified the demands of the question and, therefore, gave the correct responses. For example, in responding to part (a), some candidates wrote: *enzymes speed up the rate of reaction by lowering activation energy required to make the reaction get started, activation energy is the minimum amount of energy required to make the reaction happen. Enzymes plays the role of lowering activation energy for the reaction to take place.* Such responses show that the candidates had adequate knowledge of enzymes.

Similarly, in responding to part (b), most candidates correctly described the effect of substrate concentration on the rate of an enzyme-controlled reaction. Among the correct answers given were *rate of enzyme reaction is proportional to the increase in substrate concentration. However, when active sites are all occupied the rate of reaction becomes slow.* Other

candidates wrote: *Before saturation point is achieved the rate of enzyme controlled reaction is high with increase in substrate concentration.* Such responses suggest that the candidates had adequate knowledge of the tested concept. Extract 3.2 is a sample of the correct responses to the question.

3	(a) Enzymes speed up the rate of a reaction by lowering activation energy of a reaction.
	(b) The rate of an enzyme controlled reaction increase with the increase in substrate concentration until all active sites of enzymes are all occupied by substrate

**Extract 3.2:** A sample of the correct responses to Question 3

In Extract 3.2, the candidate correctly explained how enzymes speed up the rate of reaction and how substrate concentration affects the rate of reaction.

In contrast, 325 (50.4%) candidates scored from 0 to 1.5 marks. These candidates had inadequate knowledge of the topic. The candidates' scripts indicated that, in part (a), some candidates explained clearly how enzymes speed up the rate of reaction. Also, majority of the candidates did not understand the demand of the question. Therefore, they partially described how enzyme works, such as *enzymes speed up the rate of reaction by attaching substrate on their active sites*, *enzymes speed up the rate of reaction when they come in contact with substrates*. Specifically, one candidates wrote: *Enzyme speed up the rate of reaction when temperature is optimum*. These candidates failed to recognize that enzymes speed up the rate of reaction by reducing the activation energy required for the reaction to take place. Thus, before the reaction takes place it must overcome the energy barrier by exceeding its activation energy. Therefore, enzymes operate by lowering activation energy, allowing the reaction to occur more readily and fast.

Similarly, in part (b), one candidate wrote: *When the amount of substrate is adequate the rate of reaction becomes higher*. Another candidates wrote: *For any enzymic reaction to speed up both substrate and enzymes have to be at the same amount all the time*. Furthermore, one candidate wrote: *Substrate is very important for the reaction to take place*. Such responses

show that these candidates lacked enough understanding of the tested concept. Extract 3.1 is a sample of the incorrect responses by one of the candidates.

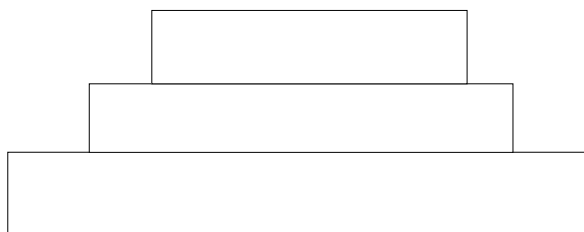
030	Enzymes speed up the rate of reaction because enzymes are the biological catalyst which alter the rate of reaction. <del>inside</del>	
06	The increase of substrates in the active site of the enzymes it lead the reaction to decrease, but the small substrates in the active site it lead the increase of reaction.	

**Extract 3.1:** A sample of the incorrect responses to Question 3

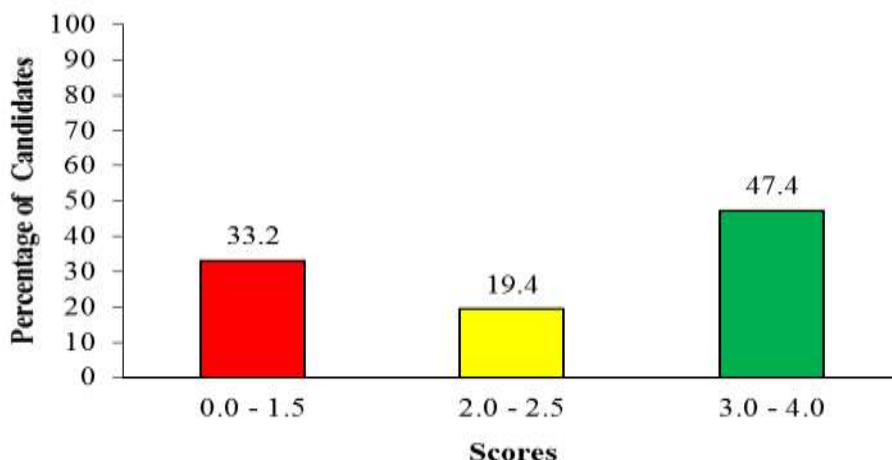
In Extract 3.1, the candidate defined enzyme, instead of explaining how enzymes speed up the rate of chemical reaction in part (a). Beside, the response given in part (b) was incorrect.

#### 2.1.4 Question 4: Ecology

This question had two parts: (a) and (b). In part (a), the candidates were required to copy the following diagram and write the names of the appropriate trophic levels in an ecosystem.



In part (b), the candidates were required to explain the reasons for the links in a food chain to oftenly being three. The question was attempted by all 645 (100%) candidates. The performance of candidates on this question was average since 431 (66.8%) scored from 2 to 4 marks, as presented in Figure 4.



**Figure 4:** *Candidates' performance on Question 4*

Based on data, 306 (47.4%) candidates scored from 3 to 4; 125 (19.4%) candidates scored from 2 to 2.5; and 214 (33.2%) candidates scored from 0 to 1.5 marks.

Further analysis shows that 432 (66.8%) candidates scored from 2 to 4 marks. These had adequate knowledge of the tested concepts. For example, in responding to part (a), the candidates correctly wrote the names of the appropriate trophic levels in an ecosystem. Most of them wrote from the bottom of the figure as *Producers, Consumers and Decomposers*, respectively.

In responding to part (b), most candidates correctly wrote: *Energy transferred from one trophic level to another is little because most of it is lost through various metabolic activities*. Other candidates wrote: *each trophic level is maintained by energy available, very little of it is transferred to other levels and some is lost*. Specifically, one candidate wrote: *As energy moves from one trophic level to another large amount of energy is lost hence little amount is taken to the next trophic level*. Such responses suggest that these candidates had adequate knowledge of the tested concepts. Extract 4.1 is a sample of the correct responses.

4	5 <sup>th</sup> trophic level	Decomposer
	2 <sup>nd</sup> trophic level	Primary consumer
	1 <sup>st</sup> trophic level	Primary producer
The number in the food chain is often three because		
se		
(i) Some of energy are used for metabolic activities.		
(ii) Not all parts of animal are digestable		
iii Not all digestable part of animal are consuming		
ble.		

**Extract 4.1:** A sample of the correct responses to Question 4

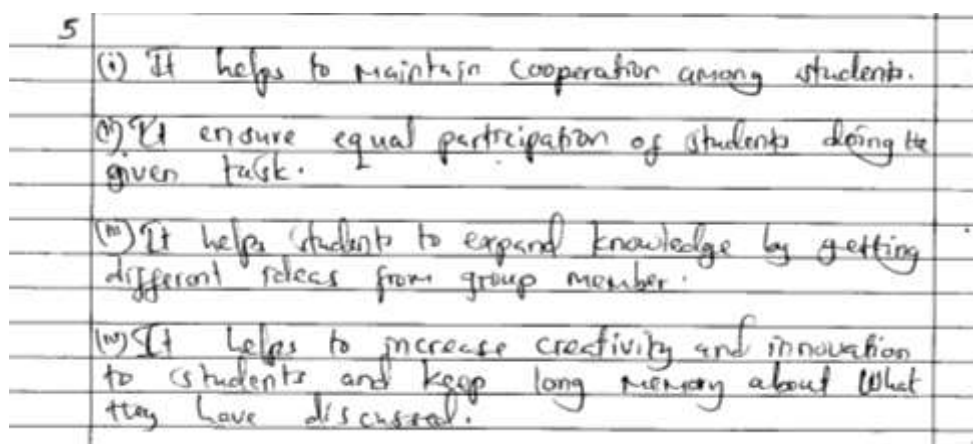
In Extract 4.1, the candidate correctly wrote the names of trophic levels in an ecosystem and gave the reasons for having three links in a food chain.

Furthermore, 214 (33.2%) candidates scored from 0 to 1.5 marks. Either they wrote one correct point or they did not write a correct point. For example, in part (a), some of the candidates interchanged the names from the bottom of the figure; they wrote *Decomposers*, *Producers* and *Consumers*. Others; *Consumers*, *Producers* and *Decomposers*. Furthermore, other candidates wrote names of specific organisms, instead of ecological groups in which they belong as *Grass*, *Giraffe* and *Bacteria*. Such responses show that the candidates had inadequate knowledge of the food chain and web. These candidates failed to recognize that trophic levels are arranged in such a way that producers start as a source of energy to the next trophic levels, namely primary consumers and decomposers.

Similarly, in part (b), most candidates wrote incorrect responses, such as *the number of links is often three because there are mainly three trophic levels*. Other candidates wrote: *any ecosystem should have three links*. Specifically, one candidate wrote: *ecosystem need links so that it can be connected*. Such responses suggest that the candidates did not understand the demands of this part of the question. Thus, they could not comprehend clearly the meaning of the word *link*. Extract 4.2 is a sample of the incorrect responses from one of the candidates.



Analysis shows that the majority of the candidates (628 (97.4%)) scored from 2 to 4 of the total marks allotted to this question. These candidates gave from two to four correct points on the importance of cooperative learning tasks to students inline with the demands of the marking guide. For example, some of the candidates wrote: *it promotes social skills, it develops communication skills, it develops positive attitude towards learning and develops cognitive skills*. Other candidates wrote: *it promotes relationship among students, it promotes curiosity and creativity, develops confidence among students and promotes team work spirit*. Also, *Promotes understanding of the content among students, develop spirit of love among learners, fosters interpersonal skills and builds a spirit of tolerance among students*. Such responses suggest that these candidates had adequate knowledge of the importance of cooperative learning tasks. Extract 5.1 is a sample of the correct responses from one of the candidates.



**Extract 5.1:** A sample of the correct responses to Question 5

Despite the good performance, 17 (2.6%) candidates scored from 0 to 1.5 marks. Some of these candidates explained the general importance of providing a task to students without specifying the type of task, as demanded by the question. For example, most candidates wrote: *task helps a teacher to assess teaching and learning process, it helps in continuous assessment, it can help in accomplishing the syllabus and it helps student to understand their position in learning*.

Specifically, one of the candidates wrote: *it helps in learning, it helps the teacher to assess, it helps learners to be busy and it help learners to go in the library for studying*. This candidate focused on cooperative learning as

a tool for assessment that can keep learners busy, instead of explaining how cooperative tasks help learners in general. In this category, other candidates thought that cooperative tasks help in the completion of the syllabus in time, instead of promoting creativity and interpersonal skills, among others. For example, one candidate wrote: *cooperative task reduce time, helps to choose proper strategies, saves the problem of space and helps to finish the curriculum*. Such responses suggest that the candidates had inadequate knowledge of the concept tested, leading to weak performance. Extract 5.2 is a sample of the incorrect responses from one of the candidates.

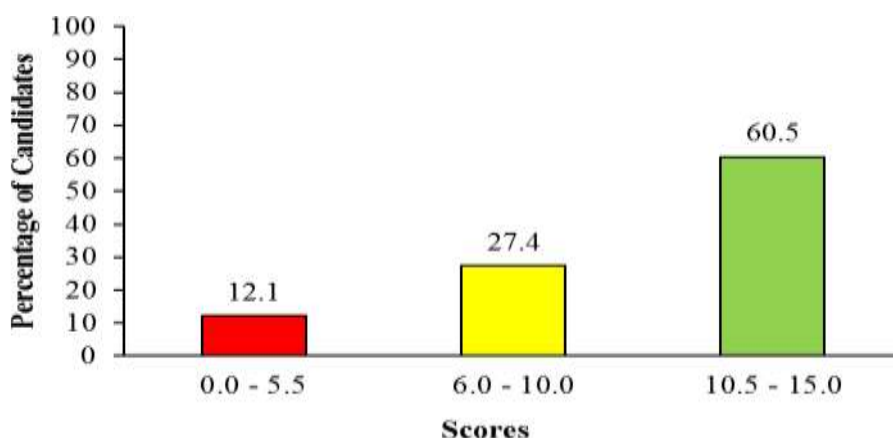
Q5	Importance of providing cooperative learning tasks to students.
(i)	Help the students to create a self concepts and skills on learning.
(ii)	Help effective teaching and learning between teacher and learners during the process of teaching and learning process.
(iii)	Help teacher to create a method on how to help the students which are slow learners.
(iv)	Help teacher to select a good teaching and learning method during teaching and learning process.

**Extract 5.2:** A sample of the incorrect responses to Question 5

In Extract 5.2, the candidate explained the cooperative task as a method that a teacher can use in teaching instead of explaining the importance of it to students; consequently, the candidate ended up scoring low marks.

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

This question required the candidates to outline four purposes that a teachers' manual serves. The question was attempted by all 645 candidates (100%). Their performance on this question was good because 567 candidates (87.9%) scored from 2 to 4 marks. Figure 6 is illustrative.



**Figure 6:** *The candidates' performance on Question 6*

Data show that 390 (60.5%) candidates scored from 3 to 4 marks; 177 (27.4%) candidates scored from 2 to 2.5; and 78 (12.1%) candidates scored from 0 to 1.5 marks.

The candidates who scored from 2 to 4 marks 567 (87.9%) revealed that they had adequate knowledge of analyzing Ordinary-level (O-level) Biology curriculum materials. Thus, they stated two to four purposes that teachers' manual serves. According to the marking guide, teachers' manual serves the following purposes: *enable teachers to use uniform procedures in teaching and learning and eventually evaluation, gives confidence to both students and teachers as they are well guided through procedures of doing experiments, can be used by both teachers and students to obtain knowledge of practical activities, it can be used to reduce chances of accidents during laboratory work.*

In responding to this question, most candidates wrote: *can be used by both teacher and student in teaching and learning process, promotes confidence to both teachers and students, teachers becomes uniform in performing different teaching and learning activities, fosters proper use of laboratory facilities.* Specifically, one of the candidates wrote: *teachers' manual guides both teachers and students in Laboratory activities, it enable both teachers and students to get skills on various practical activities, both teachers and students becomes comfortable in doing various experiments and teachers become uniform in implementing their duties.* Such responses show that the candidates had adequate knowledge of the tested concept. Extract 6.1 is a sample of the correct responses from one of the candidates.

06.	Purposes of Teacher's Manual serve.	
	→ It guides a teacher in the process of teaching.	
	→ It shows procedures to be followed during teaching.	
	→ It provides activities to be done by a teacher and learner.	
	→ It brings confidence to a teacher when teaching.	

**Extract 6.1:** A sample of the correct responses to Question 6

Extract 6.1 shows the response of a candidate who correctly outlined the purposes the teachers' manual serves in teaching and learning.

Despite the good performance, 78 candidates (12.1%) gave only one correct point or no correct point at all. Most of these candidates explained the role of the book instead of the teacher's manual. Others wrote the role of the syllabus instead of teacher's manual. Example responses are *as a tool that helps a teacher to get different questions, shows task to be done by both teacher and students, used as a reference book, it is used as a supplementary material, it prepares competent teachers, it is used inside and outside the class, it is used by new teachers, helps to identify topics, fosters learners' interests and it shows objectives and purposes of the topic*. These were observed in candidates scripts. Specifically, one candidate wrote: *Helps non-technical teachers, solve complex concepts, serves time, provide reference materials, it simplifies teaching*.

In contrast, another candidate wrote: *it helps in preparation of notice, help teachers with limited services and shows time frame for learning*. Such responses suggest that these candidates had insufficient knowledge of the concept tested. Extract 6.2 is a sample of the incorrect responses from one of the candidates.

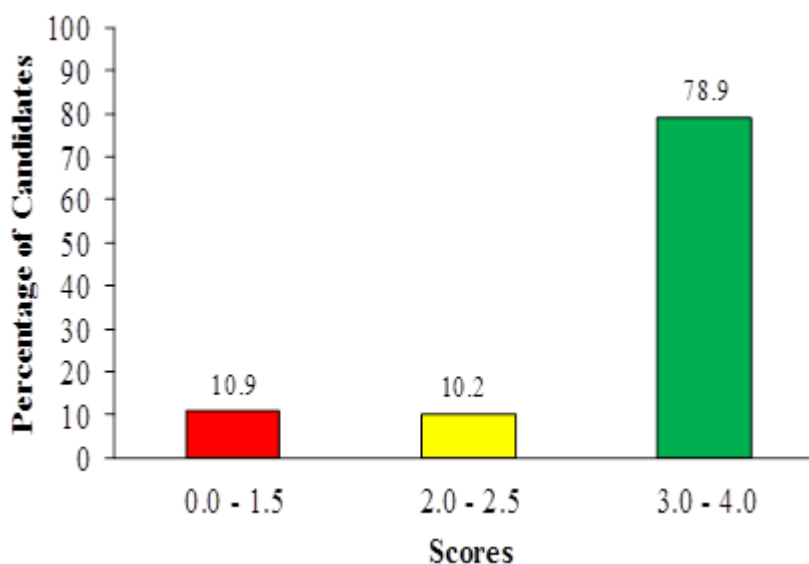
6.	(i) It give a content area to-	
	be covered.	
	(ii) It stimulates the learners on-	
	how to study particular course-	
	of study.	
	(iii) It serves in giving various-	
	clarifications.	
	(iv) It also serves in selection of-	
	suitable way of assessing learners.	

**Extract 6.2:** A sample of the incorrect responses to Question 6

In Extract 6.2 the candidate explained the role of a textbook instead of the teacher's manual.

### 2.1.7 Question 7: Planning and Preparation for Teaching

This question required the candidates to give four differences between micro teaching and block teaching. The question was attempted by all 645 candidates (100%). Their performance on this question was good because 575 candidates (89.1%) scored from 2 to 4 marks, as shown in Figure 7.



**Figure 7:** Candidates' performance on Question 7

Analysis shows that 509 (78.9%) candidates scored from 3 to 4; 66 (10.2%) candidates scored from 2 to 2.5; and 70 (10.9%) candidates scored from 0 to 1.5 marks.

Data show that 89.1% of the candidates scored from 2 to 4 marks. These had adequate knowledge of the tested concepts. Among these, 56.4% gave four differences and scored full marks. These candidates correctly distinguished between microteaching and block teaching as *microteaching is a process of teaching fellow students for short time while block teaching is a teaching that takes place at a real school setting for long period of time, micro-teaching involves staying inside the college while block teaching involves staying out of the college, in microteaching no other duties of the teaching profession that are implemented while in block teaching other duties of the teaching profession are implemented.*

Specifically, one candidate wrote: *microteaching is cheap while block teaching is expensive, microteaching is not time consuming while block teaching is time consuming, microteaching lacks reality of school teaching while block teaching reflects the reality of the teaching profession.* Such responses suggest that they had adequate knowledge of the tested concepts. Extract 7.1 is a sample of the correct responses from one of the candidates.

The following are the differences between micro-teaching and block teaching.	
Microteaching	Block teaching
i) Student teachers teach among each other in a small group of learners.	i) Student teachers sent at a certain school for teaching practice.
ii) It takes short time in the classroom or prepared place.	ii) takes long time about one or two months.
iii) Does not expose student teacher on real environment for teaching.	Student teacher is exposed to the real environment for teaching.
iv) It is less cost in terms of preparations and accommodations.	It is very and has high cost in term of preparations and accommodations eg money.

**Extract 7.1:** A sample of the correct responses to Question 7

Extract 7.1 is a response from the candidate who correctly differentiated micro teaching from block teaching in four points.

Contrarily, 70 candidates (10.9%) scored from 0 to 1.5 marks. Some of them gave one correct difference; however, they did not give clear explanations, leading them to score low marks. For example, some of the candidates explained what happens when one teaches while in the college context and out of the college context. Other candidates explained about the destiny of assessment results in block teaching and microteaching. For example, one candidate wrote: *in block teaching the teacher observe him/herself while in microteaching the teacher observes others, in microteaching assessment is not needed while in block teaching is needed, in microteaching student teachers do not learn on how to budget while in block teaching teachers learn how to budget.*

Another candidate wrote: *In block teaching the teacher use energy while in microteaching teacher does not use energy, in block teaching teacher is real while in microteaching teacher is not real.* Likewise, another candidate wrote: *Microteaching is small while block teaching is large, Microteaching involves many small classes while block teaching involves large classes, Microteaching is not good while block teaching is good.* Such responses reveal that the candidates lacked adequate knowledge of the tested concept. Extract 7.2 is a sample of the incorrect responses from one of the candidates.

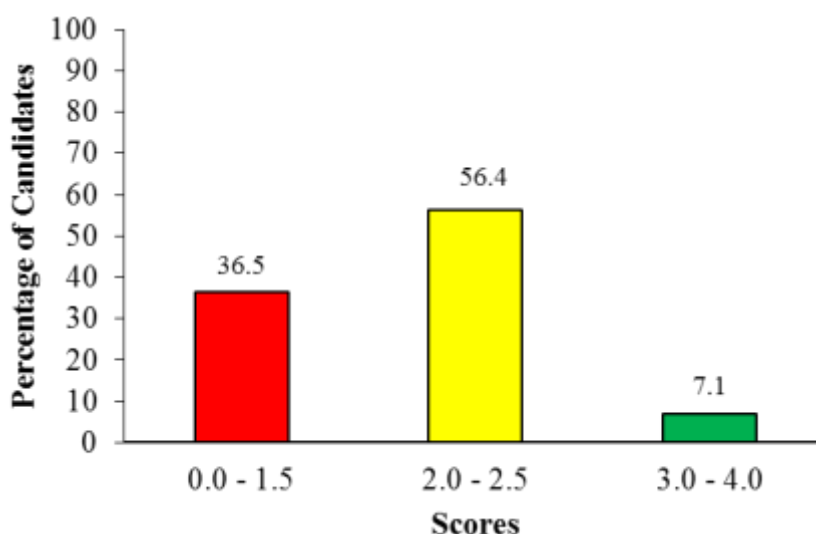
07	The following are difference between micro-teaching and block teaching.
(i)	micro teaching It is conducted any where WHILE block teaching conducted in the classroom.
(ii)	Micro-teaching it is static WHILE block teaching is dynamic.
(iii)	Micro-teaching does not involved preparation of scheme of work WHILE block teaching it involved preparation of scheme of work.
(iv)	micro-teaching It is less expensive WHILE block teaching it is more expensive.

**Extract 7.2:** A sample of the incorrect responses to Question 7

In Extract 7.2, the candidate incorrectly differentiated between microteaching and block teaching practice. He/she did not know that both microteaching and block teaching are conducted in the classroom, and they involve all preparations including that of a scheme of work.

### 2.1.8 Question 8: Assessment in Biology

This question required the candidates to explain briefly the terms (a) *A valid test* (b) *Reliable test* (c) *Standardized test* (d) *Moderated test* as used in constructing a test/examination. The question was attempted by 644 candidates (99.8%). The general performance on this question was average because 410 candidates (63.5%) scored from 2 to 4 marks. Figure 8 shows the performance of the candidates on Question 8.



**Figure 8:** *Candidates' performance on Question 8*

Data show that 46 candidates (7.1%) scored from 3 to 4; 364 candidates (56.4%) scored from 2 to 2.5; and 235 candidates (36.5%) scored from 0 to 1.5 marks.

Analysis shows that 410 candidates (63.5%) scored from 2 to 4 marks. These had adequate knowledge of the tested concepts. The candidates correctly explained two to four concepts. As per the marking guide, the concepts are explained as *A valid test is a test that measures what is supposed to be measured, a reliable test is a test that produces relatively the same scores when re-given to the same students under similar condition, Standardized test is a test which has been expertly prepared*

usually with tryout analysis and revision and it is scored under standard procedures and conditions, moderated test is a test which has been prepared and given to other experts so that they can provide their comments which will help to improve the test.

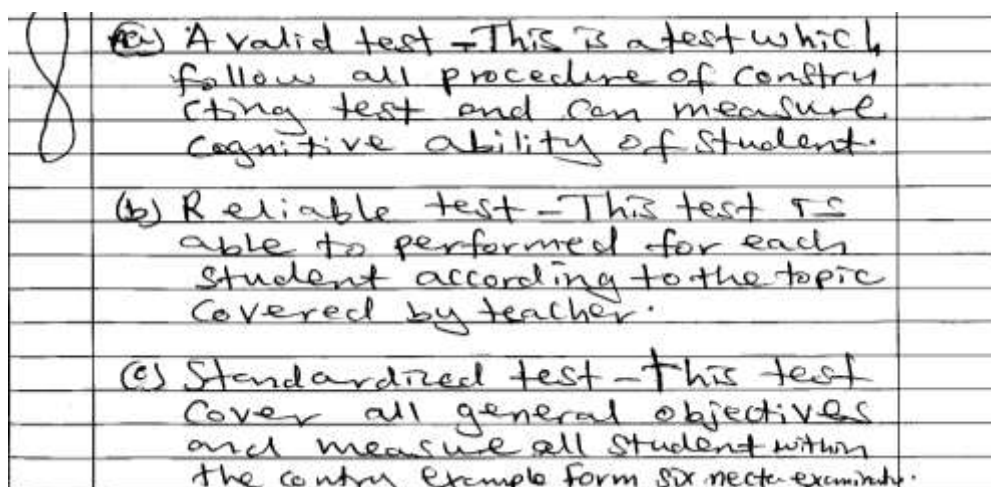
The candidates' responses in this question were (a) A valid test is a test that measures what it was supposed to measure, (b) reliable test is the one that elicit consistent results when administered several times, (c) standard test is the test that is prepared well to meet different levels of learners, (d) moderated test is the one that has involved more than one person in its preparation. Specifically, one candidate wrote: (a) valid test is the one that covers the required content, (b) reliable test is a test which offers the same results when administered several times, (c) standardized test is the one that has been well analyzed before being administered (d) moderated test is the one prepared following different procedure of involving experts. Such responses suggest that the candidates had adequate knowledge of the tested concepts. Extract 8.1 is a sample of the correct responses by one of the candidates.

Q8	a. Valid test is the test that measure things intended to be measured, that means it reach the purpose of a test
	b. Reliable test is the correctness of the test content that is consistence, that measure the same results at a different students performance with same condition
	c. Standardized test is the test that constructed in order to asses the student of different areas performance, that constructed and removing ambiguous words like national examination is standardized
	d. Moderated test is the test that constructed by the group of experts of the given subject.

**Extract 8.1:** A sample of the correct responses to Question 8

In Extract 8.1 the candidate correctly wrote the meaning of three terms in part (a), (b), and (d). However, the response given in part (c) was not correct. Hence, he/she scored three out of four marks.

In contrast, 46 candidates (7.1%) incorrectly explained the concepts. For example, some candidates wrote: *valid test measures performance to make evaluation, standardized test is a test with raw data, reliable test is the process of doing the same test, moderated test is the one designed according to students' ability*. One candidate wrote: *a valid test is the one that is well administered, reliable test is the one with all measurements, standardized test is a transformed test and moderated test is the one with all subject content*. Another candidate gave the correct meaning but interchanged the answers; hence he/she obtained low marks. This suggests that the candidates had inadequate knowledge of the tested concepts. Extract 8.2 is a sample of the incorrect responses by one of the candidates.



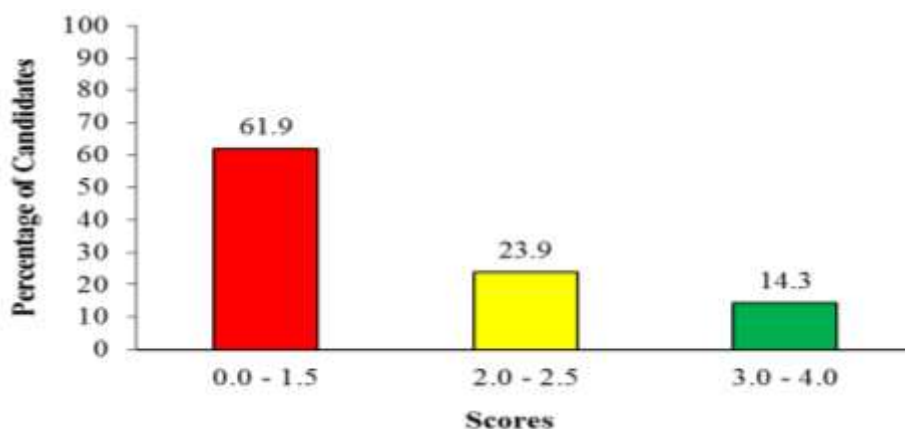
**Extract 8.2:** A sample of the incorrect responses to Question 8

Extract 8.2 is sample response by a candidate who incorrectly explained the terms. For example, in part (a), the candidate wrote a valid test is the one that follows all procedures for constructing a test/examination, instead of a test that measures what is supposed to be measured.

### 2.1.9 Question 9: Body Health and Immunity

This question required the candidates to analyze four common symptoms of STI/STDs. The question was attempted by all 645 candidates (100%). The

general performance on this question was weak because the majority of the candidates 399 (61.9%) scored from 0 to 1.5 marks, as shown in Figure 9.



**Figure 9:** Candidates' performance on Question 9

Data show that 92 candidates (14.3%) scored from 3 to 4; 154 candidates (23.9%) scored from 2 to 2.5; and 399 candidates (61.9%) scored from 0 to 1.5 marks.

The 339 candidates (61.9%) who scored from 0 to 1.5 marks lacked adequate knowledge and exposure to contemporary issues about human health. For example, some of them wrote the general symptoms that are common to most of the illnesses in human beings, including *nausea, anemia, and body weakness*. Others gave the symptoms of other specific diseases like *runny nose* for influenza, *headache, joint pain and fever, high body temperature, dizziness and vomiting* for malaria. Such responses show that the candidate lacked adequate knowledge of STIs/STDs. According to the marking guide the symptoms include *pain during urination, smelly and discolored discharge from penis or vagina, bleeding during sexual intercourse and pain during sexual intercourse*. Extract 9.1 is a sample of the incorrect responses by one of the candidates.

9.	Common symptoms of STI /STDs.
(i)	Weight loss.
(ii)	Dry skin.
(iii)	Frequently diarrhoea and Vomiting.
(iv)	loss of appetite of food.

**Extract 9.1:** A sample of the incorrect responses to Question 9

In Extract 9.1 the candidate wrote the symptoms of cholera in (i) and (ii), instead of symptoms STIs/STDs. Besides, the responses given in (ii) and (iv) were incorrect.

Nonetheless, 246 candidates (38.1%) correctly outlined two to four STI/STDs symptoms. For example, one candidate wrote *Common symptoms for STI/STDs include smelly discharges from reproductive organs, wounds or infections around genital organs, labored sexual intercourse*. Another candidate wrote *increased pain during copulation, discharge of pus from genitalia, wearing out of some genital parts and pain during urination*. Such responses suggest that the candidates were knowledgeable about the concept tested. Extract 9.2 is a sample of the correct responses from one of the candidates.

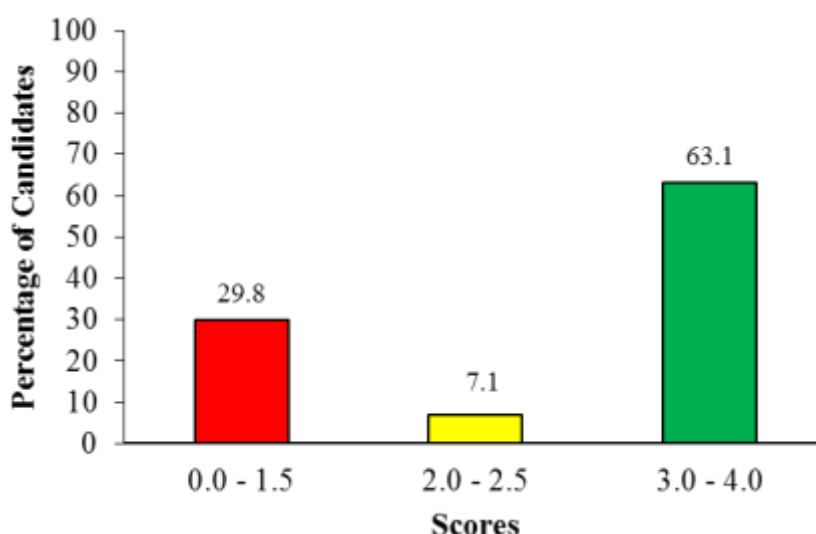
9.	i/ The occurrence of genital rashes in both male and female.	
	ii/ The flow of yellow fluid from the vagina in a female.	
	iii/ More pain during sexual intercourse.	
	iv/ Pain during urination in both male and female.	

**Extract 9.2:** A sample of the correct responses to Question 9

In Extract 9.2 the candidate correctly outlined the symptoms of STI/STDs. Thus, he/she scored all the four marks allotted to this question.

### 2.1.10 Question 10: Genetics

This question required the candidates to use letters T for tall and t for short to identify the phenotypes and genotypes of F<sub>1</sub> generation resulted from the heterozygous tall parents. The question was attempted by all 645 candidates (100%). The general performance on this question was good because 453 candidates (70.2%) passed by scoring from 2 to 4 marks. Figure 10 shows the performance of the candidates on this question .

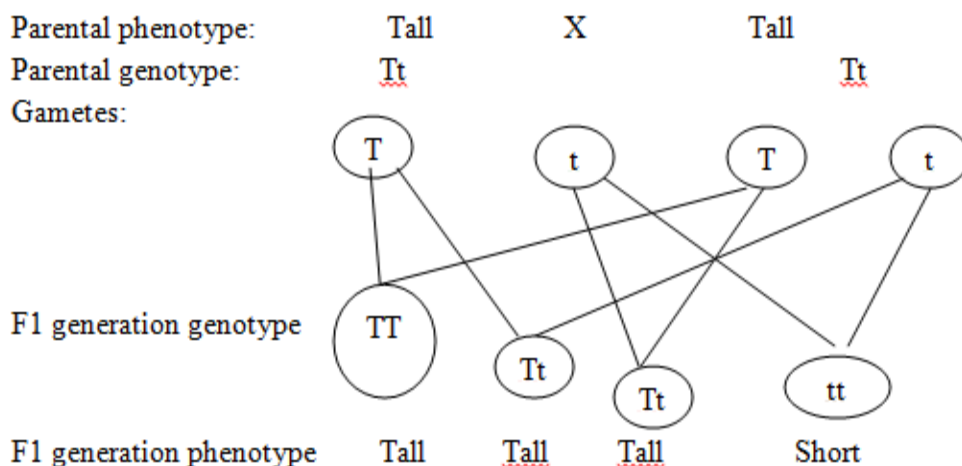


**Figure 10:** *Candidates' performance on Question 10*

Analysis shows that 407 candidates (63.1%) scored from 3 to 4; 46 (7.1%) scored from 2 to 2.5; and 192 (29.8%) scored from 0 to 1.5 marks.

Their general performance indicates that 453 candidates (70.2%) passed by scoring 2 to 4 marks. Their good performance was attributed to adequate knowledge about the tested topic. Thus, the majority of the candidates met the demands of the question by illustrating pictorially all steps, which enabled them to provide the correct answer. According to the marking guide, the candidates were asked to illustrate the following:

Let T represent a gene for tallness and t represent a gene for shortness



In responding to this question most candidates realized that, for heterozygous parents, the phenotypic appearance will be tall and genotypic appearance will be  $Tt$ . When heterozygous tall parents are crossed, the  $F_1$  generation genotype will be  $TT$ ,  $Tt$ ,  $Tt$ , and  $tt$ . These phenotypically will look 3 tall and 1 short. This shows that the candidates had adequate knowledge of monohybrid crosses. Extract 10.1 is a sample of the correct responses by one of the candidates.

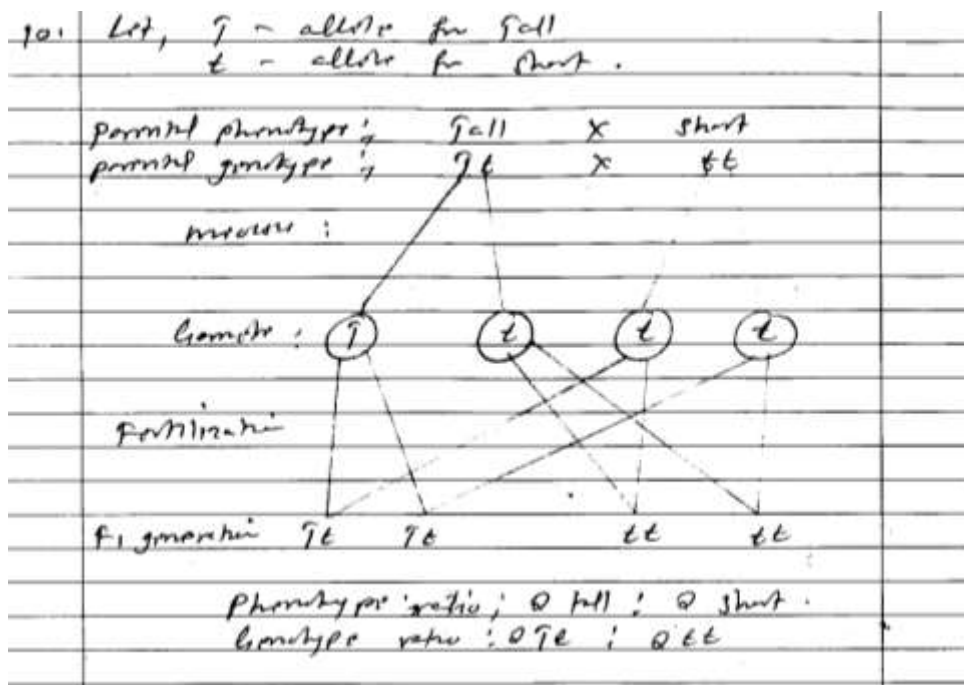
10.	Solution.
	Let:
	$T$ - gene for Tall.
	$t$ - gene for Short.
	Sum:
	Heterozygous parents; $Tt$ .
	Parents: Phenotype: Heterozygous x Heterozygous
	$Tt \times Tt$
	Meiosis:
	Gametes: $T$ $t$ $T$ $t$
	Fertilization:
	$F_1$ $TT$ $Tt$ $Tt$ $tt$
	$\therefore$ Phenotype = 3 are tall : 1 is short.
	$\therefore$ Genotype = 1 : 2 : 1

**Extract 10.1:** A sample of the correct responses to Question 10

In Extract 10.1, the candidate correctly defined the letters and followed the steps in crossing monohybrid. He/she correctly gave the genotypic and phenotypic ratio of the  $F_1$  generation.

Nevertheless, 192 candidates (29.8%) scored low marks on this question. Some of these candidates had inadequate knowledge of monohybrid crosses. They gave unclear responses. For example, most candidates wrote the genotypes of the parents as  $Tt \times tt$ . Others wrote:  $TT \times TT$ ,  $TT \times tt$  and  $tt \times tt$ . Yet, other candidates used different letters to present the parental genotype as  $Tt \times Yy$ . These candidates failed to realize that both dominant and recessive characters are presented by a similar letter, except that the dominant character is presented by a capital letter and the recessive character by a small letter. Such responses suggest that the candidates

lacked enough knowledge about monohybrid crosses since, once these parents are crossed, the  $F_1$  offspring will not give the ratio of 3 tall and 1 short. Extract 10.2 is a sample of the incorrect responses by one of the candidates.



**Extract 10.2:** A sample of the incorrect responses to Question 10

In Extract 10.2, the candidate incorrectly presented the genotypes of parents as  $Tt$  and  $tt$ , instead of  $Tt$  and  $Tt$ ; consequently, he/she obtained the incorrect  $F_1$  offspring.

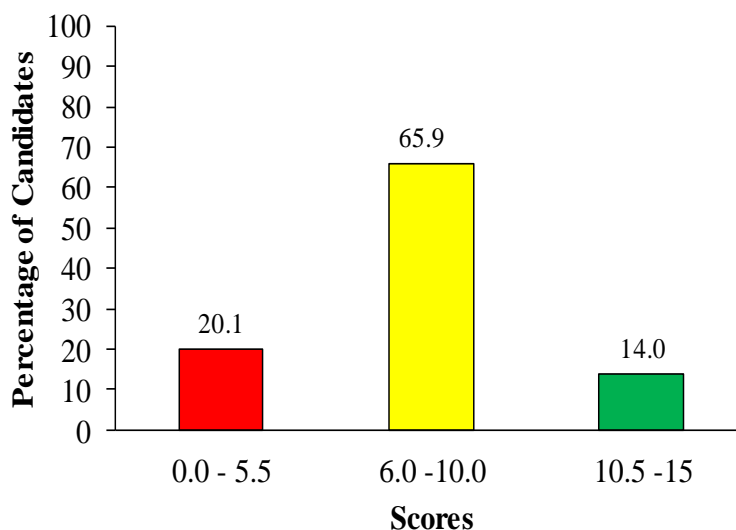
## 2.2 Section B: Essay Type Questions

This section consisted of 3 questions. The candidates were asked to answer two questions. Each question carried 15 marks, making a total of 30 marks. The questions were set from the academic syllabus. The analysis of each question is as follows:

### 2.2.1 Question 11: Classification of Living Things

This question had two parts, (a) and (b). In part (a), the candidates were required to describe three distinctive features of each phylum of Kingdom Fungi. In part (b), the candidate were required to analyse five economic importance of Kingdom Fungi. Data show that 587 candidates (91%)

attempted this question. The general performance on this question was good because 469 candidates (79.9%) scored from 6 to 15 marks. Figure 11 shows the performance of the candidates on Question 11.



**Figure 11:** Candidates' performance on Question 11

Analysis shows that 82 candidates (14.0%) scored from 10.5 to 15; 387 candidates (65.9%) scored from 6 to 10; and 118 candidates (20.1%) scored from 0 to 5.5 marks.

Furthermore, the analysis shows that 469 candidates (79.9%) scored from 6 to 15 marks. These had adequate knowledge of the topic of the classification of Living Things, specifically Kingdom Fungi. The candidates correctly described the distinctive features of each phylum of Kingdom Fungi. For example, in part (a), most candidates identified phyla of Kingdom Fungi and their distinctive features as *Phylum Zygomycota; lacks septa in hyphae, undergo asexual reproduction; Phylum Basidiomycota; reproduce sexually, have septa in hyphae; and phylum Ascomycota; have septa in hyphae, reproduce both sexually and asexually*. Specifically, one of the candidates wrote: *Kingdom Fungi have three phyla namely; Basidiomycota, which reproduce sexually, Ascomycota which reproduce asexually and Zygomycota which reproduce asexually*. Such responses suggest that the candidates had adequate knowledge about the Kingdom Fungi.

Similarly, in part (b), the candidates correctly analysed five points on the economic importance of Kingdom Fungi. Responses, such as *play part in*

the decomposition of organic matter, used in medicinal industries, used in alcohol industries, can be used in biological studies, were given. Specifically, one candidate wrote: Fungi can be used in the production of medicines, can be used as source of food, can be used in scientific studies and can be used in the decomposition of organic matter. Extract 11.1 is a sample of the correct responses by one of the candidates.

11	<p>(1) Kingdom fungi are divided into three phylum which are</p> <ul style="list-style-type: none"> <li>(i) Phylum Basidiomycota example mushrooms</li> <li>(ii) Phylum Zygomycota example black mould</li> <li>(iii) Ascomycota example yeast</li> </ul> <p>(2) Phylum Basidiomycota it consist the following characteristics</p> <ul style="list-style-type: none"> <li>(i) They have septated hyphae which are different from other phylum</li> <li>(ii) They are heterotrophic organism, hence they feed on dead organic matter</li> <li>(iii) They possess cellulase enzyme for external digestion</li> </ul> <p>Distinctive feature of kingdom Phylum zygomycota it include the following</p> <ul style="list-style-type: none"> <li>(i) They have aseptated hyphae compared to other phylum</li> <li>(ii) They grow on the dead and decomposed logs</li> <li>(iii) They undergo asexual means of reproduction</li> </ul> <p>Distinctive feature of Phylum Ascomycota it includes the following</p> <ul style="list-style-type: none"> <li>(i) They do both sexual and asexual means of reproduction</li> <li>(ii) They are saprophytes, hence feed on dead organic matter</li> <li>(iii) They have septated hyphae for absorption of nutrient from the sap</li> </ul>
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11 b) The economic importance of kingdom fungi it includes the following

It used as source of food; Some member of kingdom fungi it can be used as food for some animals example mushrooms are used as vegetable for human beings

It used in spoilage of food; Also member of kingdom fungi it can be used for spoilage of food, especially when placed for long time

It used in preparation of cheese; Also fungi it can be used in industry for preparation of cheese through the use of yeast as the main member of the kingdom fungi

It help to form fertilizer; Also member of kingdom fungi tends to digest the dead organic organism which tends to create fertilizer in that area, which enable to improve agriculture

It used in manufacturing of medicine; Also fungi it can be used in making medicine example penicillin which can be used to cure different diseases.

Therefore there is among of the important benefit from the kingdom, also it may enable to clean the environment through decomposition of the dead organic matter.

**Extract 11.1:** A sample of the correct responses to Question 11

In Extract 11.1, the candidate correctly identified the phyla of Kingdom Fungi. He/she analysed the economic importance of Kingdom Fungi, although the analysis missed the introductory part.

Conversely, 118 candidates (20.1%) scored from 0 to 5.5 marks. Some of the candidates gave responses which were contrary to the demands of the question, while others gave points that lacked clear explanations. Hence, they did not get full marks. Some of the candidates correctly identified the three phyla but failed to give correct features of each phyla. For example, in part (a), one candidate wrote three phyla of Kingdom Fungi as *Ascomycota*: with mitochondrion, Golgi apparatus, and vacuole, *Basidiomycota*: have transportation system, true leaves, special enzymes, *Zygomycota*: have true stem, cup, false root. Other candidates wrote the phyla of Kingdom

Protoctista as Phylum *Apicomplexa*, *Euglenophyta* and *Ciliophora*. Such responses suggest that the candidates had inadequate knowledge of the phyla of Kingdom Fungi.

Similarly, in part (b), some candidates gave 1 to 2 correct common economic importance, while others gave incorrect responses. Others gave the importance of Kingdom Plantae; they wrote *used as source of food, provide oxygen to other organisms and provides canopy to other organisms*. Moreover, other responses were as follows: *prevent linkage, helps in growth, used for tourism, make environment clean, used in decoration, killing and making oil, used in fermentation of food, used in making cleanliness, making animal food*. Such responses show that the candidates had inadequate knowledge about the classification of living things, specifically of Kingdom Fungi. Extract 11.2 is a sample of the incorrect responses from one of the candidates.

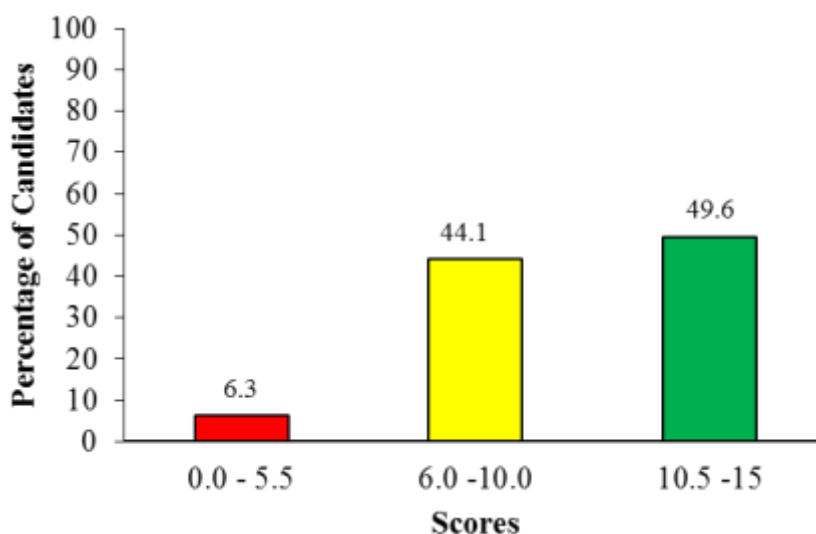
11	(a)(i)	They have both plant and animal features	
	(ii)	They are not seen by naked eyes.	
	(iii)	They respire both aerobically and anaerobically.	

**Extract 11.2:** A sample of the incorrect responses to Question 11 (a)

In Extract 11.2, the candidate gave the general characteristics of kingdom Fungi instead of the distinctive characteristics of each phyla. Besides, some of the characteristics given were incorrect. For example, fungi like mushrooms and bread moulds are seen by naked eyes.

### 2.2.2 Question 12: Biochemistry

This question required the candidates to explain six functions of lipids in the body of a living thing. Analysis shows that 633 candidates (98.1%) attempted this question. Generally, the performance on this question was good because the majority of the candidates (593 (93.7%)) scored from 6 to 15 marks, as shown in Figure 12.



**Figure 12:** *Candidates' performance on Question 12*

Analysis shows that 314 candidates (49.6%) scored from 10.5 to 15; 279 (44.1%) candidates scored from 6 to 10; and 40 (6.3%) candidates scored from 0 to 5.5 marks.

The analysis indicates that 593 (93.7%) candidates scored from 6 to 15 marks. These had adequate knowledge of explaining the role of respiratory substrates, particularly lipids in the body. Thus, they correctly explained three to six roles of lipids in the body of living organisms. Responses, such as *source of energy in the body, acts as an insulator, used as a packaging material for delicate organs, maintains animals' buoyance, are constituents of cell membrane* and *acts as ant-dump waterproof materials*, were given by the candidates.

Specifically, in responding to this question, one candidate wrote: *Lipids acts as an insulator, provide large amount of energy, forms a lining of delicate organs like heart, helps in buoyancy of large organisms like whale.* Another candidate wrote: *is a source of energy, forms a part of cell membrane, plays a role of water proof, used as an alternative substrate, in organisms found in desert areas provides large amount of metabolic water.* Such responses suggest that the candidates had adequate knowledge of the role of respiratory substrates specifically lipids. Extract 12.1 is a sample of the correct responses by one of the candidates.

12.	<p>Lipids is the organic food substance which are hydrophobic in nature in which some lipids contain saturated hydrocarbon and unsaturated hydrocarbon. The following are the functions of Lipids in the body of living <del>organism</del> things.</p> <p>Oxidized to <del>yield</del> yield energy; When lipids is completely oxidized in the body of living things, it yield energy which support other function of the body of living things.</p> <p>Source of Metabolic water; Also the metabolic water in the body of living things is obtained through the metabolic of lipids through which its broken down.</p> <p>Aid buoyancy in aquatic animals; It enable the living things which live in the water bodies to buoyance on the top of the water from one place to another hence implies movement.</p> <p>Protect in proper the vital organs of the body; The vital organs of the body such as kidney, heart are protected by lipids from abrasion when there is a high disturbance within the body.</p> <p>Prevent body against heat loss; Lipids as an organic food substance it prevent heat loss in the body through which its act as an insulator to the body of an living thing.</p> <p>Components of cell structure; The cells of living thing its composes of lipids in order to produce enough energy for metabolic rate within the cell of living organism.</p> <p>Generally, Lipids in the body of living things is more essential needed for different functions which are performed within the body.</p>	
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**Extract 12.1:** A sample of the correct responses to Question 12

In Extract 12.1, the candidate correctly explained the role of lipids in the body of an organism. He/she organised well the work into introduction, main body and conclusion.

In contrast, 40 (6.3%) candidates scored from 0 to 5.5 marks. These candidates had insufficient knowledge of respiratory substrates. Some of them gave two to three points, but their responses lacked clarity. Hence, they scored low marks. Others just outlined 2 to 3 correct points, without any explanations. Other candidates confused the role of protein, carbohydrate and lipids: some candidates wrote the role of protein instead of lipids. Most of the candidates wrote: *helps in growth, forms part of pigments, helps in formation of hormone and forms part of a cell*. Specifically, one candidate wrote: *simplify healing of wound, provide muscles, block nervous system, helps cholesterol*. Another candidate wrote: *remove infections, remove wastes, fosters energy, forms part of the body, acts as sponge*. Such responses suggest that the candidates had inadequate knowledge of the concept tested. Extract 12.2 is a sample of the incorrect responses by one of the candidates.

12.	<p>Lipids - This is the food substance which contain fat and oil. In the body lipid is converted under enzyme known as Lipase which catalyse material substance or food into Lipids which contain oil and fat. And Lipid contains elements like carbon, hydrogen and oxygen and this food substance is very important in the body as it is not needed at high percent. The following are functions of Lipids in the body of living things</p> <p>Act as a source of immunity in living body cells; During manufacturing of lipid in the body when Lipase enzyme convert food materials to ward, lipid energy is released in the body which can be used by living cell to perform different activities in the body for example immunity both natural and artificial which when joining different cell in the body in order to perform a certain function energy is needed in order to support.</p> <p>Help to protect muscles; In living cells lipid due to presence of fat and oil help to protect muscles act as a grease to when locomotion or movement occur. Help to soften the junction of muscles a joint to locomote well as a movement of either arm or legs from one place to another.</p> <p>Help to soften the skin of the body; The food substance which play part to make the skin soft and narrower is lipid due to fat and oil. When in the body presence of fat makes an improvement to the skin which will be soft and narrow as well as living things such as human being appear beautiful for human women.</p>
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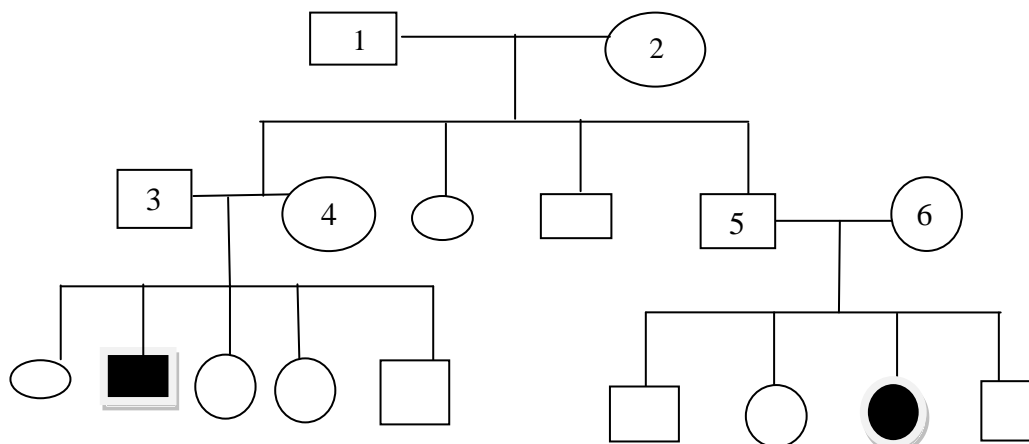
12.	<p>Help to protect an organism from diseases; lipids in the living cell <del>that</del> when increased tend to <del>one</del> cell both which fight against diseases; there are some cell which live in fat as well as some cell their life in oil which can enable to increase efficiency of the cell to perform the function of fighting against diseases.</p> <p>Play a great role in growth of the body; lipid as a food substance increase the <del>there</del> size of the body; weight of the body which all of these are the growth of living cell which played by lipid; also lipids can lead to permanent increase in height of organisms which also is a part of growth.</p> <p>Generally lipid has many functions in the body if attained or used in allowance amount to the body. Maximum using of lipid substance or food can cause many effect to the living things especially human being can be affected with different diseases but also large side in shape of the body can be affected by that <del>the</del> so in order to have good health maintain balance diet which will include <del>fat</del> containing lipid, protein, carbohydrate, vitamins which may cause a living organism to have good health.</p>
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**Extract 12.2:** A sample of the incorrect response to Question 12

In Extract 12.2, the candidate incorrectly explained the roles of lipids. For example, he/she wrote roles like to soften the skin, protect against diseases and for growth; these are the roles of sebum, vitamins and protein, respectively.

### 2.2.3 Question 13: Genetics

This question required the candidates to study carefully the pedigree showing inheritance of a certain trait and answer questions that followed:



# KEY



Normal Female



Affected Female



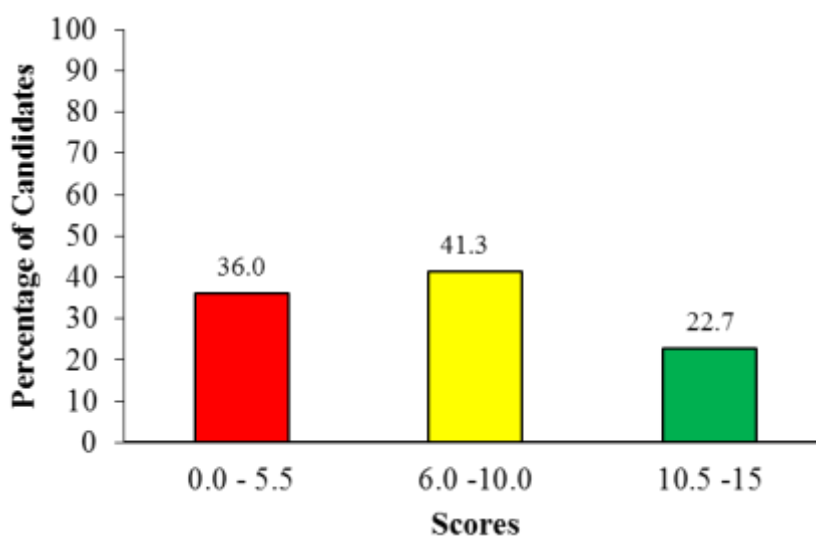
Normal Male



Affected Male

- (a) *Determine the genotypes and phenotypes of individual parents numbered 1, 2, 3, 4 and 5.*
- (b) *What type of inheritance is displayed by the pedigree?*
- (c) *Suggest two traits transmitted in a manner similar to the given pedigree.*

This was the most skipped question as only 75 candidates (11.6%) attempted it. The general performance on this question was average because 48 candidates (64.0%) scored from 6 to 15 marks. Figure 13 shows the performance of the candidates on Question 13.



**Figure 13:** *Candidates' performance on Question 13*

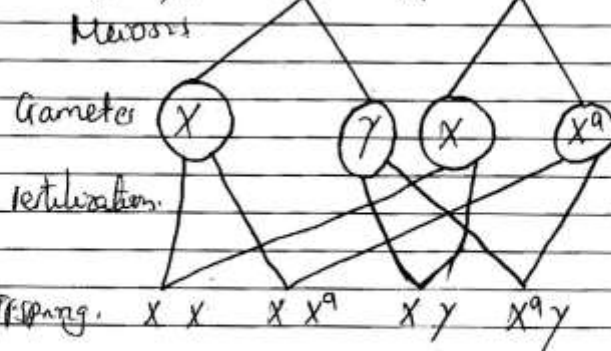
Data show that 17 candidates (22.7%) scored from 10.5 to 15; 31 candidates (41.3%) scored from 6 to 10; and 27 candidates (36.0%) scored from 0 to 5.5 marks.

A further analysis shows that 48 candidates (64.0%) scored from 6 to 15 marks. These candidates wrote correct points in most parts of the question. They had adequate knowledge about genetics, particularly about applying Mendelian and non-Mendelian inheritance principles. For example, in part (a), these candidates presented genes by letting  $X^1$  stands for gene carrier of the trait,  $X$  stands for normal gene which determine femaleness and  $Y$  stands for a gene which determine maleness. Then, they correctly crossed a normal male and a normal female, bearing in mind that the presence of one affected male offspring from parents 3 and 4 shows that the female number 4 is carrier and male number 3 is normal. They also crossed affected male ( $X^1Y$ ) and normal female ( $X^1X$ ), bearing in mind that the presence of affected female from parents 5 and 6 depicts that male number 5 must be affected while female number 6 must be a carrier. Therefore, they correctly ended in determining the genotypes of individual parents, numbered 1, 2, 3, 4 and 5.

In part (b), these candidates correctly wrote the type of inheritance displayed by pedigree. For example, they wrote *sex linked or sex linked inheritance*. Likewise, in part (c) these candidates correctly suggested two human traits transmitted in a similar manner to a given pedigree; they wrote: *Hemophilia and Sickle cell anemia*. Others wrote: *Colour blindness and Albinism*. Extract 13.1 is a sample of the correct responses by one of the candidates.

13(a)	phenotype refer to the physical appearance of an individual example colour and height while genotype refer to the internal appearance of an individual which determined by genetic traits gene, example white but carrier can be represented by ( $Ww$ ). The following show the phenotype of individual parents number 1, 2, 3, 4 and 5 from the diagram given.
	A parental phenotype: A cross between homozygous male and heterozygous female.

parental genotype:  $X Y \quad X X X^a$

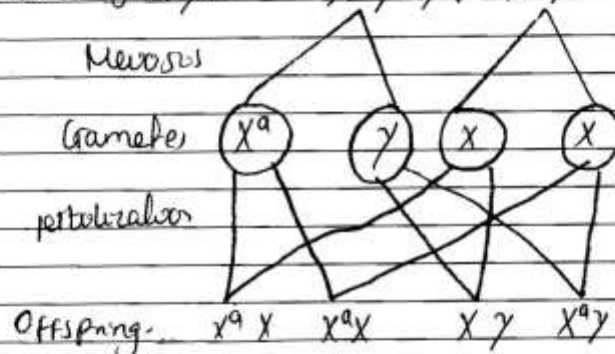


Phenotype for parent number 03 it show a normal male phenotype for parent number 04 it show normal but carrier ( $X X^a$ ).

Then. Affected man from second pedigree make a normal women from another family.

parental phenotype: A cross between affected male and normal female

parental genotype:  $X^a Y \quad X X X$



phenotype:

phenotype for parent number 15) was affected male

phenotype for parent number 06) was normal female

13b) Type of inheritance displayed in pedigree is sex linkage. Where the transfer of some character from one generation to another as shown for both family. (Albinism)

13(x)	Two human traits transmitted in a manner similar to the given pedigree are:- Sickle cell anaemia and Haemophilia.
	The above explanation shows how how genes are related to the human life and some characteristics are transferred through genetic material from one generation to another.

**Extract 13.1:** A sample of the correct responses to Question 13

In Extract 13.1, the candidate correctly crossed the parents to identify the genotypes and phenotypes of parents number 3, 4, 5 and 6. He/she correctly suggested the type of inheritance and traits transmitted in that manner.

In contrast, 27 (36.0%) candidates scored from 0 to 5.5 marks. These candidates had inadequate knowledge of the topic tested. According to the marking guide, the candidates were supposed to attempt part (a) as *let any letter represent genetic crosses*. For example,  $X^1$  be the gene carrier of the trait be a normal gene which determines femaleness and Y be a gene which determines maleness. The candidate were supposed to make crosses to obtain phenotypes and genotypes of individuals as follows:

Individuals	Phenotype	Genotype
1.	Normal male	XY
2.	Normal female	$XX^1$
3.	Normal male	XY
4.	Normal female	$XX^1$
5.	Affected male	$X^1Y$

In part (a), one of the candidates wrote the genotypes and phenotypes of individual parents numbered 1, 2, 3, 4 and 5 as *individual one XX, two XY, three XX, four XX and five XY*. In part (b), the candidates were required to write the type of inheritance, but they wrote inherited diseases; nevertheless, others wrote sex problems. In part (c), the correct responses were Hemophilia, Colour blindness, Sickle cell and Albinism. However, they wrote height and weight, which are examples of continuous variation. Such responses suggest that the candidates did not study properly the key provided in the question. Besides, they had inadequate knowledge of the

tested concepts. Extract 13.2 is a sample of the incorrect responses by one of the candidates.

13	To Study the Pedigree and answer the questions follows	
a)	To determine the genotypes and phenotypes numbers 1 to 5	
	<u>Genotype</u>	
	1 - Normal male	
	2 - Normal female	
	3 - <del>Affected</del> Normal but affected male	
	4 - Normal female but affected.	
	5 - Normal male but affected	
	<u>phenotypes</u>	
	1 - Normal male	
	2 - Normal female	
	3 - Normal male	
	4 - Normal female	
	5 - Normal male	
b	The type of inheritance displayed in the pedigree is Genetic inheritance.	
c	Human traits transmitted in a manner similar to the given pedigree are	
	- Height traits	
	- Colour	

**Extract 13.2:** A sample of the incorrect responses to Question 13

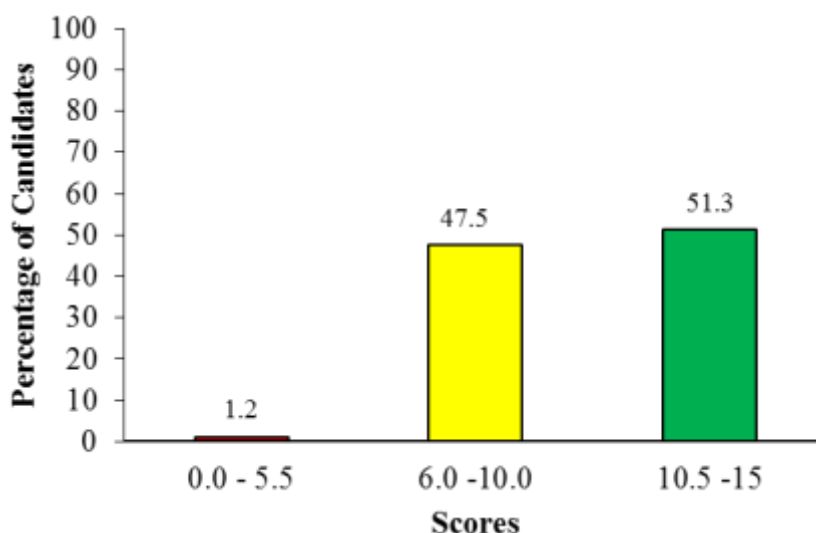
In Extract 13.2, the candidate gave incorrect phenotypes and genotypes. He/she did not understand that genotype is the genetic makeup of an individual, so it cannot be expressed phenotypically. In part (b), he/she also wrote genetic inheritance instead of sex linkage. Likewise, the response given in part (c) was incorrect.

### 2.3 Section C: Essay Type Questions

This section consisted of 3 essay type questions. The candidates were instructed to answer two questions. Each question carried 15 marks, making a total of 30 marks in this section. The questions were set from the pedagogy syllabus. The analysis of each question in this section is as follows:

### 2.3.1 Question 14: Analysis of O-Level Biology Curriculum Materials

This question required the candidates to explain seven purposes that a syllabus serves in the teaching and learning process. A total of 640 candidates (92.2%) attempted this question. The general performance on this question was good because 632 candidates (98.8%) scored from 6 to 15 marks. Figure 14 shows the performance of the candidates on Question 14.



**Figure 14:** *Candidates' performance on Question 14*

Data indicate that 328 candidates (51.3%) scored from 10.5 to 15; 304 candidates (47.5%) scored from 6 to 10; and 8 (1.2%) candidates scored from 0 to 5.5 marks.

Analysis shows that the candidates who scored from 6 to 15 had adequate knowledge of the tested concept. Thus, they correctly explained the purposes that the syllabus serves in teaching and learning. Responding to this question, one candidate wrote: *it helps a teacher to plan for teaching, highlights procedures for teaching a particular subject, guides the number and procedures for assessment, helps in the preparation of scheme of work, builds confidence to teachers.*

Another candidate wrote: *is a tool that can help both teacher and student to make evaluation, it assists on time management between a teacher and*

*students, it can guide decision making by education stakeholders, highlights responsibilities of both teachers and students.* Furthermore, another candidate wrote: *it can facilitate student learning, helps in guiding both student and teachers plan, guides a teacher to think professionally.* Such responses suggest that these candidates had adequate knowledge of the tested concept. Extract 14.1 is a sample of the correct responses by one candidate.

14.	<p><u>Syllabus</u> This is the textual materials that contains the outlined contents of the certain subject matter. In each subject the teacher should use the syllabus for the facilitating teaching and learning process, so the syllabus has different purpose during teaching and learning process.</p> <p>The following below are purpose of syllabus in teaching and learning of biology subject:</p> <p>Help teacher to teach right contents at right time, by using the syllabus it enable the teacher to teach the right contents at the right time in biology subject since the syllabus it shows the topic of a biology subject of each class so the teacher by using the syllabus can teach the right contents at the right time.</p> <p>It regulate speed of teaching, since the syllabus contains the number of period in which the biology subject can teach a topic or sub-topic with how many period hence due to the number of period shown in syllabus it help the teacher to regulate the speed of teaching.</p> <p>Used to prepare scheme of work, due to the use of the syllabus enable the teacher to prepare the scheme of work that will be used for the preparing the lesson plan in order to facilitate</p>
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14) Teaching and learning process in biology subjects.  
 It provide teaching and learning strategies, In the syllabus there are many teaching and learning strategies in which the teacher can use in order to facilitate the teaching and learning of the biology subject, hence syllabus it provide teaching and learning strategies. example Group discussion, demonstration, Question and answers.  
 It provide teaching and learning resources, Also the syllabus help to provide the teaching and learning resources to be used by the teacher during facilitating the process of teaching and learning, so the biology teacher tends to use syllabus in order to acquire different resources to be used for facilitating teaching and learning.  
 Help biology teacher to make assessment, Since in the syllabus there are many assessment tools that a teacher can use in order to make the assessment for the help his learners, hence the biology teachers tends to use different assessment tools, example portfolio, test and examination so as to make the assessment to learner.  
 Generally the syllabus help during the orientation of teaching by the teacher.

**Extract 14.1:** A sample of the correct responses to Question 14

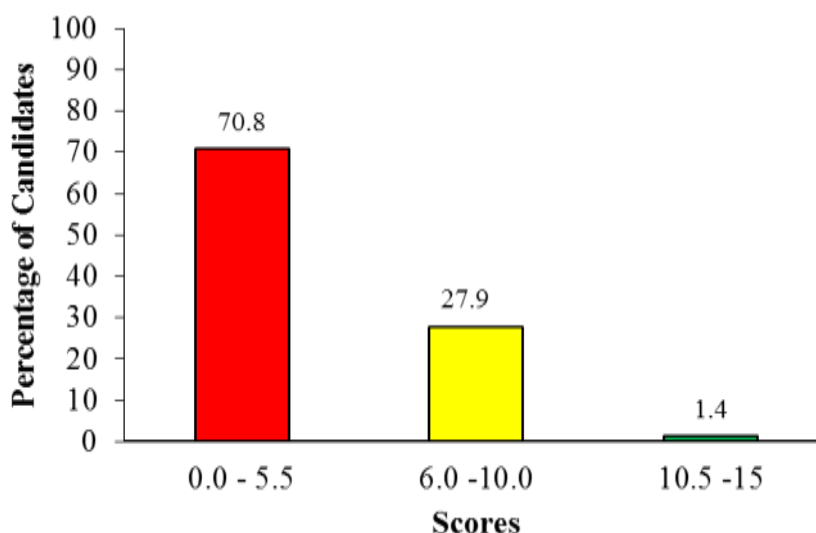
In Extract 14.1, the candidate correctly explained the purposes that a syllabus serves in the teaching and learning of Biology.

Despite the good performance on this question, 8 candidates (1.2%) scored low marks from (0 to 5.5). These candidates had partial knowledge of the tested topic as they correctly wrote two to three points but lacked clarity. Others explained the purposes that the syllabus serves as *the document that*

*help learners to get the content and skills for achieving a particular objective. Others regarded the syllabus as a document that can assist incompetent teachers to become competent in areas of their specialization. Moreover, other candidates wrote the purposes of a lesson plan as syllabus limits scope of examination, helps to understand the lesson, shows topic that has been covered. Others wrote general purposes of the syllabus as it is good for new teacher, helps teachers to use it during teaching, it can help student to learn different contents, it is simple to use, it is self-explanatory, it is cheap, it is time consuming, it is specific for certain group, it is used during examinations, it covers all contents. Such responses suggest that the candidate had insufficient knowledge of the tested concept, which attributed to their weak performance.*

### 2.3.2 Question 15: Planning and Preparation for Teaching Biology

This question had two parts, (a) and (b). In part (a), the candidates were required to identify three challenges of using computer aided programs in the teaching and learning of Biology. In part (b), the candidates were required to suggest five ways which could be used to make information retrieved from the internet useful in class. Data show that 359 candidates (55.7%) attempted this question. The general performance on this question was weak because 105 candidates (29.3%) scored from 6 to 15 marks. Figure15 shows the candidates performance on this question.



**Figure 15:** *Candidates' performance on Question 15*

Data show that 5 candidates (1.4%) scored from 10.5 to 15; 100 candidates (27.9%) scored from 6 to 10; and 254 candidates (70.8%) scored from 0 to 5.5 marks.

Analysis indicates that 254 candidates (70.8%) scored from 0 to 5.5 marks. These candidates did not understand the demands of the question. In part (a), most of them wrote the importance of using ICT in teaching and learning Biology, instead of identifying the challenges of using computer-aided programs in teaching and learning Biology. Specifically, one candidate wrote: *helps to understand the lesson, allows active participation, solve the problem of shortage of books*. Other candidates wrote different types of computer-aided programs, instead of the challenges of using those programs in teaching and learning Biology. Such responses suggest that the candidates did not understand the demand of the question.

Similarly, in part (b), most candidates wrote answers contrary to the demand of the question. For example, some of the candidates wrote the use of different guiding rules as in a science laboratory, instead of suggesting possible and practical solutions to make internet materials useful in Biology. Other candidates suggested imposing punishment on students who will misbehave in using internet materials. Moreover, other candidates explained internet materials as hard materials (books, journals and articles) that a teacher can manage and control by hiding them in different shelves. Specifically, one candidate wrote: *arrange materials properly*. Moreover, other responses are like *setting a surveillance camera in a computer room, provide education on how to use computer, maintain materials, provide punishment, supervise all the time when students are using internet, provide password to students, manage power supply in school*. Such responses suggest that the candidates had inadequate knowledge of the tested concept. Extract 15.1 is a sample of the incorrect responses by one of the candidates.

150	Avoidance installation of games; this may lead to make the computer useful in teaching and learning activities due to the fact that the computer which has to be used are prohibited to install games which will make learners to concentrate of academic performance.
	Introduction of strictly rule on the use of social media such as <del>the</del> instagram, whatsapp, thus the introduction of rules and regulation which will guide learners on the use of internet.
	It should be used only on the subject-matter; this may reduce the rate of learners to relieve the unwanted information which some of them are unacceptable <del>with</del> <del>best</del> behaviour to our society.
	The use of internet should be under supervision of teacher; this is due to the fact that in order to prevent the relieved expose of learners on the certain unwanted information should be done under the guidance and supervision of teacher.
	Generally the use of internet in teaching and learning process is very important because enable the accessibility of good material which may lead to simplify the process of teaching & learning.

**Extract 15.1:** A sample of the incorrect responses to Question 15 (b)

In Extract 15.1, the candidate wrote some rules that could be used in the computer laboratory, instead of ways to make internet-retrieved information useful in class.

Nevertheless 140 candidates (29.3%) scored from 6 to 15 marks. These candidates wrote three (3) to five (5) correct responses as per the marking guide. For example, in responding to part (a), the candidates wrote: *lack of expertise, lack of power and shortage of computer facilities*. Another candidate wrote: *negative attitude among teachers and students on the use of computer, shortage of computers, lack of knowledge about the use of computers*. Yet another candidate wrote: *shortage of power, lack of computer facilities, and lack of support from school management*. Such

responses show that the candidates were knowledgeable about the use of ICT in teaching and learning.

Similarly, in part (b), the candidates correctly suggested ways that could be used to make materials useful. Among their correct responses were: *editing of content videos and pictures, making translation of some information from the internet, restricting some programs, rewriting the content by using appropriate language, inserting voice in videos to teach the content of your interest, editing parts of videos and audios that are contrary on what is intended*. Such responses suggest that the candidate had sufficient knowledge of the use of ICT in teaching and learning Biology. Extract 15.2 is a sample of the correct responses by one of the candidates.

15 a)	Computer is a electronic device which is used to transform data into Information. There are different types of computer which are micro computer, minicomputer, Supercom puter and others. The following are the challenges of using computer aided programs in teaching and learning of biology.
	Lack of skills of using computer to some teachers; This is among the challenge which may face many teacher to use computer aided program in the process of teaching and learning so due to that many teacher fail to use these computers in teaching process.
	Absence of electricity in some schools; also some teacher face a challenge of not having electrici ty in order to operate the computer aided programs in teach ing and learning. Hence challenge facing.
	Unavailability of network; also among the challenge which face the usage of computer aided progra

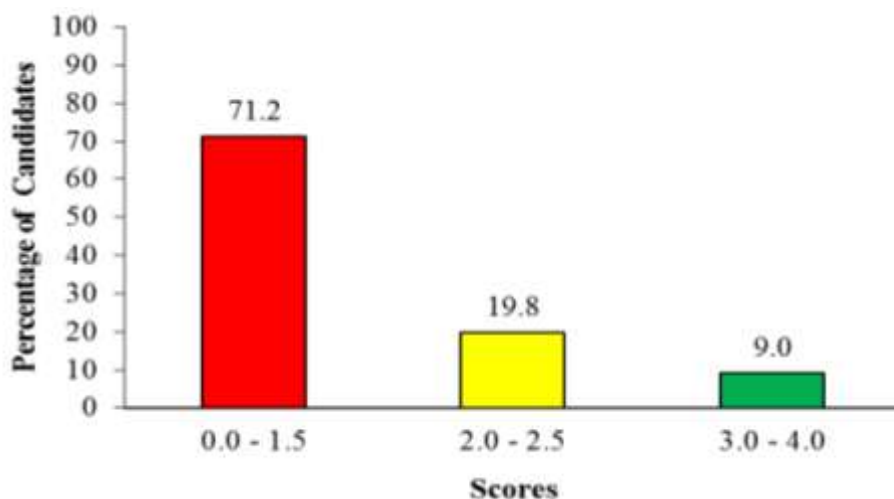
15	(b)	Internet is the connection of many network which perform the same function. Through Internet a student can obtain different materials which are helpful in the process of teaching and learning. The following are the ways used to make the material useful:- Editing materials obtained before use; Through editing materials a person can remove the information which are not required in the process of learning in the class. Therefore the way to make the materials useful. Convert the materials into Simple language; this will help to provide materials which are understandable to the learners during class since there will be no difficult terminology which will bring hardship in understanding. Selecting materials which are relevant to the level of a learner; Also through choosing the materials which are relevant to a learner will help to simplify the process of teaching and learning since there will be the required material to be learned at a particular level. Consider the ethics when downloading materials. since through considering ethics of the learner may simplify the <del>at</del> maintaining the discipline of the class and hence leads to obtained of good materials for learning. Through checking before presenting to the class, this will help to remove the materials before presenting to the student. So due to that will help to remove misunderstand.
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**Extract 15.2:** A sample of the correct responses to Question 15

In Extract 15.2, the candidate correctly identified the challenges associated with using computer aided programs in teaching and learning. He/she correctly suggested five ways of making internet materials useful in class.

### 2.3.3 Question 16: Fundamentals of Teaching and Learning Biology

This question required the candidates to suggest six strategies that will promote family and community involvement in the teaching and learning of Biology. Data show that 288 candidates (44.7%) attempted this question. The general performance on this question was weak because 83 candidates (28.8%) scored from 6 to 15 marks. Figure 16 summarizes the candidates' performance on Question 16.



**Figure 16:** *The candidates' performance on Question 16*

Data show that 26 candidates (9.0%) scored from 10.5 to 15; 57 candidates (19.8%) scored from 6 to 10; and 205 candidates (71.2%) scored from 0 to 5.5 marks.

Analysis indicates that 205 candidates (71.2%) obtained low marks; these wrote responses contrary to the demand of the question. For example, some of them wrote techniques and strategies that a teacher can employ in the teaching and learning of Biology such as the use of *groups, gallery walk and study tour*. Other candidates wrote types of information that a Biology teacher can teach the community such as *pandemic diseases, malaria and how to take care of a growing child*. Others explained roles of a school board. Such responses show that the candidate did not understand the demands of the question.

One of the candidates wrote strategies that could promote family and community involvement in teaching and learning of Biology, including *counselling of the community, provision of health education, use of role play, motivation strategy*. Another candidate wrote: *use of experimentation, presence of library, presence of laboratories, question and answers*. Moreover, another candidate wrote: *use of first aid, encourage active participation, community should be part of learning, teaching practically, improvement of creativity and improvement of teaching and learning environment*. Furthermore, another candidate wrote; *use of verbal communication, encourage doing than listening, putting theory into practice, use of teaching aid and use of media*.

Again another candidate wrote: *teaching how to conserve environment, different types of disease, types of food to eat and use of computer*. Such responses suggest that the candidates did not understand the demands of the question. Extract 16.1 is a sample of the incorrect responses by one of the candidates.

16	<p>Strategies; Refers to the all what the teacher planned to facilitate his/her teaching and learning process; The following are the strategies that will promote family and Community involvement in the teaching and learning of biology:</p> <p>Teaching and learning biology should be involve. <del>inquiry</del> inquiry; In order to promote family and community to involve in the teaching and learning biology should involve inquiry which facilitate deep investigation.</p> <p>Teaching and learning biology should be cooperative; The teachers and learners should be cooperate in the process of teaching and learning. In order to promote family and community to involve in teaching and learning of biology.</p> <p>Teaching and learning biology should be Meaningful; In order to promote family and community in the process of teaching and learning of biology should be meaningful to the family and the community.</p> <p>Teaching and learning of biology should be conducted in conducive environment; Safely environment were the process of teaching and learning of biology also promote the family and community to involves in the teaching and learning of biology.</p> <p>Teaching and learning biology should be through Practice; This also is among of the strategy which promote family and community to involves in the process of teaching and learning of biology.</p> <p>Teaching and learning biology should be reflect to real life; The family and community</p>
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16	involves in the teaching and learning of biology	
	if the knowledge, skills and experiences which	
	acquired through teaching and learning biology	
	they reflect to real life situation family and	
	community will involve.	
	Generally; This strategies that promote	
	family and community involvement in the teaching	
	and learning of biology should be encouraged and	
	improved in order to stimulate involvement in	
	teaching and learning of biology.	

**Extract 16.1:** A sample of the incorrect responses to Question 16

In Extract 16.1, the candidate explained the fundamentals of teaching and learning of Biology instead of ways that the family and the community at large can be involved in the teaching and learning of Biology.

However, 83 candidates (28.8%) scored 6 to 15 marks. These explained three to six strategies that could be used to promote the involvement of the family and community in the teaching and learning of Biology. The candidates wrote responses such as *during preparation and collection of teaching aids, communication with parents, the use of guest speaker, excursions during biological studies, involvement of the community on issues relating to the wellbeing of school.*

Most specifically, one candidate wrote: *conducting regular meetings with parents on how to enhance teaching and learning, communication with parents on students' academic progress, excursions to different places with biological resources in school catchment areas and providing feedback to parents on students' achievement.* Such responses suggest that these candidates had adequate knowledge of the topic of Fundamentals of Teaching and Learning Biology. Extract 16.2 is a sample of the correct responses by one of the candidates.

16	<p>To encourage them to buy teaching and learning materials for their children, this method also will promote them to participate in teaching and learning biology effectively example Textbook, and school uniforms to their children.</p> <p>To encourage them to ask reports about their children from the school, this will enable to participate or involve in teaching and learning biology simply because will help them to identify learning progression for their children.</p> <p>To encourage them to give their children a chance to complete their task when there is at home. A strategies will help family and community directly to be involved in teaching and learning process simply because the use of giving their children time to complete their child will encourage and themselves to identify progression study of their children.</p> <p>To encourage them to send their children in studying area like tour trip to study more information about biology subject this will promote also parents to be involvement in teaching and learning biology outside the school compound.</p> <p>To encourage them to attend various school committee related to academic issues; This strategies also will help them to be involvement in teaching and learning biology simply because through meeting is where all planning related to education issue is planned hence will help them to be involvement in teaching and learning biology.</p>	
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**Extract 16.2:** A sample of the correct responses to Question 16

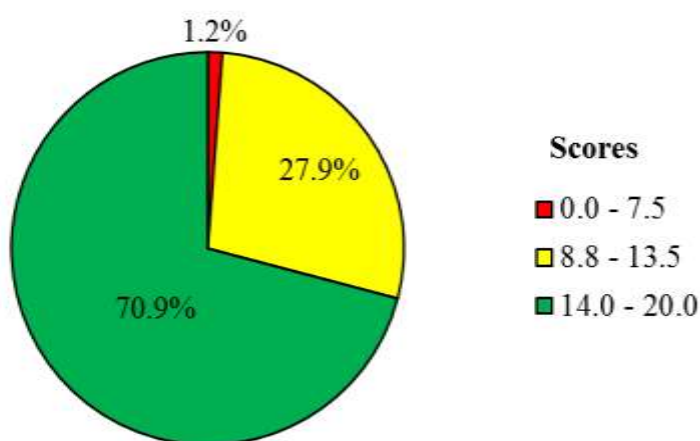
In Extract 16.2, the candidate correctly explained the strategies for promoting family and community involvement in teaching and learning Biology.

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

There were two alternative practical papers namely 733/2A - Biology 2A and 733/2B - Biology 2B. Each paper had three questions. Questions 1, 2 and 3 in each paper were set from the topics of *Basic Biology Laboratory Skills*, *Biochemistry* and *Classification of Living Things*, respectively. The candidates were required to answer all questions in their respective papers. The analysis of their responses to each question in both papers is as follows:

#### 3.1 Question 1: Basic Biology Laboratory Skills

In this question, the candidates were required to dissect the specimen provided and answer the question that followed. The question was attempted by all 645 candidates (100%). The general performance on this question was good because 637 (98.8%) candidates scored from 8 to 20 marks. Figure 17 shows the performance of the candidates on Question 1 in paper 2A and 2B.



**Figure 17:** *Candidates' performance on Question 1 in paper 2A and 2B*

Data shows that 457 candidates (70.9%) scored from 14 to 20; 180 candidates (27.9%) scored from 8 to 13.5; and 8 (1.2%) candidates scored from 0 to 7.5 marks.

### 3.1.1 733/2A Biology 2A

Question One required the candidates to dissect specimen X (a male or female (Cockroach) in the usual way to display the digestive system. The candidates were supposed to deflect the gut to their right hand side and respond to the following questions:

- (a) *Draw a large, neat, well-labelled diagram of your dissection.*
- (b) *Give the role of each part of the digestive system labeled in (a).*
- (c) *Classify specimen X to the order level.*
- (d) *Briefly describe four adaptations of specimen X to its mode of life.*
- (e) *State two advantages of specimen X in the ecosystem.*

The candidates who scored from 8 to 20 marks gave correct responses to some or all parts of the question. Their good performance was attributed to their adequate knowledge of the tested concepts and laboratory skills. In part (a), the candidates correctly drew large, neat diagrams showing parts of the cockroach digestive system. They also put a caption and magnification of the diagrams. They correctly labelled parts such as the *Salivary gland, Crop, Gizzard, Digestive caeca, Mid gut, Ileum, Colon, Rectum and Salivary receptacle*. These responses suggest that the candidate had adequate knowledge of the digestive system of the cockroach.

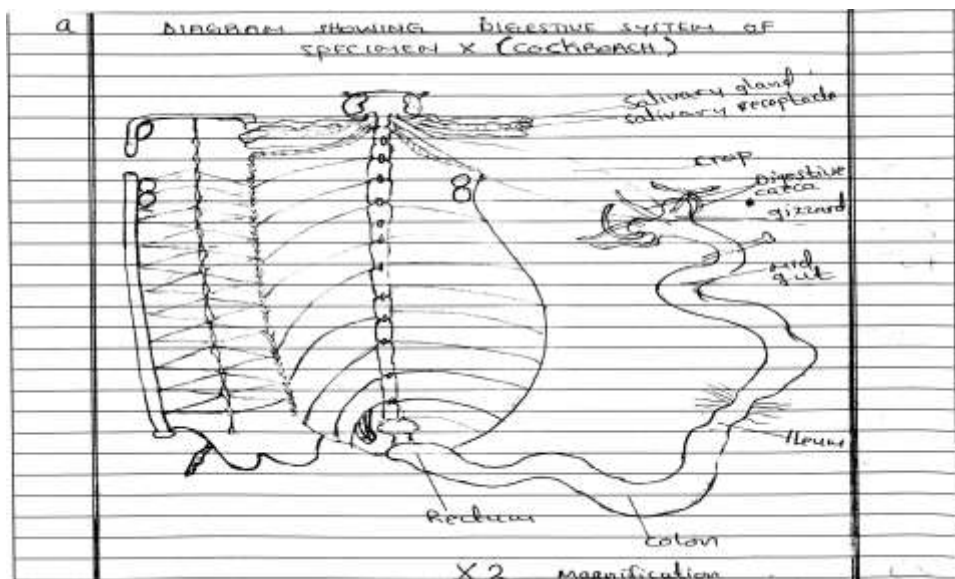
In part (b), they correctly gave the role of each part of the digestive system as labeled in (a). One candidate wrote: *Gizzard for grinding food, crop for temporary storage of food, Digestive caeca for production of digestive enzymes, ileum for absorption of nutrients and salivary gland for secretion of saliva containing enzyme*. Another candidate wrote: *colon for absorption of water and minerals, mid gut for nutrients uptake, rectum for storage of faeces, crop for temporary storage of food and gizzard for mechanical digestion of food*. Such responses suggest that the candidates had adequate knowledge of the functions of different parts of the digestive system of the cockroach.

Likewise, in part (c), the candidates correctly classified the specimen (Cockroach) to the order level. They started with the highest rank, Kingdom

Animalia, followed by Phylum *Arthropoda*, then class *Insecta* and finally order *Orthoptera*. Such responses indicate that the candidates had adequate knowledge of classifying organisms; thus, they understood that classification is hierarchical, starting from the highest rank to the lowest rank order.

In part (d), they correctly described the adaption of specimen X to its mode of life. They gave responses such as *they have wings for flight to escape predation, long antennae for sensation, special color pertains for camouflage, excrete nitrogenous wastes to avoid water loss, have special enzyme for digesting solid material, are nocturnal to avoid chance of predation, are dorsal ventrally and flattened for hiding to avoid predation*. Specifically, one candidate wrote: *they have high rate of reproduction to increase their survival, low competition in food with other organisms to survival, small flat size to avoid predations, production of nitrogenous wastes to avoid dessication*. Another candidate wrote; *they have antennae for sensation, colour pertains for camouflage, flat structure for easy hiding, high proliferation to increase their number*. These responses show that the candidates had adequate knowledge of the adaption of the cockroach to different modes of life.

Similarly, in part (e), the candidates correctly stated the advantages of specimen X (Cockroach) in the ecosystem. These candidates wrote: *act as a source of food for other organisms, used in biological research and can be used in addition of soil fertility once they die and decompose*. Such responses show that the candidates had adequate knowledge about the advantages of insects. Extract 17.1 is a sample of the correct responses by one of the candidates.



1b) i) Digestive caeca involves in the chemical digestion.

ii) Gizzard this is a place where mechanical digestion begin

iii) Ileum involves in the absorption of food

iv) Colon involve in the absorption of water.

v) Rectum involve in the storage of undigested food temporary.

1c) Kingdom Animalia  
Phylum Arthropoda  
Class Insecta

d) Adaptation of specimen X

i) They have a pair of antennae for sensation

ii) They have a pair of wings for flying

1d) i) They have compound eyes for searching for prey

ii) They have legs which facilitate the movement from one place to another to search for prey

e) Advantages of specimen X

i) They are source of food to some animals.

ii) They are used in scientific experiment.

**Extract 17.1:** A sample of the correct responses to Question 1, part of paper 2A.

In Extract 17.1, the candidate correctly drew and labeled the diagram of a dissected cockroach. He/she correctly explained the function of different parts of the digestive system of the cockroach. The candidate failed to state the order to which cockroaches belong.

Despite the good performance on this question, 8 candidates (1.2%) scored from 0 to 7.5 marks. This shows that they had inadequate knowledge of the tested concepts. For example, in responding to part (a), most of the candidates dissected specimen X (cockroach) but provided some incorrect labels of their dissection; hence they scored low marks. Some of the candidates labeled parts of the excretory system as they wrote: *Malpighian tubules*, *ejaculatory duct*. Others labeled parts of the reproductive system such as *mushroom gland* and *ovary*, instead of parts of the digestive system. Moreover, some of the candidates labeled parts of the circulatory and nervous system. Other candidates labeled external parts of the cockroach such as *wings*, *eyes* and *legs*. These responses suggest that the candidates did not understand the demands of the question as they labeled parts contrary to the demand of the question.

In part (b), most of the candidates gave incorrect functions of the parts of the digestive system of a cockroach. Other candidates mixed the functions of the digestive parts, thereby ending up getting low marks. For example, one candidate wrote the function of gizzard as *for temporary storage of food* instead of *grinding of food*. Such responses indicate that the candidates had inadequate knowledge of the parts of the digestive systems of insects. On the other hand, in part (c), most of the candidates classified the specimen to the Kingdom level. Others hierarchically classified it to the order level but wrote incorrect taxa. Conversely, others wrote the correct taxa but misspelt them, ending up getting low marks. For example, one candidate wrote: *kingdom Animalia*, *Phylum Anthopoda*, *class Insect* and *order Othoptera*. These candidates did not understand that misspelt scientific terms can not be awarded.

Similarly, in part (d), some candidates correctly outlined only one adaptation, while others completely failed to write even one correct adaptation. For example, some of the candidates wrote: *insects live together*, *insects are found in dumpy places*, *insects are found in forests* and *insects are prolific*. These candidates did not understand that the term *adaption* means structural development, which enables an organism to

perform a certain function. Such responses suggest that the candidates did not understand the demands of the question.

In part (e), some candidates correctly stated one advantage. Hence, they obtained low marks. Others incorrectly stated the advantages of specimen X in the ecosystem. For example, they wrote: *insects are source of power, source of classification, used in destroying home properties*. Such incorrect responses indicate that the candidates had inadequate knowledge of the concept.

### 3.1.2 733/2B Biology 2B

Question One in this paper required the candidates to dissect the provided specimen Y (a male or female Rat/Guinea pig) in the usual way to display the viscera in-situ system and respond to the following questions:

- (a) *Draw a large, neat, well labelled diagram, indicating ten organs observed in your dissection.*
- (b) *Classify specimen Y to the Class level.*
- (c) *Which organ observed in specimen Y is responsible for blood sugar regulation in the human body?*
- (d) *Identify the organ(s) responsible for protein digestion in specimen Y.*
- (e) *What three observable features were used to classify specimen Y to its particular class?*

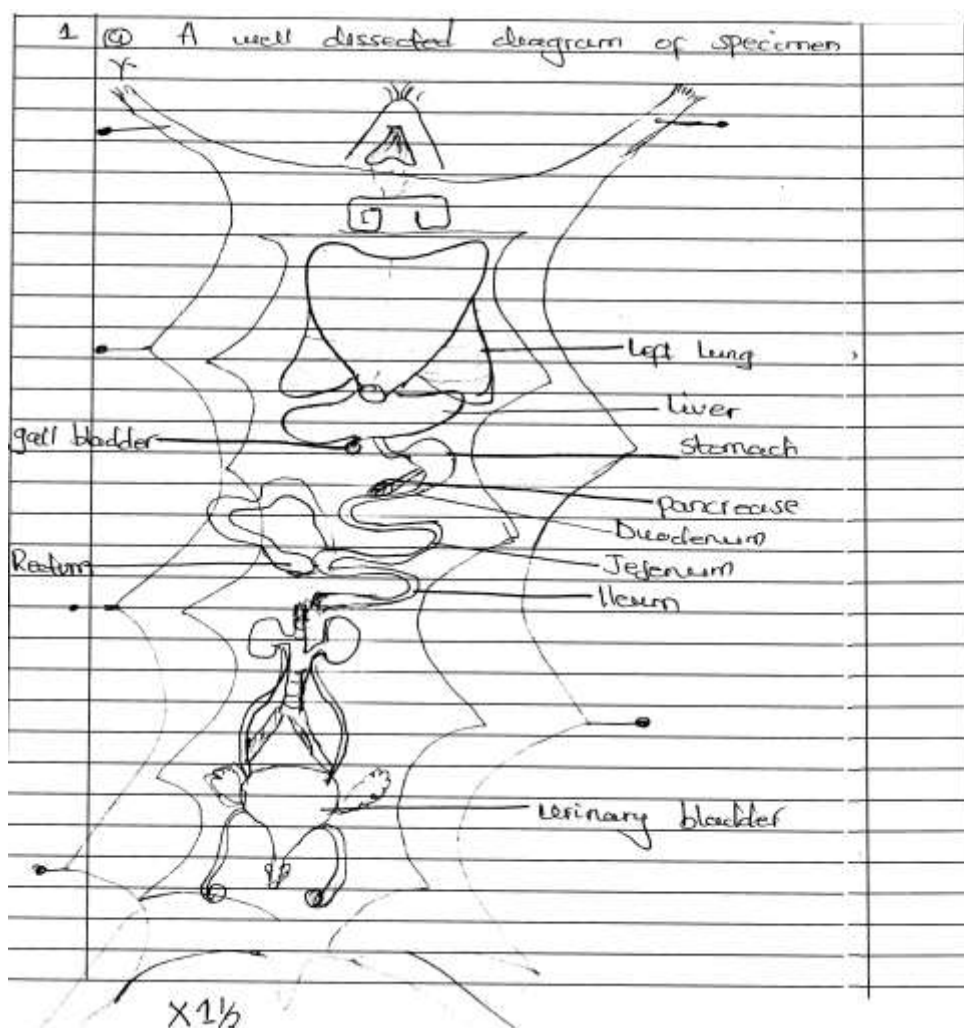
In part (a), the candidates drew a large, neat and well-labeled diagram of specimen Y. they also included captions and magnification, signifying that they understood the rules of presenting biological drawings. The candidates correctly labelled the following parts: *xiphoid cartilage, stomach, spleen, small intestine, caecum, fat tissue, bladder, colon, light and left lateral lobe of the liver and pancreas* which can be observed in situ. Most candidates correctly labeled from five to ten parts of the system, indicating their good skills in identifying parts of specimen Y (Rat).

In part (b), the candidates correctly classified specimen Y (Rat) to the class level. They identified the Kingdom *Animalia*, followed by Phylum *Chordata*, then Class *Mammalia*. These candidates understood that classification is hierarchical, starting from the highest rank to the lowest. Moreover, in part (c), the candidates correctly identified the pancreas as the responsible organ for blood sugar regulation. These candidates understood that the insulin hormone, which regulates blood sugar, is produced by cells

that are located in the pancreas. Such responses indicate that the candidates had adequate knowledge of the tested concept.

In part (d), the candidates correctly identified the organs responsible for digestion of protein, which are *stomach* and *first part of the intestine*. The candidates understood that the enzymes responsible for digesting protein are present in both the stomach and the small intestine. Such responses indicate that the candidate had adequate knowledge of the human digestive system.

Besides, in part (e), the candidates correctly provided three observable features that were used to place specimen Y to its particular class (mammalia). They wrote distinctive characteristics of the class such as *presence of nipples for mammary gland, external ear (pinna) and body covered with hairs*. Such responses indicate that the candidates were knowledgeable about the distinctive features of class mammalia. Extract 18.1 is a sample of the correct responses to Question 1 in paper 2B.



(b)	Classification of Specimen Y	
	Kingdom Animalia	
	Phylum Chordata	
	Class Mammalia	
(c)	The organ which is observed in Specimen Y which is responsible for blood sugar is <u>PANCREAS</u>	
(d)	The organs which are responsible for digestion of proteins are: (i) Stomach (ii) Ileum	
(e)	The three observable features which are used to classify Specimen Y into its particular class are: (i) It has reproductive system (ii) It has feathers (iii) has <del>spinal cord</del> four legs	

**Extract 18.1:** A sample of the correct responses to Question 1 in paper 2B

In Extract 18.1, the candidate correctly drew and labelled the parts that can be observed when the rat is displayed in-situ. He/she answered correctly parts (b), (c) and (d) of the question. However, in part (e), the candidate wrote the general features of mammals instead of the distinctive features of class mammalia. Thus, they could not score full marks.

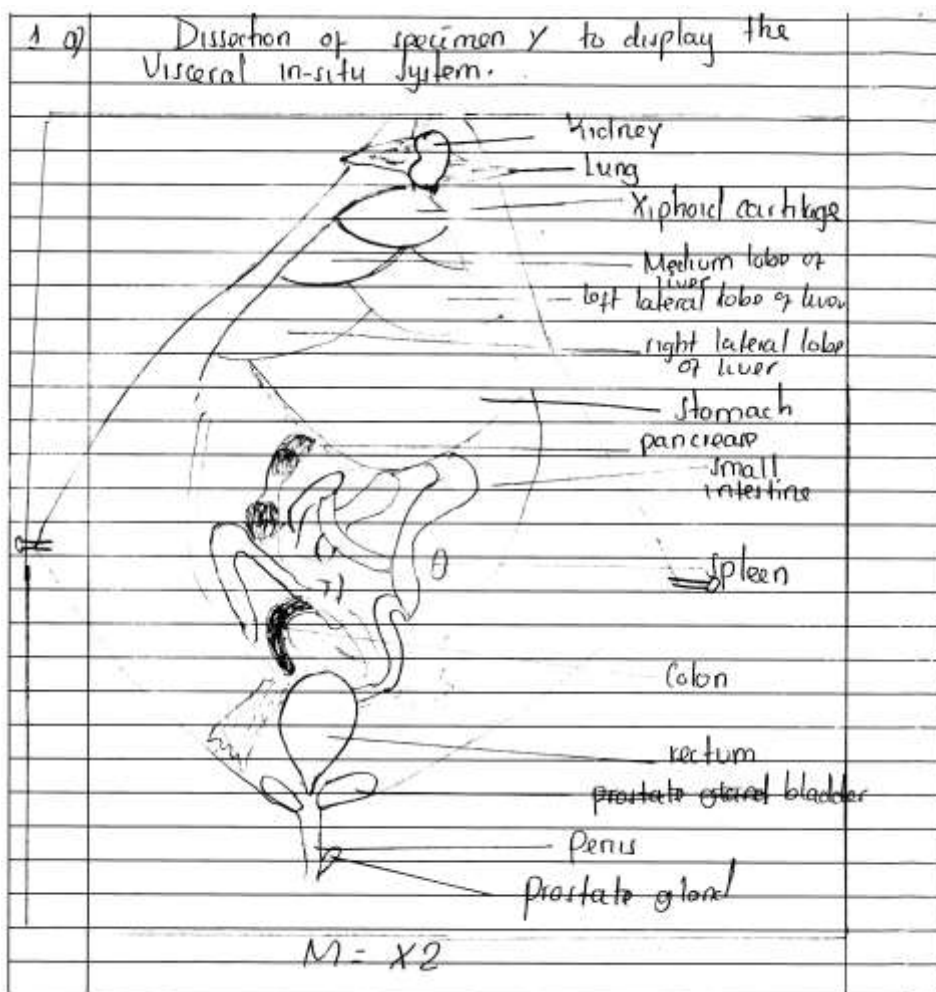
Nevertheless, the candidates who scored 0 - 7.5 marks failed to provide correct responses to some parts of the question. For example, in part (a), the candidates failed to draw neat dissected diagrams of a rat. They also provided labels of organs that were not part of viscera in-situ. The candidates labelled *kidneys*, *blood vesicles* and *heart*. Other candidates labelled the external parts of the rat like *tail*, *leg* and *eye*. Some identified correct parts but interchanged them, while others labelled less than 3 parts of the displayed diagram. Thus, they obtained low marks.

In part (b), most of them correctly classified specimen Y (rat) to the class level. Few candidates who responded incorrectly to this part either named only the kingdom or the Kingdom and Phylum to which specimen Y belongs. Others interchanged the name of the taxa. For example, one candidate wrote: *Kingdom Mammalia*. Others wrote only one correct taxa such as *Kingdom Animalia*, *Phylum Orthoptera* and *Class Chordata*. Such responses show that the candidates had inadequate knowledge of classifying living organisms, specifically the rat.

In part (c), the candidates incorrectly named the organ responsible for blood sugar regulation. Most of them named *kidney* instead of *pancreas*. Only a few named the *liver* and *bladder*. Such responses indicate that the candidates had inadequate knowledge of blood sugar regulation and the function of the different internal parts of the organism.

In part (d), some candidates in this category correctly wrote one part while others incorrectly identified the organ(s) responsible for protein digestion. Others failed to identify the organ. For example, one candidate wrote *liver* and *colon* instead of stomach and the small intestine. Other candidates wrote: *caecum*. Such responses suggest that these candidates had insufficient knowledge of the tested concepts.

In part (e), they incorrectly stated the observable features used to classify specimen Y to its class instead of distinctive features. Some of these candidates wrote: *Rat has four legs, nails on its legs and tail*. Other candidates wrote: *Rat has white colour, two pairs of walking legs and has eyes for sight*. These responses show that the candidates had inadequate knowledge of the distinctive features of class mammalia. Extract 18.2 is an example of the incorrect responses.

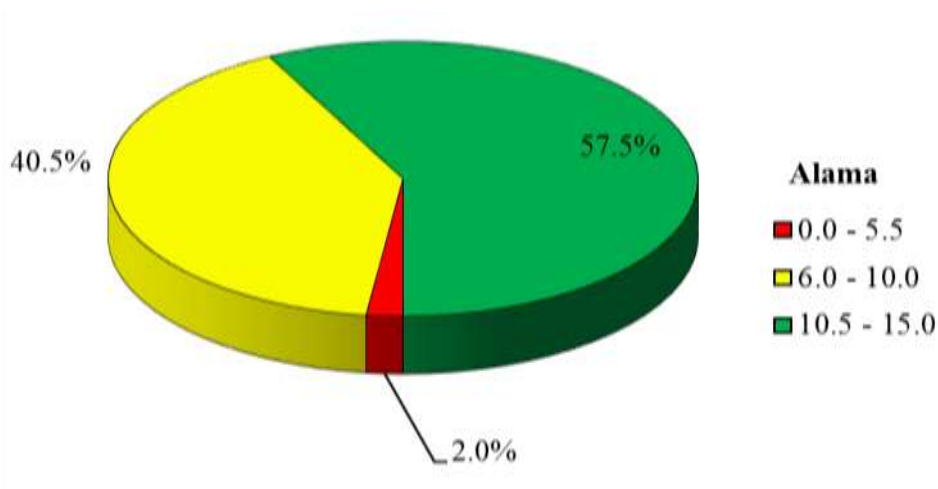


**Extract 18.2** A sample of the incorrect responses to Question 1(a) paper 2B

In Extract 18.2, the candidate dissected specimen Y but incorrectly labeled some parts that were not observable in viscera-in-situ. He/she mislocated the kidney; it is not above the stomach. He/she also labelled the urinary bladder as rectum.

### 3.2 Question 2: Biochemistry

In this question, the candidates were required to conduct a food test by abiding to the laboratory rules and procedures and then answer the question that followed. The question was attempted by all 645 (100%) candidates. Data show that the general performance on this question was good because 632 (98.0%) candidates scored from 6 to 15 marks. Figure 18 shows the performance of candidates on Question 2 in both paper 2A and 2B.



**Figure 18:** *Candidates' performance on Question 2 in paper 2A and 2B*

Data shows that 371 candidates (57.5%) scored from 10.5 to 15 marks, 261 candidates (40.5%) scored from 6 to 10 and 13 (2.0%) candidates scored from 0 to 5.5 marks.

### 3.2.1 733/2A Biology 2A

Question Two in this paper required the candidates to extract food solution from raw food stuff labelled as specimen B (Ginger). The candidates were to label the prepared food solution as solution B and answer the following questions:

- State the procedures to be followed in preparing solution B from specimen B.*
- Design an experiment to find out the classes of carbohydrates contained in solution B. Tabulate your results as shown in the following table.*

<i>Test For</i>	<i>Procedure</i>	<i>Observation</i>	<i>Inference</i>

- State the role of food substance(s) identified in solution B in your body.*
- What is the role of HCl in testing for carbohydrates?*

Analysis shows that the candidates who scored from 6 to 15 marks managed to provide correct responses to almost all parts of the question,

indicating that they had adequate knowledge of the topic and good laboratory skills.

For example, in part (a), most of the candidates correctly stated the procedures for the preparation of solution from ginger (specimen B) such as *peeling of specimen B to remove its outer cover, chopping the peeled specimen into pieces by using a sharp scalpel or knife, grinding the pieces using motor and pestle, transferring the ground food stuff into a clean beaker, adding water and steering the suspension, filtering the suspension to obtain a clear solution for biochemical tests*. Such responses show that the candidates had adequate knowledge about preparation of food sample solution from raw food stuff.

In part (b), the candidates correctly identified the classes of carbohydrates contained in solution B by outlining the correct procedures in each class. They used a specific quantity of food sample solutions and reagents for each class. Consequently, they scored high marks. For example, one candidate presented his/her answer as follows:

<b>Test For</b>	<b>Procedure</b>	<b>Observation</b>	<b>Inference</b>
<i>Starch</i>	<i>To 2 cm<sup>3</sup> of the food sample solution B in the test tube two (2) drops of Iodine solution was added and the content was gently shaken.</i>	<i>The food sample solution B in the test tube turned into Blue/Black coloration.</i>	<i>Starch present</i>
<i>Reducing sugar</i>	<i>To 2 cm<sup>3</sup> of food sample solution B in the test tube, equal amount (2cm<sup>3</sup>) of Benedict's Solution was added and the content was gently boiled.</i>	<i>The food sample solution B in the test tube retained the blue coloration of the reagent.</i>	<i>Reducing sugar absent</i>
<i>Non-reducing sugar</i>	<i>To 2 cm<sup>3</sup> of food sample solution B in the test tube, 2cm<sup>3</sup> of dil. HCl was added and the content was gently boiled then cooled. After cooling 2cm<sup>3</sup> of dilute NaOH was added followed by equal amount (2cm<sup>3</sup>) of Benedict's Solution and the content was boiled again.</i>	<i>The food sample solution B in the test tube turned into a series of color from blue, green, yellow, orange to brick red precipitates.</i>	<i>Non-reducing sugar present.</i>

This candidate correctly identified and explained the procedures for testing starch, reducing sugars and non-reducing sugars; consequently, he/she outlined good performance on this question.

In part (c), the candidates correctly stated the role of food substance(s) identified in solution B in the body. Most of them gave correct responses as *both starch and reducing sugar are sources of energy in our body*. Such responses show that they had adequate knowledge of the functions of different types food in the human body.

In part (d), most of them correctly gave the role of HCl in testing for carbohydrates as *used for breaking down bonds of complex sugars*. Specifically, one candidate wrote *HCl hydrolyses non-reducing sugar to reducing sugar so that it can be tested using Benedict's solution*. Another candidate wrote *most of the disaccharides and polysaccharides have long chain with glycosidic bonds, HCl is used to break those bonds so that they become monosaccharides*. Such responses suggest that they understood the demands of the questions, and they had adequate knowledge of the procedures for testing carbohydrates. Extract 19.1 is a sample of the correct responses to this question.

2	(a) i) peel the specimen B (ginger) with knife or scarpel to remove outer layer
	ii) put it in mortar and then grind it by using mortar and pestle
	iii) After grinding with mortar and pestle pour into the the beaker
	iv) In the ground specimen B in the beaker pour some of distilled water
	v) Finally stir it with stirring rod to make the solution and filter it with funnel into another beaker or measuring cylinder ready for biochemical test.

**Extract 19.1:** A sample of the correct responses to Question 2 (a) of paper 2A

In Extract 19.1, the candidate correctly explained the procedures for the preparation of food sample solution using ginger.

In contrast, 13 candidates (2.0%) scored from 0 to 5.5 marks. These candidates incorrectly responded to most parts of the question. For example, in part (a), some of them wrote two to three correct procedures while others skipped some procedures. Other candidates also mixed the procedures, hence scoring low marks. Other candidates listed the apparatuses and equipment required to prepare the solution. For example, one candidate wrote: *clean motor and pestle, knife and scapel, beakers, test tubes and water* instead of explaining the procedures for its preparation. Such responses suggest that the candidates were partially knowledgeable about the preparation of food sample solution from given raw food stuffs.

Similarly, in part (b), most candidates wrote the correct procedures for testing starch but wrote incorrect procedures for testing non-reducing and reducing sugars. For example, one candidate wrote: *2cm<sup>3</sup> of solution B was put in a dry and clean test tube, then 2cm<sup>3</sup> of HCl was added, then 2cm<sup>3</sup> of NaOH was added followed by 2cm<sup>3</sup> of Benedict's Solution and then boiled.* This candidate did not realize that, after the addition of 2cm<sup>3</sup> of HCl to the food sample solution, the contents were to be boiled and cooled before addition of 2cm<sup>3</sup> of dil. NaOH. Thus, he/she obtained incorrect observations and drew the wrong inferences.

Likewise, in part (c), some of the candidates incorrectly explained the role of the food identified in solution B (Carbohydrates). For example, some candidates wrote the roles of protein instead of starch and reducing sugar as *is used to repair the body cells and growth*. Other candidates explained the role of vitamins as *it is used to protect the body against disease*. Such responses indicate that the candidates had inadequate knowledge about the roles of biochemical molecules, specifically the classes of carbohydrates.

Moreover, in part (d), most of the candidates incorrectly explained the role of HCl. For example, one candidate wrote: *the role of HCl in the stomach is to provide acidic medium for the reaction to take place*. Another candidate wrote: *HCl acts as a catalyst to increase the speed of reaction..* These candidates failed to recognize that HCl is used to facilitate the break down of complex sugars. Such responses show that the candidates had

inadequate knowledge about the role of HCl in food test experiments, specifically non-reducing sugars. Extract 19.2 is a sample of the incorrect responses to Question 2 in paper 2A.

a) The procedures you wish are following to prepare a solution B from specimen B.			
i) I take the specimen B from the glass watch to the rolling and breaking into small particles by using pounding until it become small bits.			
ii) I add water into the particles.			
iii) The sample specimen B becoming a solution.			
B) To find the classes of carbohydrate contained in solution B.			
Test for	procedure	observation	inference.
Starch	2cm <sup>3</sup> of sample solution B was put into test tube equal amount of iodine solution were added the sample shake well.	The mixture was change in colour dark blue	starch present.

**Extract 19.2:** A sample of the incorrect responses to Question 2 in paper 2A

In Extract 19.2, the candidate incorrectly wrote the steps for the preparation of solution from raw food stuff. For example, he/she wrote the first step as grinding the specimen, instead of peeling it. Also, he/she incorrectly specified the quantity of iodine solution as equal instead of 2 to 3 drops in the procedure for testing starch.

### 3.2.2 733/2B Biology 2B

Question Two in this paper required the candidates to use provided solutions  $R_1$  and  $R_2$ , carry out biochemical test, and then answer the following questions:

- (a) *Using the reagents provided, carry out experiments to identify food substance(s) contained in solutions  $R_1$  and  $R_2$ . Tabulate your report, as shown in the following table:*

<b><i>Test For</i></b>	<b><i>Procedure</i></b>	<b><i>Observation</i></b>	<b><i>Inference</i></b>

- (b) *Name the end product of each food substance(s) identified from solutions  $R_1$  and  $R_2$  after digestion.*

Analysis shows that the candidates who scored from 6 to 15 marks in paper 2B gave correct responses to most parts of the question. This indicates that the candidates had adequate knowledge of the topic and skills tested.

In part (a), they correctly identified the food substance (s) contained in solutions  $R_1$  and  $R_2$  by tabulating their results as required by the question. They explained the correct procedures for identifying each food substance. They also used a specific quantity of food sample solutions and reagents in each type of food. Consequently, they obtained the correct observations and drew the correct inferences. According to the marking guide, the correct answer was as follows:

<b>Test For</b>	<b>Procedure</b>	<b>Observation</b>	<b>Inference</b>
<i>Starch</i>	<i>To 2cm<sup>3</sup> of solutions <math>R_1</math> and <math>R_2</math> in the separate dry and clean test tubes, two (2) drops of Iodine solution was added and the content was gently shaken.</i>	<i>The food sample solution <math>R_1</math> in the test tube retained the colour of the reagent.</i>	<i>Starch absent in solution <math>R_1</math>.</i>
		<i>The food sample solution <math>R_2</math> in the test tube turned into Blue/Black coloration.</i>	<i>Starch present in solution <math>R_2</math>.</i>
<i>Reducing sugar</i>	<i>To 2 cm<sup>3</sup> of solutions <math>R_1</math> and <math>R_2</math> in the separate dry and clean test tubes, equal amount (2cm<sup>3</sup>) of Benedict's</i>	<i>The food sample solution <math>R_1</math> in the test tube turned into a series of color from blue, green, yellow, orange to brick red</i>	<i>Reducing sugar present in solution <math>R_1</math>.</i>

Test For	Procedure	Observation	Inference
	<i>Solution was added and the content was gently boiled.</i>	<i>precipitates.</i>	
		<i>The food sample solution R<sub>2</sub> in the test tube retained the colour of the reagent</i>	<i>Reducing sugar absent in solution R<sub>2</sub>.</i>
<i>Non-reducing sugar</i>	<i>To 2cm<sup>3</sup> of solutions R<sub>1</sub> and R<sub>2</sub> in the separate dry and clean test tubes, 2cm<sup>3</sup> of HCl was added and the content was gently boiled then cooled. After cooling 2cm<sup>3</sup> of dilute NaOH was added followed by equal amount (2cm<sup>3</sup>) of Benedict's Solution and the content was boiled again.</i>	<i>The food sample solution R<sub>2</sub> in the test tube retained the colour of the reagent</i>	<i>Non-reducing sugar absent in solution R<sub>2</sub>.</i>
<i>Protein</i>	<i>To 2cm<sup>3</sup> of solutions R<sub>1</sub> and R<sub>2</sub> in separate dry and clean test tubes, equal amount of dilute NaOH was added followed by drop by drop of 1% CuSO<sub>4</sub> solution while shaking.</i>	<i>The food sample solution R<sub>1</sub> in the test tube turned into purple/violet coloration.</i>	<i>Protein present in solution R<sub>1</sub>.</i>
		<i>The food sample solution R<sub>2</sub> in the test tube retained with the blue colour of the reagent</i>	<i>Protein absent in solution R<sub>2</sub>.</i>
<i>Lipid</i>	<i>To 2cm<sup>3</sup> of solutions R<sub>1</sub> and R<sub>2</sub> in separate dry and clean test tubes, 2 drops of Sudan III solution was added and the content was vigorously shaken and left to settle for sometimes.</i>	<i>The food sample solution R<sub>1</sub> in the test tube formed a red ring at the top surface of the solution.</i>	<i>Lipid present in solution R<sub>1</sub>.</i>
		<i>The food sample solution R<sub>2</sub> in the test tube acquired red coloration of the reagent.</i>	<i>Lipid absent in solution R<sub>2</sub>.</i>

Most of the candidates wrote the correct procedures, observations and inference, suggesting that they had adequate knowledge of how to write a good experiment report. Consequently, they scored high marks.

Likewise, in part (b), the candidates correctly identified the end product of each food substance identified from solutions  $R_1$  and  $R_2$  after digestion. Most candidates wrote the end product of lipids, protein and carbohydrates as *fatty acids and glycerol*, *amino acids and glucose*, respectively. Such responses indicate that the candidates had sufficient knowledge of the digestion process in human beings. Thus, they correctly identified the food and their end products. Extract 20.1 presents a sample of the correct responses to Question 2 (a) in paper 2B.

Non reducing sugar	2 cm <sup>3</sup> of solutions $R_1$ and $R_2$ was added in different clean test tube, then 1 cm <sup>3</sup> of Dil. HCl was added to each test tube followed by boiling and then cooled. Then 1 cm <sup>3</sup> of NaOH solution was added to each test tube followed by 2 cm <sup>3</sup> of benedict solution then heated gently.	In solution $R_1$ the colour changes from blue to black after heating then after cooling turned to colourless colouration. In solution $R_2$ the colour change from blue to green, yellow, orange and finally to brick red.	In sample solution $R_1$ non reducing sugar was absent. In sample solution $R_2$ non reducing sugar was present.
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**Extract 20.1:** A sample of the correct responses to part of Question 2 (a) in paper 2B

In Extract 20.1, the candidate correctly outlined the procedures for testing non-reducing sugars. He/she wrote the correct observation and inference.

In contrast, the candidates who scored from 0 to 5.5 marks scored on only some parts of the question. They provided incorrect responses, especially on the procedures, observations and inferences. For example, in part (a), a candidate wrote the procedures for testing protein as *To 2 cm<sup>3</sup> of solutions  $R_1$  and  $R_2$  in separate dry and clean test tubes, 2 drops of Sudan III solution were added and the content was shaken gently*. This candidate interchanged the procedures for testing protein with lipids. Another candidate wrote: *in testing for protein  $\text{CuSO}_4$  was added in food sample solution followed by NaOH*. These candidates did not understand that NaOH was supposed to be added first because  $\text{CuSO}_4$  works efficiently under basic medium. Another candidate wrote: *in testing for non reducing sugars HCl was added followed by NaOH and Benedict solution*. These candidates did not

understand that boiling is important for activating the break down of complex sugars. Besides, some candidates did not indicate specific quantities of the reagents used in each procedure. Such responses suggest that the candidates had partial knowledge and skills in testing the respective food substances.

Similarly, in part (b), some candidates gave incorrect responses. They wrote the elements which make carbohydrates such as *Hydrogen, Oxygen, and carbon*, instead of the end products of the food substances. Others wrote the functions of starch as *to provide energy* instead of its end product after digestion. These candidates did not understand the demands of the question. Specifically, one candidate wrote: *the end product of starch is maltose, protein is peptides*. Other candidates provided correct answers but interchanged them. Such responses indicate that they had inadequate knowledge of the tested concepts. Extract 20.2 shows a sample of the incorrect responses to Question 2 (a) in paper 2B.

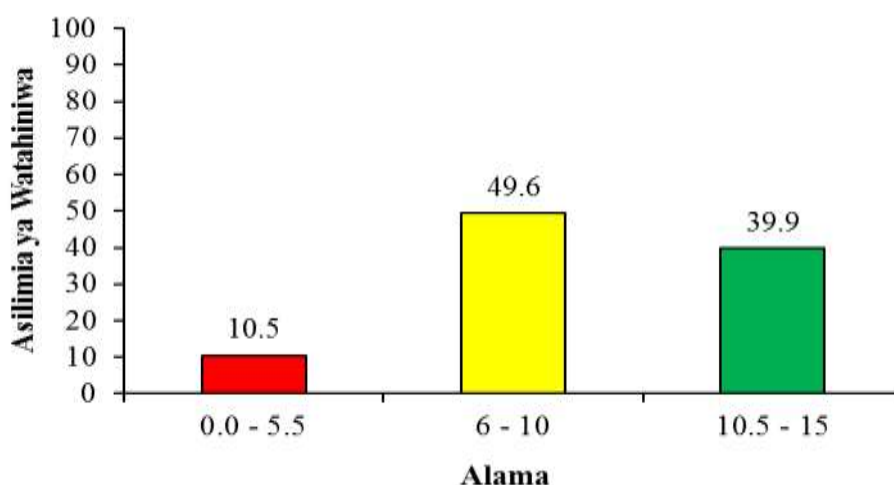
STARCH	2cm <sup>3</sup> of food Sample Solution R <sub>1</sub> where put in a dry test tube followed by 3 drops of iodine solution then shake gently	Blue black colour was observed from the mixture	Starch was present
REDUCING SUGAR	2cm <sup>3</sup> of food Sample Solution R <sub>2</sub> was placed in a test tube followed by Benedict's solution then heat gently	The series of colour change from green, yellow, orange and finally brick red	Reducing sugar was present
NON-REDUCING SUGAR	3cm <sup>3</sup> of food Sample Solution R <sub>3</sub> was placed in a test tube followed by equal amount of dilute hydrochloric acid then warm for one minute and cool then add 10% sodium hydroxide solution then heat again	The series of colour change from green, yellow, orange and finally brick red	Non-reducing sugar was present

**Extract 20.2:** A sample of the incorrect responses to Question 2 in paper 2B.

In Extract 20.2, the candidate correctly outlined the food to be tested. However, he/she did not state the quantity of Benedict solution and dilute HCl in the experiment for testing reducing and non-reducing sugars. The candidate also performed the experiment for solution R<sub>1</sub> only instead of both solutions. Again, the inferences given for starch and non reducing sugar were incorrect with respect to the R<sub>1</sub> solution.

### 3.3 Question 3: Classification of Living Things

In this question, the candidates were given specimen(s) for identification and then answer the question that followed. The question was attempted by 645 (100%) candidates. The general performance on this question was good because 577 (89.5%) candidates scored from 6 to 15 marks. Figure 19 shows the performance of the candidates on Question 2 in both paper 2A and 2B.



**Figure 19:** Candidates' performance on Question 3 in paper 2A and 2B

Data show that, 257 candidates (39.9%) scored from 10.5 to 15 marks. Other 320 candidates (49.6%) scored from 6 to 10; and 68 (10.5%) candidates scored from 0 to 5.5 marks.

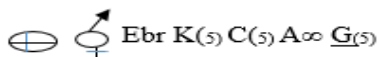
#### 3.3.1 733/2A BIOLOGY 2A

Question Three provided the candidates with specimen M, the (Hibiscus) flower, and then required them to:

- (a) *Carefully examine the specimen and then answer the following questions:*
  - (i) *Identify the specimen by its common name.*

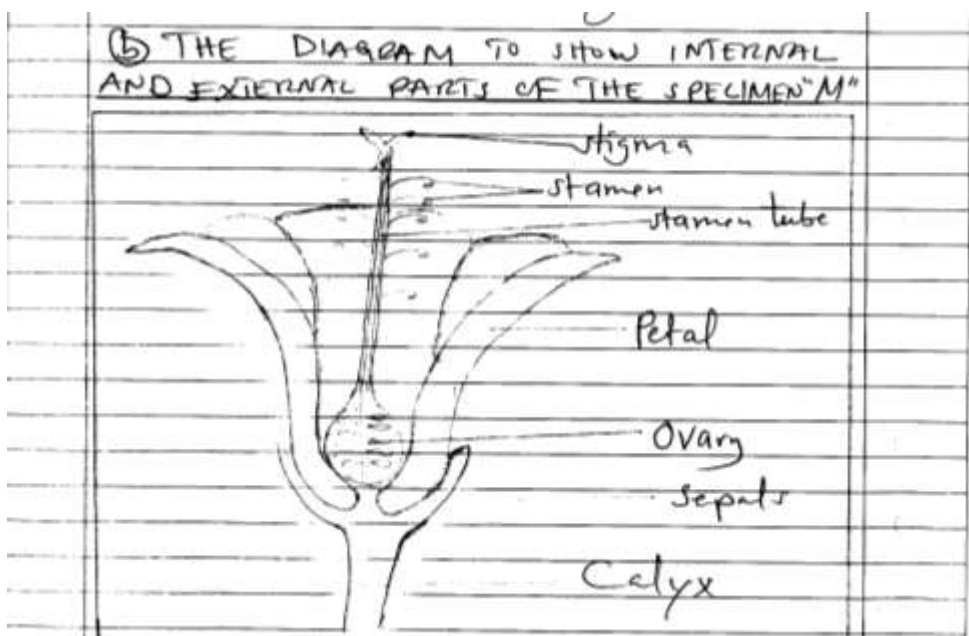
- (ii) *Classify the specimen to the Class level.*
  - (iii) *Draw a well labelled floral diagram for the specimen.*
  - (iv) *Write a floral formula for the floral diagram you have drawn in 3 (a) (iii).*
- (b) *By using a scalpel, cut the longitudinal section of specimen M. Take one part with the cut surface facing upwards. Observe it using a hand lens and then, draw a well labelled diagram showing internal and external parts of the specimen M.*

Analysis indicates that the candidates who scored from 6 to 15 marks gave correct responses to almost all parts of the question, suggesting that they had adequate knowledge of the concepts and skills tested. Consequently, they obtained good scores. In part (a) (i), these candidates correctly identified specimen M as the *Hibiscus flower*. In (a) (ii), they correctly classified specimen M to its class level by starting from the highest rank: *Kingdom Plantae, Division Angiospermophyta* and *Class Dicotyledonae*. In part (a) (iii), they correctly drew the specimen (*Hibiscus flower*), indicating parts such as *bracts, calyx, corolla, androecium* and *gynoecium*. In (a) (iv), they correctly wrote the floral formula for the floral diagram drawn in (a) (iii) as:



Such responses indicate that the candidate had adequate knowledge of identifying flowers, their parts and classification.

Similarly, in part (b), most candidates correctly cut the longitudinal section of specimen M, showing its internal and external parts. The candidates labelled the parts as *stigma, style, petal, staminal tube, ovary, sepal, thalamus*, and *ovules*. Such responses suggest that they had sufficient knowledge about different parts of flowers. Extract 21.1 is a sample of the correct responses to Question 3(b).



**Extract 21.1:** A sample of the correct responses to Question 3  
(b) of paper 2A

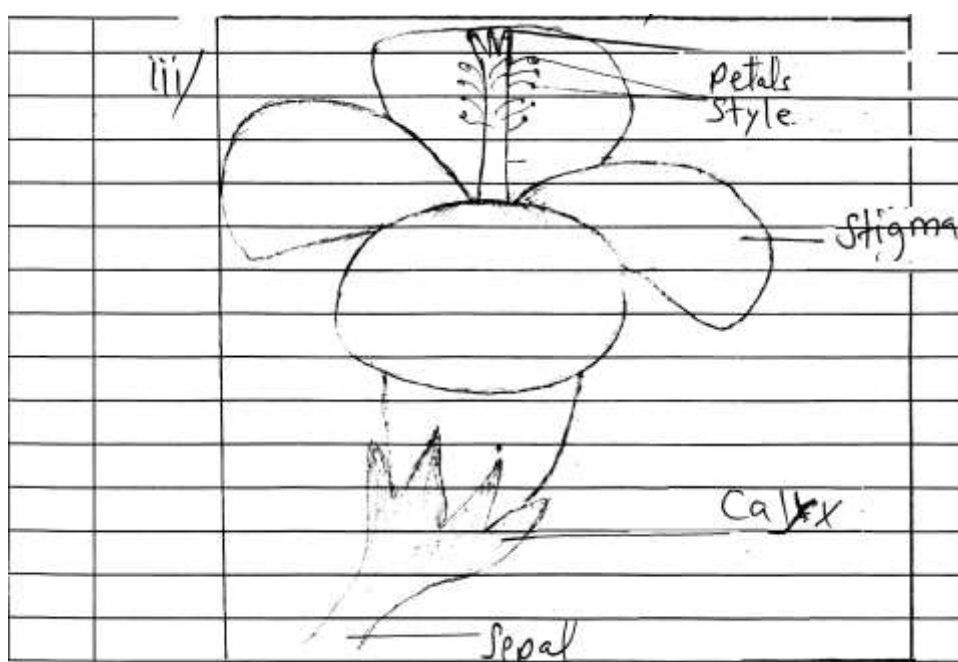
In Extract 21.1, the candidate correctly cut the specimen longitudinally, drew and labelled the external and internal parts of the Hibiscus flower.

However, those who scored from 0 to 5.5 marks wrote correct responses to one or two parts of the question. For example, in part (a) (i), some candidates wrote general names of specimen M as *flower* instead of the Hibiscus flower. Likewise, in part (a) (ii), most candidates correctly wrote one taxon of the specimen instead of classifying up to the class level. Others classified specimen M to the class level, but they wrote class *monocotyledonae* instead of *dicotyledonae*. Other candidates identified the correct taxa but misspelt it. For example, one candidate wrote: *Kingdom plantae*, *Division gymnospermae* and *Class of flowering plants*. These responses suggest that the candidates had inadequate knowledge of classifying organisms, specifically plants.

In part (a) (iii), some candidates drew correct diagrams but incorrectly labeled them; hence they obtained low marks. Other candidates drew the longitudinal section of the flower, which is contrary to demand of the question. In part (a) (iv), the candidates also wrote incorrect floral formula. The inferiority of ovary and fusion of calyx, corolla, androecium and gynoecium were not indicated in their formula. For example, most of the

candidates wrote:  $G_5 K_6 C_5 A_9$ . Specifically, one candidate wrote:  $G_5 K_5 C_5$ . Moreover, another candidate wrote:  $\infty G_5 K_{(5)} C_5$ . Such responses suggest that the candidates had inadequate knowledge of identifying different parts of the flower and presenting their floral formula.

In part (b), the candidates also incorrectly drew a diagram of a longitudinal section of specimen M, showing its internal and external parts. Most of the candidates drew diagrams which showed that the pistil tube was peeled and the filaments were radiating from the ovary in a scattered pattern. Others drew the whole flower and not a section, as demanded by the question. Others drew a flower and included parts that were not features of the specimen given. Such responses indicate that the candidates had inadequate knowledge of flowers and their parts. Extract 21.2 is a sample of the incorrect responses to Question 3 (b) in paper 2A.



**Extract 21.2:** A sample of the incorrect responses to Question 3 (b) in paper 2A

In Extract 21.2, the candidate did not cut the specimen longitudinally. Therefore, he/she drew and labelled the parts of a Hibiscus flower incorrectly. The candidate interchanged different labels. For example, the candidate directed the line to petals but labelled stigma.

### 3.3.2 733/2B BIOLOGY 2B

In this question, the candidates were provided with specimens  $G_1$  (Bread mould),  $G_2$  (Crab) and  $G_3$  (Butterfly). They were required to observe the specimens carefully and then answer the following questions:

- (a) *Identify each of the specimens  $G_1$ ,  $G_2$  and  $G_3$  by its common name.*
- (b) *Classify each of the specimens  $G_1$ ,  $G_2$  and  $G_3$  to the class level.*
- (c) *Draw a well labelled diagram of specimen  $G_1$ .*
- (d) *Explain three advantages of specimen  $G_3$  to the ecosystem.*
- (e) *State three observable features which were used to classify specimen  $G_2$  to its respective class.*

Analysis shows that the candidates who scored from 6 to 15 marks on Question 3 in paper 2B wrote correct responses in most parts of the question. In part (a), these candidates correctly identified the specimens as  $G_1$  Bread mould,  $G_2$  Crab and  $G_3$  Butterfly. In part (b), the candidates correctly classified specimen  $G_1$ ,  $G_2$  and  $G_3$  into the class level as the Kingdom in which  $G_1$  belongs is *Fungi*, division *Zygomycota* and class *Zygomycetes*.  $G_2$  belongs to Kingdom *Animalia* Phylum *Athropoda* and Class *Crustacea* and  $G_3$  belongs to Kingdom *Animalia*, Phylum *Arthropoda* and Class *Insect*. Such responses show that the candidate had adequate knowledge about the classification of living organisms. In part (c), the candidates also correctly drew specimen  $G_1$  (Bread mould) and labelled parts like *Hypha*, *sporangia* and *sporangiphore*. This suggests that the candidates had sufficient knowledge of the structure of bread mould.

In part (d), they responded correctly by explaining the advantages of specimen  $G_3$ . They wrote *it helps in pollination, used in scientific studies, some are used in attracting tourists*. Other candidates wrote: *can be source of food to other organisms, when they die they decompose to add soil fertility, can be used for pollination*. Such responses show that the candidates had adequate knowledge of the economic importance of insects.

Similarly, in part (e) most of the candidates wrote distinctive features of specimen  $G_2$  - (Crab). For example, one of the candidates wrote: *have five pair of walking legs, two pair of antennae, staled eyes*. Another candidate

wrote: *their legs are divided into two parts (forked legs) and the body is covered with hard part (carapace)*. Such responses show that the candidates correctly observed and clearly interpreted the characteristics of arthropods, specifically of Class Crustacea. Extract 22.1 shows a sample of the correct responses to Question 3 (a) and (b) in paper 2B.

Q3:	(a) To identify each of the specimens G <sub>1</sub> , G <sub>2</sub> , G <sub>3</sub> by its common name.
	Answer
	G <sub>1</sub> → Bread Mould
	G <sub>2</sub> → Crab
	G <sub>3</sub> → Butterfly
(b)	To classify each of the specimens G <sub>1</sub> , G <sub>2</sub> and G <sub>3</sub> to the class level.
	1. Classifying Specimen G <sub>1</sub>
	Kingdom <u>Fungi</u>
	Phylum <u>Zygomycota</u>
	Class <u>Zygomycetes (Mucormycetozoa)</u>
	G <sub>2</sub> Classification
	Kingdom <u>Animalia</u>
	Phylum <u>Arthropoda</u>
	Class <u>Crustacea</u>
	G <sub>3</sub> Classification
	Kingdom <u>Animalia</u>
	Phylum <u>Arthropoda</u>
	Class <u>Insecta</u>

**Extract 22.1:** A sample of the correct responses to Question 3 (a) and (b) in paper 2B

Extract 22.1 shows a sample response to parts (a) and (b) of the question. The candidate correctly identified the specimen and classified the specimen up to the class level.

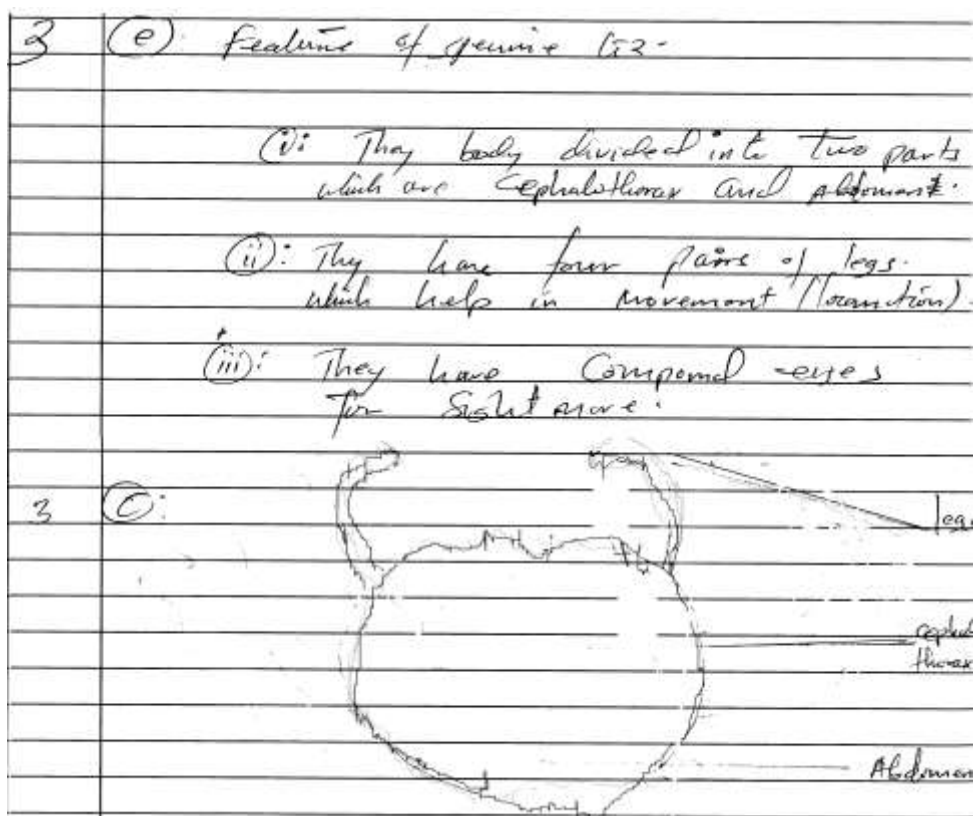
However, the candidates who scored from 0 to 5.5 marks provided incorrect responses to all or some parts of the question. For instance, in part (a), some of them incorrectly identified the specimens such as G<sub>2</sub> *Spider* instead of Crab and *Bee* instead of butterfly. In part (b) some of the candidates either wrote incorrect taxa or misspelt them. For example, one candidate wrote *the Class of specimen G<sub>3</sub> as insecter* instead of insecta.

Another candidate wrote the Phylum of G<sub>3</sub> as *Arthropods*, instead of Arthropoda. Moreover, one candidate wrote the class of G<sub>3</sub> as *Basidiomycota*, instead of Zygomycetes. Other candidates wrote the specific taxa without classifying hierarchically from kingdom to class. Hence, they obtained low marks. Such responses suggest that the candidate had inadequate knowledge about classifying living organisms.

In part (c), some of the candidates drew diagrams of yeast, while others drew mushrooms. Yet, other candidates correctly drew diagrams of specimen G<sub>1</sub>. However, they did not label all parts correctly. Hence they obtained low marks. For example, some of the candidates labelled *fibrous roots* instead of *hyphae*. Others labelled *leaves* instead of sporangia. This suggests that the candidates had insufficient knowledge about the structure of organisms in Kingdom Fungi, specifically those of bread mould.

In part (d), some of the candidates correctly gave one to two advantages, while others incorrectly explained three advantages of specimen G<sub>3</sub> to the ecosystem. Some of the candidates failed to understand the demands of the question. Accordingly, they outlined adaptive features of the specimen instead of its advantages. For example, one candidate wrote: *specimen G<sub>3</sub> (Butterfly) have wings covered with poisonous powder for self-protection against predators, have legs for movement and have antennae for sensing*. Others mixed advantages and disadvantages. Such responses suggest that the candidates did not understand the demands of the question.

In part (e), the candidates also incorrectly stated three distinctive features which were used to classify specimen G<sub>2</sub> to its respective class. Most of the candidates gave features of an insect as *have wings, have three (3) pairs of legs* instead of features of class Crustacea. Other candidates wrote the general feature of Phylum Arthropoda. Such responses suggest that the candidates had inadequate knowledge of the classes of Phylum Arthropoda, specifically of Class Crustacea. Extract 22.2 is a sample of the incorrect responses to Question 3 in paper 2B.



**Extract 22.2:** A sample of the incorrect responses to Question 3 (c) and (e) in paper 2B

In Extract 22.2, the candidate wrote that they have four legs, instead of five legs in part (ii). The candidate also drew a diagram of Crab G<sub>2</sub> instead of specimen G<sub>1</sub> (Bread mould). Moreover, the candidate wrote one incorrect point in (i), leading to scoring low marks.

#### 4.0 ANALYSIS OF CANDIDATES' PERFORMANCE ON EACH TOPIC

Eleven topics were included in the Biology examination for the DSEE 2021. Analysis shows that the candidates demonstrated good performance on *Basic Biology Laboratory Skills* (98.0%), *Analysis of the O-Level Biology Curriculum Materials* (93.4%), *Respiration* (87.9.0%) *Clasification of Living Things* (81.4%) and *Biochemistry* (80.4%). The candidates attained average performance on the topics of *Genetics* (67.1%), *Ecology* (66.8%), *Assesment in Biology* (63.4%), *Fundamentals of Teaching and Learning Biology* (63.1%) and *Planing and Preparation for Teaching* (59.2%). Moreover, they demonstrated weak performance on the topic of *Body Health and Immunity* (38.2%). A summary of the candidates' performance in Biology DSEE 2021 per topic is attached as Appendix I and II for theory and practical papers, respectively.

Considering the candidates' perfomance in the years 2020 and 2021 topic wise, analysis shows that the performance has improved from weak to good on the topic of *Basic Biology Labaratory skills* and from weak to average on the topic of *Genetics*. Furthermore, performance has improved from average to good on the topics of *Analysis of O level Biology Curriculum Materials*, *Respiration*, *Classification of Living Things* and *Biochemistry*. This shows that some efforts have been directed towards improving teaching and learning the Biology subject.

Furthermore, the topics *Assessment in Biology* has maintained average performance. However, performance on *Ecology*, *Fundamental of Teaching and Learning Biology* and *Planing and Prepartion for Teaching* has dropped from good in 2020 to average in 2021, while that on the topic of *Body Health and Immunity* has dropped from good to weak. The comparison of the perfomance topic-wise in years 2020/2021 is summarized in Appendix III.

#### 5.0 CONCLUSION AND RECOMMENDATIONS

##### 5.1 CONCLUSION

The analysis on the Biology DSEE examination 2021 shows that the performance of the candidates in the Biology examination for DSEE 2021 was good since 638 candidates (99.69%) passed the examination. The questions on which thay had good performance

were Question One on the practical paper (98.8%), question 14 (98.8%), Question Two practical paper (98.0%), question 5 (97.4%), question 12 (93.7%), Question Three practical paper (89.6%), question 7 (89.1%), question 1 (88.0%), question 6 (87.9%), question 11 (79.9%), question 2 (74.6%) and question 10 (70.2%). Questions on which they had average performance were question 4 (66.8%), question 13 (64.0%), question 8 (63.4%) and question 3 (49.6%). Analysis indicates that the candidates' adequate knowledge of the assessed topics, ability to understand the requirements of the questions, good presentation skills, accompanied by their mastery of English and good laboratory skills led to good performance.

In contrast, the questions on which they had weak performance were question 9 (38.2%), question 15 (29.3%) and question 16 (28.8%). Factors which made some of the candidates fail to score high marks include inadequate knowledge about the respective topics, failure to understand the requirement of the question, misconception of facts and lack of skills in addressing questions.

A further analysis shows that the performance of candidates in the practical paper was higher when compared to the theory paper. The candidates had good performances on the three questions in paper 2A and 2B; Their performance ranged from 89.5% to 98.8%. This shows that candidates perform better when they learn by doing. Therefore, teaching through practice can help in improving the performance of the topics which had weak performance.

## **5.2 RECOMMENDATIONS**

Generally, the candidates' performance was good. Based on the observations made through the candidates' item response analysis, the following recommendations are put forward to reinforce the performance in future:

- (a) To address the problem resulting from candidates' inability to identify the demands of the question, prospective candidates should be given exercises, assignments, tests and examinations, accompanied with immediate feedback, to enable them build confidence, skills and experience needed for meeting the demands of the questions.

- (b) Student teachers should be engaged in activities such as debates, reading and speaking English in the naturalistic environment. This will improve their proficiency in the English language.
- (c) Tutors and student teachers are advised to read Candidates' Item Response Analysis reports (CIRA) for them to know the factors that affect candidates' responses and take appropriate measures in teaching and learning.
- (d) Tutors should use charts and pictures showing symptoms of different STIs /STDs when teaching *Body Health and Immunity*. Tutors should also invite guest speakers such as health personnel, to provide information to student-teachers on health-related problems. During the session, students should be given enough time for discussion on issues related to the topic under discussion. Furthermore, prospective teachers should be encouraged to seek information on diseases and other contemporary issues through media like Radio, Television and news papers.
- (e) Tutors should engage student teachers in using ICT during preparation for teaching. This will help them recognize the challenges of integrating ICT in teaching and learning and methods of overcoming them.
- (f) Tutors should engage student teachers in the preparation of teaching and learning resources such as collection of specimens for them to cooperate with the nearby society to value community engagement in the teaching and learning process.

## Appendix I

### A Summary of the Candidates' Performance per Topic in Paper 1 DSEE 2021

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	87.9	93.4	Good
		14	98.8		
2.	Respiration	1	87.9	87.9	Good
3.	Classification of Living Things	2	74.6	77.3	Good
		11	79.9		
4.	Biochemistry	3	49.6	71.7	Good
		12	93.7		
5.	Genetics	10	70.2	67.1	Average
		13	64.1		
6.	Ecology	4	66.8	66.8	Average
7.	Assessment in Biology	8	63.5	63.5	Average
8.	Fundamentals of Teaching and Learning Biology	5	97.4	63.1	Average
		16	28.8		
9.	Planning and Preparation for Teaching	15	29.3	59.2	Average
		7	89.1		
10.	Body Health and Immunity	9	38.2	38.2	Weak

## Appendix II

### A Summary of the Candidates' Performance per Topic in Paper 2 DSEE 2021

SN.	Topic	Question number	Percentage of the Candidates with Scores of 40% or Above	Remarks
1.	Basic Biology Laboratory Skills	1	98.8	Good
2.	Biochemistry	2	98.0	Good
3.	Classification of Living Things	3	89.5	Good

### Appendix III

#### Comparison of the Candidates' Performance Topic-wise in DSEE 2020 and 2021 Biology Examinations

S/N.	Topic	DSEE 2020			DSEE 2021		
		Number of Question	Average Percentage of Candidates With Scores of 40% or Above	Remarks	Number of Question	Average (%) of Candidates With Scores of 40% or Above	Remarks
1.	Basic Biology Laboratory Skills	1	29.7	Weak	1	98.8	Good
3.	Analysis of O-Level Biology Curriculum Materials	1	68.7	Average	2	93.4	Good
3.	Respiration	2	58.2	Average	1	87.9	Good
4.	Classification of Living Things	2	61.3	Average	3	81.3	Good
5.	Biochemistry	2	57.8	Average	3	80.4	Good
6.	Genetics	1	30.9	Weak	2	67.1	Average
7.	Ecology	1	73.4	Good	1	66.8	Average
8.	Assessment in Biology	2	61.4	Average	1	63.4	Average
9.	Fundamentals of Teaching and Learning Biology	2	85.4	Good	2	63.1	Average
10.	Planning and Preparation for Teaching	1	97.6	Good	2	59.2	Average
11.	Body Health and Immunity	1	80.8	Good	1	38.2	Weak

