



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) 2022

BIOLOGY



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733 BIOLOGY

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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 Biology for the Diploma in Secondary Education Examination (DSEE), 2022. The report aims to provide feedback to educational administrators, college principals, tutors, student teachers and other stakeholders in education 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 in responding to the examination questions.

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

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

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



Athumani S Amasi
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report analyses the candidates' performance on the 2022 Biology Diploma in Secondary Education Examination. The examination questions intended to measure the competences stipulated in the 2009 Biology academic and pedagogy syllabus for diploma in secondary education.

A total of 1,581 candidates registered for the Biology DSEE examination; of whom, 1,570 sat for it. Among them, 1,539 (99.42%) passed, and 9 (0.58%) failed. This implies that the general performance on this subject was good. The candidates' performance in grades is as follows: A – 0, B – 136, C – 956 and D – 447. The performance in 2022 has decreased by 0.27 per cent compared to the performance in 2021, where 638 (99.69%) candidates passed.

This report analyses the candidates' responses to 733/1 Biology 1 (Theory Paper) and 733/2 Biology 2 (Actual Practical Paper) questions. The theory paper consisted of fourteen questions, divided into Sections A and B. Section A had 10 short-answer questions, each carrying four (4) marks, making a total of 40 marks. Section B had four (4) essay questions, carrying a total of 15 marks. The candidates were required to attempt all questions in each section. The practical paper had three (3) alternative papers: 733/2 Biology 2A, 2B and 2C. Each 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 as good, average or weak if the percentage of the candidates who scored 40 per cent 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 are used in charts to indicate good, average and weak performance levels, respectively.

The following section analyses the candidates' performance on each question by describing the questions' demands 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 included as texts or extracts to illustrate the

correct or incorrect responses. In addition, charts and graphs are used to illustrate the candidates' performance on each question.

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

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

This section analyses the candidates' performance on each question in Sections A and B.

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: Body Health and Immunity

The question required the candidates to give four differences between active and passive body immunity. The question was attempted by all 1,570 candidates. The general performance on this question was average because 804 (51.2%) candidates scored from 2 to 4 marks. Figure 1 summarizes the candidates' performance on this question.

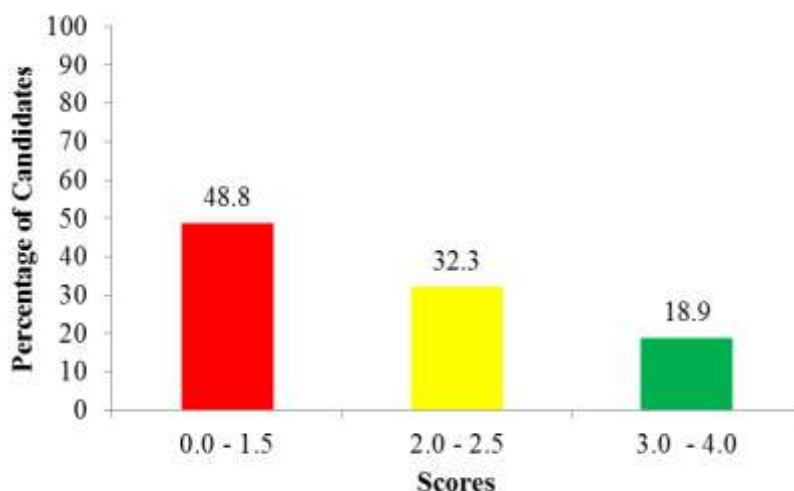


Figure 1: *Candidates' Performance on Question 1*

The data shows that 297 (18.9%) candidates scored from 3 to 4 marks and 507 (32.3%) candidates scored from 2 to 2.5 marks. The candidates who scored from 0 to 1.5 marks were 766 (48.8%); out of whom, 235 (15.0%) scored 0 out of the 4 allocated marks to this question.

Analysis shows that 804 (51.2%) candidates scored from 2 to 4 marks. Most of those who scored average marks (32.3%) provided 2 differences between active and passive body immunity; thus they could not score full marks. Further analysis reveals that, out of the 297 candidates who scored 3 to 4 marks, only 59 (3.8%) correctly gave four differences. Hence they scored all the 4 marks. The candidates' adequate knowledge of the concepts asked enabled them to give correct responses such as: *active immunity does not involve side effect while passive immunity the side effect can take place during reaction, active immunity stays for a long time while passive immunity is short lived, active immunity an individual is born with while passive immunity individual gets through vaccination and active immunity antibodies takes time to form while passive immunity provides immediate relief*. Extract 1.1 is a sample of the correct responses to the question.

1		
	Active immunity	Passive Immunity
	(i) Acquired naturally	(i) Acquired through immunization or vaccination.
	(ii) It is long time immunity.	(ii) It is short time immunity.
	(iii) Produced after the pathogen attacks the body.	(iii) Introduced to the body of individual when pathogen attacks the body.
	(iv) Have no effect in human body.	(iv) Can cause some effects when injected.

Extract 1.1: Candidate's correct responses to question 1.

In Extract 1.1, the candidate correctly gave four differences between active and passive body immunity demonstrating good performance.

Conversely, 48.8 per cent of the candidates scored from 0 to 1.5 marks. These candidates gave incorrect differences or got only one difference correctly. Some of the candidates 235 (15.0%) who scored zero mark

regarded active immunity as a communicable disease and passive immunity as a non communicable disease. They wrote *active immunity can be passed on from one person to another while passive immunity can not be passed on from one person to another, active immunity is caused by pathogens while passive immunity can be caused by environment or food deficiency*. Other incorrect responses to the question were *Active immunity leads to strong people's health while in passive immunity the person becomes weak, Active immunity is obtained automatically while passive immunity is obtained through balance diet, With active immunity the disease does not affect the body easily while with passive immunity the disease get high chance to affect the body, Active immunity occurs in children while passive immunity occurs in elders, active immunity is obtained using ATP while passive immunity is obtained without using ATP, Active immunity is the one which stands itself while passive immunity needs medicines*. These responses signify that the candidates lacked adequate knowledge about the Body Health and Immunity topic, specifically the types of immunity. Extract 1.2 is a sample of the incorrect responses from one of the candidates.

1	Active immunity	Passive immunity
i> Long & short term process	i> Long term process	
ii> Have no immunological process	ii> Have immunological process	
iii> It is a slow process	iii> It is active process	
iv> Have a side effect in the body	iv> Have not a side effect in the body	

Extract 1.2: Candidate's incorrect responses to question 1.

In Extract 1.2, the candidate confused the differences as he/she wrote passive immunity in the place of active body immunity.

2.1.2 Question 2: Ecology

The question required the candidates to briefly explain two challenges which made Tanzanian government ban the use of plastic bags in the society. The question was attempted by all 1,570 candidates. The performance of candidates on this question was good since 1,473 (93.8%) scored from 2 to 4 marks. Figure 2 summarizes the candidates' performance on this question.

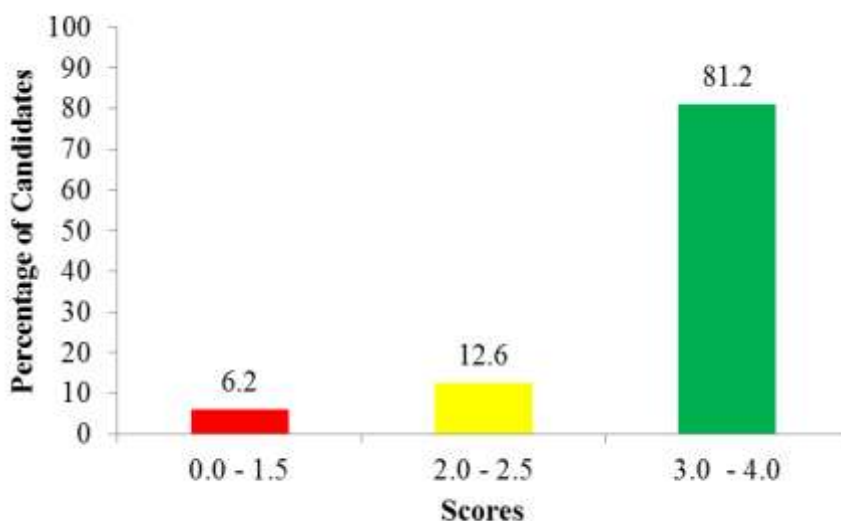


Figure 2: *Candidates' Performance on Question 2*

Data shows that 1,275 (81.2%) candidates scored from 3 to 4 marks, and 198 (12.6%) scored from 2 to 2.5. The candidates who scored from 0 to 1.5 marks were 97 (6.2%); out of whom, 95 (6.1%) scored 0 out of the 4 allocated marks.

The general performance shows that 1,473 (93.8%) candidates passed; they scored from 2 to 4 marks. The candidates who scored from 2 to 2.5 marks gave 1 correct response, losing some marks. Further analysis reveals that, out of the 1,275 candidates who scored 3 to 4 marks, 1,272 gave two correct points; therefore they scored all the 4 marks. The candidates' good performance was attributed to their adequate knowledge of the tested concepts. Therefore, they correctly explained the challenges which made the Tanzanian government ban the use of plastic bags in the society. Examples of the correct responses by the candidates are *plastic bags are hard and can not be decomposed by decomposers therefore they accumulate in the environment for more than ten years. Plastic bags*

accumulates in the water bodies like lakes and rivers and cause death to aquatic organisms due to lack of oxygen. Such responses show that the candidates were adequate knowledgable about the tested concept. Extract 2.1 is a sample of the correct responses by one of the candidates.

2	i) Plastic bags cannot be decomposed by decomposers (they are non-biodegradable) hence they remain only existing for long period of time.
	ii) plastic bags cannot be recycled or be re-used in the society hence government seen no need of producing them more as they lead to environmental pollution.

Extract 2.1: Candidate's correct responses to question 2.

In Extract 2.1, the candidate correctly explained two challenges, which made the Tanzanian government, ban the use of plastic bags in the society.

In contrast, a few candidates (97 (6.2%)) scored from 0 to 1.5 marks. Out of whom, 6.1 per cent scored 0 mark; they neither understood the question's demands nor possessed adequate knowledge of the tested concept. Thus they provided incorrect responses. Some of the candidates wrote the uses of plastic bags, instead of the challenges. They wrote *it helps for carrying items from the markets and can be used to plant flowers*. Other candidates wrote about what the government should do to those who would continue using plastic bags such as *punishment for those who reject to obey and if found using plastic bag should be fined*. Other responses were *It needs high capital, lack of education, plastic bags are very expensive, there is no raw materials for its production, poverty, lack of education, poor government support, low level of science and technology that result into having plastic bags only rather than other bags*. These responses indicate that the candidates did not understand the demands of the question as Extract 2.2 shows.

2	
	is insufficient of bags for carrying various things
	if decrease of national income since the taxes collected from those carrying selling of that bag has been removed.

Extract 2.2: Candidate's incorrect responses to question 2.

In Extract 2.2, the candidate wrote the effects which the government will get due to banning plastic bags instead of the challenges, which made the government ban plastic bags in the society.

2.1.3 Question 3: Classification of Living Things

The question required the candidates to use four points to justify the statement that “Despite the large size of a mango tree, it is grouped in the same class with a bean plant.” The question was attempted by all 1,570 candidates. The candidates' performance on this question was average since 909 (57.9%) scored from 2 to 4 marks. Figure 3 shows the candidates' performance on this question.

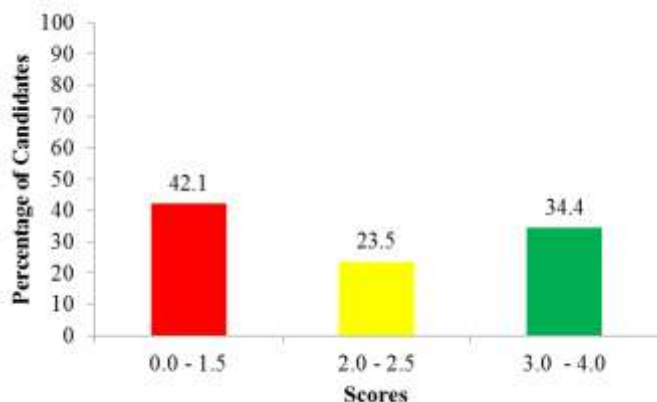


Figure 3: Candidates' Performance on Question 3

Based on data, 540 (34.4%) scored from 3 to 4 marks, and 369 (23.5%) candidates scored from 2 to 2.5. The candidates who scored from 0 to 1.5 marks were 661 (42.1%); out of whom 365 (23.3%) scored 0 out of the 4 allocated marks.

Further analysis shows that the candidates who scored from 2 to 2.5 marks correctly gave 1 to 2 points, losing some marks. A total of 540 (34.4%) candidates scored from 3 to 4 marks. These identified correctly the demands of the question and gave all or most of the explanation needed. They were aware that a mango tree is grouped in the same class with a bean plant because *it has leaves with net like venation, stem with vascular bundles which appear in a ring form, seeds with two cotyledons, roots with a tap root which develops lateral roots, vascular cambium which gives secondary growth, floral parts with four/five or in a multiple of them and they have leaves with different upper and lower surfaces*. Further analysis reveals that, out of the 540 candidates who scored 3 to 4 marks, only 187 (11.9%) gave four points, scoring all the 4 marks. Extract 3.1 is a sample of the correct responses to the question.

i)	Both of them have net venation. Their leaves are broaden with net venation.
ii)	Both of them bear seeds with two cotyledons the bean and mango seeds have two cotyledons
iii)	Both of them have tap root system.
iv)	Their vascular bundles are arranged in a ring form in the stem.

Extract 3.1: Candidate's correct responses to question 3.

In Extract 3.1, the candidate correctly justified the statement that, despite the large size of the mango tree, it is grouped in the same class with the bean plant.

The candidates who scored low marks (0 to 1.5) gave not more than one correct point. The candidates who scored 0 did not understand the demand of the question; thus they gave incorrect responses. For example, some of them wrote the features of the class Monocotyledonae instead of Dicotyledonae, such as *Seeds have one cotyledons, the leaves have parallel veins, they have fibrous roots and the flower parts are in three or multiples of three*. Other candidates wrote the advantages of plants as *they produce*

food for animals; they are source of fuel, provide home for birds, they provide timber and some are used to produce paper. Yet, other candidates wrote the importance of classifying organisms, as it ease communication among biologists, it allow predictions, it helps in identification of organisms and it helps to understand the characteristics of living organisms, instead of the features of the class to which the mango tree and bean plant belong. Extract 3.2 is a sample of the incorrect responses from one of the candidates.

3	
	i/ Because mango tree and bean plant # have the etc chloroplast
	ii/ Because mango tree and bean plant have the can store their food in form of starch.
	iii/ Because mango tree and bean plant have the a vascular bundles.
	iv/ Because mango tree and bean plant have the same end product in photo- synthesis process which are food and water.

Extract 3.2: Candidate's incorrect responses to question 3.

In Extract 3.2, the candidate wrote the general features of plants such as *mango plant and bean plant store food in form of starch* instead of the features of the Class Dicotyledonae into which the mango tree and bean plant belong.

2.1.4 Question 4: Respiration

The candidates were given the statement, “Although the process of respiration is concerned with energy production in the body, it requires some energy especially in its initial sub-stage. They were required to give two reasons as to why energy is required and to identify two sub-stages that follow after the sub-stage in which energy is required in parts (a) and (b), respectively.

The question was attempted by all 1,570 candidates. The candidates' performance on this question was weak because 1,371 (87.3%) candidates scored from 0 to 1.5 marks. Figure 4 summarizes the candidates' performance on this question.

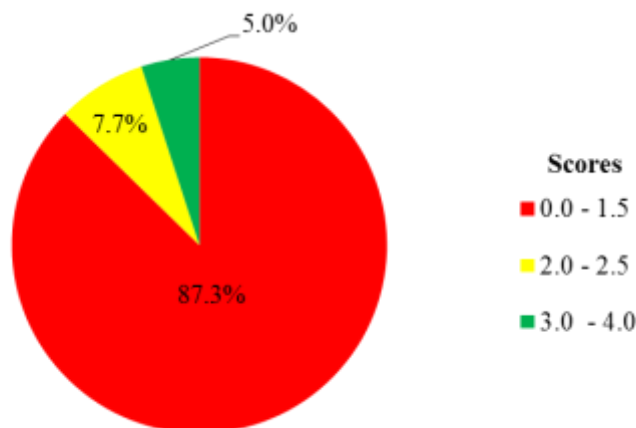


Figure 4: *Candidates' performance on Question 4*

Data indicates that 1,371 (87.3%) candidates scored from 0 to 1.5 marks. Out of whom, 968 (61.7%) scored 0 on this question. A total of 121 (7.7%) candidates scored from 2 to 2.5 marks, whereas 78 (5.0%) scored from 3 to 4 marks.

Further analysis indicates that the weak candidates' performance was attributed to their inadequate knowledge of the tested concepts. These candidates provided incorrect responses to almost all parts of the question. For example, in part (a), most of them wrote the types of energy which are used in respiration as *ATP* (Adenosine triphosphate) na *ADP* (Adenosine diphosphate) instead of giving the reasons for energy requirement. Others wrote the importance of energy as *provides energy which is needed for various activities in the body* instead of giving the reasons why energy is required in its initial stages. Other candidates also skipped the question. These candidates failed to realize that *cellular respiration requires energy because initially the glucose which is the respiratory substrate is insufficiently reactive. So energy is required for activation of glucose to glucose 6-phosphate through a process called phosphorylation. Also energy is required for activation of fructose 6-phosphate to fructose 1,6-biphospate.*

In part (b), some candidates wrote the types of respiration as *aerobic stage* and *anaerobic stage*. Others wrote the stages of photosynthesis as *dark stage* and *light stage*, while others wrote raw materials of krebs cycle as *pyruvic acid* and *acetyl Co enzyme A*. Furthermore, some candidates wrote the *products* found after glucose break down in different stages as *fructose-6-phosphate*, *glucose-6-phosphate*, *oxaloacetate*, *pyruvate* and *phosphoglycerate*. This indicates that these candidates lacked sufficient knowledge about the concepts tested. Extract 4.1 is a sample of the incorrect responses by one of the candidates.

4	
	(a) Energy Required In the Body
	So as to Ensure the growth of
	Cell.
	Also
	(ii) And Help to Make Active
	Transport.
	(iii) Also need In Nerve Impulse.
	(b). (i) Glycolysis
	(ii) Krebs cycle.

Extract 4.1: Candidate's incorrect responses to question 4.

In Extract 4.1, the candidate wrote the general uses of energy in the human body instead of giving reasons as to why energy is required in the initial sub-stage of respiration in part (a). Also, he/she wrote the main stages of respiration instead of sub-stages that follow after the sub- stage in which energy is required.

However, the analysis indicates that 121 (7.7%) candidates scored from 2 to 2.5 marks. These candidates provided correct response to either part (a) or (b) but not both. Therefore, they could not score full marks. Further analysis revealed that 78 (5.0%) candidates who scored from 3 to 4 marks gave correct responses to parts (a) and (b) but did not get full marks because they gave one out of two reasons in part (a). Extract 4.2 is a sample of the correct response by one of the candidates.

4	
	(a) Energy is required in the initial sub-stage of respiration in order to activate the reactive state of the sugar in the process, the stage called phosphorylation of the sugar.
	(b) The next two sub-stages that follow are:-
	-i- Lysis of the sugar.
	-ii- Oxidation by dehydrogenation of the sugar.

Extract 4.2: Candidate's correct response to question 4.

In Extract 4.2, the candidate correctly wrote the reason in part (a). He/she identified the two sub-stages that follow the sub-stage in which energy is required in part (b). However he/she gave one reason in part (a) instead of two, failing to score full marks.

2.1.5 Question 5: Biochemistry

This question required the candidates to give two ways in which the induced fit model of enzyme action explains the effects of non-competitive inhibitor better than the lock and key model.

The question was attempted by all 1,570 candidates. The candidates' performance on this question was weak because 1,336 (85.1%) scored from 0 to 1.5 marks. Figure 5 summarizes the performance on this question.

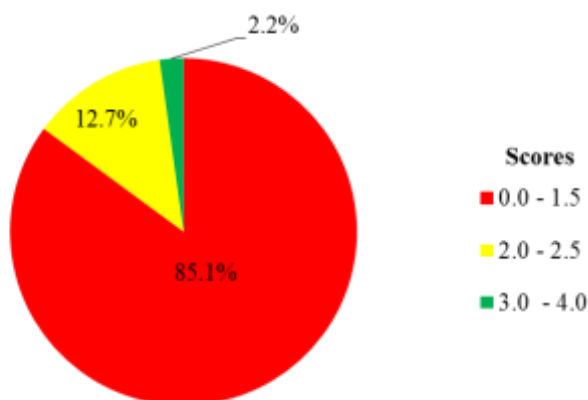
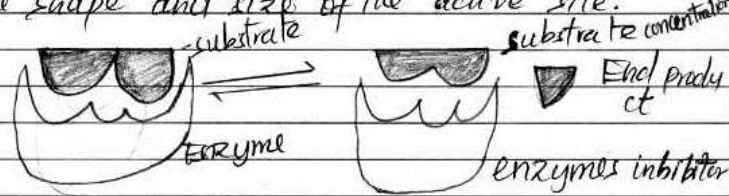


Figure 5: Candidates' Performance on Question 5

Data shows that 1,336 (85.1%) candidates scored from 0 to 1.5 marks; out of whom, 1,173 (74.7%) scored 0. A total of 200 (12.7%) scored from 2 to 2.5 marks and 34 (2.2 %) scored from 3 to 4 marks.

Analysis shows that the candidates who obtained low marks (0 – 1.5) had either little or no knowledge of the modes/mechanisms for enzyme action. Thus they provided incorrect responses. For example, one candidate wrote the differences between competitive inhibition and non-competitive inhibition as *competitive inhibition involves a molecule, other than the substrate, binding to the enzyme's active site while non-competitive inhibition involves a molecule binding to a site other than the active site (an allosteric site)*. Others listed the factors that affect the rate of enzyme activity such as *enzyme concentration, concentration of substrate, effect of temperature, pH and effect of product concentration*. Other candidates wrote the properties of enzymes such as *enzymes are specific in nature, enzymes are inactive at low temperature and can be denatured at high temperature, enzymes have specific pH to act upon and enzymes are reversible in their action*. Yet, some candidates skipped the question. These candidates did not understand that the induced fit model of enzyme action assumes that *the substrate plays a role to determine the final shape of the enzyme thus the enzymes are partially flexible and mould to fit the substrate molecules. According to induced fit model active site could be modified as the enzymes interacts with the substrate, the amino acids which make up the active site are moulded into a precise shape which enable the enzymes to perform its catalytic function most effectively. Non-competitive inhibitor is a substance that does not resemble substrate therefore neither competes nor attach to the active site of the enzymes. It fixes itself elsewhere on the enzymes molecules in doing so it completely alter the shape of the enzymes molecules in a way that active site cannot accommodate the substrate*. Extract 5 is a sample of the incorrect responses to the question.

5	
(i)	Substrate concentration: This is the chemical substance that the enzymes work best on it.
(ii)	Competition of the active site; This is the site in which the enzyme attached or bind to it
	As the increase in the active site the concentration of the substrate also increase due to the change into the shape and size of the active site.
	

Extract 5: Candidate's incorrect response to question 5.

In Extract 5, the candidate incorrectly explained the effect of substrate on enzyme controlled reaction instead of how induced fit model of enzymes action explain the effects of non-competitive inhibitor better than the lock and key model.

On the other hand, the analysis shows that the candidates who scored from 2 to 2.5 managed to give only one explanation correctly hence they failed to score full marks. Furthermore, analysis shows that the candidates who scored from 3 to 4 marks were aware that unlike key and lock model which explain that the shape of the enzymes' active site is fixed, induced fit model explain that the active site of the enzyme can be moulded/changed by the substrate. In addition, they were aware that non-competitive inhibitors attach to any part of the enzyme apart from the active site and alter/change the shape of the active site, thus making the substrate unable to fit to the active site.

2.1.6 Question 6: Basic Biology Laboratory Skills

This question required the candidates to prepare 1% of Iodine solution and 50% from 95% of alcohol using two points in parts (a) and (b), respectively.

The question was attempted by all 1,570 candidates. The candidates' performance on this question was weak since 1,467 (93.4%) scored from 0 to 1.5 marks. Figure 5 summarizes their performance on this question.

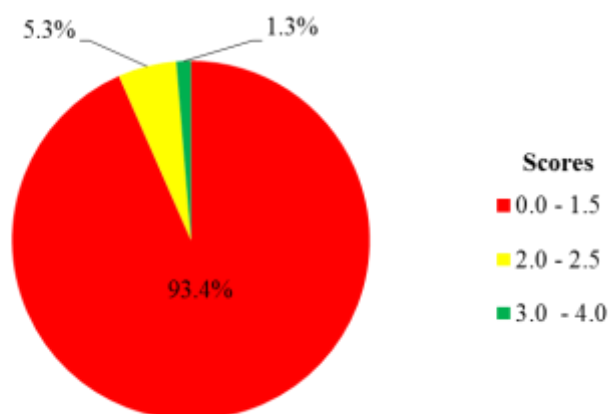


Figure 6: Candidates' Performance on Question 6

Data show that 1,467 (93.4%) candidates scored from 0 to 1.5 marks. Out of whom, 1,388 (88.4%) scored 0 out of the 4 allocated marks; 83 (5.3%) candidates scored from 2 to 2.5 marks; and 20 (1.3%) scored from 3 to 4 marks.

The candidates who scored low marks (from 0 – 1.5) were incompetent in preparing of biochemical solutions. They provided incorrect responses to most parts of this question. Some of them failed to prepare 1% of Iodine solution. For example, in part (a), some of the candidates wrote things to consider in preparing chemicals instead of the procedures for preparing chemicals. They provided responses such as *consider the number of students who will perform the experiment, consider the availability of the chemicals to be prepared, wear lab coats and consider the concentration of the chemical to be prepared*. Others wrote the formula for calculating biochemical solutions, contrary to the questions' demand. For example, in part (a), some of the candidates wrote,

1 % of iodine solution from 1cc of iodine solution = 100 cc
Let the volume to be prepared be y therefore $y = \frac{1cc \times 1000 cc}{100cc}$

y = 10 cc 1L.

Therefore the volume of iodine solution to be prepared is 10 cc in 1 L. Such responses show that the candidates had inadequate knowledge of the tested concept.

Also, in part (b), these candidates failed to prepare 50% from the 95% of alcohol. For example, some of the candidates incorrectly calculated the volume of alcohol and water to be mixed and therefore got an incorrect answer. They failed to realize that, as prospective teachers, they were supposed to know the procedures for preparing the reagents and chemicals. This knowledge is useful for them during preparing and supervising Biology practicals to O'Level students. These candidates were required to give the procedures as follows: In part (a) 1% of iodine: *weigh 1 g of iodine; then, add the 1g of iodine to the solvent to make 100 ml.* Also, to prepare 50% from 95% alcohol, *measure out 50 ml of the 95% alcohol; then, add 45 ml of distilled water to this solution.* Extract 6.1 is a sample of the incorrect responses by one of the candidates.

6	(a) In preparing 1% iodine the following are done: (i) To put 100 ml of water in a reagent bottle (ii) To put 100 ml of iodine and shake well.
	(b) In preparing 50% from 95% of alcohol, the following are done: (i) put 50 ml of water in a reagent bottle (ii) put 45 ml of alcohol and shake well.

Extract 6.1: Candidate's incorrect responses to question 6.

In Extract 6.1, the candidate confused the procedure for preparing alcohol; he/she wrote *50 ml of water and 45 ml of alcohol* instead of mixing 50 ml alcohol and 45 ml of water. The responses given in part (a) are also incorrect.

Despite the weak performance on this question, 103 (6.6%) candidates scored from 2 to 4 marks. The candidates who scored averagely (from 2 to 2.5 marks) correctly gave the procedure in either part (a) or part (b). Therefore they could not score full marks. A further analysis reveals that, out of the 20 (1.3%) candidates who scored 3 to 4 marks, only 8 (0.5%) gave the correct responses to parts (a) and (b). Thus they scored full marks. This indicates that the candidates were knowledgeable about the tested concepts. Extract 6.2 is a sample of the correct responses to the question.

6	
(a)(i)	To measure 1 gram of Iodine crystals through beam balance.
(ii)	To dissolve 1 gram of Iodine crystals to the distilled water of about 100 cm ³ and stirred.
(b) (i)	To Measure 50 cm ³ of alcohol from alcoholic bottle and put in a beaker.
(ii)	To add 45 cm ³ of water to the measured solution.

Extract 6.2: Candidate's correct responses to question 6.

In Extract 6.2, the candidate correctly explained how to prepare 1% of Iodine solution and 50% from 95% of alcohol in parts (a) and (b), respectively.

2.1.7 Question 7: Planning and Preparation for Teaching

The candidates were given the statement that “Second year student teachers were planning for a microteaching activity.” They were required to identify four requirements to prepare before the microteaching activity.

The question was attempted by all 1,570 candidates. Their performance on this question was good since 1,431 (91.1%) candidates scored from 2 to 4 marks. Figure 7 summarizes their performance on this question.

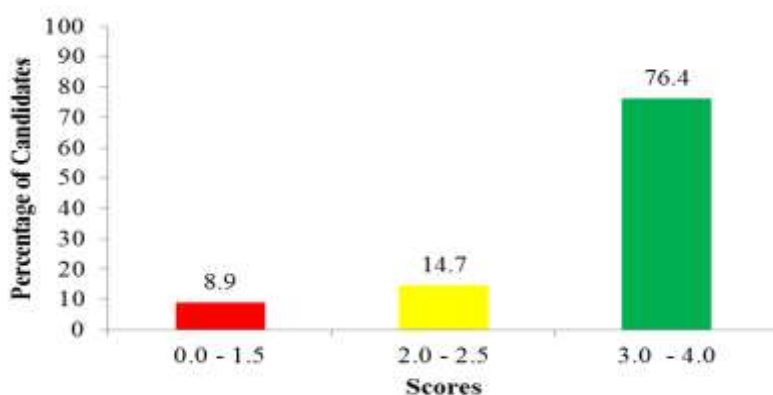


Figure 7: Candidates' Performance on Question 7

The data shows that 1,200 (76.4%) candidates scored from 3 to 4 marks; 231 (14.7%) scored from 2 to 2.5 marks; and 139 (8.9%) scored from 0 to 1.5 marks; out of whom 45 (6.1%) scored 0 out of the 4 allocated marks.

The candidates who scored high marks (from 3 to 4) were knowledgeable about Planning and Preparation for Teaching topic especially microteaching. These candidates provided the correct requirements to prepare before the microteaching activity. However, the candidates who had average performance provided two correct requirements to prepare before the microteaching activity; therefore they scored from 2 to 2.5 marks. Further analysis reveals that out of 1200 (76.4%) candidates who scored 3 to 4 marks, only 382 (24.3%) correctly identified the four requirements. Hence they scored all 4 marks. These candidates were aware that, before planning for microteaching, the following activities should be done: *a familiar topic should be chosen, preparation of a lesson plan, preparation of teaching and learning materials which will assist a student in elaborating the lesson and preparation of teaching and learning activities that will allow learners participation (involvement of learners)*. Specifically, one candidate wrote before preparing a microteaching activity, the requirements are *subject matter should be prepared, teaching and learning materials, teaching and learning activities and the topic to be covered*. Extract 7.1 is a sample of the correct responses to the question.

7	
	Requirements for preparation of microteaching activity.
	i) To prepare the topic to be presented.
	ii) Preparation of lesson plan and lesson notes.
	iii) Preparation of teaching and learning material.
	iv) To prepare teaching and learning activities that involve learners participation.

Extract 7.1: Candidate's correct responses to question 7.

In Extract 7.1, the candidate correctly identified the four requirements to prepare before the microteaching activity.

Contrarily, 139 candidates (8.9%) scored from 0 to 1.5 marks. Some of them correctly identified one requirement, scoring low marks. Of the candidates who scored 0, 6.1 per cent wrote responses that were contrary to the demands of the question. For example, some of them wrote the

requirements for test preparation instead of the microteaching activity. Their responses included the *subject matter to be examined, marking schemes, a room where the students will sit for the test, prepare sitting plan and time to be spent for the tests*. Others wrote requirements that a student should have during normal classroom teaching instead of the microteaching activity such as *ruler for drawing lines, exercise books for notes taking, pen for writing notes and pencil for drawing diagrams*. These incorrect responses reveal that the candidates had inadequate knowledge of the tested microteaching. Extract 7.2 is a sample of the incorrect responses to the question.

7	Requirements for a microteaching activity are:
	i. Availability of school
	ii. Availability of experienced teacher
	iii. Availability of funds (money)
	iv. Availability of security.

Extract 7.2: Candidate's incorrect responses to question 7.

In Extract 7.2, the candidate wrote the general requirements for effective education provision such as the *availability of school* instead of the requirements to prepare before the microteaching activity.

2.1.8 Question 8: Fundamentals of Teaching and Learning Biology

This question required the candidates to briefly explain four ways to be employed in the biology subject to encourage curiosity and creativity during the teaching and learning process.

The question was attempted by all 1,570 candidates. Their performance on this question was good since 1,280 (81.5%) scored from 2 to 4 marks. Figure 8 indicates the candidates' performance on this question.

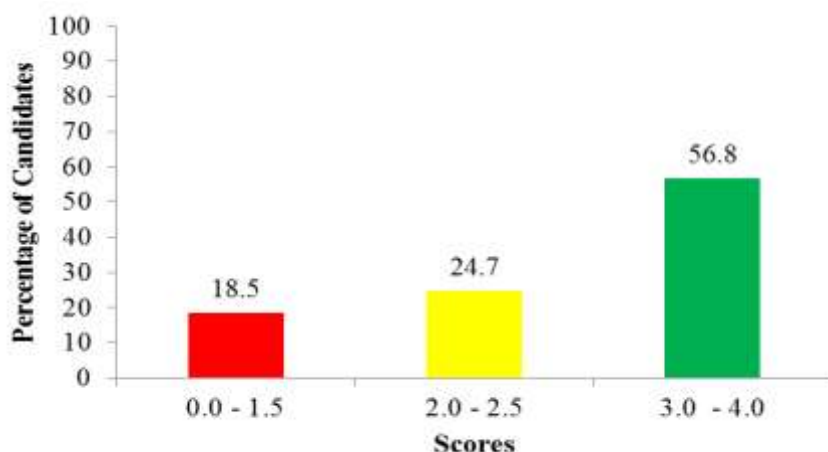


Figure 8: *Candidates' Performance on Question 8*

The candidates' performance reveals that 892 (56.8%) scored from 3 to 4 marks and 388 (24.7%) scored from 2 to 2.5 marks. Those who scored from 0 to 1.5 marks were 290 (18.5%); out of whom 111 (7.1%) scored 0.

Analysis shows that 1,280 (81.5%) candidates scored from 2 to 4 marks. Some of them wrote two instead of four ways. Therefore, they could not score full marks. Further analysis reveals that, out of 892 (56.8%) candidates who scored 3 to 4 marks, 454 (28.9%) explained four ways that can be employed in the Biology subject to encourage curiosity and creativity during teaching and learning. Hence they scored all 4 marks. These candidates were aware that curiosity and creativity during teaching and learning can be enhanced by *encouraging students to raise questions about the material used, using teaching methods, techniques and the content learnt, invent activities that will involve them during project work, encourage them to engage on activities of doing self-guided experiments and emphasize essay writing, encourage students to engage more on the improvisation of teaching and learning materials. Also encourage them to participate in doing min research studies/projects, engaging in creating poems on various themes in biology and inventing activities that will engage them in debates and role play.* Extract 8.1 is a sample of the correct responses to the question.

8	(i) Through improvisation Means one student are involved in making teaching and learning and can help them to become creative
	(ii) Through conducting research, this could help them to think logically and following scientific research during conducting research.
	(iii) Through conducting experiments, for instance biology experiments can help them to become creative and curiosity
	(iv) Through collecting biology specimens, for instance one a teacher announce to his/her student to find ginger, carrot and onion Means that a student could start to search what are the aim of these specimen in case of teaching and learning process.

Extract 8.1: Candidate's correct responses to question 8.

In Extract 8.1, the candidate correctly explained four ways which could be employed in the biology subject to encourage curiosity and creativity during teaching and learning.

In contrast, 290 (18.5%) candidates scored low marks. Some of these wrote only one correct point losing some marks. A total of 111 (7.1%) scored zero. These did not understand the demand of the question. For example, some of them wrote various methods used in teaching and learning Biology such as *demonstration method, lecture method, jig saw method, use of models and real objects and group discussion*. Others wrote *think pair share, using question and answer, teaching from simple to complex, through presentation and student learner centred approach*. Furthermore, others wrote things to emphasize in teaching of the English language, such as *good pronunciation of a word, use of correct vocabulary and practicing speaking English*. In addition, some of them wrote different skills acquired by students during teaching and learning such as *reading skills, listening skills, writing skills and measurement skills*. These suggest that the candidates had inadequate knowledge of the tested concepts. Extract 8.2 is a sample of incorrect responses to the question.

8	
	i). To prepare lesson plan.
	ii). To prepare lesson notes for teaching and learning process for future use.
	iii). Use syllabus to follow the series of the content in the curriculum.
	iv). To prepare scheme of work because it help to know the content to need to cover in the lesson and help to prepare teaching and learning aid.

Extract 8.2: Candidate's incorrect responses to question 8.

In Extract 8.2, the candidate wrote the teachers' requirements before teaching instead of the ways which can be employed to encourage curiosity and creativity during teaching and learning process.

2.1.9 Question 9: Analysis of O-level Biology Curriculum Materials

The candidates were given the statement, "Form One students want to buy additional books to supplement available text books." They were required to give advice for them to get quality books by using four points.

The question was attempted by all 1,570 candidates. The candidates' performance was good as 1,276 (81.3%) scored from 2 to 4 marks. Figure 9 presents their performance on this question.

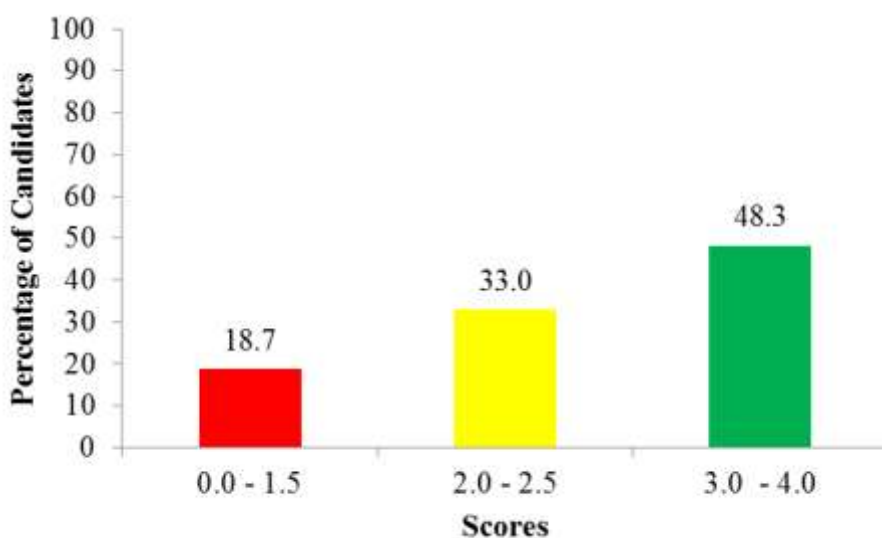


Figure 9: Candidates' Performance on Question 9

Performance analysis shows, that among the candidates who attempted the question, 758 (48.3%) scored from 3 to 4 marks and 518 (33.0%) scored from 2 to 2.5 marks. The candidates who scored from 0 to 1.5 marks were 294 (18.7%); out of whom 43 (2.7%) scored 0.

The candidates who scored from 3 to 4 had good knowledge about the Analysis of O-level Biology Curriculum Materials especially Biology textbooks. These candidates provided the correct considerations when one wants to buy additional books to supplement the available text books. The candidates with average performance provided 2 to 3 points, losing some marks. Further analysis shows that, out of 758 (48.3%) candidates who scored from 3 to 4 marks, only 232 (14.8%) gave all four points correctly, thus they scored all 4 marks. Responding to the question, one candidate wrote, *it should contain relevant illustrations, it should contain appropriate topic according to the syllabus of the subject, it should contain clear and understandable language to the level of the learner and it should be made of materials that ensure long time use of the book*. Such responses suggest that the candidates were knowledgeable about the concepts tested. Extract 9.1 is a sample of the correct responses to the question.

9	
	(i) They must Consider type of language used must familiar and simple to them so as to enhance understanding
	(ii) To Consider systematic organization of Content of a book.
	(iii) To Consider illustrations and drawings which found in a book.
	(iv) To Consider Author of a book

Extract 9.1: Candidate's correct responses to question 9.

In Extract 9.1, the candidate gave correct advice on what to consider to get quality books, scoring high marks.

Although the general performance on this question was good, 294 (18.7%) candidates provided incorrect responses. These candidates either did not understand the demand of the question or lacked knowledge of the tested concepts. Hence, they provided incorrect responses. For example, some

candidates wrote general considerations when buying a book. These included *costs of the book, place where the books are sold, cover of the book and going direct to the shop*. Others wrote the importance of books instead of providing on how to get quality books. They wrote *it promote the confidence, it increase performance, it encourage critical thinking, it promote reading skills and it enhance the vocabulary*. Such responses suggest that the candidates did not have adequate knowledge of the concept tested. Extract 9.2 is a sample of the incorrect responses to the question.

9	
(i)	she must have introduction part
(ii)	Must have Main body
(iii)	Must be having the reference
(iv)	Must be having the conclusion.

Extract 9.2: Candidate's incorrect responses to question 9.

In Extract 9.2, the candidate wrote the structural components of a report instead of providing advice on how to get quality books.

2.1.10 Question 10: Assessment in Biology

The candidates were given the statement “A team of biology teachers were preparing for marking a biology examination.” They were required to give four general principles to be followed during the actual marking process.

The question was attempted by all 1,570 candidates. Generally, their performance was average since 639 (40.7%) candidates scored from 2 to 4 marks. Figure 10 summarizes their performance on this question.

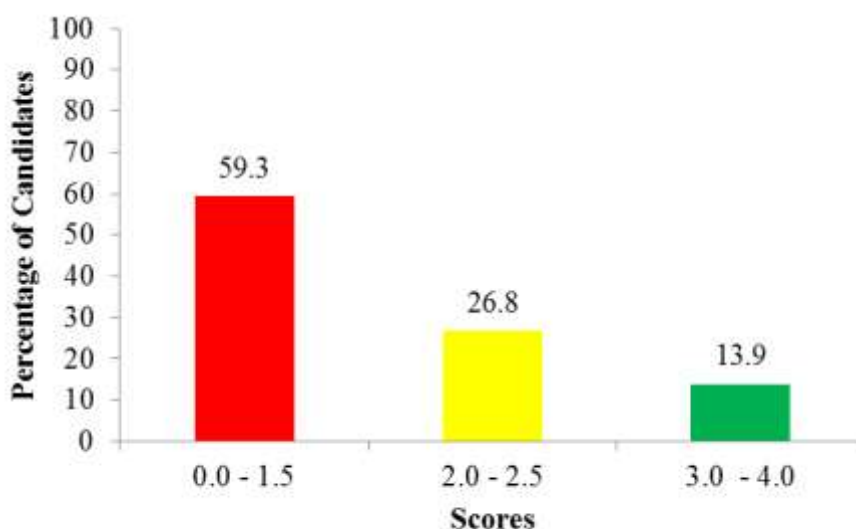


Figure 10: Candidates' Performance on Question 10

Data show that 218 (13.9%) scored from 3 to 4 marks, and 421 (26.8%) scored from 2 to 2.5 marks. The candidates who scored from 0 to 1.5 marks were 931; out of whom 228 (14.5) scored 0 out of 4 allocated marks.

Data analysis reveals that 26.8 per cent of the candidates gave 2 general principles to be followed during the actual marking process; therefore they failed to score full marks. Further analysis shows that, out of 218 (13.9%) candidates who scored from 3 to 4 marks, only 17 (1.1%) correctly gave all the four points. Thus they scored full marks. These candidates were aware that, during the actual marking, the *validated model answer (marking scheme) should be used, scoring the same item for all scripts then shift to another, re- check the earlier marked scripts to ensure consistency, taking short break in between to avoid fatigue if you have many scripts and making sure you are in good health condition*. Extract 10.1 presents the correct response by one of the candidates.

10	
(i)	strictly use the marking scheme
(ii)	score one question per each student before jumping to another question.
(iii)	Re-check the marked script in order to ensure consistency.
(iv)	Get break after a certain interval of time to avoid fatigue when you have many scripts.

Extract 10.1: Candidate's correct responses to question 10.

In Extract 10.1, the candidate correctly gave four general principles to be followed during the actual marking process.

However, 931 (59.3%) scored from 0 to 1.5 marks. The candidates who scored 1 mark provided only one correct principle to follow during the actual marking. A total of 228 (14.5%) candidates who scored 0 mark provided incorrect responses, contrary to the demands of the question. For example, some of them wrote things to consider when preparing a marking scheme such as *organize the relevant materials that help to get the answer of that test such as textbook, distribute marks according to the weight of the question, calculate weight of marks provided to each question and prepare the marking schemes when constructing the items*. Other responses focused on prior requirement such as *prepare red pen for marking and distribute questions to the markers*. Others wrote rules and regulations on marking such as *memorize your answers and start to mark, follow the instruction provided, read the answer of the candidates, communication devices are not allowed in the room and should not make noise or stories during marking and one teacher should mark only one question*. These incorrect responses signify that the candidates had inadequate knowledge about marking tests and examinations. Extract 10.2 is a sample of the incorrect responses to this question.

10	
	(i) The material used in making test should be relevant to the level of the learners.
	(ii) The content used should be understandable to the learners to avoid the difficult items in tests.
	(iii) The length of the test should be reasonable to the time that have been done.
	(iv) The limit provided for marking the test should be suitable for the examination to be done well.

Extract 10.2: Candidate's correct responses to question 10.

In Extract 10.2, the candidate wrote things to consider when constructing test items instead of general principles to follow during the actual marking process.

2.2 Section B: Essay Questions

This section consisted of four (4) questions. The candidates were required to answer all questions. Each question carried 15 marks, making a total of 60 marks. The questions were set from both academic and pedagogy Biology syllabi. The analysis of each question is as follows:

2.2.1 Question 11: Body Health and Immunity

The candidates were given the statement “You have been invited as a guest speaker to the Tanzania Youth Alliance against STD’s meeting.” They were required to recommend six strategies that they will address to help the youth in their mission.

The question was attempted by all 1,570 candidates. Their performance was good since 1,396 (88.9%) scored from 6 to 15 marks as summarised in Figure 11.

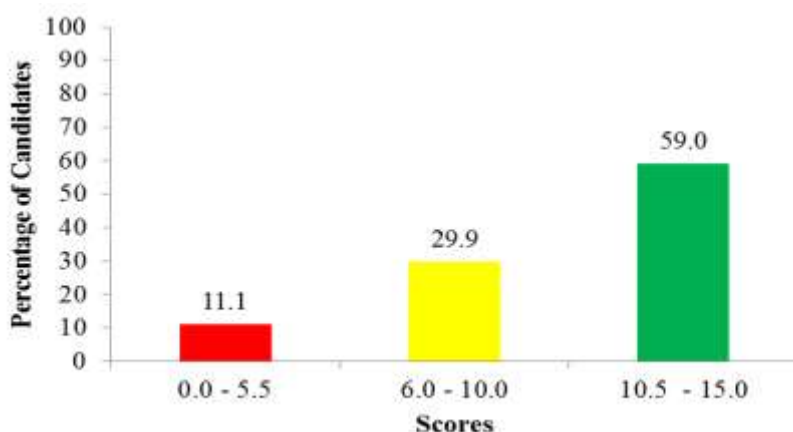


Figure 11: *Candidates' Performance on Question 11*

Data indicates that 926 (59.0%) candidates scored from 10.5 to 15 marks, and 470 (29.9%) scored from 6 to 10 marks. The candidates who scored from 0 to 5.5 marks were 174 (11.1%); out of whom 9 scored 0 out of the 15 allocated marks.

Analysis shows that 88.9 per cent of the candidates performed well on this question. Among them, 59.0 per cent had good performance, and 29.9 per cent had average performance. Those with average performance provided responses with some weaknesses, scoring low marks. Some provided correct introductions and conclusions, but listed the strategies without

giving explanations. In addition, others correctly mentioned the strategies but explained only three or four points. The candidates who scored high marks correctly gave six strategies following the rules of essay writing, such as providing an introduction, main body and conclusion. This indicates that the candidates had adequate knowledge of Body Health and Immunity, specifically sexually transmitted diseases (STDs) and sexually transmitted infections (STIs). Extract 11.1 is a sample of the correct responses to the question.

11	
	<p>STD's: This is a disease which is caused by a virus known as human immunodeficient virus (HIV) which weakens the body, and can be spreaded from one person to another through sexual intercourse. The following are the strategies to address so as to help the youth in their mission against STD's.</p> <p>Abstinence: From sexual intercourse before marriage; The youth must get knowledge and skills concern with a STD's infection through abstaining from sexual intercourse - until they get married so as to be safe from infections and diseases to increase their life span.</p> <p>Use condom; also the youth should know the way and how to use condom especially during sexual intercourse so as to be safe from the spread of diseases such as STD's which some time accelerates to the weight loss of a person as attacked by the virus - of HIV which tend to weaken the body immunity.</p> <p>Avoid sharing of sharp objects; such as needles, razor blade, syringe and other since can transmit diseases from one person especially the affected one to another person who is unaffected.</p> <p>Be with one sexual partner; also when you are in relationship tend to be only with one sexual - partner so as to avoid the transmission of diseases from one person to another as a result of many partners in which one among of them has been affected by STD's.</p>

11 Cont.	
	Avoid transfusion of Unsecured blood; also people should ensure that when they have low blood, before transfusion there must be a need of the blood to be secured in order to ensure that it's safe to be used by another person, this will help to know whether the blood to be transfused is safe and away of the virus that can lead or cause the spread of diseases like STD's.
	Attend at health centre for check up; this will help youth if they have been affected by STD's to obtain treatment for such disease to ensure the provision of disease to individual who have been affected by STD's also, a person can get guidance and counseling as well as education on how to live with out stress.
	Therefore: The youth should be helped against STD's by following the given strategies.

Extract 11.1: Candidate's correct responses to question 11.

In Extract 11.1, the candidate correctly explained the strategies for helping the youth in their mission against STDs. However, he/she wrote incorrect an introduction and a conclusion.

Despite the good performance by the majority (88.9%) of the candidates, further analysis revealed that 174 (11.1%) candidates faced difficulty in recommending six strategies to help the youth in their mission against STD's. For example, some of the candidates explained the symptoms of sexually transmitted diseases such as *rashes in private parts, painful intercourse, pain when urinating, menstrual irregularities and discharge of mucus from the private parts*. Other incorrect responses given were *firstly explaining the meaning of STDs, second categorizing the various STDs which are HIV/AIDS, syphilis and gonorrhoea, third explaining modes of transmission, fourth explaining the symptoms, fifth explaining the effects and sixth explaining the control measures of the STDs*. Other candidates wrote different ways of educating the youth such as *through presentation, discussions method, through question and answer, role play method, peer pressure and rewarding*. Some candidates also wrote preventive measures of epidemic diseases such as *eating hot food, washing hands after visiting toilets, washing fruits before eating and covering foods when not in use*. These incorrect responses indicate that the candidates were not knowledgeable about sexually transmitted diseases (STDs) and sexually

transmitted infections (STIs). Extract 11.2 is a sample of the incorrect responses to the question.

11	
	<p>ST.D's- This stands for Sexual Transmitted Diseases, It involves the diseases which caused by sexual intercourse whereby two people of opposite sex conducting sexual sex without any preventive measure if one of them being affected with cause to his or her partner to get it too.</p> <p>The following are negative effects of S.T.D's:-</p> <p>It can cause death to the people; S.T.Ds as sexual transmitted diseases lead to death whereby after the process of affecting a person cause the contribution of another, diseases to affect the body immunity hence become weak and suddenly may results to death of the people who affected.</p> <p>It lead to the poverty; Hence the affected person required to be taken to the hospitals for professional helps the much money should required for in order to him or her get good and complete treatment so as to remain alive whereby they contribute on the poverty problem.</p> <p>Underdevelopment to the country, due to S.T.Ds, may the loss of man power experience hence this attributes on the country to be underdeveloped instead of development due to lack of workers at different areas which need manpower.</p> <p>It can cause the extreme stress; After someone understanding that he or she affected already so having the big chance of thinking about that vibration where those stress may lead him or her to take difficult options such as engage on drugs abuse.</p> <p>Lead to conflicts; the rise of conflict may occur when someone determines the one cause him or her to be affected hence the absence of love to each other and also no cooperation will be observed in any kind of aspects in the lives as a result of S.T.Ds.</p>

Extract 11.2: Candidate's incorrect responses to question 11.

In Extract 11.2, the candidate provided an incorrect introduction and wrote the effects of STDs to the society such as *it can cause death to the people*, instead of the strategies for helping the youth in their mission against STDs. In addition, Also he/she did not write a conclusion.

2.2.2 Question 12: Genetics

This question had two parts: (a) and (b). Part (a) required the candidates to carry out genetic crosses to show the possible blood group of children whose parents were heterozygous: father being blood group A and the mother being blood group B. In part (b), they were required to find the probability that both twins would have blood group A if the parents have non- identical twins.

The question was attempted by all 1,570 candidates. Their performance on this question was weak because 1,149 (73.2%) scored from 0 to 5.5 marks. Figure 12 summarizes the performance on this question.

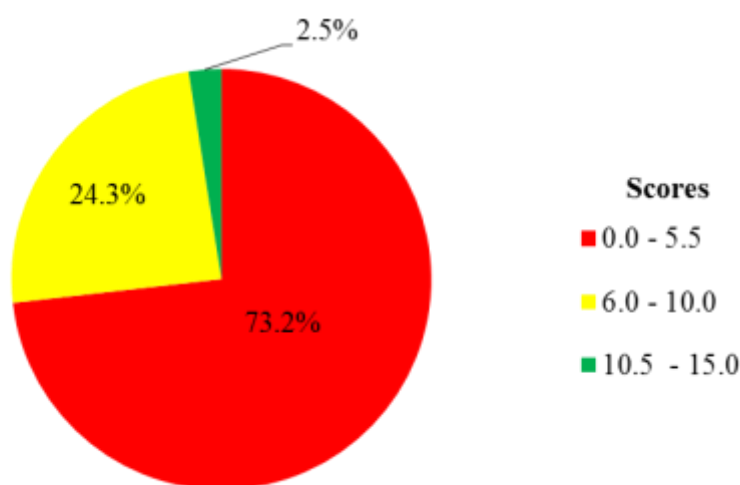


Figure 12: *Candidates' Performance on Question 12*

Analysis shows that 1,149 (73.2%) candidates scored from 0 to 5.5 marks; out of whom 755 (48.1%) scored 0. The candidates who scored from 6 to 10 marks were 382 (24.3%) and 39 (2.5%) candidates scored from 10.5 to 15 marks.

It was observed that, some of the candidates who scored low (0 to 5) marks used incorrect letters contrary to the Mendelian crosses. Others outlined the correct symbols used in a cross but failed to cross. The candidates who scored 0 mark wrote incorrect responses in all parts of the question. They crossed without defining the letters used. Other candidates used sex chromosomes (X and Y) to show the possible blood group of the children whose parents were heterozygous contrary to the demands of the question. For example, some candidates wrote let X for mother blood group B and Y

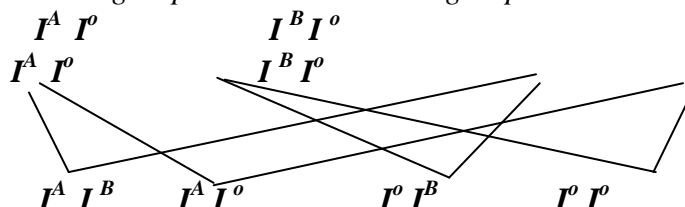
father blood group A and crossed. The results were $X^B X^A$, $X^B Y^A$, $X^B X^A$ and $X^B Y^A$ which were incorrect. Also they failed to calculate probability and make correct interpretation of their results in part (b). These the candidates were supposed to, let I represents the gene for blood group where A represents dominant allele A for blood group A; B represents dominant allele for blood group B and o represents recessive allele for blood group O. Then they were supposed to cross as follow:

Parental phenotype: Father: blood group A X Mother: blood group B

Parental genotype (2n):

Gametes formation:

Random fertilisation:



Offspring phenotype blood:	Group AB	Group A	Group B	Group O
Offspring Genotype	$I^A I^B$	$I^A I^o$	$I^o I^B$	$I^o I^o$

Therefore, if these parents bear 4 children their possible blood group will be as follows: Blood group AB, Blood group A, Blood group B and Blood group O.

Also in part (b) they were supposed to use the formula $P(E) = \frac{n(E)}{n(S)}$ where $P(E)$ probability of event to occur, $n(E)$ number of event to occur and $n(S)$ number of sample space present.

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

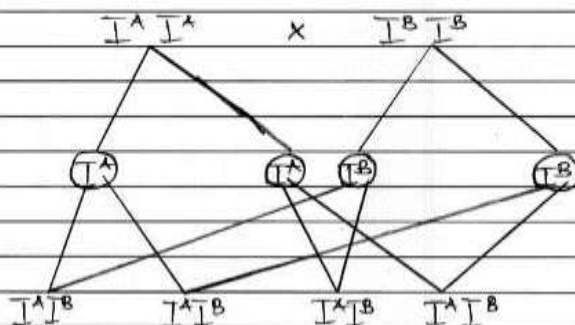
First individual with blood group A; $P(E) = \frac{1}{4}$

Second individual with blood group A; $P(E) = \frac{1}{4}$

Both individuals to have blood group A; $P(E) = \frac{1}{4} * \frac{1}{4} = \frac{1}{16} = 6.25\%$

Therefore, the probability that both twins will have blood group A is = 6.25%. Extract 12.1 is a sample of the incorrect responses by one of the candidates.

(a)



Phenotype: All are group

Phenotype: All are blood group A.

Genotype: All are

⑤ If the parents have non-identical twins, the probability that both twins will be blood group A is 4:4.

→ This means that all twins will be blood group A.

Extract 12.1: Candidate's incorrect response to question 12.

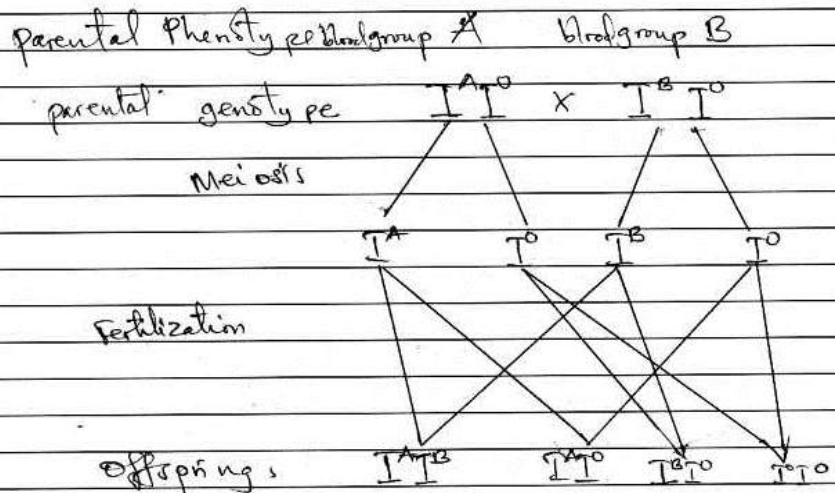
In Extract 12.1, the candidate did not define the letters used in the cross. He/she also carried out genetic crosses using homozygous parents instead of heterozygous parents, ending up with incorrect offsprings in part (a). Also he/she just wrote the answer without showing the calculation in part (b). However, the answer was incorrect as well.

In contrast, 26.8 per cent of the candidates scored averagely from 6 to 15 marks. They responded correctly to only one part of the question, scoring less marks. Some of these candidates managed to define the letters used and carry out the genetic cross but failed to show the calculation of the probability in part (b). Further analysis reveals that a few candidates (2.5%) scored high marks (10 to 15). They managed to show the possible blood group of children whose parents were heterozygous: the father being blood group A and the mother being blood group B. Moreover, they calculated the probability that both twins will have blood group A if the parents have non-identical twins. Extract 12.2 is a sample of the correct to the question.

12 Cont.

(a)

let A stands for blood group A.
B stands for blood group B.
I stands for blood group



Results of offsprings are

(b)

Blood group AB
Blood group A
Blood group O
Blood group B.

(c)

Probability of having blood group A birth twins is

$$\text{from } \text{Probability} = \frac{nE}{nS} \text{ number of event} / \text{number of sample space}$$

12 Cont.

no of event = 1.

no of sample space = 4

$$P.E = \frac{nE}{nS}$$

First child with blood group A $P.E = \frac{1}{4}$

Second child with blood group A $P.E = \frac{1}{4}$

∴ The probability of having non-identical twins
 $= \frac{1}{4} \times \frac{1}{4} = \frac{1}{16}$.

Extract 12.2: Candidate's correct responses to question 12.

In Extract 12.2, the candidate correctly carried out genetic crosses to show the possible blood group of children whose parents were heterozygous in part (a). He/she also correctly calculated the probability of non-identical twins in part (b).

2.2.3 Question 13: Basic Biology Laboratory Skills

The candidates were given a list of mushroom, pine branch, ascaris worms, mosses, centipedes and lizard to be prepared for the National Examination. They were required to explain how they would collect and preserve each of the organisms before the examination.

The question was attempted by all 1,570 candidates. The candidates' performance on this question was weak because 1,371 (72.8%) scored from 0 to 5.5 marks. Figure 13 summarizes their performance on this question.

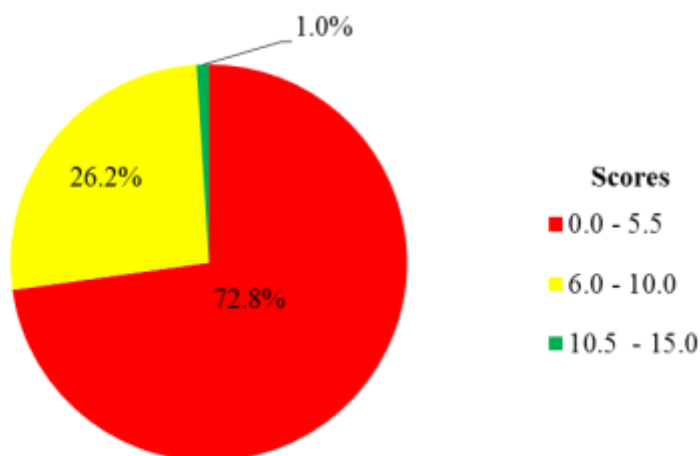


Figure 13: Candidates' Performance on Question 13

Data indicates that 1,143 (72.8%) candidates scored from 0 to 5.5 marks. Out of whom, 252 (16.1%) scored 0. The candidates who scored from 6 to 10 marks were 412 (26.2%), and 15 (1.0%) scored from 10.5 to 15 marks.

The candidates with weak performance (72.8%) either lacked knowledge of the tested concept or did not understand the requirements of the question. For example, some of the candidates classified the given organisms into Kingdoms and Phyla such as *mushroom- Kingdom Fungi and Phylum Basidiomycota*; *pine branch-Kingdom Plantae and Division Coniferophyta*, *ascaris worms- Kingdom Animalia and Phylum Nematoda*; *mosses*

Kingdom Plantae and Division Bryophyta, centipedes-Kingdom Animalia and Phylum Arthropoda and lizard- Kingdom Animalia and Phylum Chordata instead of explaining how to collect and preserve them. In contrast, some of these candidates drew diagrams of the given organisms. Besides, other candidates grouped the organisms into specific ranks and wrote features of the ranks. Specifically, one candidate wrote *mosses and pines Kingdom plantae therefore they have autotrophic nutrition, they store food in form of starch, they have alternation of generation, they are green in colour, they are eukaryotic organisms and they are multicellular organisms*. In addition, these candidates did not write introductions or conclusions. This shows that they had inadequate knowledge of Basic Biology Laboratory Skills. Extract 13.1 is a sample of the incorrect responses to the question.

13	<p>Preservation and collection are the processes that involve the collection of various groups of organisms and storing them for different purposes if it is done for the aim of accomplishing a desired goal example for practice:</p> <p>The following are the ways through which the organisms can be collected and preserved:</p> <p>Wear the special tool equipment like gloves etc in order to prevent accident or being bitten during collecting them in the habitat but also to store them in dry place so that they could not get spoiled/damaged.</p> <p>Through asking learners to bring them this can actually help a teacher to obtain large number of them and drying them in a sun or spraying them drug to prevent them from being destroyed.</p> <p>Through preparing the farm especially damp area where the organisms may survive for example mushrooms are mostly found in damp areas therefore through preparing damp areas it can make easier for the teacher to obtain and collect them.</p> <p>Through using laboratory apparatus like fish nets in their usual areas to enable them to flow into these nets this makes easier for a teacher to collect them at large extent.</p>
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Extract 13.1: Candidate's incorrect response to question 13.

In Extract 13.1, the candidate wrote the general ways of collecting the specimens such as *through using laboratory apparatus like fish net* instead of writing how to collect and preserve each organism. He/she did not provide a conclusion; however, the introduction was correct.

Nevertheless, the responses reveal that the candidates who scored from 6 to 10 marks did not score full marks since they correctly explained the collection and preservation of only three to four organisms. Besides, most of them provided incorrect introductions or conclusions while others did not write introductions or conclusions. Most of the candidates who scored from 10.5 to 14 marks correctly explained the collection and preservation of the organisms but failed to introduce or conclude the essay. Their responses imply that they mastered the topic of Basic Biology Laboratory Skills. Extract 13.2 is a sample of the correct responses to the question.

Collection of an organism, is the process of collect the living organism that used for the further studying and practice on the practical activities. And preservation of an organism is the process of keeping an organism in the safe areas that can use for the studying and for teaching. For example a frog can preserved in the specimen bottles. The following are the procedure and way of collection the organism which provide and preservation areas to them.

i) Mushroom

This can be collected from the dead organism matters and some waste areas for example dump, and sometime in the soil.

its preservation.

This can be preserved in the specimen bottle but before preserved first dry it well on the sun and preserve in the dry specimen bottle.

ii) Pine branch.

This can be collected from the pine trees, that located at the terrestrial areas with cool environment.

its preservation

- This can be preserved in the areas that sunlight penetrate and keep in, dry place.

iii) Ascaris worms.

They can be collected from the intestine of an animals like goats, cows sometimes human being feces.

13 Cont.	Its preservation
	This can be preserved in the air tight bottles which is mixed with the formaldehyde
	iv) Mosses
	This can be collected from the place which are wet and moistures areas during the rain seasons.
	its preservation
	This can be preserved in the areas that the sunlight can penetrate easily and preserve in the specimen bottles.
	v) Centipedes
	This can be collected from the dark areas, and some on the rocks by using tray
	its preservation
	This can be preserved in the two process either dry them and preserved in the specimen bottle, and other preserved in the specimen with formaldehyde in order to keep them for the long time.
	vi) Lizard
	This can be collected from the rocks areas sometimes on walls and some on the trees by using trays
	its preservation
	This can be preserved in the specimen bottle with formaldehyde

Extract 13.2: Candidate's correct responses to question 13.

In Extract 13.2, the candidate correctly explained the collection and preservation of mushroom, pine branch, ascaris worms, centipedes and lizard. However, the preservation of mosses given was incorrect, and the essay lacked a conclusion.

2.2.4 Question 14: Basic Biology Laboratory Skills

The candidates were given the statement "Amina was accidentally bitten by a snake as she was cleaning the college surroundings and started screaming for help." They were required to give (using six points) a critical analysis of the assistance she required before being taken to hospital.

The question was attempted by all 1,570 candidates. The general performance on this question was good since 1,372 (87.4%) candidates scored from 6 to 15 marks. Figure 14 shows the candidates' performance on the question.

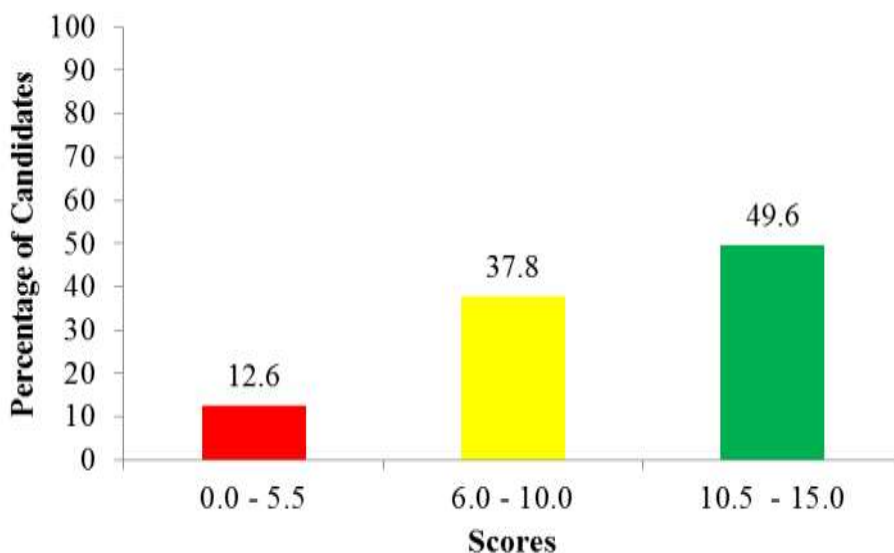


Figure 14: *Candidates' Performance on Question 14*

Data shows that 779 (49.6%) candidates scored from 10.5 to 15 marks, and 593 (37.8%) scored from 6 to 10 marks. The candidates who scored from 0 to 5.5 marks were 198 (12.6%); out of whom, 14 (0.9%) scored 0.

Analysis shows that 87.4 per cent of the candidates passed the question. Among them, 593 (37.8%) had average performance, and 49.6 per cent had good performance. Those with average performance gave only four to five correct points; hence they did not score full marks. Further analysis reveals that those who scored from 10.5 to 15 marks were aware of the steps to be followed. These were: *Calm and reassure the casualty and lay him/her down; support and immobilize the bitten area because the poison (venom) will fast spread throughout the body; tie a wide elastic bandage or clean cloth around the limb above the bite to stop the spread of venom in the blood stream; wash the wound with soap and water to remove any dirty around the wound; if breathing fails start mouth to mouth ventilation and lastly take the person immediately to the hospital. Also if possible, take the snake to help the doctor to know which ant-snake bite serum to give.* Extract 14.1 is a sample of the correct responses to the question.

First Aid is the sudden assistance given to a person who is sick or injured before he/she is taken to the hospital for further treatments. Snake bite is one of incidence that require first Aid.

The following are some points or steps to follow when helping (giving) a first Aid to a person who is bitten by a snake, these steps are:

Calm her down. First Aid provider should calm her (Amina) down and Lay her down in order to reduce extreme stress.

The service provider should not move the bitten area to slow down or reduce the speed of spreading of poison.

Tie the upper part from the wound this will help to reduce the rate of flow of poisoned blood.

Clean the wound - After closing the upper part of the wound you should stop start to clean the wound by using soap and water in order to remove dirty.

Close the wound by using bandage or a clean piece of dress. This will help to reduce the outflow of blood and infection. Therefore wound should be covered after being cleaned.

14 Cont.	Take her to the hospital for further treatment. This should be done as fast as possible in order to save her life and for further check up.
	Generally, first aid provision is very important in our daily life since it saves life of people. Therefore first aid kit should be available at home, school, hospital and any other place where people are gathering for a particular purpose or activity.

Extract 14.1: Candidate's correct response to question 14.

In Extract 14.1, the candidate correctly wrote the steps required in giving assistance to Amina who was bitten by a snake before being taken to hospital. However the fifth step written as *close the wound by using bandage or clean piece of dress* was incorrect.

Despite the good performance on this question, 12.6 per cent of the candidates scored low marks (from 0 to 5.5). Those who scored 0 marks either failed to provide any response or provided incorrect responses. Some of the candidates wrote incorrect procedures such as *killing the snake, cutting the victim's bitten area with razor blade, place the victim where there is air, remove the victims clothes and giving antibiotic to reduce pains*. the importance of first aid *such as it saves life, it give hope and encouragement, reduces pain and removes fear of death*. Other candidates wrote the ways on how the victims can be treated, such as *use traditional medicine, give her antibiotics and give the victim pain killer*. Others wrote the procedures for giving first aid to an insect bite victim, such as *Remove the sting from the wound by pressing a hollow ring around it, wash the area with a weak solution of baking powder, cover the wound with cold compress and if symptoms persist take the patient to the hosital*. Such responses suggest that the candidates had insufficient knowledge of the tested concepts. Extract 14.2 is a sample of the incorrect responses to the question.

Amira required first aid service when a snake bitten her. First aid service is an assistance given to a person when he or she gets an injury before being taken to hospital for further medical assistance. First aid service to Amira had the following importance.

Saves life, the first aid service can save life when one is to die after an accident or injury.

First aid service also reduces pain to an injured person. The assistance provided to Amira after she was bitten by a snake reduced pain to her than if she was left without any services.

First aid service also brings hope of life, apart from saving life it creates confidence of someone in a manner of health. When you receive services before being taken to hospital then you can have hope so that you

14 Cont.	
	don't worry for your self.
	First aid service to Amina assisted a doctor at hospital to begin medication careful. This is to tell the doctor or nurse to understand how to begin the service in a correct money. This is because when a doctor receive some one in a bad situation may provide service quickly leading to mistakes hence loss of life.
	First aid service reduces costs of treatment. After painful is reduced treatment may only requires less cost for giving some one medicine, so the service that was given to Amina before going to the hospital reduced amount of money that Amina would pay at hospital.
	First aid assistance given to Amina reminded other collages to give the same favour when their friends get accidents. This is because others did not know how they would care some one after having been bitten by a snake, but through the observation they can now practice and serves other people's life.
	Schools and collages must have first aid kit, this is a small box in which different tools and instruments used for first aid service are kept.

Extract 14.2: Candidate's incorrect response to question 14.

In Extract 14.2, the candidate wrote the importance of first aid in points (i) through (iii) instead of the steps required in giving assistance to Amina who was bitten by a snake before being taken to hospital. The other responses given are also incorrect. Besides, he/she demonstrated poor grammar and spelling errors. For instance, he/she spelt the word *serves* instead of *saves*. However, the introduction was correct.

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

There were three alternative practical papers namely 733/2A - Biology 2A, 733/2B - Biology 2B and 733/2C – Biology 2C. 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 all alternative papers is as follows:

3.1 Question 1: Basic Biology Laboratory Skills

This question required the candidates to dissect the provided specimen and answer the question that followed. The question was attempted by all 1,570 candidates. Their general performance on question 1 for all alternative papers (A, B and C) was good because 1,437 (91.5%) candidates scored from 8 to 20 marks. Figure 15 shows the candidates' performance on Question 1 in Paper 2A, 2B and 2C.

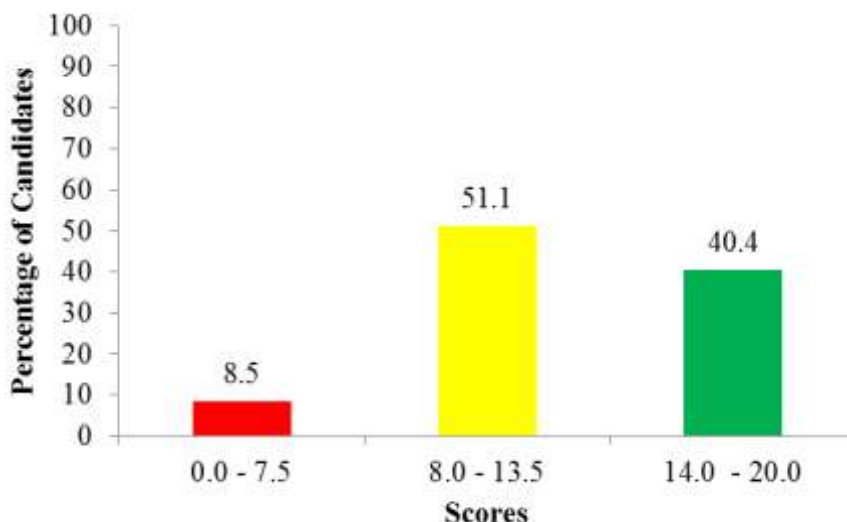


Figure 15: *Candidates' Performance on Question 1 in Paper 2A, 2B and 2C*

Performance analysis shows that 634 (40.4%) candidates scored from 14 to 20; 802 (51.1%) scored from 8 to 13.5 marks; and 134 (8.5%) scored from 0 to 7.5 marks.

3.1.1 733/2A Biology 2A

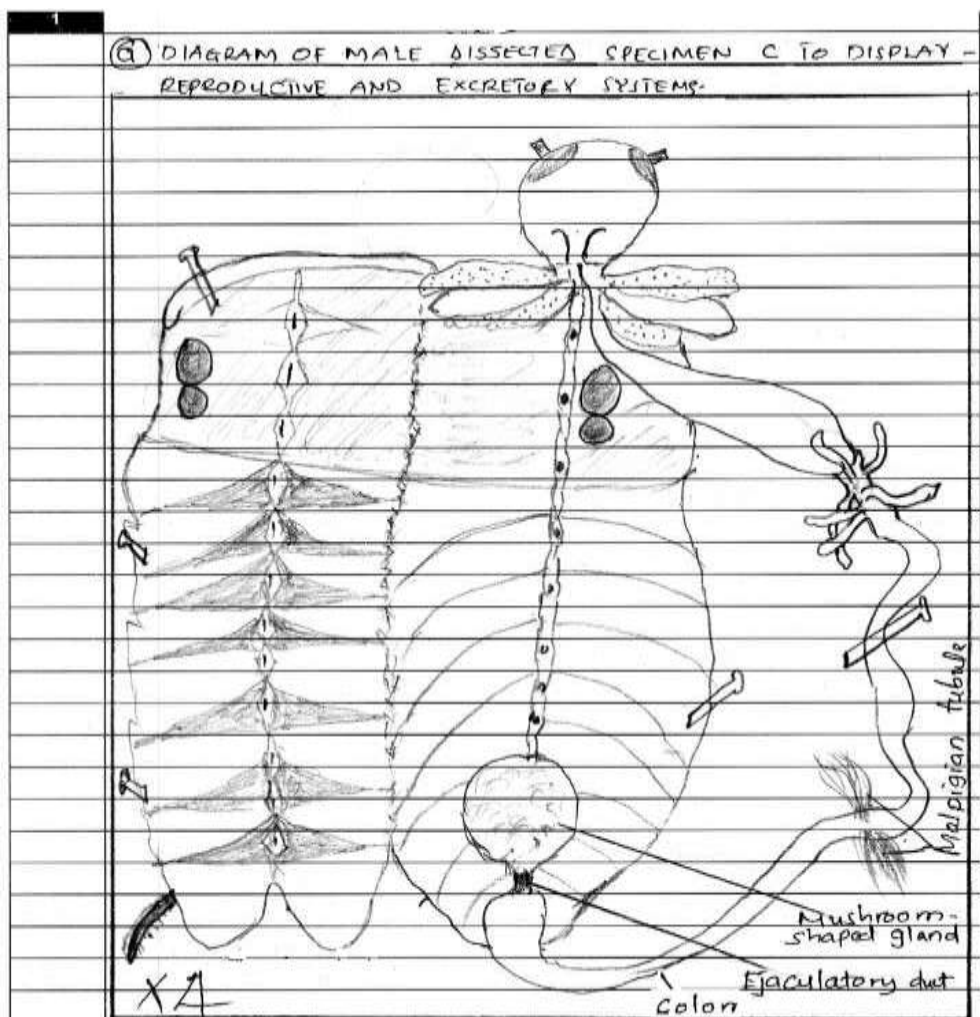
This question required the candidates to dissect specimen C (a male or female cockroach) in the usual way to display the reproductive and excretory systems. The candidates were supposed to respond to the following questions:

- (a) *Draw a well-labelled diagram of dissected specimen C to show two parts that form each of the reproductive and excretory systems.*
- (b) *What function does each of the two reproductive parts labelled in 1(a) have?*
- (c) *What is the sex of specimen C? Give three evidences.*
- (d) *Observe the thread like structures present in specimen C and state why they are so numerous.*

The candidates who scored average (8 to 13.5) marks drew diagrams of dissected specimen C but labelled one part that form each of the reproductive and excretory systems in part (a). Also, they gave the function of only one part of the reproductive system and two pieces of evidence of the sex of the specimen. Thus they could not score full marks. The candidates who scored high marks (14 to 20) gave correct responses to some or all parts of the question. Their good performance was attributed to their adequate knowledge of the tested concepts. In part (a), the candidates followed the principles of biological drawing. The principles include: use of pencil, large diagram, drawing in sharp lines, neatness, non-arrowed labeled lines, parallel/non crossing labelling lines, free hand drawing, magnification and caption. Thus the candidates drew the correct diagrams of dissected specimen C (Cockroach). In addition, they were knowledgeable about the parts of the excretory system such as *malpighian tubules*, *colon* and *rectum* as well as the reproductive system such as *mushroom gland*, *ejaculatory duct*, *ovary* and *oviduct*. These responses suggest that the candidate had adequate knowledge of animal dissection, especially of the cockroaches.

In part (b), they correctly gave the role of each part of the reproductive system labeled in 1(a). For example, one candidate wrote *Mushroom gland for maturation and storage of sperms*, *ejaculatory duct for passage of sperm to the female*. Another candidate wrote *ovary for production of eggs and oviduct for storage of female gametes*. Such responses suggest that the candidates had adequate knowledge of the functions of different parts of the cockroach's reproductive system.

Likewise, in part (c), the candidates correctly identified the sex of specimen C (cockroach) and gave reasons for the sex identified. For example, one candidate wrote *The sex of specimen C is male due to presence of anal style, ejaculatory duct and mushroom gland.* In part (d), they correctly stated the reason for the presence of numerous thread-like structures in specimen C. One candidate wrote, *The thread like structures are numerous to increase the surface area for removal of uric acid which is a form of nitrogenous waste.* Another candidate wrote *The thread like structures are numerous to increase the surface area for absorption of waste products produced in its body.* Such responses show that the candidates had adequate knowledge about the adaptation of malpighian tubules to their functions. Extract 15.1 is a sample of the correct responses to Question 1 in paper 2A.



(b) The function of
(i) Mushroom shaped gland - nourishment of sperms
(ii) Ejaculatory duct - Used for ejaculation during copulation. Helps in transportation of sperms
(c) The sex of specimen C is male
The following are evidences showing that specimen C is male
- Presence of mushroom shaped gland
- Presence of ejaculatory duct
(d) The thread like structures present in specimen C are numerous to increase the surface area for diffusion of excretory wastes

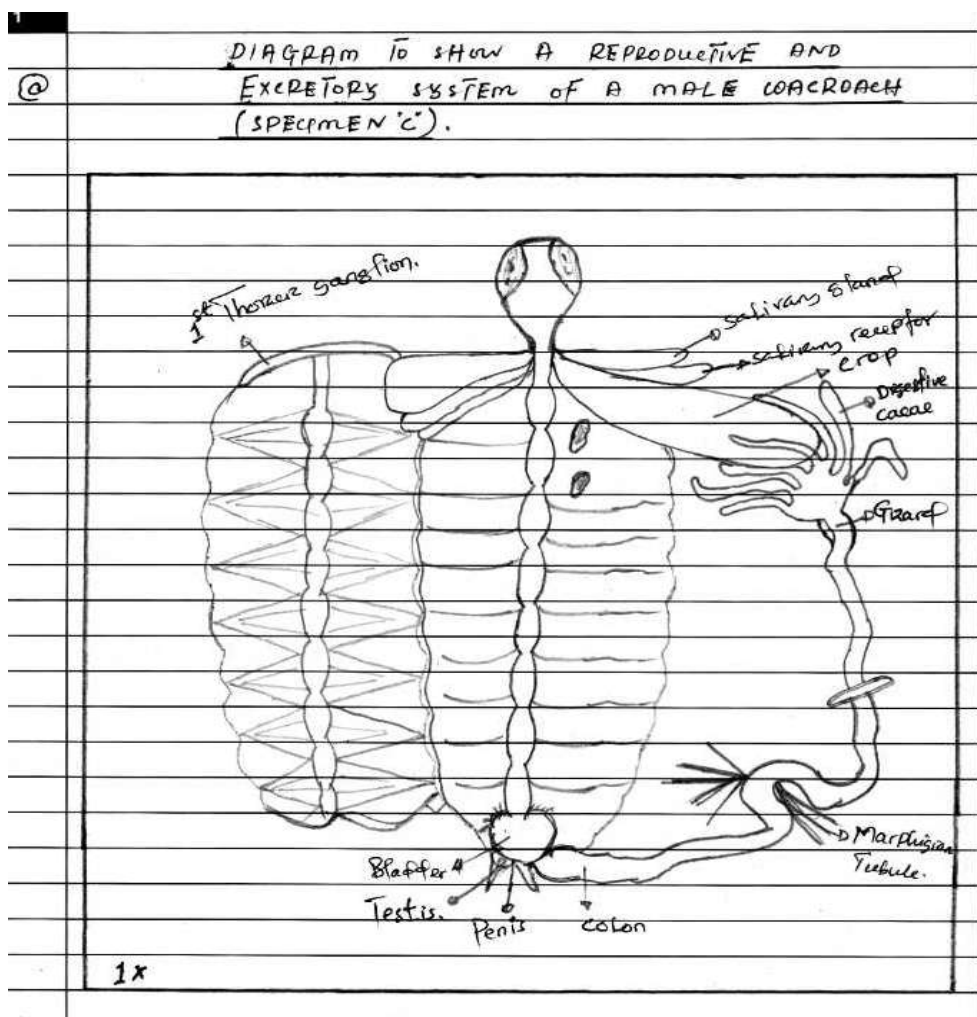
Extract 15.1: Candidate's correct response to Question 1, in Paper 2A.

In Extract 15.1, the candidate correctly drew a labelled diagram of a dissected cockroach. He/she correctly explained the function of the two reproductive parts of the cockroach, identified the sex and gave reasons for thread-like structures being numerous.

Despite the good performance on this question, 134 (8.5%) candidates scored from 0 to 7.5 marks. These candidates provided correct responses to only some parts scoring low marks. For example, in responding to part (a), most of them dissected specimen C (a male or female cockroach) but drew diagrams without a caption or magnification. They also incorrectly labelled their diagrams scoring low marks. Some of the candidates labelled the external parts of the cockroach such as *antennae*, *eyes*, *legs* and *wings*. In part (b), most of them failed to identify the function of the parts in labelling the diagrams in part (a). For example, one candidate wrote, *The function of cloaca and vas differens instead of mushroom shaped gland and ejaculatory duct*. Other candidate wrote the function without specifying the parts of the reproductive system which is responsible for the function. Such

responses indicate that the candidates had inadequate knowledge of the parts of the cockroach's reproductive system.

Similarly, in part (c), most of the candidates correctly identified the sex of the specimen but failed to justify the sex; they provided incorrect responses. One candidate wrote *The sex of specimen C is male because it has narrow abdomen, two pairs of antennae and large wings*. In part (d), some candidates incorrectly stated the reason for the presence of numerous thread like structures in specimen C. One candidate wrote *The thread like structures are numerous to ensure coordination of the body*. Another candidate wrote, *To ensure its survival*. Such responses suggest that the candidates had inadequate knowledge about dissection, the reproductive system and excretory system of animals, specifically the cockroach. Extract 15.2 is a sample of the incorrect responses to Question 1 Paper 2A.



(b)	Function of the Reproductive Part labelled.
(i) Testis	
	<p>⇒ This is where there is secretion of gametes that plays a role in sexual reproduction of the cockroach.</p>
(ii) Penis.	
	<p>⇒ It is important in the sexual reproductive as an organ that passes the gametes.</p>
(c)	The sex of specimen "c"
	The sex of the specimen "c" is a male cockroach.
	This is because of the following evidence.
	(i) Presence of testis.
	(ii) Presence of Penis.
	(iii) Few numbers of Malpighian tubule.
(d)	The reason why there are numerous number of spiracles is to protect the internal organs of the cockroach.

Extract 15.2: Candidate's incorrect responses to Question 1, Paper 2A.

In Extract 15.2, the candidate drew the diagram but incorrectly labelled the parts such as *bladder*, *digestive caeca*, *1st thoracic ganglion*, *salivary gland* and *testis* in part (a). The candidate provided the functions of testis and penis instead of the function of the reproductive parts found in male such as anal style, ejaculatory duct and the mushroom shaped gland in part (b). He/she correctly identified the sex of specimen C but gave incorrect justifications in part (c). The response given in part (d) was also incorrect.

3.1.2 733/2B Biology 2B

This question required the candidates to dissect the provided specimen T (a male or female Rat/Guinea pig) in the usual way to display the reproductive system and respond to the following questions:

(a) Why should the specimen be anaesthetized before dissection?

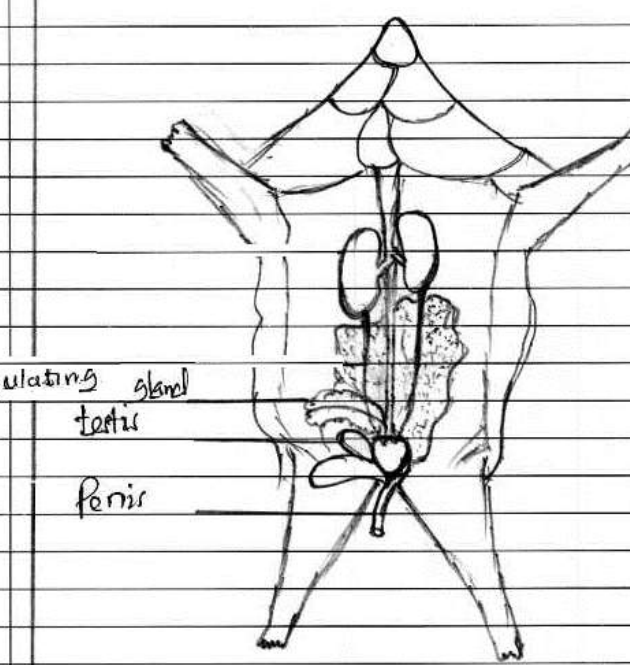
- (b) *Draw a diagram of the dissected specimen T and label five parts that form the reproductive system.*
- (c) *What is the sex of specimen T? Give four reasons.*

The candidates who scored high marks (8 to 20) gave the correct responses to some or all parts of the question. In part (a), the candidates correctly explained the reason for anesthetizing specimen T (male or female rat). One candidate wrote *The reason for anaesthetizing specimen T before dissecting it is to reduce movement of specimen during the process of dissection.* In part (b), the candidates drew well labelled diagrams of the dissected specimen T to show the reproductive system. They also included captions and magnification, signifying that they understood the rules of presenting biological drawings. The candidates correctly labelled the following parts of the reproductive system in a male rat: *caput epididymis, vas deferens, testes, cauda epididymis, penis, cowper's glands, prostate glands, vesicula seminalis and cagulating glands.* Other parts of the reproductive system in female rat mentioned were the *right ovary, left ovary, mesovarium of oviduct, preputial gland, vaginal opening, vagina* and the *uterus*. Most of the candidates correctly labelled the parts of the reproductive system, indicating their good skills in identifying parts of specimen T (Rat).

In part (c), the candidates correctly identified the sex of specimen T (Rat) as either male or female. They also gave four reasons to justify the named sex of the specimen. For example, one candidate wrote *The sex of specimen T is male because it has testis, penis, vas deferens and scorotal sack.* Another candidate wrote *The sex of specimen T is female because it has ovary, vagina, oviduct and uterus.* These responses indicate that the candidate had adequate knowledge of animal dissection of and animal's reproductive system specifically rats. Extract 16.1 is a sample of the candidate's correct responses to Question 1 Paper 2B.

1 a) The specimen was anesthetized before dissection so as to dissect it easily.

b) THE DIAGRAM OF SPECIMEN "I" TO DISPLAY THE REPRODUCTIVE SYSTEM:



coagulating gland
testis
penis

Magnif: X2

c) The sex of the specimen is male due to it

- has penis
- has testis
- has vas deferens
- has coagulating gland

Extract 16.1: Candidate's correct responses to Question 1, Paper 2B.

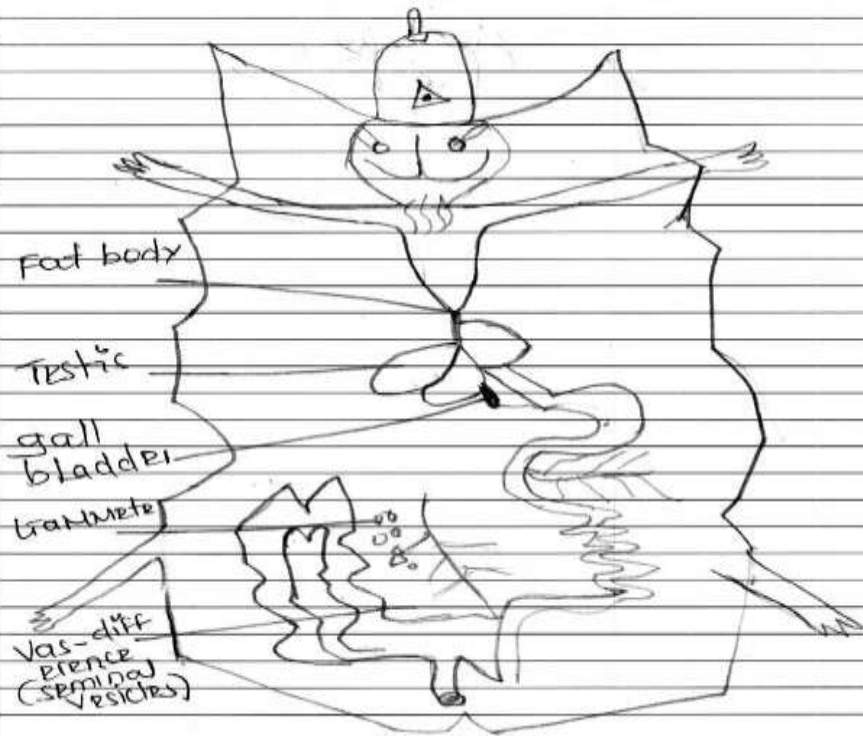
In Extract 16.1, the candidate wrote a correct caption, identified the sex of the specimen, and gave reasons to justify the sex of the specimen in parts (a) and (c). he/she also drew a well labelled diagram, showing the correct reproductive system. However, the diagram did not well represent the dissection; thus the candidate could not score full marks.

In contrast, the candidates who scored from 0 – 7.5 marks failed to provide correct responses to most parts of the question. In part (a), they failed to state the reason of anaesthetizing the specimen T. For example, one

candidate wrote *The reason for anaesthetizing specimen T before dissecting it is to soften the tissue of the specimen that will be cut during dissection.* Another candidate wrote *The reason for anaesthetizing specimen T before dissecting it is to sterilize the specimen and make it less infectious.* Such responses indicate that the candidate failed to understand the concept tested, resulting in the incorrect responses. In part (b), the candidates drew diagrams of the dissected specimen T. However, they provided labels that were not part of the reproductive system, and sometimes they misspelt the names of organs. For example, some candidates labelled *kidneys*, *blood vesicles* and *heart*. Others labelled the external parts of the rat like *tail*, *leg* and *eye*. Also, other candidates identified correct parts but interchanged them, while others labelled less than 3 parts of the displayed diagram, obtaining low marks.

Likewise, in part (c), most of them correctly identified the sex of specimen T (rat) but they failed to provide four relevant reasons for the mentioned sex. A few candidates responded incorrectly to this part. They gave either one or two correct reasons. For example, one candidate wrote *The sex of specimen T is male because it possesses temporary storage of sperm, has large size, has bladder and has no ovary.* Another candidate responded *The sex of specimen T is female because it has no sperm cord, has no penis and has no testis.* Such responses show that the candidates had inadequate knowledge of identifying parts of the rat's reproductive system. Extract 16.2 is a sample of the incorrect responses to Question 1 Paper 2B.

BY THE DIAGRAM WHICH SHOW DISSECTED SPECIMEN



ont.	
	C) What is the sex of specimen T
	SEX OF SPECIMEN T is Male
	because they contain Testis Which used in Producing and storing sperm for Women Male specimen
	A)
	i) It contain fat body which help a gamete to undergo Fertilization by or for swimming by providing energy that used during the sperm formation
	ii) It contain urinary bladder which help the gamete ^{formation} of the specimen T during the Fertilization.
	iii) It contain gall bladder which help during the Enzyme formation.
	A) Why should the specimen be anaesthetized before dissection
	The specimen be anaesthetized before dissection because the specimen having are dangerous to the health of the human being because they having a characteristics of beating that why before dissection we are anaesthetized

Extract 16.2: Candidate's incorrect responses to Question 1, Paper 2B

In Extract 16.2, the candidate dissected specimen T to show the digestive system instead of the reproductive system. He/she drew a poor diagram and put incorrect labelling as he/she mislocated the testis and placed it above the stomach. He/she correctly identified the sex of specimen T and gave one correct justification that *it has testis*, but the other justifications given were incorrect. He/she also failed to give a reason for anaesthisising the specimen.

3.1.3 733/2B Biology 2C

This question required the candidates to dissect specimen A (a male or female frog/toad) in the usual way to display the viscera-in-situ and respond to the following questions:

- (a) *Which procedures did you follow from pinning back the outer skin to pinning back the inner skin?*
- (b) *Draw a diagram of the dissected specimen and label three observable parts which are concerned with the transportation of blood.*

The candidates who scored high marks (8 to 20) gave correct responses to some or all parts of the question. In part (a), they provided correct responses on the procedures for dissecting specimen A (frog/toad). However, some of the candidates wrote only five to six procedures correctly. Therefore they scored less than 20 marks.

These candidates were required to point out the procedures they followed from pinning back the outer skin to pinning back the inner skin as follows:

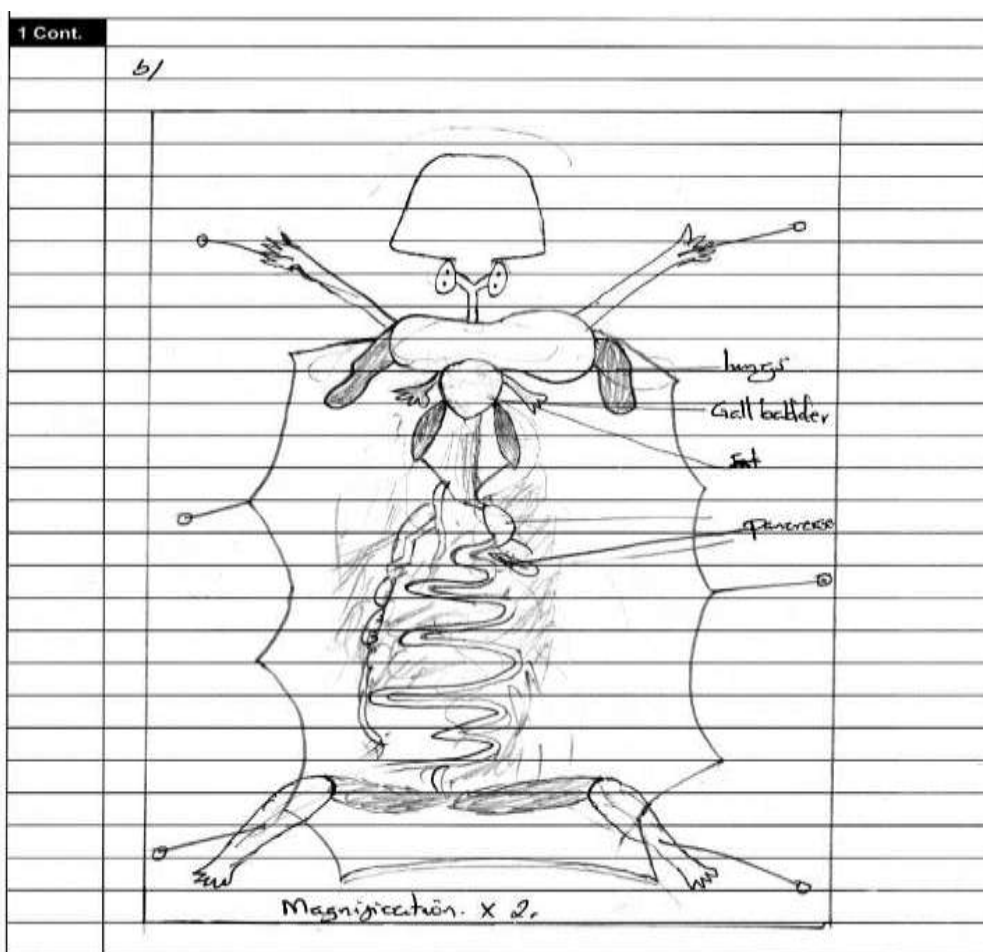
- (i) *make two small incisions in the abdominal wall one on either side of the mid-ventral line while taking care not to pierce the rectum.*
- (ii) *insert the forceps through the slit in order to grip in the loop of thread.*
- (iii) *pull the thread through the slits and cut the loop.*
- (iv) *tie the thread, a quarter of an inch apart in order to ligature the interior abdominal vein.*
- (v) *ligature the anterior abdominal vein/cutting through the vein and the body wall between the threads.*
- (vi) *cut forwards on either sides of the mid-line to the level of the centre of the xiphisternum and through the pectoral girdle or pelvic on the either sides of the mid-line while taking care not to pierce the internal organs.*
- (vii) *move the pins holding the arms outwards slightly to widen the gap while taking care not to stretch it forcibly and tear the blood vessel of the region.*
- (viii) *hold the loose piece of the abdominal wall up and cut across posterior to the pelvic veins and transversely at the level of the pelvic veins*

In part (b), these candidates drew a diagram of specimen A. They followed the principles of biological drawing. The principles include: use of pencil, large diagram, drawing in sharp lines, neatness, non-arrowed labeled lines, parallel/non crossing labelling lines, free hand drawing, magnification and caption. In addition, they were aware of the parts which are concerned with the transportation of blood such as heart, veins and arteries. However, for

those who scored above 8 marks but below 20 marks their diagrams did not well represent the dissection and also they did not indicate a caption.

Conversely, the candidates who scored from 0 – 7.5 marks failed to provide correct responses to most parts of the question. Some of them provided procedures for dissecting rats and cockroaches instead of the procedures for dissection of frogs. Other candidates provided correct procedures but confused them, losing some marks. For example, one candidate wrote the following procedures: *Tie the muscle near the heart with a piece of thread to prevent bleeding of specimen during dissection, Place the specimen A in the dissection tray, Cut the outer skin vertically and pin it well, Cut the inner layer horizontally and pin it well. Pin the fore and hind limbs using pins.* Such responses suggest that the candidates had inadequate knowledge about the procedures for dissecting frogs.

Likewise, in part (b), most of them drew diagrams of dissected specimen A but do not display viscera in-situ. They also provided labels of other systems such the digestive system and the urinary system such as *kidneys, lung, stomach* and *liver*. Some candidates identified the parts correctly but interchanged them, while others labelled less than 2 parts in the displayed diagram. Thus, they obtained low marks. Extract 17 is a sample of the incorrect responses to Question 1 in paper 2C.



Extract 17: Candidate's incorrect responses to Question 1(b), in Paper 2C

In Extract 17, the candidate dissected specimen A to display the digestive system instead of visceral-in-situ. He/she also had poor skills in drawing, and he/she labelled *pancreas* and *gall bladder* which are parts of the digestive system instead of the parts of transport system. Moreover, he/she did not provide its caption.

3.2 Question 2: Biochemistry

This question required the candidates 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 1,570 candidates. Their performance was good as 1,473 (93.8%) scored from 6 to 15 marks. Figure 16 summarises the performance on Question 2 in paper 2A, 2B and 2C.

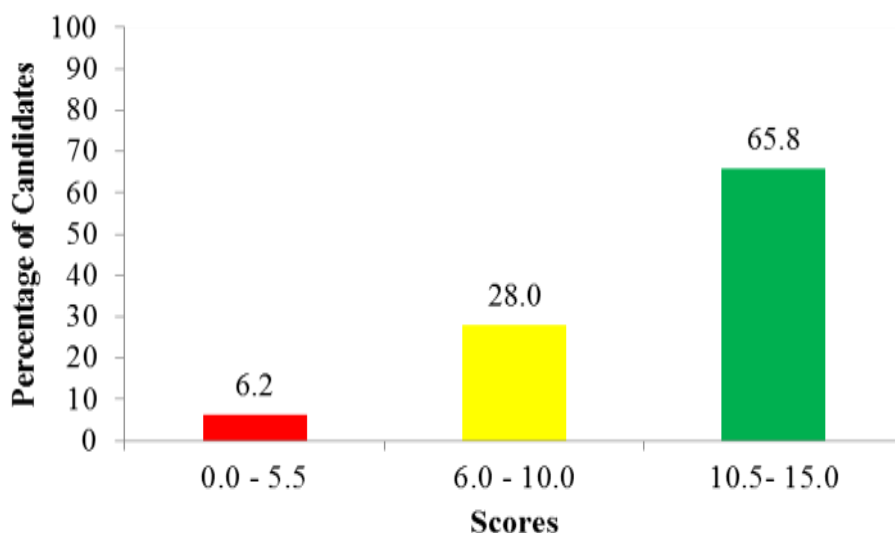


Figure 16: *Candidates' Performance on Question 2 in Paper 2A, 2B and 2C*

Data shows that 1,033 (65.8%) candidates scored from 10.5 to 15 marks; 440 (28.0%) scored from 6 to 10; and 97 (6.2%) scored from 0 to 5.5 marks.

3.2.1 733/2A Biology 2A

In this paper the candidates were provided with solutions P and Q (Egg albumen solution) and required to answer the following questions:

- (a) *Use the reagent provided to carry out the biochemical test to identify classes of food contained in solution P and Q. Tabulate your results as shown in the following table.*

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

- (b) *State three functions of the food substance(s) identified in solution P and Q in human body.*
- (c) (i) *What digestive enzyme is responsible for digestion of food substance identified in solution Q in the duodenum?*
- (ii) *Give the end product of digestion carried by the enzyme identified in (c) (i).*

(d) What nutritional disease is caused by the deficiency of food substance contained in solution Q to human?

Analysis of the candidates' responses reveals that 1,473 (93.8%) candidates who scored high marks (6 to 15) were competent in using apparatuses and measurements. Therefore, they correctly identified the classes of food contained in solution P and Q in part (a). In part (b), they stated three functions of the food substance(s) identified in solutions P and Q in the human body. They were also knowledgeable about the digestive enzyme responsible for digesting protein food in the duodenum and the end product of digestion carried by the enzyme identified in part (c). Moreover, they correctly identified the nutritional disease caused by the deficiency of food substance contained in solution Q to human. This shows that the candidates had adequate knowledge of food test experiments. Extract 18.1 is a sample of the correct responses to Question 2 in paper 2A.

2	Food Tested	Procedure	Observation	Inference
	Starch	To 2cm ³ of food sample P and Q was put in a different test tube 2 drops of iodine solution was added then the solution shaken well until the colour change	Both solution on P and Q retained the brown colour of reagent	In both solution P and Q starch was not present
	Reducing sugar	To 2cm ³ of sample P and Q was put in different test tube and 2cm ³ of benedict solution were added in each test tube followed by boiling.	Both solution P and Q retained the blue colour of reagent	Reducing sugar was absent in both solution P and Q
	Non-reducing sugar	To 2cm ³ of sample solution P and Q was put in a different test tube followed by addition of 2cm ³ of dil. hydrochloric acid followed by boiling left to cool and adding 2cm ³ of dil. sodium hydroxide followed by adding 2cm ³ of benedict solution	Both solution P and Q retained the blue colour of reagent	Non-reducing sugar was not present in both solution P and Q

2 Cont.		solution and boiled then left to cool to observe colour change.		
	Protein	To 2cm ³ of sample P and Q was put in a different test tube 2cm ³ of sodium hydroxide were added shaken well followed by addition of 2 drops of 1% copper two sulphate (CuSO ₄) shaken per each drop.	colour of the solution changed to purple	Protein was present in both solution P and Q
(b) The function of food substance present in Q above				
Q - Protein				
(i) Used for growth				
(ii) Used in the component of hair and nails				
(iii) Used to repair the body tissue.				
(c) The enzyme which responsible to the food substance identify in solution. Q in the duodenum				
trypsin enzyme				
(d) The end product of digested carried by the enzyme is Amino acid.				
(d) Kwashiorkor.				

Extract 18.1 Candidate's correct responses to Question 2, in Paper 2B.

In Extract 18.1, the candidate correctly explained the procedures for the biochemical test of starch, reducing sugar, non reducing sugar and protein. He/she correctly stated the functions of protein, identified the enzymes responsible for digesting protein in the duodenum as well as the end product of the digestion brought about by the enzyme. He/she also correctly identified the nutritional disease caused by protein deficiency.

Most of the candidates who scored average marks (from 6 to 10) correctly carried out biochemical tests of three food classes and gave the correct responses to part (b) but failed to give correct responses to parts (c) and (d). In contrast, 98 (6.2%) candidates who scored from 0 to 5.5 marks wrote the biochemical test of one to two food classes only, scoring low marks. These candidates were not knowledgeable about food test experiments. Thus, they gave incorrect procedures, observations and inferences for testing most of the foods. For example, one candidate wrote, *2 cm³ of solution P and Q were put in separate test tubes, then iodine solution was added to the two test tubes and starch was present.* This candidate did not specify the quantity of iodine solution added to the two test tubes. Therefore, he/she obtained incorrect observations and drew the wrong inferences.

In part (b), most of the candidates provide only one correct response on the function of protein instead of three. Other candidates wrote the functions of vitamins such as *it helps to protect the body against diseases* and *it helps to fight diseases*. In part (c), some of them failed to name the enzyme responsible for digesting protein in the duodenum and the end product of digestion by the named enzyme. For example, they wrote *pepsin*, which is the enzyme responsible for digesting protein in the stomach and not in duodenum. Other candidates wrote the enzymes responsible for digesting of starch in different parts of the alimentary canal such as *salivary amylase* and *pancreatic amylase*. These responses indicate that the candidates had inadequate knowledge about the roles of various enzymes.

Moreover, in part (d), some of them mentioned vitamin nutritional deficiency diseases such as *night blindness*, *pellagra* and *scurvy*. Other candidates wrote *marasmus* while others wrote *obesity* instead of kwashiorkor. Such responses show that the candidates had inadequate knowledge about the nutritional disorders. Extract 18.2 is a sample of the incorrect responses to Question 2 in paper 2A.

FOOD TESTED	PROCEDURE	OBSERVATION	INFERENCE
	To 2cm ³ of Solution		
STARCH	P and Q in separate test tube, 2 drops of Iodine solution were added in both test tubes and the contents gently shaken and left for sometimes.	The colour return to dark blue / blue black in both test tube	Starch Present in Solution P and Q
	2 To 2cm ³ of Solution		
PROTEIN	To 2cm ³ of Solution P and Q in separate test tube, 2cm ³ of the 1% of sodium hydroxide (NaOH) were added in both test tube then the and then boiled.	The colour return from blue to yellow to brick red.	The Protein Present in Solution P and Q
			Protein Present in solution Q

FOOD TESTED	PROCEDURE	OBSERVATION	INFERENCE
	To 2cm ³ of Solution		
REDUCING SUGAR:	P and Q in the separate test tube, 2 drops of the Benedict Solution were added in both test tube and the content shaken followed by boiling then cooling then add 1% of NaOH in both test tube the shake the content and left for 'Some times'.	The colour return from Blue, green, Yellow, orange and to brick red	The Reducing Sugar was Present in Solution P and Q.
NON-REDUCING SUGAR:	To 2cm ³ of Solution P and Q in separate test tube, 2 drops of the Benedict Solution were added in both test tube and the content Boiled, then cooled, then followed by adding the Hydrochloric acid (HCl) the Boiled again and then Cooling	The colour return from Blue, green, Yellow, orange to brick red.	The Non-Reducing Sugar Present in Solution P.
			The Non-Reducing Sugar Present in Solution Q.
b) Protein			
- To provide energy of the body.			
c) Digestive enzyme responsible for digestion of the Food Substance identified in solution Q in the duodenum			
- the enzyme is Pancreatic amylase			
ii) The end product of the Pancreatic amylase is			
Glucose.			

Extract 18.2: Candidate's incorrect responses to Question 2, in Paper 2A

In Extract 18.2, the candidate correctly outlined the food substances to be tested and the procedure for testing starch and inference for protein.

However, he/she incorrectly wrote the procedures, observations and inferences of the other foods in part (a). He/she also wrote the function of carbohydrate as to *provide energy of the body* instead of the functions of protein in part (b). Furthermore, he/she wrote the digestive enzyme as *pancreatic peptide* instead of erepsin and *glucose* as the end product instead of amino acid in parts (c) (i) and (ii) respectively.

3.2.2 733/2B Biology 2B

This paper provided the candidates were with solution U (Sucrose solution) and required them to answer the following questions:

- (a) *Using the reagents provided, carry out the biochemical test to identify food substance(s) contained in solution U. Tabulate your results, as shown in the following table:*

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

- (b) *Identify two natural food stuffs from which solution U could have been extracted from.*
- (c) *State the first site of digestion, the digestive juice and the product of digestion of the food substances identified in solution U.*

Analysis reveals that the candidates who scored high marks (from 6 to 15) were competent in using of apparatuses and measurements. Therefore, they explained the correct procedures for identifying each food substance. Consequently, they obtained the correct observations and drew the correct inferences. Moreover, they correctly identified the food substance(s) contained in solution U in part (a). In part (b), they identified two natural foodstuffs from which solution U was extracted. Moreover, they were aware of the the first site of digestion, the digestive juice, and the product of digestion of the food substances identified in solution U in part (c). This shows that the candidates had adequate knowledge of food test experiments. Extract 19.1 is a sample of the correct responses to Question 2 in paper 2B.

a) FOOD TESTED	PROCEDURES	OBSERVATION	INFERENCE
NON-RED UCING SUGAR	<p>To 2cm³ of solution sample U in a test tube one (1cm³) of dil. Hydrochloric acid (HCl) was added the mixture was shaken and boiled then cooled then 2cm³ of dil. sodium hydroxide was added followed by 2cm³ of benedict's soln the mixture was shaken and boiled</p>	<p>The colour change from blue to green to yellow, to orange and finally to brick red precipitate</p>	<p>Non-reducing sugar was present</p>

2 Cont.			
a)	FOOD TESTED	PROCEDURES	OBSERVATION INFERENCE
	REDUCING SUGAR	To 2cm ³ of solution sample U in a test tube (two) 2cm ³ of benedict solution was added the mixture was shaken and boiled	The blue colour reagent retained which is benedict solution colour Reducing sugar was absent
	PROTEIN	To 2cm ³ of solution sample U in a test tube 2cm ³ of dil. sodium hydroxide (NaOH) were added followed by two drops of 1% copper II sulphate the mixture was shaken	The colour reagent retained blue colour Protein was absent
	LIPIDS	To 2cm ³ of solution sample U in a test tube three drops of sudan III were added the mixture was shaken	The colour reagent of sudan III retained red Lipids was absent
2 Cont.			
	Food obtained is Non-reducing sugar		
	b) Natural foods		
	i) Sugar cane		
	ii) ginger		
	c) The first site of digestion of the Food substance identified in solution U is duodenum		
	-The digestive juice is <u>sucrase</u>		
	- The end product of digestion of is <u>Glucose</u>		

Extract 19.1: Candidate's correct responses to Question 2, in Paper 2B.

In Extract 19.1, the candidate correctly outlined the procedures for testing non-reducing sugar. He/she wrote the correct observation and inference in part (a). He/she also correctly identified the food substance in solution U as well as the natural foods and the part where the food is firstly digested, the digestive juice responsible, and the end products.

In contrast, the candidates who scored low marks (0 to 5.5) provided correct response to only some parts of the question. They correctly outlined the food substances to be tested but provided either incorrect procedures or observations and inferences, losing some marks. Some of the candidates added the correct reagents to the incorrect food types. For example, in part (a), some candidates wrote the procedures for testing protein as, *in a dry and clean test tube add 2 cm³ of solution U, followed by 2 cm³ of Benedicts solution shaken gently and boiled then cooled*. Other candidates used the correct reagents but did not indicate specific quantities of the reagents used in each procedure; hence, they did not score full marks. These responses indicate that the candidates had partial knowledge of food test and skills in doing food test experiments.

In part (b), some of the candidates identified the food as *reducing sugars* while others wrote protein. They also wrote incorrect natural foodstuffs from which solution U was taken such as *carrots* while others wrote *oranges*. Likewise, in part (c), they incorrectly identified the first part where the food substance in solution U is digested. Some of the candidates wrote the *stomach* and *mouth* while others wrote *ileum*. Likewise, these candidates wrote the digestive juice found in the stomach instead of the digestive juice found in the duodenum as *pepsin* and *rennin*. Some candidates wrote *amino acid* as the end product of digestion of non reducing sugar instead of glucose. Such responses indicate that they had inadequate knowledge of the tested concepts. Extract 19.2 is a sample of the incorrect responses to Question 2 in paper 2B.

(01)

Food tested	Procedures	Observation	Inference
Lipids	- To 2 cm ³ of food sample solution in a test tube, drops of Sudan III solution were added. Shaken and left to settle.	- The mixture remained white. No colour of the reagent or no change.	- Lipids were not present.
Protein	- To 2 cm ³ of food sample solution in a test tube, drops of solution were added. Shaken well.	- The colour of the solution was changed to purple.	- Protein was present.

2 Cont.	Reducing sugar	To 2cm ³ of a food sample solution in a test tube, 2cm ³ of benedict solution were added and left to cool.	The colour of the solution remained unchanged	Reducing sugar was present
	Non-reducing sugar	To 2cm ³ of a food sample in test tube, 2cm ³ of dilute hydrochloric acid was added. Shaken, boiled and left to cool, followed by 3 drops of	The food sample solution were changed to blue	Non-reducing sugar was present

2 Cont.		sodium hydroxide (NaOH) shaken well; followed by 2 drops of benedict solution, boiled, shaken and left to cool		
	(b) i) Sugarcane ii) Liver			
	(c) Non-reducing sugar			
	- The first part of digestion is within the stomach			
	- The digestive juice is Gastric juice			
	- End product is peptide			

Extract 19.2: Candidate's incorrect response to Question 2, in Paper 2B.

In Extract 19.2, the candidate incorrectly wrote the procedures for and observations from testing protein, reducing sugar, lipid and non reducing sugar. He/she wrote incorrect inference for protein in part (a). He/she wrote the first part of the digestion of non reducing sugar as *stomach* instead of duodenum. He/she also wrote the digestive juice produced as *gastric juice* instead of sucrase and the end product as *peptide* instead of glucose and fructose. However, he/she correctly identified the food substance contained in solution U and the natural foodstuffs from which solution U could have been extracted.

3.2.3 733/2C Biology 2C

This paper provided the candidates with specimen Q (Liver) and required them to carry out procedures (a) to (i) and then answer the questions follow:

- (a) *Cut specimen Q into small pieces using scapel.*
- (b) *Place the pieces into mortar and mix it with one spatula full of sand*
- (c) *Grind the mixture using pestle to make a paste.*
- (d) *Label 2 test tubes as test tube B and C.*
- (e) *Place a small portion of the paste into each test tube*
- (f) *Add 2 ml of 2% H₂O₂ solution into the test tube B and note the change.*
- (g) *Test the nature of the gas evolved from the test tube using a wooden splint. Record your observation.*
- (h) *Add 2 cm³ of distilled water to the contents of test tube C then boil for 3 minutes.*
- (i) *Repeat the same procedure in stage (f) and (g) for test tube C then record your observation.*

The questions asked were:

- (a)
 - (i) *What was the aim of this experiment*
 - (ii) *Which test tube was used as a control experiment?*
- (b) *Give a reason for doing each of the following:*
 - (i) *Mixing specimen Q with sand.*
 - (ii) *Grinding the specimen Q.*
- (c)
 - (i) *What did you observe after adding 2% hydrogen peroxide solution into each of the test tubes B and C? Give reason for each observation*

- (ii) *Suggest the name of the substance contained in the specimen Q which was responsible for the changes noted in (f).*
- (iii) *Write a chemical equation for the reaction which occurred after adding 2% hydrogen peroxide solution to the test tube B.*
- (d) *Name the gas evolved in this experiment. Give reason for your answer.*
- (e) *What can you deduce from this experiment?*

Analysis shows that the candidates who scored high marks (6 to 15) on this question were competent in conducting experiments, giving the correct responses to most parts of the question. In part (a), they correctly gave the aim of the experiment and identified the test tube used as a control experiment. In part (b), they were aware that specimen Q was mixed with sand to increase friction and to stop the slippery nature of the liver. The liver was also ground to increase the surface area of the substrate and the rate of reaction. In part (c), they wrote the correct observation on test tube B; they observed an evolution of strong effervescence which appeared as air bubbles because the enzyme catalase was active. In test tube C, they observed little or no evolution of effervescence because the boiling of the contents denatured the catalase enzyme. Moreover, they correctly identified the substance contained in the specimen Q, which was responsible for the changes noted in (f) as well as the chemical equation for the reaction which occurred after adding 2% hydrogen peroxide solution to test tube B. In addition, they were aware of the rules of writing chemical equations. Thus they correctly provided a balanced equation. They named the gas evolved in the experiment as well as gave reasons. They were also aware that enzymes work best under a certain range of temperature known as optimum temperature, lower or higher temperature than the optimum can cause the enzymes to be denatured. Extract 20.1 is a sample of the correct responses to Question 2 in paper 2C.

2	a)		
i/	The aim of experiment was to determine the effect of Surface area on enzyme activity.		
ii/	Test tube B was used as a Control experiment.		
i/	b) Specimen B mixed with Sand for the purpose of increasing Friction force.		
ii/	Specimen Q grinded for the purpose of increasing Surface area of the specimen so as to speed up the rate of reaction.		
i/	c)		
	Procedure	Observation	Reasons
	Q% hydrogen peroxide solution into test tube B and C containing mixture of specimen Q	High effervescence observed (formation of bubbles) in test tube B.	Enzyme catalase was high to cause increase rate of reaction.
		Low effervescence observed (Low formation of bubbles) in test tube C	Heating process denatured the activity of the enzyme catalase in test tube C

2 Cont.	c)
ii)	Specimen Q contained catalase enzyme which cause high formation of bubbles in test tube B.
iii)	Chemical equation for the reaction occurred to test tube B was
	$2\text{H}_2\text{O}_2 + \text{Catalase enzyme in Specimen Q} \longrightarrow 2\text{H}_2\text{O} + \text{O}_2$
	d)
	Gas evolved in experiment was Oxygen gas
	Because after testing the gas evolved by using wooden splint, the gas supported the burning of the wooden splint, and cause burning process to take place.
	e). Enzymatic reaction is affected by the change in temperature.
	At optimal temperature, the rate of enzymic reaction become high while at very high temperature, the rate of reaction decrease because enzymes become denatured.

Extract 20.1: Candidate's correct responses to Question 2, in Paper 2C.

In Extract 20.1, the candidate correctly gave the aim of the experiment and identified the test tube used as a control experiment in part (a). The candidate gave the reason for mixing specimen Q with sand and grinding specimen Q. He/she gave the correct observation and the reason after adding 2% hydrogen peroxide solution into each of test tubes B and C. He/she also suggested the name of the substance contained in specimen Q, which was responsible for the changes noted in (f). He/she also wrote a balanced chemical equation for the reaction which occurred after adding 2% of hydrogen peroxide solution to test tube B in part (c). He/she correctly named the gas evolved from this experiment, gave the reason and

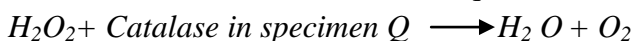
correct deduction from the experiment. However, he/she could not score full marks because of giving one reason as to why specimen Q was mixed with sand.

In contrast, analysis shows that candidates who scored from 0 to 5.5 marks provided incorrect responses to most parts of the question. Hence, they could not score full marks. For example, in part (a), some of the candidates wrote the aim of experiment was *to determine the effect of enzyme on temperature activity and the test tube which was used as a control experiment is test tube C*. In part (b), most of them wrote the correct reasons for mixing specimen Q with sand and grinding it but scored less marks because they wrote only one reason for mixing specimen Q with sand instead of two. In part (c), (i) they wrote incorrect observations after adding 2% hydrogen peroxide solution into each of test tubes B and C. For example, some candidates wrote *in test tube B there was evolution of smoke while in test tube B nothing was given out*. In part (c) (ii) some candidates wrote *temperature* while others wrote general term as *enzyme* without specifying the exact name of the enzyme.

Likewise, in part (c) (iii) these candidates wrote incorrect chemical equations for the reaction, such as



Others wrote the correct chemical equation but did not balance it, such as



Moreover, in part (d) the candidates failed to name the gas evolved from the experiment. For example, some candidates wrote *carbon dioxide* and others wrote *carbon monoxide*. These candidates did not understand that, the gas evolved was oxygen. In part (e), most of the candidates gave properties of enzymes as conclusion from the experiment by writing that *enzymes are protein in nature*. These candidates failed to realize that *enzyme work best under a certain range of temperature known as optimum temperature. The lower or higher temperature than that causes the enzymes to be denatured*. Such incorrect responses signify that the candidates had partial or no knowledge about enzyme controlled reactions. Extract 20.2 is a sample of the incorrect responses to Question 2 in Paper 2C.

2 Cont.	
a (i)	To determine the effect of temperature action.
ii.	Test tube C
b. i.	We are mixing Specime Q with sand in order to increase surface area on the Enzymes
	(ii) We are grinding the Specime Q so that we can get a sample that can enable us to conduct the experiment.
C (i)	After adding 2% hydrogen peroxide solution in test tube B the gas evolved.
b.	
	(ii) the The name of substance contained in the Specimen Q which was responsible for the the changes noted in (f) is Catalase.
iii.	Chemical equation for the reaction which occurred is
	$\text{H}_2\text{O}_2 \xrightarrow{\text{Catalase}} 2\text{H}_2\text{O} + \text{O}_2 + \text{H}_2$
D.	The gas evolved in experiment is Oxygen gas (O_2) simply because when the reaction of $2\text{H}_2\text{O} + \text{O}_2$ formed

Extract 20.2 : Candidate's incorrect responses to Question 2, in Paper 2C.

In Extract 20.2, the candidate wrote the answer control experiment is *test tube C* instead of test tube B in part (a) (ii). He/she wrote that specimen Q was mixed with sand *to increase surface area on the enzymes* instead of increasing friction and to stop its slippery nature in part (b). He/she wrote the answer *gas evolved* instead of giving the observation and its reasons in (c) (i). In addition, he/she did not write observations and reasons for test tube C. The candidate also gave an incorrect chemical equation for the reaction which occurred after adding 2% hydrogen peroxide solution to the

test tube B. The responses to part (c) (ii) and part (d) were correct, though the candidate did not give reasons to support the answer in part (d). In addition he/she skipped part (e).

3.3 Question 3: Classification of Living Things

This question gave the candidates specimens for identification and required them to answer the question that followed. The question was attempted by all 1,570 candidates. Their general performance on this question was good because 1,447 (92.2%) scored from 6 to 15 marks. Figure 17 shows the candidates' performance on Question 3 in all three papers (2A, 2B and 2C).

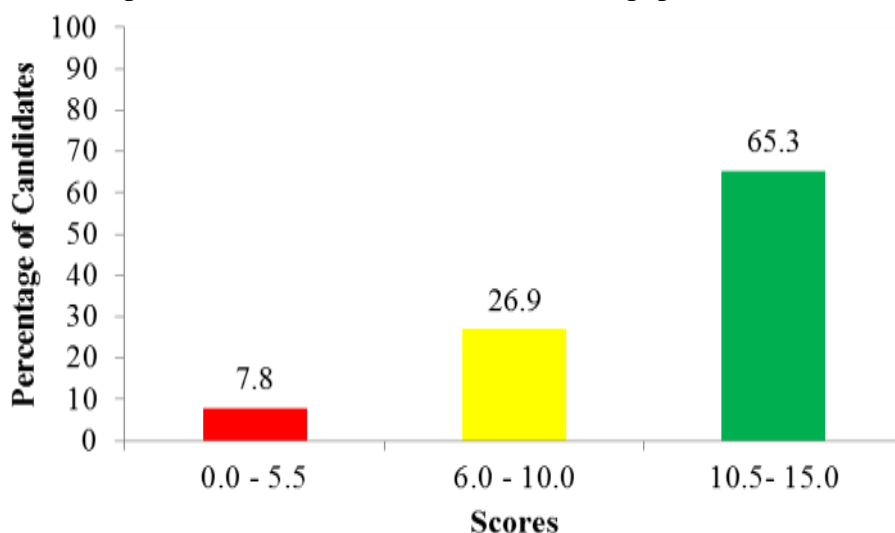


Figure 17: *Candidates' Performance on Question 3 in Paper 2A, 2B and 2C.*

Data shows that, 1,025 (65.3%) candidates scored from 10.5 to 15 marks; 422 (26.9%) scored from 6 to 10 marks; and 123 (7.8%) scored from 0 to 5.5 marks.

3.3.1 733/2A BIOLOGY 2A

This question provided the candidates with a bee, spider, tilapia fish, grasshopper and a monocot plant labelled as specimen L, M, N, O and R, respectively. It required them to observe the specimens carefully and answer the questions that follow:

- (a) *With what observable features would you place the specimens M, N and R in their respective classes? Give two points for each.*

- (b) Which observable features help the specimen O to be an agent of pollination? Give two points.
- (c) Draw a diagram of specimen N and label the locomotive structures.

Analysis indicates that the candidates who scored from 6 to 15 marks gave the correct responses to almost all parts of the question, suggesting that they had adequate knowledge about Major grouping of Living Organisms. They identified that specimen M *has no antennae, has four pairs of legs and two body parts where the head is fused with the thorax*. Thus, it belongs to class Arachnida. Likewise, specimen N belongs to Osteichthyes since *it has symmetrical caudal fins, cycloid scales, has one large dorsal fin and gill opening covered by an operculum*. Specimen R belongs to class Monocotyledonae since *it has leaves with parallel veins and adventitious roots (fibrous roots)* in part (a) of the question.

In part (b), they correctly identified an observable feature that helps specimen O to be an agent of pollination such as the *presence of wings, which enable it to fly from one flower to another for transfer of pollen grains*. In addition, *it has hairy body that makes pollen grains to stick to it for easy transfer from one flower to another*. Lastly, the candidates correctly drew diagrams of a tilapia showing its locomotive parts, such as pectoral and pelvic fins, caudal and anal fins and the dorsal fin. Extract 21.1 is a sample of the correct responses to Question 3 in Paper 2A.

a) i/ The observable features that I would place Specimen M in it's class are:

It has cephalothorax and abdomen.

It has four pairs of legs.

ii/ The observable features that I would place Specimen N in it's class are:

It has cycloid scale.

It has terminal mouth.

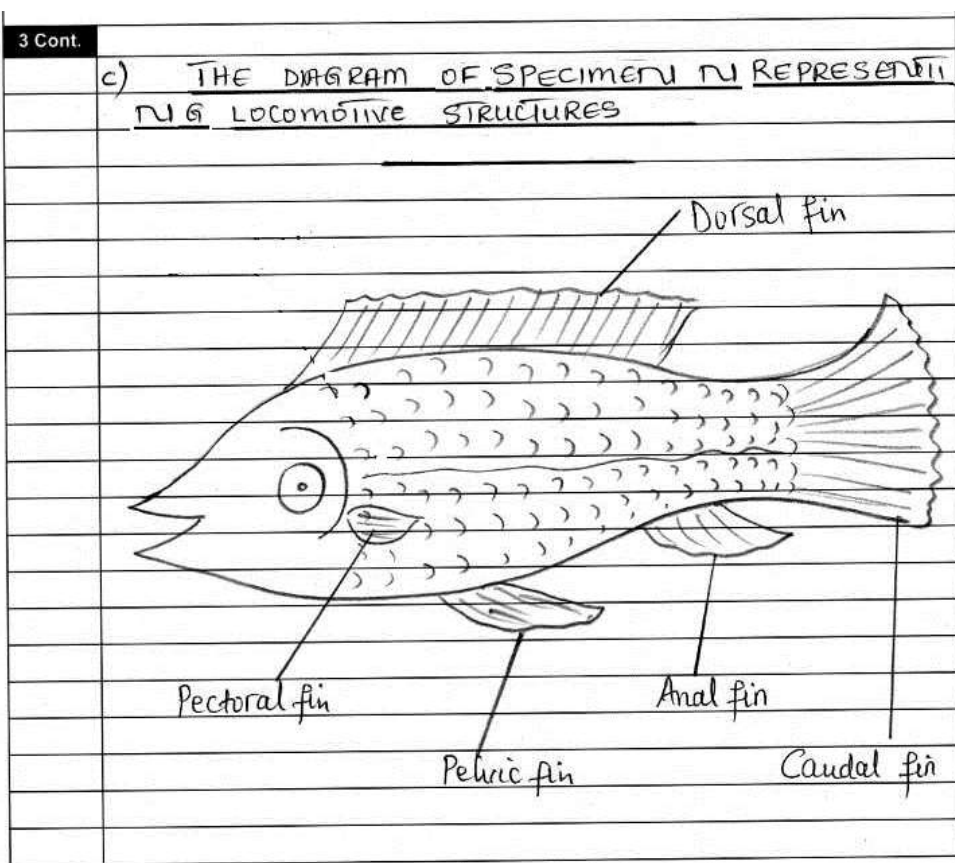
iii/ The observable features that I would place Specimen R in it's class are:

- It has thin and narrow leaves with parallel veins
It has adventitious roots.

b) The observable feature that helps the Specimen O to be an agent of pollination are:

i/ It has wings which is used for flying so as to transfer pollen grains.

ii/ It has hairy body which aid in carrying pollen grains.



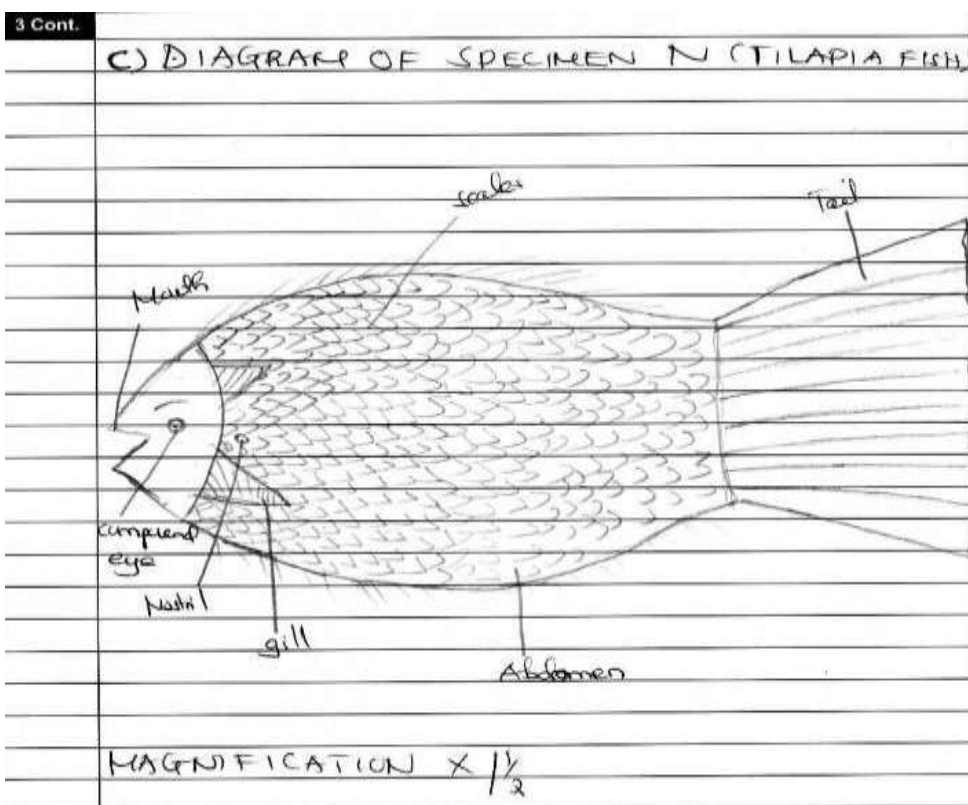
Extract 21.1: Candidate's correct responses to Question 3 in Paper 2A.

In Extract 21.1, the candidate correctly identified the provided specimens. He/she identified the features used to place specimens M, N and R into their respective classes in part (a). He/she gave observable features that help specimen O to be an agent of pollination in part (b). In addition, he/she correctly drew the diagram of specimen N to show the structures used for locomotion in part (c).

In contrast, the candidates who scored from 0 to 5.5 had inadequate knowledge of the groups of living organisms. For example, in part (a), some candidates confused the characteristic features of the given specimens. Others wrote the general features of the organisms instead of the distinctive characteristics that place the organisms to their respective classes. For example, some of the candidates wrote the features that placed specimen M to its respective class as *spider has exoskeleton and segmented body*, which are general characteristics of Phylum Arthropoda and not Class Arachnida. Others wrote the characteristics of Class Insecta instead of Class Arachnida, such as *has one pair of antenna, wings and body*

divided into three parts. Likewise, regarding specimen N (tilapia fish) the candidateS wrote the general characteristics of all kinds of fish, such as *presence of fins*, *presence of gills* and *tails*. In addition, the candidates incorrectly identified *presence of veins in leaves* and *ability to produce cotyledon* as features that place specimen R (monocot plant) to its respective class. Some of the candidates drew correct diagrams but labelled irrelevant structures. Others drew diagrams of other fishes such as sharks contrary to the demand of the question. Extract 21.2 is a sample of the incorrect responses to Question 3 in Paper 2A.

3	
a) Specimen M.	
i) Have four pair of legs.	
ii) Have found in class insecta	
Specimen N	
i) Have found in class amphibia	
ii) Have live in aquatic area (habitat)	
Specimen R	
i) Have found in the class dicotyledoneae.	
ii) Have habitat on the land (terrestrial)	
b) Have mouth help to take anther and flower to the other plant in order to increase the pollination.	
iii) Have leg support takes anther and flower from male gamete and female gamete from one plant to another.	



Extract 21.2: Candidate's incorrect response to Question 3, in Paper 2A.

In Extract 21.2, the candidate incorrectly identified the classes to which spider, tilapia fish and monocot plant belong as insect, amphibian and dicotyledonae instead of Arachnida, Chondrichthyes and Monocotyledonae, respectively. However, the classes were not part of the question. He/she also drew the diagram of tilapia fish but did not indicate the dorsal, pelvic and anal fins. In addition, he/she labelled the parts such as *compound eye*, *abdomen*, *gill*, *nostril* and *scales* instead of the locomotive parts. However, the feature of specimen M that it *has four pairs of legs* was correct.

3.3.2 733/2B BIOLOGY 2B

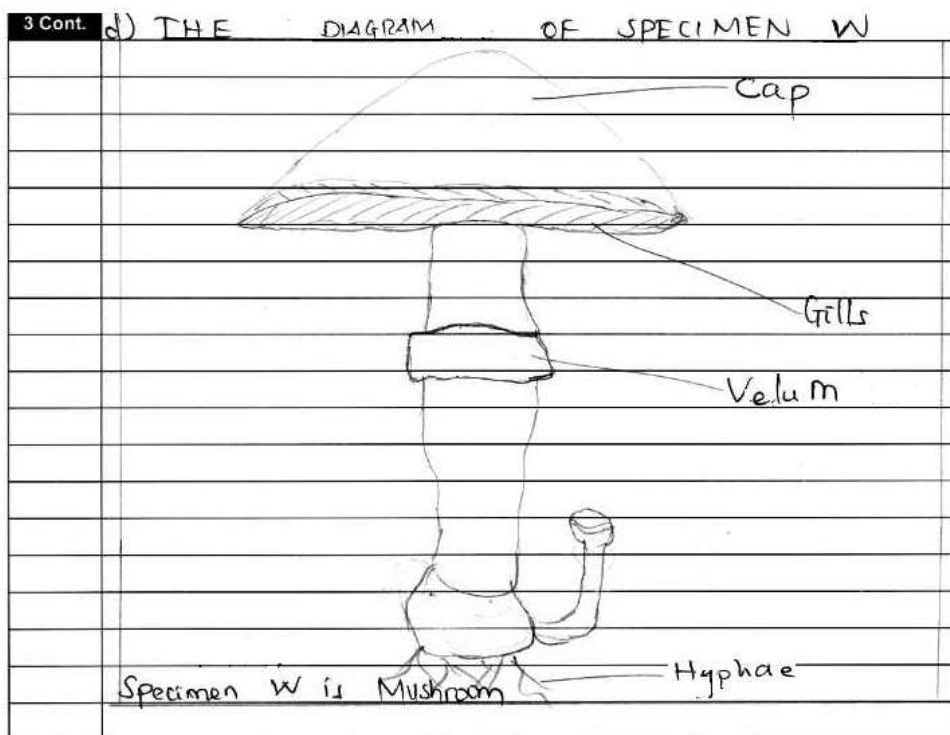
This question required the candidates to observe the provided specimens V (Crab), W (Mushroom) and Y (Bee) and then answer the following questions:

- In what ways is specimen Y useful to human beings? Give two points.*
- Why is specimen Y placed in the Class Insecta? Give three reasons.*

- (c) *Using three observable features, differentiate between specimen V and Y.*
- (d) *Draw specimen W and label three parts.*

Analysis shows that the candidates who scored from 6 to 15 marks on this question had adequate knowledge about the major groups of living organisms. They understood that specimen Y is useful to human since *it is an agent of pollination, produces honey that is used as food and it produces wax, which is used as raw materials for the industries*. Specimen Y belongs to class Insecta since *it has three pairs of legs, three body parts/regions (head, thorax and abdomen) and one pair of antennae*. They also correctly wrote observable features, which differentiate specimen V and Y. Additionally, some drew diagrams of specimen W and labelled parts such as the gills, velum, stipes, pileus and hyphae. Extract 22.1 shows a sample of the correct responses to Question 3 in paper 2B.

3	a) The specimen Y is useful to human being because	
	i) It helps in pollination of flowers.	
	ii) The specimen Y helps and produce waxes and honey that used in different manufacturing industries	
	*#	
	b) The specimen Y Placed in the class Insecta because	
	i) It has three pair of Segmented legs.	
	ii) It has two pair of wings.	
	iii) Its body divided into three parts such as head, thorax and abdomen.	
	c) Differences between specimen V and Y	
	Observable features	Differences
		Specimen V Specimen Y
	i) Locomotion legs.	Have (4) pair pairs of locomotion legs - Have three (3) pairs of locomotion legs
	ii) Flying wings	Has no wings for flying - Have two (2) pair of wings
	iii) Antennae.	- Has one (1) pair for sensitivity - Have two (2) pairs of antennae for sensitivity
	hence Specimen V is Crab	
	Specimen Y is honey bee	

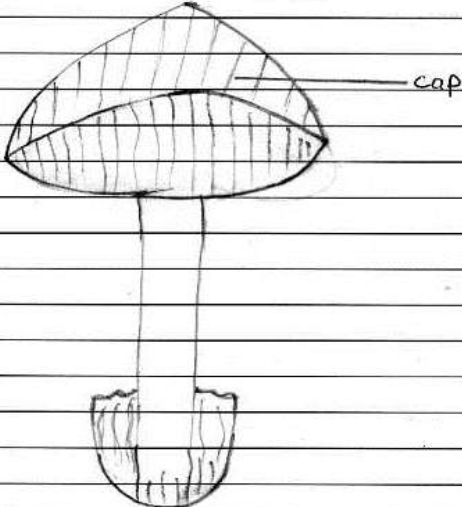


Extract 22.1: Candidate's correct response to Question 3, in Paper 2B

In Extract 22.1, the candidate correctly identified specimens V, W and Y with their characteristics. He/she drew the diagram of specimen W and labelled 4 parts correctly.

However, the candidates who scored low marks (0 to 5.5) had inadequate knowledge about the major groups of living organisms. They provided incorrect responses to all or some parts of the question. For instance, in part (a), some of them incorrectly identified the usefulness of specimen Y (bee) as *it is used as food for human being*. In part (b), most of these candidates wrote only one or two correct reasons for placing specimen Y in their respective classes. Nevertheless, some of them wrote the general features of the bee, such as *Has abdomen, exoskeleton and jointed appendages* instead of the distinctive features of Class Insecta. Others wrote the distinctive features of Class Arachnida instead of Class Insecta's such as *it has body divided into two parts and has four pairs of jointed appendages*. Likewise, in part (c) some of these candidates used incompatible features to differentiate specimen V and W, losing some marks. For example, one candidate wrote specimen V- *body is covered with skeleton while specimen Y body is divided into three parts, specimen V is an aquatic organism while*

specimen Y has three pairs of legs and specimen V has five pairs of appendages while specimen Y has two pairs of antenna. Moreover, in part (d), some of the candidates drew diagrams of different organisms from specimen W (Mushroom). For instance, one candidate drew a diagram of the moss plant. Others drew diagrams of breadmould and yeast instead of mushroom. Moreover, other candidates drew correct diagrams but failed to indicate the parts of specimen W; conversely, others indicated correct labels but interchanged them. Hence they obtained low marks. Extract 22.2 shows a sample of the incorrect responses to Question 3 in paper 2B.

3	a) i) specimen Y used in production of honey ii) specimen Y used in production of wax	
	b) specimen Y is placed in the class Insecta because, i) It has legs for movement. ii) used as a source of food for other animals. iii) It has wings for movement.	
	c) specimen V	specimen Y.
	- It has wings	- It has no wings
	- It has five pair of legs	- It has two pair of legs.
	- It has segmented body	- Its body is flattened.
	DRAWINGS TO SHOW SPECIMEN W	
d.		

Extract 22.2: Candidate's incorrect responses to Question 3, in Paper 2B.

In Extract 22.2, the candidate wrote the uses of specimen Y's body parts such as *it has wings for movement* instead of the reasons for placing specimen Y in the Class Insecta in part (b). The candidate incorrectly differentiated specimen V and Y in part (c). For example, he/she wrote *specimen V has five* instead of four pairs of legs while *specimen Y has two* instead of three pairs of legs. He drew the diagram of specimen W, but she did not indicate hyphae in the diagram. Also he/she labelled only one out of three parts. However, the responses in part (a) were correct.

3.3.3 733/2C BIOLOGY 2C

This question provided the candidates with specimens D (Hind limb of a grasshopper), E (small bird) and F (Black ant) and required them to answer the following questions:

- (a) (i) *What are the observable features used to place specimen E to its respective Kingdom? State two features.*
- (ii) *How are the members of the Class to which the specimen E belong important for industrial development? Give three points.*
- (iii) *State four observable features which enable specimen E to adapt to its habitat.*
- (b) (i) *Identify the organism from which specimen D was taken.*
- (ii) *How is specimen D important to the organism from which it was taken? Give two points.*
- (c) *What observable features are used to place specimen F to its respective Phylum? State three features.*

The candidates who scored high marks on this question (from 6 – 15) were competent in identifying living organisms. They understood that the observable features which place specimen E (small bird) to its respective Kingdom Animalia are the *presence of sense organs such as ears, nose and eyes and locomotive structures such as legs and wings*. These candidates were knowledgeable about the importance of the members of the class to which specimen E belongs for industrial development; that is, *they have feathers which are used to make ornaments, their bones are used to make supplements for animals feed and they are used in meat processing industries*. Additionally, specimen E is successfully adapted to its habitat since *it has feathers, which insulate the body, has streamlined body to*

resist air friction when flying, has pointed beak modified for feeding, wings for flying in search of food, avoidance of enemies and search for mate. Also, it has legs modified for scratching.

In part (b), the candidates had adequate skills in identifying the organism's body parts. Therefore, they identified the organism from which the specimen D was taken as *Grasshopper*. In addition, they correctly gave ways in which specimen D (Hind limb of a grasshopper) is important to the organism as *it helps the organism to defend itself against enemies and it helps the organism to locomote*. Finally, they identified the features used to place specimen F to its respective Phylum (Athropoda) such as *presence of exoskeleton, jointed appendages and segmented body*. Extract 23.1 shows a sample of the correct responses to the question.

(a)

(i) - Specimen E possess one pair of leg and one pair of wing that enable them for locomotion and movement.

- Specimen E have sense organs.

(ii) - They are used for pollination hence increase reproduction of plant materials or products.

- They are used in meat industries.

- They are used to make ornaments.

(iii) Observable features that enable Specimen E to adapt in its habitat.

- They possess wings that enable them to move to find food and habitats.

- They have the ~~comp~~ simple eyes that enable them to focus.

- They possess mouth for taking in food.

- They have feathers to insulate the body.

3 Cont.	
(b).	
(*)	The organism from which specimen D was taken is <u>Grasshopper</u> .
(11)	- It is important because it is used during movement and locomotion.
	- It is important because also it used to defend against enemies.
(C)	- The presence of segmented body.
	- The body of specimen D have jointed appendages.
	- The Specimen D possess exoskeleton

Extract 23.1: Candidates correct responses to Question 3, in Paper 2C.

Extract 23.1, the candidate correctly wrote the observable features used to place specimen E to its respective Kingdom. He/she wrote the importance of the members of the Class to which specimen E belongs for industrial development and stated four observable features which enable specimen E to adapt to its habitat in part (a). He/she correctly identified the organism from which specimen D was taken and gave the importance of specimen D to the organism from which it was taken in part (b). He/she also gave observable features used to place specimen F to its respective Phylum. He/she gave the importance of the members of the class from which specimen E belongs that is not for industrial development as *they are used for pollination*; thus, they could not score full marks.

On the contrary, the candidates who scored from 0 to 5.5 were incompetent in identifying living things. They provided incorrect responses to almost all parts of the question, signifying a lack of knowledge about the concepts. For example, in part (a), most of the candidates were unaware of the characteristic features of Kingdom Animalia. Therefore, failed to identify observable features which place specimen E (small bird) to its respective

Kingdom. Most of the candidates wrote observable characteristic features of Class Aves, such as *presence of beaked mouth, feathers and claws*. Others wrote features of phylum Chordata instead of the Kingdom such as *they have dorsal nerve cord* and *they have tail, which is rudimentary*. In addition, these candidates wrote incorrect features, which enable specimen E to adapt to its habitat. Some of the candidates wrote the structures without explaining how they were adapted to their functions. For example, one candidate wrote *they have feathers, they have streamlined body, they have pointed beak and they have wings*. Other candidates stated only one or two correct observable features, which enable specimen E to adapt to its habitat. Hence did not score full marks. Extract 23.2 is a sample of the incorrect responses to this question.

(a) (i)

(i) It has pair of wings which enable it to move or to fly from one point to another for searching food and escaping from dangerous situation.

(ii) It possesses long mouth and sharp one, enable it to feed easily various organism including microorganisms/small insects.

(ii) (a) Used to eat dead organic matter

(b) Used to clean environment through feeding from dead organisms.

(c) Used to balance the ecology system, due to they are source of food to other organisms as well as they eat other organisms.

(b) (i) Grasshopper organism.

(ii) (a) It is a source of food to other organisms.

(b) ~~It is used in soil formation~~

(b) It is used to balance population through feeding other organisms in order for it to survive.

(c) (i) A pair of wings

(ii) ~~A long mouth~~

(ii) A long and sharp mouth.

(iii) Its abdomen and thorax fuses to form ~~the~~ cephalothorax and pair of legs.

Extract 23.2: Candidate's incorrect responses to Question 3 in Paper 2C.

In Extract 23.2, the candidate wrote adaptive observable features of a bird instead of observable features used to place specimen E to its respective

Kingdom in (a) (i). He/she wrote the advantages of the members of the Class to which specimen E belongs, which were not important for industrial development in part (a) (ii). Although he/she correctly identified specimen D, he/she wrote the advantages of the organisms from which specimen D was taken instead of the importance of specimen D (Hind limb of a grasshopper) to the grasshopper in (b) (ii). He/she also wrote features of Class Insecta such as a *pair of wings* and feature of class Arachnida, instead of the observable features used to place specimen F to its respective Phylum Arthropoda in part (c).

4.0 ANALYSIS OF CANDIDATES' PERFORMANCE ON EACH TOPIC

Paper 1 comprised of 11 topics which were examined in 14 questions. Analysis shows that the candidates demonstrated good performance on the topics of *Ecology* (93.8%), *Planing and Preparation for Teaching* (91.2%), *Fundamentals of Teaching and Learning Biology* (81.5%), *Analysis of the O-Level Biology Curriculum Materials* (81.3%) and *Body Health and Immunity* (70.1%). The topics on which they had average performance were *Clasifification of Living Things* (57.9%), *Assement in Biology* (40.7%) and *Basic Biology Laboratory Skills* (40.4%).

The topics with weak performance were *Genetics* (26.8%), *Biochemistry* (14.9%) and *Respiration* (12.7%). The candidates' performance on each topic in 733/1 Biology 1 is summarized in Appendix I.

Paper 2 (practical paper) comprised 3 topics which were examined in 3 questions. The candidates demonstrated good performance on *Biochemistry* (93.8%), *Classification of Living Things* (92.2%) and *Basic Biology Laboratory Skills* (91.5%). The candidates' performance on each topic in 733/2 Biology 2 is summarized in Appendix II.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

The analysis of candidates' performance on the Biology DSEE examination 2022 shows that the performance in paper 1 was good since 1,539 (99.42%) candidates passed the examination. The questions which had good performance were 2 (93.8%), 7 (91.2%), 14 (87.4%), 8 (81.5%), 9 (81.3%) and 11 (70.1%). The questions which had average performance were 3

(57.9%), 1 (51.2%) and 10 (40.7%). However, they demonstrated weak performance on questions 12 (26.8%), 5 (14.9%) and 4 (12.7%). In 733/2 Biology 2, questions 3 (93.8%), 2 (92.1%) and 1 (91.5%) had good performance. This shows that candidates perform better and remember easily taught materials when they learn by doing. Teaching through practice can also help in improving the performance on the topics with weak performance. Furthermore, analysis indicates that the ability to understand the requirements of the questions, candidates' adequate knowledge of the examined topics, good presentation skills, mastery of English and good laboratory skills led to the good performance. However, weak performance by some candidates was due to inadequate knowledge of the subject matter, failure to understand the requirements of the questions and poor proficiency in English.

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) Tutors and student teachers should 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.
- (b) Prospective candidates should be given exercises, assignments, tests and examinations, accompanied with immediate feedback, to enable them build confidence, skills and experience needed to address the demands of the questions.
- (c) Prospective candidates are advised to practise drawing various biological diagrams to improve drawing skills since 'practice makes perfect'.
- (d) Tutors should adhere to the teaching and learning strategies underlined in the Biology syllabus for better students' acquisition of knowledge about the poorly performed topics, as follows:
 - (i) Use charts or models on the respiratory pathways and Krebs' cycle to guide prospective teachers through conducting group

discussion. Prospective teachers should also do library survey on respiratory pathways and carry out presentation in groups. Then, tutors should guide them through providing clarifications and conclusions.

- (ii) Guide prospective teachers in groups through doing biochemical tests on factors affecting enzyme reaction. They should discuss the modes/mechanism for enzyme action and present their work in plenary sessions. Tutor should provide clarifications and make conclusions.
- (iii) Design and guide prospective teachers through conducting breeding experiments in drosophila and peas. Also, use photographs or pictures showing different plants and animals phenotypes inherited in a Mendelian and non-mendelian fashion to make clarifications and conclusions. This should be accompanied with different exercises and immediate feedback. This will make prospective teachers to be competent in the Mendelian principles of inheritance.

**Appendix I: Summary of the Candidates' Performance per Topic in Paper 1,
DSEE 2022**

S/N.	Topic	Question Number	Percentage of the Candidates with Scores of 40% or Above	Average Performance Per Topic (%)	Remarks
1.	Ecology	2	93.8	93.8	Good
2.	Planning and Preparation for Teaching	7	91.2	91.2	Good
3.	Fundamentals of Teaching and Learning Biology	8	81.5	81.5	Good
4.	Analysis of O-level Biology Curriculum Materials	9	81.3	81.3	Good
5.	Body Health and Immunity	1	51.2	70.1	Good
		11	88.9		
6.	Classification of Living Things	3	57.9	57.9	Average
7.	Assessment in Biology	10	40.7	40.7	Average
8.	Basic Biology Laboratory Skills	6	6.6	40.4	Average
		13	27.2		
		14	87.4		
9.	Genetics	12	26.8	26.8	Weak
10.	Biochemistry	5	14.9	14.9	Weak
11.	Respiration	4	12.7	12.7	Weak

**Appendix II: Summary of the Candidates' Performance per Topic in Paper 2,
DSEE 2022**

SN.	Topic	Question number	Percentage of the Candidates with Scores of 40% or Above	Remarks
1.	Biochemistry	2	93.8	Good
2.	Classification of Living Things	3	92.2	Good
3.	Basic Biology Laboratory Skills	1	91.5	Good

