



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



**CANDIDATES' ITEM RESPONSE ANALYSIS  
REPORT ON THE CERTIFICATE OF SECONDARY  
EDUCATION EXAMINATION (CSEE) 2025**

**BIOLOGY**



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



**CANDIDATES' ITEM RESPONSE ANALYSIS**  
**REPORT ON THE CERTIFICATE OF SECONDARY**  
**EDUCATION EXAMINATION (CSEE) 2025**

**033 BIOLOGY**

*Published by:*

The National Examinations Council of Tanzania,  
P.O. Box 2624,  
Dar es Salaam, Tanzania.

© **The National Examinations Council of Tanzania, 2026**

All rights reserved.

## TABLE OF CONTENTS

|                                                                                          |     |
|------------------------------------------------------------------------------------------|-----|
| FOREWORD .....                                                                           | iv  |
| 1.0 INTRODUCTION.....                                                                    | 5   |
| 2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE ON EACH QUESTION IN 033/1 BIOLOGY 1.....     | 6   |
| 2.1 SECTION A: Objective Questions .....                                                 | 6   |
| 2.1.1 Question 1: Multiple Choice Items .....                                            | 6   |
| 2.1.2 Question 2: Matching Items .....                                                   | 13  |
| 2.2 SECTION B: Short Answer Questions .....                                              | 16  |
| 2.2.1 Question 3: Nutrition.....                                                         | 16  |
| 2.2.2 Question 4: Growth .....                                                           | 21  |
| 2.2.3 Question 5: Movement.....                                                          | 24  |
| 2.2.4 Question 6: Reproduction.....                                                      | 28  |
| 2.2.5 Question 7: Genetics .....                                                         | 32  |
| 2.2.6 Question 8: Evolution.....                                                         | 35  |
| 2.3 SECTION C: Essay Questions.....                                                      | 40  |
| 2.3.1 Question 9: Coordination .....                                                     | 40  |
| 2.3.2 Question 10: Health and Immunity .....                                             | 46  |
| 2.3.3 Question 11: Transport of Materials in Living Things.....                          | 51  |
| 3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE ON EACH QUESTION IN 033/2 - BIOLOGY .....    | 56  |
| 3.1 Question 1: Nutrition.....                                                           | 57  |
| 3.1.1 033/2A Biology 2A .....                                                            | 57  |
| 3.1.2 033/2B Biology 2B.....                                                             | 66  |
| 3.1.3 033/2C Biology 2C.....                                                             | 75  |
| 3.2 Question 2: Classification of Living Things .....                                    | 85  |
| 3.2.1 033/2A Biology 2A .....                                                            | 86  |
| 3.2.2 033/2B Biology 2B.....                                                             | 91  |
| 3.2.3 033/2C Biology 2C.....                                                             | 97  |
| 4.0 ANALYSIS OF CANDIDATES' PERFORMANCE ON EACH TOPIC....                                | 103 |
| 5.0 CONCLUSION AND RECOMMENDATIONS .....                                                 | 104 |
| 5.1 Conclusion.....                                                                      | 104 |
| 5.2 Recommendations .....                                                                | 105 |
| Appendix I: Summary of the Candidates' Performance Per Topic in CSEE 2025 .....          | 107 |
| Appendix II: Comparison of Candidates' Performance Per Topic in CSEE 2025 and 2024 ..... | 108 |

## **FOREWORD**

This report presents the Candidates' Item Response Analysis (CIRA) on the Certificate of Secondary Education Examination (CSEE) in Biology which was conducted in November 2025. The CSEE marks the end of four years of secondary education and serves as a summative evaluation, assessing the knowledge and skills acquired by candidates at the Ordinary Secondary Education level. The report aims to provide feedback to all education stakeholders on the candidates' performance in various question items in Biology.

The report indicates that performance in Biology on the CSEE 2025 was generally good, with 65.68 per cent of candidates passing the examination. It further highlights that candidates who achieved high scores demonstrated adequate knowledge of the examined concepts, the ability to comprehend the requirements of the questions, and competence in drawing accurate biological diagrams. Weak performance was associated with insufficient knowledge, misinterpretation of question demands, inadequate drawing skills, poor command of scientific terminology, and limited proficiency in English. However, the weak performance in practical question 1 was specifically linked to procedural challenges, including incorrect use of reagents, inappropriate measurement units, improper sequencing of steps, limited understanding of experimental procedures and human nutrition, and inappropriate scientific reporting language.

The National Examinations Council of Tanzania (NECTA) expects that the feedback presented in this report will assist educational stakeholders in identifying effective strategies to enhance the teaching and learning of Biology. It will also enable students to acquire the skills and competences needed to answer examination questions.

The Council appreciates the contribution of all those who participated in the preparation of this report.



Prof. Said Ally Mohamed

**EXECUTIVE SECRETARY**

## 1.0 INTRODUCTION

This report focuses on the Candidates' Item Responses Analysis (CIRA) on the candidates who sat for the Certificate of Secondary Education Examination (CSEE) Biology paper in November, 2025. The examination was designed to assess candidates' competences on the content specified in the 2005 Biology syllabus, reprinted in 2012. The CSEE Biology paper was set in accordance with the NECTA format issued in 2022.

The Biology examination comprised two papers, namely 033/1 Biology 1 (Theory paper) and 033/2 Biology 2 (Actual practical paper). The theory paper consisted of 11 questions divided into sections A, B, and C with a total of 100 marks. The practical paper had three alternative papers: 033/2A Biology 2A, 033/2B Biology 2B and 033/2C Biology 2C. Each alternative paper had two structured questions, each worth 25 marks, hence a total of 50 marks.

A total of 555,519 candidates sat for the Biology CSEE 2025, of whom 364,097 (65.68%) passed, indicating good overall performance. However, performance in 2025 decreased by 8.47 per cent compared to CSEE 2024, where 517,377 candidates sat for the examination and 383,108 (74.15%) passed. A summary of candidates' performance by grade on CSEE 2024 and 2025 is presented in Table 1.

**Table 1: The Candidates' Performance in Biology CSEE 2025 and 2024 in each Grade**

| Year | Sat     | Grades |        |         |         |         | %     |
|------|---------|--------|--------|---------|---------|---------|-------|
|      |         | A      | B      | C       | D       | F       |       |
| 2024 | 517,377 | 23,471 | 37,186 | 146,184 | 176,267 | 133,529 | 74.15 |
| 2025 | 555,519 | 3,415  | 14,588 | 120,176 | 225,918 | 190,288 | 65.68 |

Table 1 shows that most of the candidates (225,918) who passed the examination in 2025, as in 2024, attained grade D, which is a marginal pass. A few of them (3,415) attained an A grade in 2025.

The analysis of candidates' performance on each question in the Biology examination begins by indicating the topic, the specific demand of the

question, and the percentage of candidates who attempted it. The analysis further identifies misconceptions in candidates' responses and explains possible reasons for these misconceptions. Selected samples of candidates' responses are used as extracts to illustrate both correct and incorrect responses. Additionally, charts and graphs have been employed to represent candidates' performance on each question. Candidates' performance is classified as good, average, or weak, based on the percentage of candidates who scored at least 30 percent of the marks allocated for a question, falling within the ranges of 65 to 100, 30 to 64, and 0 to 29, respectively. Moreover, green, yellow, and red colours have been used in charts and appendices to indicate good, average, and weak performance, respectively.

The next part analyses the performance of the candidates in 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 033/1 BIOLOGY 1**

This section presents the analysis of the candidates' performance on each question in section A, B and C.

### **2.1. SECTION A: Objective Questions**

The section consisted of multiple-choice and matching items in questions 1 and 2, respectively. The candidates were instructed to answer all the questions.

#### **2.1.1. Question 1: Multiple Choice Items**

The question consisted of ten multiple-choice items. The candidates were required to choose the correct answer from the five given alternatives and write the corresponding letter beside the item number in the provided answer booklet. The items were set on 10 topics, namely: Introduction to Biology, Balance of Nature, Gaseous Exchange and Respiration, Reproduction, Regulation, Health and Immunity, Safety in Our Environment, Movement, Genetics and Classification of Living Things.

The analysis shows that 555,416 candidates responded to this question. Among them, 129,505 (23.32%) scored 0 to 2 marks of whom, 12,981 (2.34%) scored 0 in this question. Candidates who scored 3 to 6 marks were 310,917 (55.98%), whereas 114,994 (20.70%) scored 7 to 10 marks.

Further analysis shows that a few 6,385 candidates scored all 10 marks. The overall performance was good, with 76.68 per cent of the candidates scoring from 3 to 10 marks. Figure 1 summarises the candidates' performance on question 1.

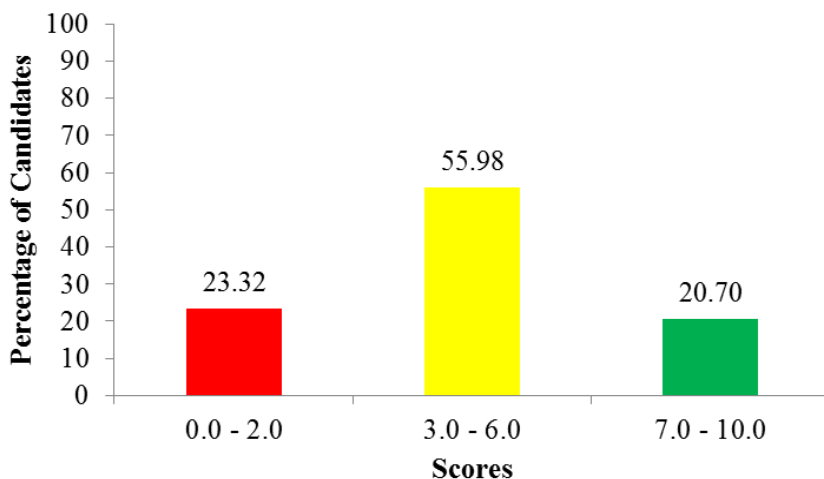


**Figure 1:** *Candidates' Performance on Question 1*

Candidates who scored high marks (7 to 10) demonstrated adequate knowledge of the concepts tested and, consequently, provided correct responses to all or most of the items. Those who scored average marks (3 to 6) provided correct responses to at least three up to six items and, therefore, were unable to attain full marks. Furthermore, candidates who scored 0 to 2 marks either gave correct responses to only one or two items or provided incorrect responses to all items. These candidates showed limited understanding of the concepts tested. The following section presents a detailed analysis of candidates' responses to each item.

Item (i) *Farmers at Mtakuja village observed a continuous decrease of amount of beans yield in their farms. How is this step in the scientific process refers?*

- |   |                 |   |                        |
|---|-----------------|---|------------------------|
| A | Experimentation | B | Problem identification |
| C | Hypothesis      | D | Conclusion             |
| E | Data collection |   |                        |

The correct response was alternative *B, Problem Identification*. Candidates who selected this option demonstrated an understanding of the stages of scientific investigation. They recognised that problem identification occurs when a scientist makes a puzzling observation arising from the environment or from the work of other scientists. Conversely, candidates who selected alternative *A, Experimentation*, showed a misunderstanding of this stage, as experimentation involves conducting a scientific procedure under controlled conditions to determine whether a hypothesis is correct. Those who chose alternative *C, Hypothesis*, did not recognise that a hypothesis is a proposed explanation or tentative answer to a scientific question formulated to explain an observation. Similarly, candidates who selected alternative *D, Conclusion*, and alternative *E, Data Collection*, failed to understand that a conclusion summarises what a scientist has learned from an experiment. In contrast, data collection involves recording information from the beginning of the experiment to its completion.

Item (ii) *Form two students who recently visited Mikumi National Park saw Zebra, Shrubs, Giraffe, Lion, Cheetah, Grasses and Mushroom. Which of these organisms would they group as primary consumers?*

- A Grasses and shrubs*
- B Giraffe and shrubs*
- C Lion and cheetah*
- D Zebra and giraffe*
- E Mushroom and zebra*

The correct response was Option *D, Zebra and giraffe*. The candidate, who chose the correct response, were aware of feeding relationships among organisms in the ecosystem. Therefore, they realised that primary consumers are herbivores that feed directly on producers such as grasses and shrubs. In this case, zebras and giraffes obtain their energy by feeding on plants and therefore occupy the primary consumer level in a food chain. Those who chose option *A, Grasses and Shrubs*, did not recognise that these are producers, which manufacture their own food through photosynthesis. Those who selected option *B, Giraffe and Shrubs*, and option *E, mushroom and zebra*, did not understand that although giraffe and zebra are primary consumers shrubs are producers. In contrast mushrooms are decomposers that obtain nutrients from dead and decaying matter.

Likewise, those who opted for *C, Lion and Cheetah*, failed to recognise that these are carnivores that feed on other animals and are classified as secondary consumers.

Item (iii) *In the process of making doughnuts a woman mixed wheat flour, yeasts, sugar and water; kneaded the mixture and covered it. After half an hour the dough raised. Which one of the following made the dough to rise?*

- |          |                    |          |                |
|----------|--------------------|----------|----------------|
| <i>A</i> | <i>Yeasts</i>      | <i>B</i> | <i>Glucose</i> |
| <i>C</i> | <i>Wheat flour</i> | <i>D</i> | <i>Water</i>   |
| <i>E</i> | <i>Sugar</i>       |          |                |

The correct response was alternative *A, Yeasts*. The candidates, who chose the correct response, were aware of Anaerobic Respiration. Therefore they recognised that the dough rises because yeast carries out fermentation, during which it breaks down sugars in the dough and releases carbon dioxide gas. This gas becomes trapped in the dough, causing it to expand and rise. Those who chose alternative *B, Glucose*, and *E, Sugar*, failed to realise that these serve as food for the yeast but do not directly cause the dough to rise. Similarly, those who chose alternative *C, Wheat flour*, and *D, Water* failed to understand that wheat flour provides structure and nutrients but does not produce gas. At the same time, water is necessary for activating the ingredients and forming the dough but does not cause gas production.

Item (iv) *A bleeding pregnant woman was confirmed to have an embryo implanted in the fallopian tube. Which complication was she suffering from?*

- |          |                          |          |                        |
|----------|--------------------------|----------|------------------------|
| <i>A</i> | <i>Preeclampsia</i>      | <i>B</i> | <i>Miscarriage</i>     |
| <i>C</i> | <i>Breech birth</i>      | <i>D</i> | <i>Premature birth</i> |
| <i>E</i> | <i>Ectopic pregnancy</i> |          |                        |

The correct response was alternative *E, Ectopic pregnancy*. The candidates who selected this option demonstrated an understanding of complications of the reproductive system, recognising that ectopic pregnancy occurs when a fertilised egg implants outside the uterus, most commonly in the fallopian tube. Contrarily, candidates who chose alternative *A, Preeclampsia*, were not aware that preeclampsia is a pregnancy-related condition characterised

by high blood pressure and the presence of protein in the urine. Those who selected alternatives *B, Miscarriage*, and *D, Premature birth*, failed to recognise that miscarriage refers to the unintentional expulsion of the foetus from the uterus before approximately 20 to 24 weeks of gestation. In contrast, a premature birth involves delivery after six months but before the completion of nine months of pregnancy. Similarly, candidates who chose alternative *C Breech birth* did not understand that breech birth is a condition in which the foetus presents with the buttocks or feet entering the maternal pelvis before the head during birth.

Item (v) *Which mechanism does the human body undergo in response to cold weather condition?*

- A Vasodilation of arterioles*
- B Vasoconstriction of arterioles*
- C Sweating and panting*
- D Relaxation of erector muscles*
- E Decreased metabolic rate*

The correct answer was alternative *B, Vasoconstriction of arterioles*. The candidates who chose a correct response were competent on Temperature regulation in animals. Therefore, they recognised that in cold weather, the human body conserves heat by constricting the arterioles near the skin, reducing blood flow to the body surface, thus minimising heat loss. On the other hand, those who chose alternatives *A, Vasodilation of arterioles*, and *D, Relaxation of erector muscles*, failed to recognise that vasodilation of arterioles occurs in hot conditions to increase heat loss, while in cold conditions, the erector muscles contract, causing hairs to stand upright and trapping a layer of insulating air. Those who selected alternative *C, Sweating and panting*, failed to recognise that both are mechanisms of thermoregulation used primarily to reduce body temperature. Sweating involves the release of sweat from skin glands, whose evaporation removes heat from the body surface and is common in humans and many mammals, whereas panting involves rapid, shallow breathing that enhances evaporative heat loss from respiratory surfaces and is mainly observed in some animals such as dogs and some birds. Similarly, those who selected alternative *E, Decreased metabolic rate*, were not aware that metabolic rate generally increases in cold conditions to generate more heat and maintain normal body temperature.

Item (vi) *Which diseases occur worldwide?*

- |          |                                 |          |                              |
|----------|---------------------------------|----------|------------------------------|
| <i>A</i> | <i>Tuberculosis and cholera</i> | <i>B</i> | <i>Malaria and bilharzia</i> |
| <i>C</i> | <i>COVID-19 and cholera</i>     | <i>D</i> | <i>AIDS and COVID-19</i>     |
| <i>E</i> | <i>AIDS and tuberculosis</i>    |          |                              |

The correct response was alternative *D*, *AIDS and COVID-19*. Candidates who selected this option demonstrated an understanding of infections and diseases, recognising that AIDS and COVID-19 are diseases capable of spreading widely across large geographical areas. Conversely, those who chose alternative *A*, *Tuberculosis and cholera*, did not understand that these are communicable diseases that typically affect a large number of people within a short period in a specific locality. Those who selected alternative *B*, *Malaria and bilharzia*, failed to recognise that these diseases are endemic, meaning they occur consistently within particular regions. Similarly, those who chose alternative *C*, *COVID-19 and cholera*, and *E*, *AIDS and tuberculosis*, did not understand that while COVID-19 and AIDS have a worldwide distribution, tuberculosis and cholera are generally localized outbreaks affecting concentrated populations over a short period.

Item (vii) *If you have noticed water spills on the floor of the class room, what would you do to prevent accident?*

- A*    *Wait for the floor to dry*
- B*    *Walk slowly on the floor*
- C*    *Wipe the floor immediately*
- D*    *Apply mud on the floor*
- E*    *Shift to another class room*

The correct response was option *C*, *Wipe the floor immediately*. The candidates who chose the correct response demonstrated adequate knowledge about safety at home and school. Therefore, they realised that this action prevents slips and falls, thereby reducing the risk of accidents in the classroom. However, those who chose option *A*, *Wait for the floor to dry* failed to recognise that this action leaves the floor slippery and hazardous. Those who chose option *B*, *Walk slowly on the floor*, and *D*, *Apply mud on the floor*, showed limited understanding of accident prevention, as walking slowly on the floor does not eliminate the risk to others, while applying mud on the floor is unhygienic and may worsen the

hazard. Similarly, candidates who chose option *E, Shift to another classroom*, merely avoided the problem without addressing the unsafe condition. Therefore, immediate floor wiping remains the safest and most appropriate preventive measure.

Item (viii) Which part of the following is **not** a part of a movable joint?

- |                         |                   |                    |
|-------------------------|-------------------|--------------------|
| <i>A Bone</i>           | <i>B Tendon</i>   | <i>C Cartilage</i> |
| <i>D Synovial fluid</i> | <i>E Ligament</i> |                    |

The correct response was option *B, Tendon*. The candidates who opted for the correct response demonstrated a clear understanding of support and movement in animals, especially the functions of the major components of the human skeleton and their adaptations. They were aware that tendons are connective tissues that attach muscles to bones and transmit the force generated by muscles to move the bones, but they do not form the joint itself. In contrast, cartilage, synovial fluid, and ligaments are essential components of a joint: cartilage covers the ends of bones to reduce friction and absorb shock; synovial fluid lubricates the joint to enable smooth movement; and ligaments connect bones to provide stability.

Item (ix) Which one of the following are examples of sex linked characteristics in human?

- A Colour blindness and albinism*
- B Haemophilia and tongue rolling*
- C Colour blindness and haemophilia*
- D Tongue rolling and blood group*
- E Blood group and haemophilia*

The correct response was option *C, Colour blindness and haemophilia*. The candidates who chose the correct response had adequate knowledge about Sex determination and inheritance. Therefore, they were aware that sex-linked characters are controlled by genes located on the X chromosome, and that colour blindness and haemophilia are classic examples of sex linked genes. Those who chose alternative *A, Colour blindness and albinism*, *B, Haemophilia and tongue rolling*, *D, Tongue rolling and blood group* and *E, Blood group and haemophilia* failed to recognise that although colour blindness and haemophilia are sex-linked traits but albinism, tongue rolling, and blood group are traits that are controlled by genes located on the

autosomes, which are the non-sex chromosomes. These characteristics are inherited independently of sex, and unlike sex-linked traits, autosomal traits are not carried on the X or Y chromosomes and therefore do not show sex-biased inheritance patterns.

Item (x) *Organisms in class Reptilia have dry skin with horny scales. Which of the following organisms fall under this category?*

- A *Lizard, crocodile, turtle and snake*
- B *Crocodile, bat, chicken and lizard*
- C *Snake, salamander, frog, and crocodile*
- D *Turtle, mouse, snake and salamander*
- E *Eagle, flamingo, chicken and lizard*

The correct response was option A: *lizard, crocodile, turtle, and snake*. Candidates who selected this option had adequate knowledge of the distinguishing characteristics of the classes within Phylum Chordata. In particular, they correctly recognised that organisms belonging to Class Reptilia are characterised by dry skin covered with horny scales. Candidates who chose alternative B, *Crocodile, bat, chicken, and lizard* failed to recognise that a bat belongs to Class Mammalia, while a chicken is classified under Class Aves. Similarly, candidates who selected alternative C, *Snake, salamander, frog, and crocodile*, and D, *Turtle, mouse, snake, and salamander* did not realise that salamanders and frogs are amphibians and that a mouse is a mammal, not a reptile. Likewise, those who selected alternative E, *Eagle, flamingo, chicken, and lizard* failed to recognise that eagle, flamingo, and chicken are birds, and that only the lizard belongs to Class Reptilia.

### 2.1.2. Question 2: Matching Items

The question consisted of six (6) matching items. The candidates were required to match the roles of the hormones in List A with their corresponding hormones in List B by writing the letter of the correct response beside the item number in the answer booklet(s) provided.

| <b>List A</b> |                                                                      | <b>List B</b> |              |
|---------------|----------------------------------------------------------------------|---------------|--------------|
| (i)           | Controls contraction and relation of the uterine walls during birth. | A             | Antidiuretic |
| (ii)          | Promotes conversion of excess glucose into glycogen in the blood.    | B             | Thyroxine    |
| (iii)         | Regulates the amount of water reabsorption in the kidney tubules.    | C             | Adrenaline   |
| (iv)          | Stimulates milk production in lactating mammals.                     | D             | Oxytocin     |
| (v)           | Controls metabolic activities in the body                            | E             | Glucagon     |
| (vi)          | Promotes development of secondary sexual characteristics in females. | F             | Insulin      |
|               |                                                                      | G             | Oestrogen    |
|               |                                                                      | H             | Prolactin    |

This question was attempted by candidates 555,416. Analysis shows that 236,992 (42.67%) scored 0 to 1, of whom 110,989 (19.98%) scored 0 in this question. Candidates who scored 2 to 3 marks were 163,164 (29.38%), whereas 155,260 (27.95%) scored 4 to 6 marks, of whom 49177 (8.85%) scored all 6 marks. Generally, the candidates' performance on this question was average, with 57.33 per cent scoring from 2 to 6 marks. Figure 2 summarizes the candidates' performance on question 2.

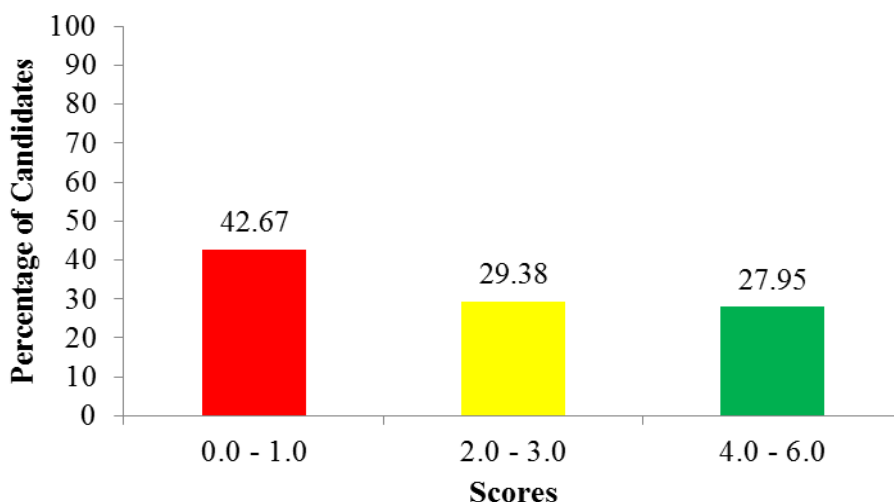


**Figure 2:** Candidates' Performance on Question 2

The candidates who scored 2 to 3 marks matched correctly 2 to 3 items and hence lost marks. The candidates who scored high marks (4 to 6) demonstrated adequate knowledge about the Endocrine glands, specifically hormones and their functions. Therefore, they correctly matched most or all of the items given. Extract 2.1 is a sample of the candidates' correct responses to question 2.

|     |   |    |     |    |   |    |
|-----|---|----|-----|----|---|----|
| 02. | i | ii | iii | iv | v | vi |
|     | D | F  | A   | H  | B | G  |

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

In Extract 2.1, the candidate correctly matched the roles of hormones, thus scored all the 6 marks allocated to this question.

Conversely, 42.67 per cent of the candidates who scored 0 to 1 marks either gave incorrect responses to all the items or gave a correct response to only one item, hence lost some marks. Extract 2.2 is a sample of the candidates' incorrect responses to question 2.

|     |        |   |    |     |    |   |    |
|-----|--------|---|----|-----|----|---|----|
| 02. | List A | i | ii | iii | iv | v | vi |
|     | List B | E | D  | F   | C  | G | A  |

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

In Extract 2.2, the candidate incorrectly matched all the items of the question. These responses suggest that the candidate lacked knowledge about the hormones and their roles. The analysis of the candidates' responses in each item is presented as follows:

Item (i) required the candidates to match the hormone which controls contraction and relaxation of uterine walls during birth. The correct response was *D, Oxytocin*. Candidates who chose *D, Oxytocin* had adequate knowledge about the hormones and their roles. However, other candidates chose alternative *B, Thyroxine*, which controls metabolic activities in the body.

Item (ii) required the candidates to match the hormone which promotes conversion of excess glucose into glycogen in the blood. The correct

response was *F, Insulin*. However, most of the candidates chose *E, Glucagon* which convert glycogen into glucose.

Item (iii) required the candidates to match the hormone that regulates the amount of water reabsorption in the kidney tubules. The correct response was *A, Antidiuretic*. On the other hand, some of the candidates selected *F, Insulin* which converts excess glucose into glycogen.

Item (iv) required the candidates to match the hormone that stimulates milk production in lactating mammals. The correct response was *H, Prolactin*. However, most of the candidates chose *G, Oestrogen*, which promotes the development of secondary sexual characteristics in females.

Item (v) required the candidates to match the hormone that controls metabolic activities in the body. The correct response was *B, Thyroxine*. Other candidates chose *C, Adrenaline*, which prepares the body for emergencies of fight, fright, or flight by increasing the metabolic rate and heart rate and diverting blood to vital organs.

Item (vi) required the candidates to match the hormone that promotes the development of secondary sexual characteristics in females. The correct response was *G, Oestrogen*. Other candidates chose *D, Oxytocin*, which controls contraction and relaxation of the uterine walls during birth.

## **2.2. SECTION B: Short Answer Questions**

The section consisted of six (6) short answer questions. The candidates were required to answer all questions in this section. The analysis of each question is as follows;

### **2.2.1. Question 3: Nutrition**

In this question, the candidates were given a scenario: “Mkutano villagers use traditional methods to process, preserve, and store a variety of foods they obtained from their daily activities.” Then, they were required to outline six advantages of such methods.

The analysis shows that 555,416 candidates responded to this question. Among them, 344,336 (62.00%) scored 0 to 2.5 marks, of whom 255,318 (45.97%) scored 0 in this question. Candidates who scored 3 to 5.5 marks

were 146,690 (26.41%), whereas 64,390 (11.59%) scored 6 to 9 marks. Further analysis shows that 5,216 (0.94%) candidates scored all 9 marks. The overall performance was average because 38.00 per cent of the candidates scored from 3 to 9 marks. Figure 3 summarises the candidates' performance on question 3.

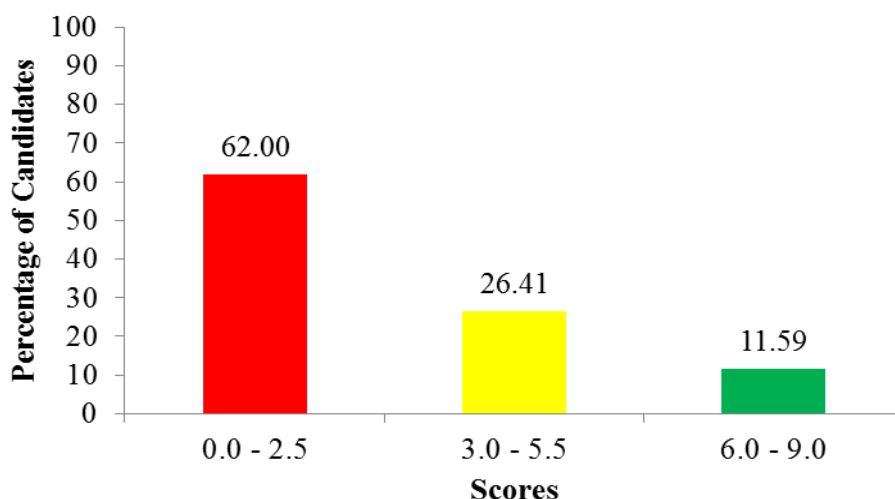


**Figure 3:** *Candidates' Performance on Question 3*

Candidates who scored high marks demonstrated adequate knowledge of traditional methods of food processing, preservation, and storage. They correctly outlined the advantages associated with these traditional methods. Extract 3.1 is a sample of the candidates' correct responses to question 3.

|      |                                                                                                                                                                                                       |  |
|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 3 i) | Traditional methods are cheap. They are cheap because they use materials and substances which are not expensive to get.                                                                               |  |
| ii)  | Traditional methods add a distinct flavour to food. The methods involve the use of substances like salt and sugar which add an extraordinary flavour to food which is better than the original taste. |  |
| iii) | Traditional methods are simple. They use locally available materials which are easy to use therefore making them simple.                                                                              |  |
| iv)  | Traditional methods do not involve addition of chemicals. The methods mostly use natural substances. They do not use harmful chemicals which can cause negative effects when consumed.                |  |
| v)   | Traditional methods do not destroy nutrients. Traditional methods do not involve any processes which can destruct the nutrients present in food hence the food remains nutritious.                    |  |
| vi)  | Traditional methods do not need skilled personnel. The methods do not involve special training to apply.                                                                                              |  |

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

In Extract 3.1, the candidate correctly outlined the advantages of traditional methods of food processing, preservation, and storage.

Conversely, more than half (62.00%) of the candidates who scored low marks (0 - 2.5) demonstrated insufficient knowledge of Food processing, preservation, and storage. Some of the candidates outlined the advantages of modern methods over traditional ones. For example, some candidates wrote that such methods are *fast and hence save time, preserves food for a long time, and large quantities of food can be stored for a time*. Other candidates incorrectly outlined the disadvantages of traditional methods, stating that the *methods are manual; limited to specific types of food, and that food cannot be stored for long periods*. In addition, some candidates listed common food processing techniques instead of the advantages of

traditional methods. Examples of such responses included *removing unwanted outer layers, chopping or slicing, and cooking methods such as steaming*, rather than outlining the benefits of traditional food processing, preservation, and storage.

Furthermore, some candidates merely listed traditional methods of food preservation, processing, and storage, such as *smoking, curing, salting, and drying in the sun*, without outlining their advantages. Others listed modern methods, including *canning and bottling, liquefaction, irradiation, and pasteurization*, rather than outlining the advantages of the traditional method. Additionally, some candidates described the functions of food nutrients in the human body rather than the advantages of traditional food preservation methods. For instance, some explained the functions of proteins, such as *promoting growth, repairing damaged tissues, forming part of cell structures, and serving as an energy source when carbohydrates are lacking*. Extract 3.2 is a sample of candidates' incorrect responses to question 3.

|     |                                                                                                                                 |  |
|-----|---------------------------------------------------------------------------------------------------------------------------------|--|
| 3:  | Advantage of Use traditional Method:                                                                                            |  |
| i   | It preserve food for the future use which enable to be moderate on some family which enable to use that food.                   |  |
| ii  | It help to maintain food does not spoil because some of the people enable to achieve on different form to be use that food.     |  |
| iii | It help to kill microorganism to the food substance enable to managed on the some area.                                         |  |
| iv  | It a source of food to the family which enable to be moderate on some area in order to achieve different form.                  |  |
| v   | It provide the nutrient to the food which enable to make the body to have an powerfull to fight again st infection and disease. |  |
| vi  | It protect the food from other disease which enable to be managed on the some idea.                                             |  |

**Extract 3.2:** Candidate's incorrect response to question 3

In Extract 3.2, the candidate outlined the general importance of food processing, preservation, and storage in parts (i) - (iii), instead of outlining the advantages of traditional methods of food processing, preservation, and storage, as required. For instance, the candidate stated that *it preserves food for future use*, a general importance of food processing, preservation, and storage, not specific to traditional methods. The other responses provided were also incorrect.

### 2.2.2. Question 4: Growth

The question required the candidates to describe the events which take place during the prophase stage of mitosis with the aid of a labelled diagram.

This question was attempted by candidates 555,416. Data show that 541,614 (97.52%) scored from 0 to 2.5 marks, of whom 519,116 (93.46%) scored 0 in this question. Candidates who scored 3 to 5.5 marks were 10,091 (1.81%), whereas 3,711 (0.67%) scored from 6 to 9 marks, out of whom 343 (0.06%) scored all 9 marks. In general, the candidates' performance on this question was weak, as 97.52 per cent scored from 0 to 2.5 marks. Figure 4 summarises the candidates' performance on question 4.

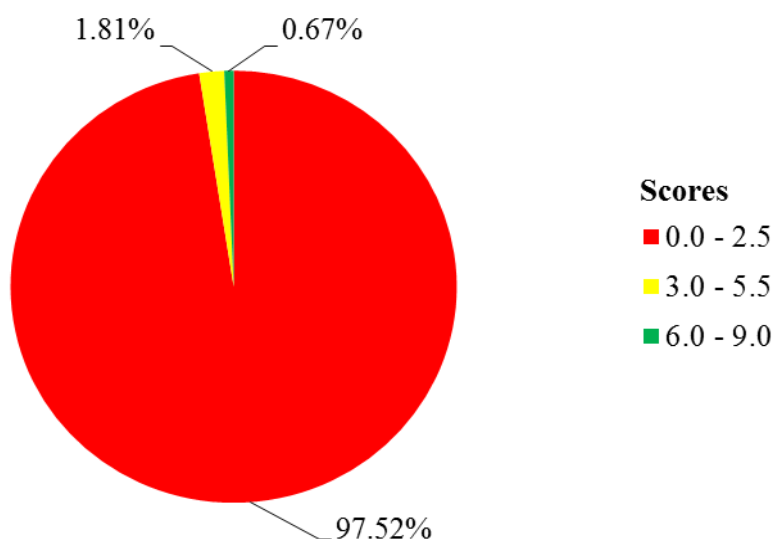


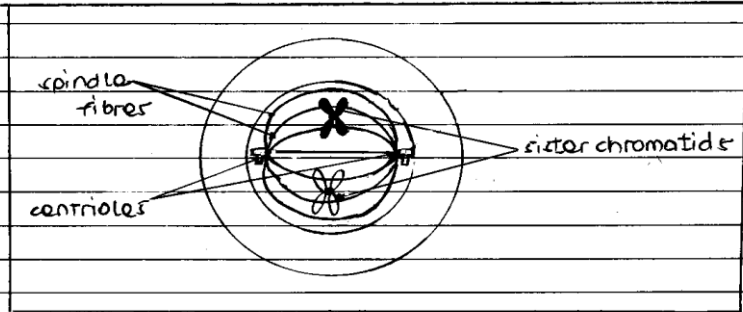
**Figure 4:** *Candidates' Performance on Question 4*

The candidates who scored low marks (0 - 2.5) demonstrated limited knowledge of Mitosis and Growth. Consequently, they provided responses that did not meet question's requirements. Those who scored 1 to 2.5 marks stated only one or two correct events, resulting in a loss of marks. Candidates who scored 0 demonstrated limited understanding of the events that occur during prophase. Most were unable to correctly describe the events characteristic of this stage, with some describing events of other stages of mitosis. For example, some candidates described interphase events, such as *DNA replication*, *histone protein synthesis*, *organelle*

replication, and cell growth. Others described the events that occur during the anaphase stage of mitosis, including *the migration of chromosomes to opposite poles and elongation of the cell in preparation for division*.

Furthermore, the majority of candidates either did not draw a diagram or presented diagrams that were unlabeled or incorrectly labelled, failing to illustrate key features such as condensed chromosomes, the nuclear membrane, spindle fibres, or centrioles. Some drew diagrams unrelated to mitosis or provided general cell structure without indicating the specific changes that occur during prophase.

In addition, several candidates lacked drawing skills, producing irrelevant diagrams. For instance, some drew a DNA molecule, others drew an animal cell, and some drew isolated chromosomes rather than a diagram of the prophase stage of mitosis. Overall, the low-scoring candidates lacked both a conceptual understanding of prophase and the ability to communicate this knowledge clearly through accurate descriptions and appropriate diagrams. Extract 4.1 is a sample of candidates' incorrect response to question 4.

|   |                                                                                      |  |
|---|--------------------------------------------------------------------------------------|--|
| 4 | The events which take place during prophase stage of mitosis are as follows:         |  |
|   | i) The spindle fibres are fully formed                                               |  |
|   | ii. The chromosomes align themselves at the centre of a cell                         |  |
|   | iii. The sister chromatids are not yet separated from each other                     |  |
|   | A DIAGRAM SHOWING PROPHASE STAGE                                                     |  |
|   |  |  |

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

In Extract 4.1, the candidate outlined the events and drew a diagram of the metaphase stage of mitosis instead of describing the events of prophase.

The candidates who scored high marks demonstrated adequate knowledge of Mitosis and Growth. They were able to accurately describe the events occurring during the prophase stage of mitosis, including the condensation of chromosomes, which become thickened and visible; the movement of centrioles to opposite poles; the initiation of spindle fibre formation; the disintegration of the nuclear membrane; and the disappearance of the nucleolus. Moreover, these candidates exhibited drawing skills by producing well-labelled diagrams illustrating the prophase stage of mitosis. Extract 4.2 is a sample of candidates' correct responses to question 4.

|   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 4 | <p>Prophase, is the stage of mitosis that follows the interphase stage. During this stage the following take place:</p> <ul style="list-style-type: none"> <li>i/ Disintegration of the nuclear membrane and disappearance of the nucleolus.</li> <li>ii/ Thickening of the chromatids shorten and become visible.</li> <li>iii/ Spindle fibres start to get developed.</li> <li>iv/ Centrioles move to the opposite pole from each other and start to produce spindle fibres.</li> </ul> |
|   | <p style="text-align: center;"><b>DIAGRAM OF SHOWING PROPHASE STAGE OF MITOSIS</b></p>                                                                                                                                                                                                                                                                                                                                                                                                    |

**Extract 4.2:** Candidates' correct response to question 4

In Extract 4.2, the candidate correctly drew a well-labelled diagram of the prophase stage of mitosis and described the events that occur during this phase.

### 2.2.3. Question 5: Movement

In this question, candidates were required to give six points on how the cardiac muscles are adapted to perform their roles.

Data show that 555,416 candidates attempted the question. Among them, 514,897 (92.70%) scored 0 to 2.5 marks, of whom 476,252 (85.75%) scored 0 marks. The candidates who scored 3 to 5.5 marks were 35,896 (6.47%), whereas 4,623 (0.83%) scored 6 to 9 marks, out of whom 171 (0.03%) scored all 9 marks. The overall performance was weak since 92.70 per cent of the candidates scored from 0 to 2.5 marks. Figure 5 summarises the candidates' performance on question 5.

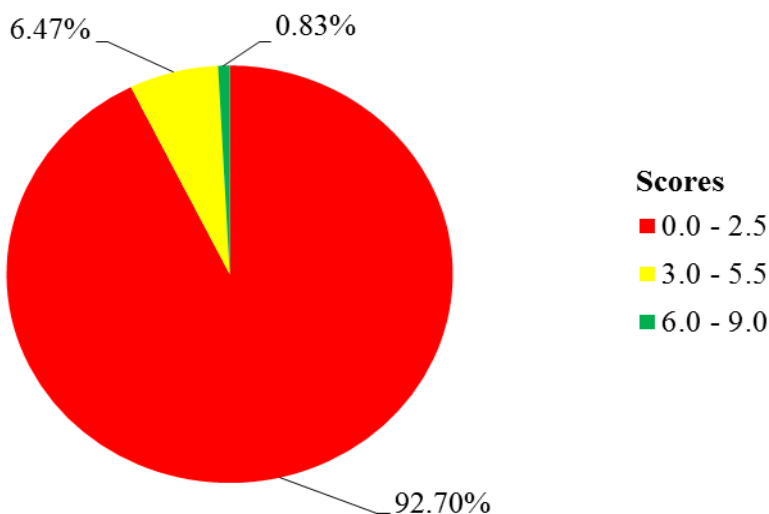


**Figure 5:** *Candidates' Performance on Question 5*

Candidates who scored low marks demonstrated limited competence in explaining the adaptations of different types of muscles, particularly cardiac muscle. Consequently, they provided incorrect responses. Some candidates explained the types of skeletal muscle rather than cardiac muscle adaptations. For example, they explained the *endoskeleton*,

*exoskeleton*, and *hydrostatic skeleton*. Others listed components of the human skeleton, such as *tendons*, *ligaments*, *bones*, and *cartilage*.

In addition, some candidates provided general characteristics of cardiac muscle without adequately explaining how these features serve as adaptations to its specific function. For example, they wrote that *cardiac muscles have many mitochondria, are branched, do not fatigue easily, possess a sinoatrial node, and are found only in the heart*. However, they did not elaborate on how these features contribute to the muscle's ability to function effectively. These candidates failed to recognise that adaptations refer to structural features that enable an organism or tissue to perform its function efficiently. An understanding of how these structural features support the continuous and rhythmic contraction of cardiac muscle is essential for a comprehensive response.

Furthermore, some candidates described adaptations in other muscle types rather than in cardiac muscle. For example, they explained adaptations of skeletal muscles, such as *being long to provide a large surface area for contraction and relaxation*, while others described adaptations of smooth muscles. For instance, some wrote that, they *have spindle-shaped cells which allow slow, uniform contraction of organs, have single central nucleus which supports slow metabolic activity and sustained contraction and absence of striations which enables smooth contraction*. Extract 5.1 is a sample of candidates' incorrect responses to question 5.

|   |                                                                                  |  |
|---|----------------------------------------------------------------------------------|--|
| 5 | i) Locomotion: This perform in a whole body of an organism                       |  |
|   | ii) movement: This performed in part or parts of an organism                     |  |
|   | iii) supporting: This means support in performed of muscles                      |  |
|   | iv) manufacturing of blood cell: This means all cell performed in your both cell |  |
|   | v) store: mineral in the body to run many working                                |  |
|   | vi) attachment: This means to attach damp muscle in the body                     |  |

**Extract 5.1:** Candidate's incorrect responses to question 5

In Extract 5.1, the candidate explained the functions of human skeleton instead of how cardiac muscles are adapted to perform their roles. For example, the candidate wrote *manufacturing of blood cell*.

The candidates who scored high marks (6 to 9) had sufficient knowledge of muscles and movement, particularly the adaptations of cardiac muscles. They managed to explain how cardiac muscles are adapted to perform their roles. Extract 5.2 is a sample of the candidates' correct responses to question 5.

|    |                                                                                                                                                                    |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 5. | i. They are Myogenic Muscles, thus not relying on nervous system.                                                                                                  |  |
|    | - Cardiac muscles are Myogenic as they have their own pacemaker called sinoatrial node thus not depending on the Nervous system to function.                       |  |
|    |                                                                                                                                                                    |  |
|    | ii. They are elastic muscles to allow contraction and Relaxation                                                                                                   |  |
|    | - Cardiac Muscles are very elastic to contract and Relax easily and fast to pump blood to the body efficiently.                                                    |  |
|    |                                                                                                                                                                    |  |
|    | iii. They have intercalated discs to allow electrical impulse transmission                                                                                         |  |
|    | - Intercalated discs in Cardiac Muscles allow's electrical Conduction and Mechanical Connections between Cardiac cells for efficient blood circulation.            |  |
|    |                                                                                                                                                                    |  |
|    | iv. They are striated to enable continuous pumping of blood                                                                                                        |  |
|    | - Cardiac Muscles have striations which enable them to pump bloods throughout an individual's life without stopping.                                               |  |
|    |                                                                                                                                                                    |  |
|    | v. They have many Mitochondria to generate a lot of energy required for functioning of the Muscles                                                                 |  |
|    | - This is because they work tirelessly throughout the organisms life without stopping thus require sufficient energy.                                              |  |
|    |                                                                                                                                                                    |  |
|    | vi. They have a good supply of blood through capillaries to enable them get Oxygen and Nutrients as well as to remove its wastes.                                  |  |
|    | - This is because they constantly work thus need a continuous blood supply for the Muscles to obtain Oxygen and Nutrients and remove the Metabolic waste products. |  |

**Extract 5.2:** Candidate's correct responses to question 5

In Extract 5.2, the candidate correctly explained how cardiac muscles are adapted to perform their roles.

#### 2.2.4. Question 6: Reproduction

The candidates were given a statement “Bacteria, Amoeba, and Non-flowering plants reproduce asexually.” Then they were required to explain three merits and three demerits of the type of reproduction exhibited by these organisms.

Data show that 555,416 candidates attempted the question. The analysis shows that 500,448 (90.10%) scored from 0 to 2.5 marks, of whom 389,153 (70.07 %) scored 0 marks. The candidates who scored from 3 to 5.5 marks were 40,777 (7.34%), whereas 14,191 (2.56%) scored from 6 to 9 marks. Further, the analysis shows that 1,734 (0.31%) scored all 9 marks. The candidates’ overall performance was weak, with 90.10 per cent scoring from 0 and 2.5 marks. Figure 6 summarises the candidates’ performance on question 6.

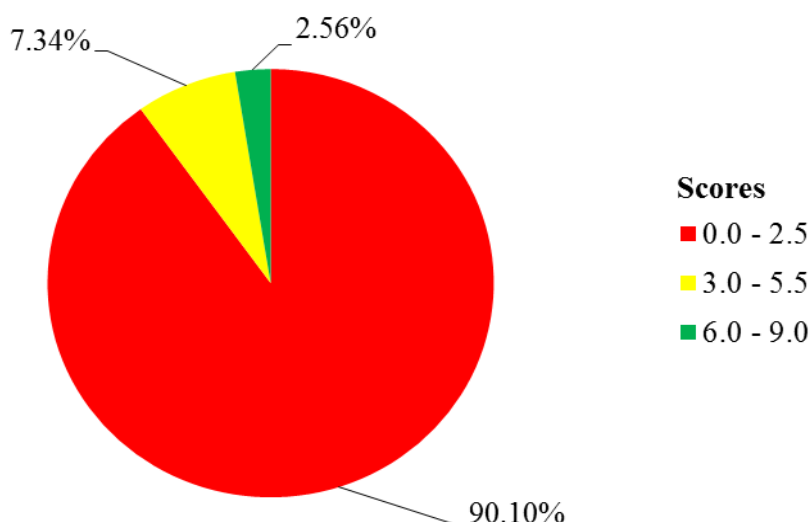


**Figure 6:** *Candidates’ Performance on Question 6*

Candidates who scored from 1 to 2.5 marks demonstrated a limited understanding of the concept of reproduction, particularly the merits and demerits of sexual and asexual reproduction. Most of them outlined the merits and demerits without providing explanations, and therefore lost marks. Candidates who scored 0 showed a complete lack of knowledge and provided responses that were contrary to the requirements of the question. Some candidates explained the general characteristics of bacteria, amoeba,

and non-flowering plants, rather than the advantages and disadvantages of the reproduction exhibited by these organisms. For example, some candidates stated that *bacteria are prokaryotic or unicellular, that amoeba possesses contractile vacuoles for osmoregulation, or that non-flowering plants reproduce asexually and produce their own food.*

Additionally, a significant number of candidates confused asexual reproduction with sexual reproduction. These candidates incorrectly identified the merits of asexual reproduction as *a source of variation, involving the fusion of haploid gametes to maintain chromosome number, and enabling organisms to adapt to changing environmental conditions.* Similarly, they incorrectly attributed demerits of asexual reproduction to factors such as *only half of the population being capable of gestation, failure of reproduction when gametes do not meet, and dependence on chance.* These points are characteristic of sexual reproduction and reflect a fundamental conceptual misunderstanding.

Furthermore, instead of explaining the merits and demerits of asexual reproduction as required, some candidates merely described its forms or processes. For example, they explained *binary fission in bacteria and amoeba as division into two halves, or described spore formation in non-flowering plants,* without linking these processes to their advantages or disadvantages. Others deviated from the focus of the question by explaining the general importance of reproduction, such as *ensuring the continuity of life, maintaining species population, transferring genetic information, or contributing to growth and repair in some organisms,* rather than addressing the merits and demerits of asexual reproduction. Extract 6.1 is a sample of candidates' incorrect responses to question 6.

|       |                                                                                                                                                                    |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6     | Merits Of Bacterial, Amoeba, Non Flowering.                                                                                                                        |
| (i)   | They are used in biological study.<br>Bacterial, Amoeba and non flowering are used in biological study to do practical so that people can study the practicaly.    |
| (ii)  | They are used in manufacturing of medicine.<br>Bacterial, Amoeba and non flowering are used in manufacturing of medicine in the different industry for people use. |
| (iii) | They are source of food to other Organism.<br>Bacterial, amoeba and non flowering are used as the source of food to another Organism in the society.               |
|       | Demerits.                                                                                                                                                          |
| (i)   | They are poisonous.<br>Bacterial, amoeba and non flowering, some of them are the poisonous to human being also to the other organism.                              |
| (ii)  | They can lead death.<br>Bacterial, amoeba and non flowering they can lead death to the people when people kill us them for food.                                   |
| (iii) | They are not good for food. some are not good for food because can lead death.                                                                                     |

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

In Extract 6.1, the candidate explained the economic importance of amoeba, bacteria, and non-flowering plants instead of the merits and demerits of asexual reproduction.

Candidates who scored high marks (6 to 9) demonstrated adequate knowledge of asexual reproduction. They were able to correctly explain the

merits and demerits of asexual reproduction in organisms such as bacteria, amoeba, and non-flowering plants. Extract 6.2 illustrates a sample of the candidates' correct responses to question 6.

|       |                                                                                                                                                                                                  |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5(i)  | It produces many offsprings at a time Asexual reproduction is very important because it increases the population rapidly compared to sexual reproduction.                                        |
| (ii)  | hereditary characteristics are maintained to the offsprings as their parents; asexual reproduction lead to the maintenance of hereditary characteristics of an individual.                       |
| (iii) | It saves time; Asexual reproduction saves time by minimizing time needed to search for mate and hence to bring about reproduction by producing new offsprings.                                   |
|       | The following are the disadvantages of asexual reproduction                                                                                                                                      |
| (i)   | Undesired characteristics are easily passed to their offsprings. In asexual reproduction most of hereditary characteristics which may contain undesirable traits may be passed to offsprings.    |
| (ii)  | It leads to competition among offsprings due to the number of offsprings produced at a time; Asexual reproduction result to the competition among offsprings and hence death of some offsprings. |
| (iii) | It doesn't give variable offsprings since no variation. Asexual reproduction has no variation due to the fact that hereditary characteristics are passed to the offsprings.                      |

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

In Extract 6.2, the candidate correctly explained the merits and demerits of asexual reproduction in bacteria, amoeba and non-flowering plants.

### 2.2.5. Question 7: Genetics

The candidates were given a scenario “A man with heterozygous blood group A married a woman with heterozygous blood group B. One among their offspring produced was blood group O, then they were required to use genetic cross to show the probability of producing such offspring.

The question was attempted by 555,416 candidates. Data show that 335,702 (60.44%) scored from 0 to 2.5 marks, of whom 187,384 (33.74%) scored 0 marks. The candidates who scored 3 to 5.5 marks were 143,381 (25.82%), whereas 76,333 (13.74%) scored from 6 to 9 marks. Further, the analysis shows that 870 (0.16%) scored all 9 marks. The candidates’ overall performance was average, with 39.56 per cent scoring from 3 and 9 marks. Figure 7 summarises candidates’ performance on question 7.

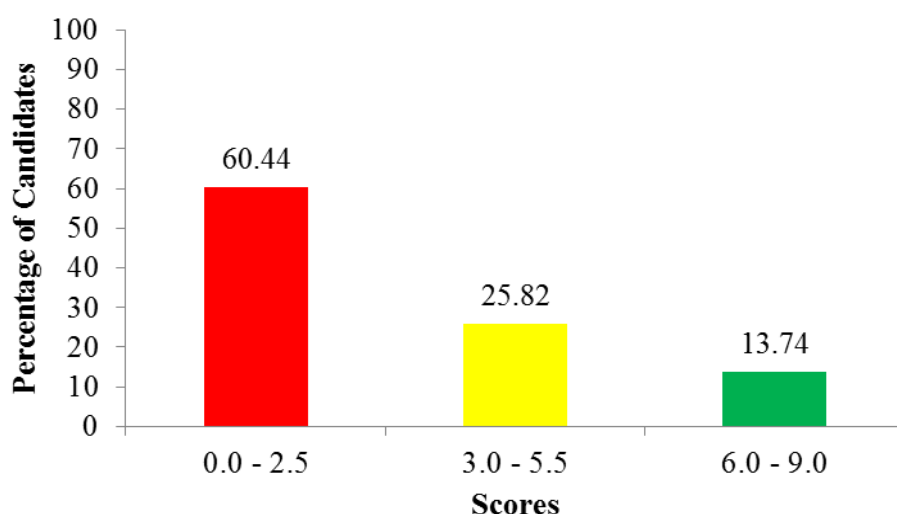


**Figure 7:** *Candidates' Performance on Question 7*

The candidates who scored high marks had sufficient knowledge of the patterns of Inheritance that follow Mendel's First Law of Inheritance, which is codominance. They were aware that codominance occurs when both genes of an allelomorph pair produce their effects in an individual. In this case, the genes for a particular trait are both dominant; therefore, none of them masks the other and each gene expresses its character in the offspring. They were also aware that the gene locus is designated I, and that the genes for blood group A and B are dominant, whereas those for blood group O are recessive. Therefore, they used parental genotypes which were

heterozygous dominant,  $I^A$  and  $I^O$  for the man and  $I^B$  and  $I^O$  for the woman, and crossed them between a heterozygous blood group A and a heterozygous blood group B, which produced offspring with blood group O in the  $F_1$  generation. Extract 7.1 is a sample of candidates' correct responses to question 7.

|    |                                                                                                                                                               |  |
|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 07 | Let $I^A$ stand for dominant allele of blood group A<br>$I^B$ stand for dominant allele of blood group B<br>$I^O$ stand for recessive allele of blood group O |  |
|    | Man Woman                                                                                                                                                     |  |
|    | Parental phenotype: heterozygous blood group A × heterozygous blood group B                                                                                   |  |
|    | Parental genotype: $I^A I^O$ × $I^B I^O$                                                                                                                      |  |
|    | Meiosis                                                                                                                                                       |  |
|    | Gametes: $I^A$ $I^O$ $I^B$ $I^O$                                                                                                                              |  |
|    | fertilisation:                                                                                                                                                |  |
|    | $F_1$ genotype: $I^A I^B$ $I^A I^O$ $I^B I^O$ $I^O I^O$                                                                                                       |  |
|    | $F_1$ phenotype: Blood group AB Blood group A Blood group B Blood group O                                                                                     |  |
|    | Number of offspring = 4                                                                                                                                       |  |
|    | Number of blood group O offspring = 1                                                                                                                         |  |
|    | then;                                                                                                                                                         |  |
|    | Probability of blood group O = $\frac{\text{No. of blood group O offspring}}{\text{No. of offspring}}$                                                        |  |
|    | $= \frac{1}{4}$                                                                                                                                               |  |
|    | $\therefore$ Probability of producing blood group O offspring is $\frac{1}{4}$                                                                                |  |

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

In Extract 7.1, the candidate correctly applied a genetic cross between heterozygous blood group A and heterozygous blood group B individuals to determine the probability of producing offspring with blood group O. The response clearly presented all essential components of a genetic

diagram, including the parental phenotypes and genotypes, the process of meiosis, gamete formation, and subsequent fertilization.

On the other hand, the analysis indicates that more than half of the candidates (60.44%) who obtained low marks (0 - 2.5) demonstrated inadequate knowledge of genetics, particularly with respect to patterns of inheritance governed by Mendel's First Law, as applied to codominance. These candidates were unable to identify parental genotypes correctly, and several failed to construct appropriate genetic crosses. Some candidates incorrectly applied principles of complete dominance, for example, by using heterozygous genotypes such as  $Aa$  for blood group A and  $Bb$  for blood group B. Others used the homozygous recessive  $aa \times bb$  and, in some cases, failed to use the appropriate capital-letter notation for blood group alleles, resulting in incorrect outcomes.

In addition, many candidates used incorrect or inconsistent labels in their genetic diagrams. Common errors included writing phenotypes in place of parental genotypes, indicating gametes where genotypes were required, and referring to mitosis instead of meiosis. In some responses, essential information was omitted entirely.

Furthermore, several candidates incorrectly interpreted blood group inheritance as a sex-linked trait. For example, some represented heterozygous individuals using notations such as  $X^A Y^O$  for a man and  $X^B X^O$  for a woman. These candidates also failed to calculate the probability of producing offspring with blood group O. In other cases, candidates did not address the specific demands of the question; instead of illustrating a genetic cross, they presented tables showing compatible blood groups for transfusion under the ABO system. Collectively, these responses indicate a lack of clear understanding of codominance and its application to ABO blood group inheritance. Extract 7.2 is a sample of candidates' incorrect responses to question 7.

|   |                                                                                                                                                                                                                                                                               |  |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 7 | <p>Group B - blood group O</p> <p>Group A - blood group A</p> <p>Solution</p> <p>Genotype <math>RR</math> group <math>YY</math></p> <p>genotype</p> <p>meiosis</p> <p>Oxytosis</p> <p>generation</p> <p>∴ The probability of producing such offspring is <math>RY</math>.</p> |  |
|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

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

In Extract 7.2, the candidate incorrectly used the genotypes  $RR$  and  $YY$  in place of the appropriate ABO blood group genotypes  $I^A I^O$  and  $I^B I^O$ . As a result, the candidate derived gametes  $R$ ,  $R$ ,  $Y$ , and  $Y$  instead of the correct gametes  $I^A$ ,  $I^O$ ,  $I^B$ , and  $I^O$ , which led to all offspring being incorrectly shown as having the genotype  $RY$  rather than the expected genotypes  $I^A I^B$ ,  $I^A I^O$ ,  $I^B I^O$ , and  $I^O I^O$ . In addition, the candidate incorrectly referred to mitosis instead of meiosis and misspelled the term genotype as *genotre*, which was also incorrectly positioned within the genetic diagram.

## 2.2.6. Question 8: Evolution

The question required the candidates to explain, by using an example, how fossil records and comparative embryology provide evidence for organic evolution in parts (a) and (b).

The question was attempted by 555,416 (100%) candidates. The analysis shows that 549,162 (98.87%) scored from 0 to 2.5 marks, of whom 515,820 (92.87%) scored 0 marks. The candidates who scored 3 to 5.5 marks were 5,509 (1.00%), whereas 745 (0.13%) scored 6 to 9 marks. Only 39 candidates scored all 9 marks. The analysis of the candidates' performance is presented in Table 2.

**Table 2: Distribution of the Candidates' Scores on Question 8**

| Scores    | Description | Percentage of Candidates |
|-----------|-------------|--------------------------|
| 0.0 - 2.5 | Weak        | 98.87                    |
| 3.0 - 5.5 | Average     | 1.00                     |
| 6.0 - 9.0 | Good        | 0.13                     |

Table 2 shows that the candidates' overall performance on this question was weak, as only 1.13 per cent scored from 3 to 9 marks.

Analysis shows that 549,162 (98.87%) candidates who scored low marks (0 -2.5) demonstrated limited understanding of the evidence of organic evolution and therefore provided responses that did not meet the demands of the question. Candidates who scored from 1 to 2.5 marks were able to provide one to two correct points with one example, while those who scored 0 showed no understanding of the evidence of organic evolution. In part (a), some candidates explained the importance of evolution rather than the evidence for organic evolution. For instance, some candidates wrote that *it helps to understand the origin of life, helps to understand the genetic relationships among organisms, and helps us to understand how species change over time*. Others explained the ideas of Lamarck's theory of evolution, rather than the required evidence. For example, some candidates wrote that *acquired characteristics can be passed from one generation to another; the more an organ is used, the stronger it becomes, and changes in the environment create new needs that cause organisms to adapt by developing new structures*.

In part (b), some candidates failed to understand the demands of the question by explaining theories of the origin of life instead of explaining how comparative embryology provides evidence for organic evolution. For instance, some candidates wrote about spontaneous generation, stating that *living things arose from non-living things*, while others stated the special creation theory and the steady-state theory. Other candidates presented different evidence for organic evolution, rather than the fossil record and comparative embryology that were asked. They explained evidence such as comparative anatomy and morphology. For example, some candidates wrote about *homologous structures, analogous structures, and vestigial*

structures. Extract 8.1 is a sample of the candidate's incorrect responses to question 8.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 8. | <p>(a) Fossil records</p> <p>(i) Natural selection<br/>Some of the species to adapt the environment to survival in the evidence of fossil record during the struggle. Some of animals died for this evidence to make fossil records.</p> <p>(ii) <del>Existence of</del> Struggle for existence<br/>Through to adapt the environment. Some of organisms are struggle in order to survival, and some are organisms are died. Example of organism, <i>Dinosaur</i> is an organism which die for because not to adapt their environment.</p> <p>(iii) Over population<br/>Many organisms to survival example of organism. Say is giraffe, pre-adapt their environment and caused to long necked.</p> <p>(b) Comparative embryology</p> <p>(i) Variation<br/>Some of the embryo like embryo of human being and chicken are different after growing while some before growing.</p> <p>(ii) Competition<br/>Through the competition it help organism to different to change <del>body</del> body in order to adapt their environment.</p> |  |
|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**Extract 8.1:** Candidate's incorrect responses to question 8

In Extract 8.1, the candidate explained the ideas of Darwin's theory of organic evolution instead of explaining how fossil record and comparative embryology provide evidences for organic evolution. Furthermore, the candidate did not provide any example.

Contrarily, analysis shows that 6,254 candidates (1.13%) scored 3 and 9 marks, of whom 39 candidates attained the maximum score of 9 marks allocated to this question. These candidates demonstrated adequate knowledge of the evidence of organic evolution. Consequently, they correctly explained how fossil records and comparative embryology provide evidence for organic evolution and provided appropriate examples in each case. Extract 8.2 is a sample of candidates' correct responses to question 8.

|  |                                                                                                                                                                                                                                           |  |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | <u>Fossil records</u>                                                                                                                                                                                                                     |  |
|  | Fossils are the remains of organisms that have been preserved by natural processes.                                                                                                                                                       |  |
|  | Fossils found in the bottom rocks are simple compared to those fossils found in the upper layers of the rocks.                                                                                                                            |  |
|  | In the bottom rocks there are many fossils compared to those fossils found in the upper layers of the rocks.                                                                                                                              |  |
|  | This shows that, fossils become more complex as we proceed from earliest to today's rocks. This shows that evolution is taking place.                                                                                                     |  |
|  | For example, evolution of horse from primitive to complex form.                                                                                                                                                                           |  |
|  | <u>Comparative embryology</u>                                                                                                                                                                                                             |  |
|  | Embryology is the study of the development of embryos from fertilization to a foetus.                                                                                                                                                     |  |
|  | Comparative embryology is the study which compares embryos of different species to show how animals are related.                                                                                                                          |  |
|  | The greater the similarities of structures, the more closely related the species are.                                                                                                                                                     |  |
|  | The early embryos show a greater similarity than the later stages of development. This shows that evolution has taken place.                                                                                                              |  |
|  | Example early embryos of fish, chick and human are very similar. They tend to be different as they continue to develop and become similar to their parents, this shows that the course of development, organic evolution is taking place. |  |

**Extract 8.2:** Candidate's correct responses to question 8

In Extract 8.2, the candidate correctly explained how fossil records and comparative embryology provide evidence for organic evolution and gave an example in each case.

## 2.3. SECTION C: Essay Questions

This section had three essay-type questions: 9, 10, and 11. The candidates were required to answer any two questions. Each question was carried 15 marks, making a total of 30 marks.

### 2.3.1. Question 9: Coordination

In this question, the candidates were given a scenario: “You are invited as a guest speaker in a youth meeting to fight against drug abuse.” They were required to recommend six preventive and control measures they would address.

A total of 491,175 candidates attempted this question. Data show that 260,501 (53.04%) scored from 0 to 4 marks, of whom 64,414 (13.11%) scored 0 marks. The candidates who scored from 4.5 to 9.5 marks were 174,601 (35.54%), and 56,073 (11.42%) scored from 10 to 15 marks. Further, the analysis shows that 3,578 (0.64%) scored all 15 marks. The candidates’ overall performance was average, with 46.96 per cent scoring from 4.5 and 15 marks. Figure 8 summarises the candidates’ performance on question 9.

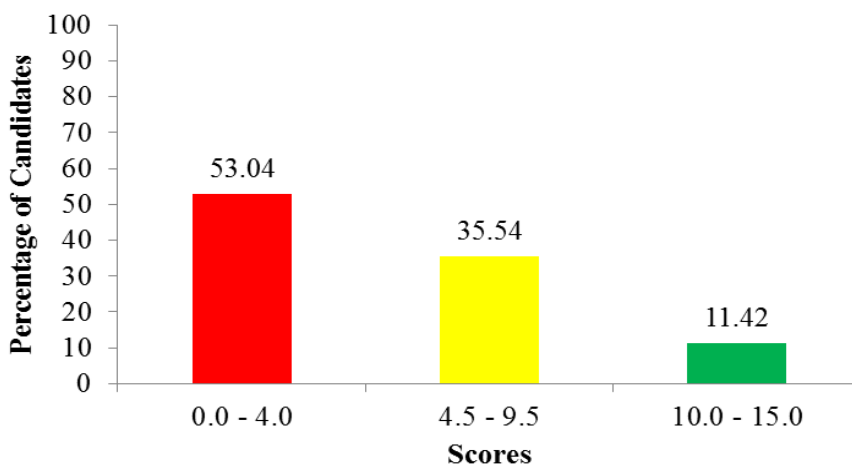


**Figure 8:** *Candidates Performance on Question 9*

Candidates who scored high marks (10 - 15) demonstrated adequate knowledge of drug abuse and its related concepts. They provided relevant and accurate introductions, defining drug abuse as the indiscriminate and excessive use or misuse of psychoactive drugs for non-medical purposes without regard to their side effects, or as the use of drugs for self-indulgence.

These candidates correctly identified and explained appropriate preventive and control measures for drug abuse. The measures included the provision of education/guidance and counselling; the promotion of role models/strong and stable family/Good parental care; avoidance of peer pressure; effective drug management; enforcement of laws against drug dealers; prevention of drug cultivation/importation and distribution of illegal drugs; community involvement; engagement in creative activities/proper management of leisure time and participation in physical activities; establishment of rehabilitation centres/sober houses and counselling centres; provision of employment opportunities and stress management.

Furthermore, these candidates demonstrated strong essay-writing skills by organizing their responses logically, with a clear introduction, well-developed main body, and a relevant conclusion. Extract 9.1 is sample of candidates' correct responses to question 9.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 9. | <p>Drug abuse refers to the incorrect and misuse of drugs for purposes rather than medical treatment. Drug abuse is mostly done by youth for the purpose of obtaining pleasure, reducing stress and influence from fellow peers. Drug abuse is bad and has several effects to one's health and social wellbeing. Some of the preventive and control measures taken to fight against drug abuse include;</p> <p>Provision of mass education on the effects of drug abuse; education should be provided to the entire society and especially youths who are mostly vulnerable to drug abuse on the effects of drug abuse, how to correctly use drugs and to avoid the effects of drug abuse to the environment. This will help in creating awareness among youths on the harmful effects of abusing drugs.</p> <p>Formulation of strict laws and policies that discourage drug abuse; the government should formulate strict laws and policies that discourage drug abuse in the society. These laws and policies should aim at restricting importation and selling or buying of harmful drugs like cocaine, marijuana, morphine and others, also; the law should provide severe punishment to any one who is convicted of abusing drugs or selling illegal drugs in the society.</p> <p>Construction of sober and rehabilitation houses for people affected by drugs; drug abuse can also be controlled by establishing sober houses and rehabilitation centres for people who are affected by drugs. Sober houses and rehabilitation centres aim at restoring the addicted person back to his or her normal condition and stop the effect of drug abuse. These places provide</p> |  |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9. | <p>treatment to these people and thus helps to control the effects of drug abuse in the society.</p> <p>Encouraging youths to engage in positive and productive activities like sports; drug abuse can be controlled and prevented by encouraging youths to engage in positive activities like sports and games which help in reducing stress, maintaining physical and mental fitness and can provide income to an individual. This prevents youth from the possibility of engaging in drug abuse as a way of reducing stress and providing psychological relief.</p> <p>Discouraging bad peer groups in the society drug abuse can be controlled and prevented by discouraging bad peer groups in our society as drug abuse among most of the youth is caused by influence from fellow peers and desire to fit among his/her fellow peers. Therefore, the society should put effort in identifying and discouraging peer groups that show bad qualities in the society. Also, youth should avoid involving themselves in bad peer groups that can influence them to engage in drug abuse.</p> <p>Prevention of drug trafficking in the country drug trafficking involves the act of selling and buying illegal drugs within and outside the country. The government should combat drug trafficking especially importation of illegal drugs such as cocaine, marijuana and others which have affected a lot of people. Prevention of drug trafficking will decrease the availability of drugs and will prevent drug abuse in the society.</p> <p>Generally, drug abuse has various effects to an individual and society at large such as diseases like liver and lung cancer. Therefore measures should be taken to fight it.</p> |
|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

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

In extract 9.1, the candidates correctly recommended preventive and control measures of drug abuse.

The analysis reveals that half of the candidates (53.04%) scored low marks (0 - 4) in this question. Candidates who scored from 1 to 4 marks demonstrated insufficient knowledge about drugs and drug abuse. Most of

them listed points without providing explanations, and failed to structure their responses with a proper introduction and conclusion, resulting in a loss of marks. Candidates who scored 0 mark provided irrelevant introductions and explanations and displayed fundamental misconceptions about drug abuse. For instance, some candidates incorrectly defined drug abuse as *a drug which does not respect people, chemicals used to treat disease, or substances which inhibit body activities*.

In the main body many candidates focused on the causes of drug abuse rather than addressing the preventive and control measures, as was required. For example, some candidates wrote *curiosity, desire for refreshment, escape from life difficulties such as hunger, and peer pressure*. Additionally, other candidates explained the correct ways of handling drugs. For example, some candidates wrote *We must use the drugs until doctor's description, Do not take more or less drugs, keep drugs away from children and do not use expired drugs*. Other incorrect responses found in candidates' scripts were *We must avoid stress, put away to the children, By checking first if they use medicine, By drinking enough and clean water and to give people care*. Extract 9.2 is a sample of candidates' incorrect responses.

|    |                                                                                                                                                                                                                                   |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 9. | Drug abuse is the process of human being to bad traits and have not good Manners in the society for example bad traits, thefts, robbery and Smoking Marijuana                                                                     |
|    | There are the following effects of Drug abuse in the society these are:                                                                                                                                                           |
|    | Disease: The people of used drugs abuse it necessary of health conditions of disease for example of disease that for used drugs abuse of loss of body weight HIV/AIDS etc                                                         |
|    | Death: Drug abuse it necessary death of people of use drug abuse. Because those of death of people that have cell of human body dead and to necessary of death.                                                                   |
|    | Bad traits: Drug abuse it there are people to joined of bad traits in the society. eg. Smoking Marijuana prostitution, rape, robbery and theft in the society. people of use drug abuse that to joined bad traits in the society. |
|    | poverty: Those some people of use drug abuse that the condition of poverty of their family and development in the country.                                                                                                        |
|    | Street of children. Those children 20 Under take age boy and girl that use of drug abuse this are condition it necessary of Street children.                                                                                      |
|    | Conflict: Those of people in the society that get conflict of people of use drug abuse and some people.                                                                                                                           |

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

In Extract 9.2, the candidate incorrectly defined drug abuse in the introduction. Also, the candidate explained the effects of drug abuse instead of the preventive and control measures of drug abuse. The candidate did not provide a conclusion.

### 2.3.2. Question 10: Health and Immunity

The candidates were given a scenario: “Matatu villagers have appointed you as a chairperson for a campaign against gonorrhoea prevention”. Candidates were required to explain the modes of transmission and five measures to help them prevent disease.

A total of 190,925 candidates attempted the question. Data show that 132,151 (69.22%) scored from 0 to 4 marks, of whom 63,106 (33.05%) scored 0 marks. The candidates who scored from 4.5 to 9.5 marks were 46,912 (24.57%), whereas 11,862 (6.21%) scored from 10 to 15 marks. Further, the analysis shows that 132 (0.02%) scored all 15 marks. The overall performance was average, with 30.78 per cent of the candidates scoring from 4.5 and 15 marks out of 15. Figure 9 summarises the candidates’ performance on question 10.

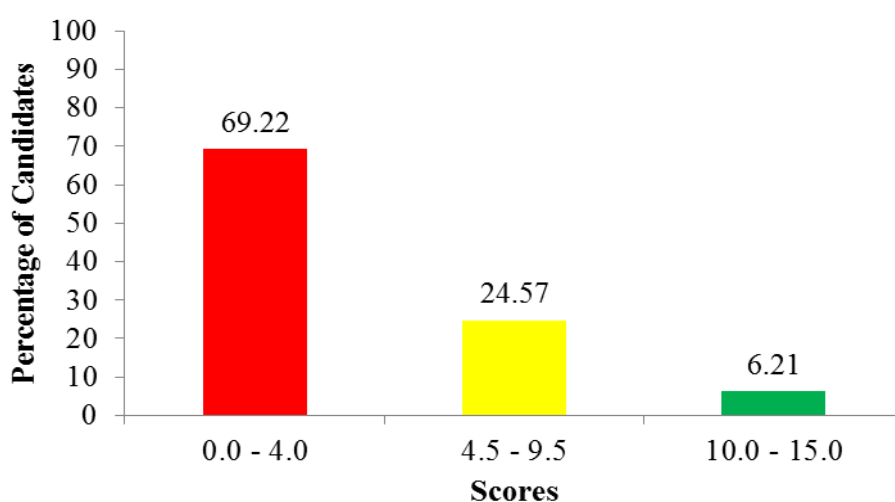


**Figure 9:** *Candidates' Performance on Question 10*

Candidates who scored high marks (10 - 15) demonstrated adequate knowledge of infections and diseases, particularly the modes of transmission and preventive measures of gonorrhoea. These candidates correctly identified gonorrhoea as a sexually transmitted infection. They explained that it is primarily transmitted through unprotected sexual intercourse with an infected person, from an infected mother to her child during childbirth, and through sharing contaminated personal items such as

towels, underwear, and swimsuits. Furthermore, they correctly explained five preventive measures of gonorrhoea, demonstrating a clear understanding of disease prevention and control. In addition, these candidates demonstrated strong essay writing skills by providing relevant introductions, well-developed and correct main bodies, and appropriate conclusions. Extract 10. 1 is a sample of candidates' correct responses.

|     |                                                                                                                                                                                                                                                            |  |
|-----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 10. | Gonorrhoea is a communicable disease which is caused by bacteria. This bacteria is known as <i>Neisseria gonorrhoea</i> . This disease is transmitted as follows:                                                                                          |  |
|     | Unprotected sexual intercourse with a person who is infected by gonorrhoea.                                                                                                                                                                                |  |
|     | Infected mother to her child during birth. During birth the mother can pass a bacteria to her child during birth and a child can also be affected.                                                                                                         |  |
|     | Sharing personal items like underpants, towels and swimming dress. These items can have bacteria which will enter to another person if shared.                                                                                                             |  |
|     | The following are preventive measures of gonorrhoea, that are: Abstain from sex or wait until you get married with your lover one. If you abstain from sex until you get married you can't get gonorrhoea as you don't do sex and no spread of gonorrhoea. |  |
|     | Use of condoms. Condoms are devices worn by either male or female during sexual intercourse so as to collect body fluid (semen). This prevents the spread of the disease.                                                                                  |  |
|     | Avoid sharing of personal items; person                                                                                                                                                                                                                    |  |

|  |                                                    |  |
|--|----------------------------------------------------|--|
|  | al items like under pants, towels should           |  |
|  | not be shared by one person to another             |  |
|  | so as to prevent gonorrhoea disease.               |  |
|  | Treat pregnant women. When the                     |  |
|  | diagnosis test done in hospital and the            |  |
|  | results is positive. Also when the infected mother |  |
|  | goes to clinic for prenatal check up,              |  |
|  | Treat the mother to avoid the spread               |  |
|  | to her child.                                      |  |
|  | Treatment for a victim of gonorrhoea               |  |
|  | If the checkup is done, and you are                |  |
|  | diagnosed with a gonorrhoea take full              |  |
|  | dose as doctor's instructions, so as to            |  |
|  | avoid getting the disease again.                   |  |
|  | By concluding, gonorrhoea if not treated           |  |
|  | can cause infertility, swollen and painful         |  |
|  | joints, complications in the reproductive          |  |
|  | system for human being.                            |  |

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

In extract 10.1, the candidate correctly explained three ways of transmission and five preventive measures of gonorrhoea.

Conversely, more than two-thirds of the candidates (69.22%) scored low marks (0 - 4). Candidates who scored from 1 to 4 marks demonstrated insufficient knowledge of infections and diseases, while those who scored 0 were largely incompetent in the concepts assessed. Most of the candidates wrote an incorrect introduction. For example, some candidates incorrectly stated that *gonorrhoea is a communicable disease caused by a virus*, while others wrote that *it is caused by a fungus*. Although a few candidates correctly identified gonorrhoea as a bacterial infection, they failed to name the causative organism accurately. For instance, some incorrectly stated that gonorrhoea is caused by *Treponema pallidum* instead of *Neisseria gonorrhoea*.

In the main body of their responses, many candidates outlined only one or two modes of transmission and three to four preventive measures, which were inadequate and resulted in a loss of marks. Other candidates confused gonorrhoea with different diseases and therefore described incorrect modes of transmission. For example, some explained the transmission of COVID-

19 as: *occurring through coming into contact with infected person or touching the contaminated surfaces with the virus*, while others described the transmission of tuberculosis and measles, citing *droplet infection* and *physical contact*.

Furthermore, several candidates provided incorrect preventive measures for gonorrhoea. In some cases, candidates listed symptoms instead of preventive measures, such as *burning pain during urination*, *irregular menstruation*, *itching of the genital area*, and *urine retention in males*. Other candidates explained general practices for maintaining good health rather than disease-specific preventive measures. For instance, some candidates wrote about *eating a balanced diet*, *engaging in physical exercise*, *maintaining personal hygiene*, *drinking sufficient water*, and *allowing time for leisure*. Additionally, some candidates outlined preventive measures for other diseases, such as malaria, including *using mosquito repellents*, *draining stagnant water*, *clearing long grass around houses*, and *sleeping under treated mosquito nets* while others wrote about tuberculosis as *avoiding crowded areas*, *isolation*, and *covering nose and mouth when sneezing*. Generally, most candidates showed limited understanding of gonorrhoea, with common misconceptions about its cause, transmission, and prevention. Extract 10.2 is a sample of candidates' incorrect responses to question 10.

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 10 | <p>Gonorrhoea : Gonorrhoea is a type of disease which is transmitted in different ways and can be prevented in different ways. for example ways of transmission</p> <p>By drinking dirty water<br/>Gonorrhoea can be transmitted by drinking dirty water in that you can easily drinking germs.</p> <p>By eating without washing hand : Gonorrhoea can be transmitted through eating things without washing his or her hand can easily get gonorrhoea.</p> <p>By staying dirty places : By staying dirty or dumping places it will be easy for you to get gonorrhoea because of the places.</p> <p>There are many ways of preventing the diseases which is gonorrhoea by.</p> <p>By boiling water before using or drinking them. In order to avoid gonorrhoea you must boil water before drinking because if you boil water it kill germs and microorganism by boil.</p> <p>By washing hand before and after visiting the toilet : You must wash hand before and after visit the toilet in order to do not get easily gonorrhoea because if you wash hand it remove germs.</p> |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

|  |                                                                                                                                                                                                 |  |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|  | By cleaning the place where<br>you stay. By cleaning the place where<br>you stay by dumping the waste<br>to avoid different type of<br>diseases for example gonorrhoea and<br>cholera.          |  |
|  | By washing hand before<br>and after eating. By washing hand<br>before and after eating in order to<br>remain clean and to avoid from<br>getting diseases for example Typhoid<br>and gonorrhoea. |  |
|  | Finally there are<br>the prevention transmission and measures<br>of gonorrhoea in the community and<br>society.                                                                                 |  |

**Extract 10.2:** Candidate's incorrect responses to question 10

In Extract 10.2, the candidate explained the modes of transmission and preventive measures for cholera rather than those of gonorrhoea. For example, he/she stated that the disease can be prevented *by boiling water before use or drinking*. The conclusion was incorrect as well.

### 2.3.3. Question 11: Transport of Materials in Living Things

The question required the candidates to analyse five environmental factors that affect the rate of transpiration in plants.

The question was attempted by 428,732 candidates. Analysis shows that 370,241 (86.36%) scored 0 to 4 marks, of whom 63,411 (14.79%) scored 0 marks. The candidates who scored 4.5 to 9.5 marks were 41,605 (9.70%), whereas 16,886 (3.94%) scored from 10 to 15 marks. Further, the analysis shows that 2,235 (0.40%) scored all 15 marks. The candidates' overall performance was weak, with 86.36 per cent scoring from 0 to 4 marks. Figure 10 summarises the candidates' performance on question 11.

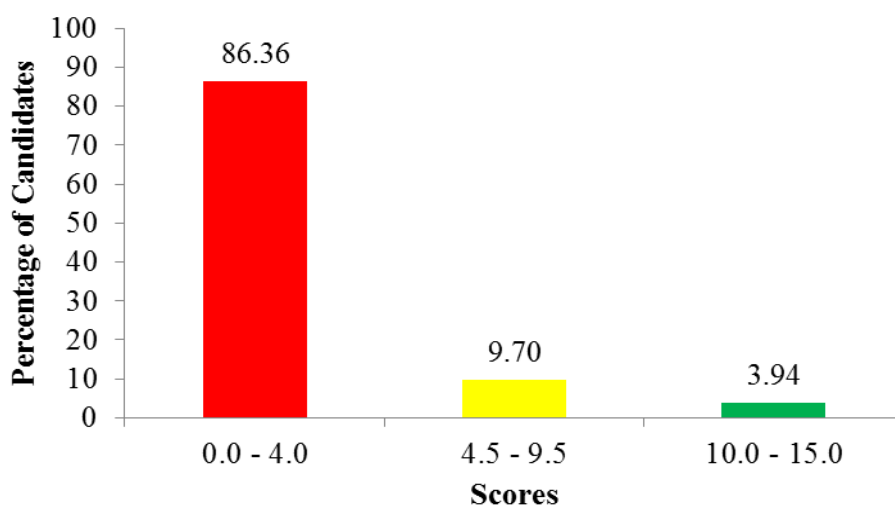


**Figure 10:** *Candidates' Performance on Question 11*

The analysis indicates that candidates who scored low marks (0 - 4) were largely incompetent in the concepts assessed. Those who scored 1 to 4 marks demonstrated limited knowledge of the absorption and movement of water and mineral salts in plants, particularly regarding the environmental factors that affect transpiration. In contrast, candidates who scored 0 showed little or no understanding of the tested concepts. In the introduction, some candidates incorrectly defined root pressure instead of transpiration, *describing it as the force that pushes water and mineral salts from the roots*. Others defined capillarity as *the ability of water to rise in narrow tubes*, rather than explaining transpiration.

In the main body, several candidates explained the importance of transpiration in plants rather than the factors that affect it. For example, some stated that *transpiration helps to maintain the transpiration stream, cools the plant, enables the loss of excess water, and facilitates water absorption*. Other candidates confused transpiration with respiration and explained factors affecting the rate of respiration, such as *age, size of the organism, carbon dioxide concentration, and physical activity*, instead of environmental factors affecting transpiration. Additionally, some candidates outlined factors affecting photosynthesis, including *chlorophyll, sunlight, water, and soil fertility*. In contrast, others described factors affecting gaseous exchange, such as *carbon dioxide concentration, physical activity, health status, and age*.

Furthermore, many candidates provided incorrect or irrelevant conclusions. Generally, these responses reveal common misconceptions and poor interpretation of the question, particularly in distinguishing transpiration from other physiological processes in plants. Extract 11.1 is a sample of candidates' incorrect responses to question 11.

|     |                                                                                                                                                                                                                                                                         |
|-----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11. | Transpiration is The process in which the plant + loose their leaf. Transpiration is one among The environmental factors which affect the rate of transpiration in plants. The following are the factors which affect the rate of transpiration                         |
|     | Leaf age This is one among the environmental factors which affect the rate of transpiration in plants. so the leaf of stomata it cause transpiration in plant . rate affected in the environmental factors so it need the rate of transpiration in plant to be average. |

|     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11. | <p>Structure of stomata Also This is one among the environmental factor which affect the rate of transpiration in plant during transpiration. so structure of the stomata it lead to the increase or decrease of rate of transpiration in plant and reduce the effect of transpiration in plant.</p> <p>Sunken stomata This is one among the environmental factor of which affect the rate of transpiration in plant to be sunken of stomata. so sunken stomata is environmental factor which can affect the transpiration in plant.</p> <p>Number of stomata Also number of stomata is one among the environmental factor which affect the rate of transpiration in plant to be the increase of number of stomata. so number of stomata it cause the environmental factor affected in transpiration process in plant.</p> <p>Size of leaf Also size of leaf is one among the environmental factor which affect the rate of transpiration in plant. when the size of leaf increases or decreases it cause environmental factor which affect the rate of transpiration in plant.</p> <p>Conclusion Government should be provide education of different activities like Lumbering, agriculture, pastoralism in order to preserve and conserve our environment and also to avoid over grazing, to avoid deforestation and maintain afforestation.</p> |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Extract 11.1:** Candidate's incorrect responses to question 11

In Extract 11.1, the candidate explained plant (internal) features that affect transpiration rate instead of environmental factors. The candidate also provided an incorrect introduction and conclusion. For example, he/she defined transpiration as *the process by which a plant loses its leaf*, which is incorrect.

Candidates who scored high marks demonstrated adequate knowledge of the environmental factors that affect transpiration in plants. They showed a clear understanding that environmental factors affecting transpiration are external environmental conditions that influence the rate at which plants lose water vapour from their leaves, mainly through the stomata. Accordingly, these candidates provided relevant and accurate introductions to transpiration, correctly analysed the environmental factors influencing its rate, and presented correct and well-structured conclusions. Extract 11.2 is a sample of candidates' correct responses to question 11.

|     |                                                                                                                                                                                                                                                                                                                                                                                                        |
|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11. | Transpiration refers to the process where by plants lose water to the atmosphere in form of water vapour. There are three types of transpiration which are cuticular transpiration, lenticular transpiration and stomatal transpiration. There are both environmental (external) and plant factors for transpiration. The following are the environmental factors affecting the rate of transpiration; |
|     | Humidity; the atmosphere with a higher humidity tends to be saturated with water vapour, this limits the transpiration process due to a saturated atmosphere with water vapour. But; during the less or no humidity, there tends to be less atmospheric saturation thus provide more room for water loss. Thus, the rate of transpiration is higher.                                                   |
|     | Light intensity; the intensity of the sunlight tends to affect the rate of transpiration. The higher / greater intensity of sunlight tends to cause opening up of the stomata. Thus, increases the rate of transpiration. But; the lower sunlight intensity reduces the opening of the stomata. Hence, the rate of transpiration decreases.                                                            |
|     | Wind; the speed of air also determines the rate of transpiration process to occur. The area with higher wind tends to experience the higher rate of transpiration as the wind dries up the atmosphere. But less windy places experience less transpiration.                                                                                                                                            |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| 11 | <p>Atmospheric pressure; the atmospheric pressure can determine rate of transpiration of a plant. This is because, areas with higher atmospheric pressure tend to experience lower rate of transpiration but higher rate of transpiration is determined by lower atmospheric pressure.</p> <p>Soil moisture; the moisture content that is higher in the soil tend to bring about higher rate of transpiration. This is due to the higher absorption of water by the roots. But; the soil with less soil moisture content, there is less water that is absorbed. Hence, lowers the rate of transpiration by the plant.</p> <p>Conclusively; transpiration has got variety of effects to the plants. Example it may cause wilting of plant once in excess.</p> |  |
|----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**Extract 11.2:** Candidate's correct responses to question 11

In Extract 11.2, the candidate provided a clear and correct introduction. He/she correctly analysed five environmental factors that affect transpiration in plants and presented a relevant conclusion. The candidate also demonstrated a good command of the English language.

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

This section presents the analysis of the practical examination, which had three alternative papers: 033/2A Biology 2A, 033/2B Biology 2B, and 033/2C Biology 2C. The candidate had to do only one of these alternatives. Each paper comprised two (2) questions. Question 1 was set on Nutrition, while Question 2 was set on the Classification of Living Things. Each question carried 25 marks.

The analysis of the candidates' performance on each paper in Biology 2 begins by presenting the overall performance of the candidates for the three

alternative papers: 033/2A Biology 2A, 033/2B Biology 2B, and 033/2C Biology 2C, followed by the candidates' responses to each question.

### 3.1. Question 1: Nutrition

In all three alternatives, this question was set from the topic of Nutrition. Analysis of the candidates' performance for the question on all three alternatives is presented as follows:

A total of 553,733 candidates attempted this question. The analysis shows that 403,764 (72.92%) scored 0 to 7 marks, of whom 33,434 (6.04%) scored 0. The candidates who scored 7.5 to 16 marks were 114,832 (20.73%), whereas 35,137 (6.35%) scored from 16.5 to 25 marks. Further, the analysis shows that 817 (0.15%) scored all 25 marks. The overall performance was weak, with 72.92 per cent of the candidates scoring from 0 to 7 marks out of 25. Figure 11 summarises the candidates' performance on question 1 for all alternative papers, namely 033/2A, 033/2B, and 033/2C.

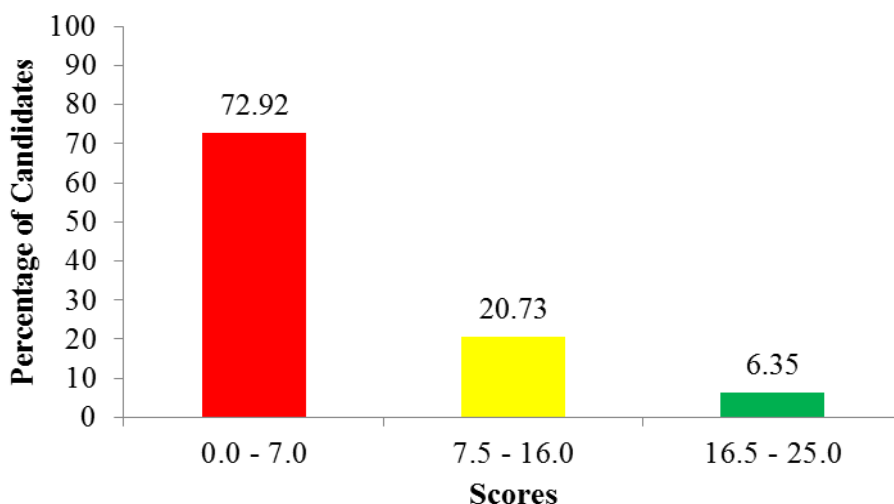


**Figure 11:** *Candidates' Performance on Question 1 Paper 2*

#### 3.1.1. 033/2A Biology 2A

Question 1 of the alternative 2A had four parts (a) to (d), which carried a total of 25 marks. The candidates were provided with specimen O (Castor seeds) and M (Sucrose crystals), chemical reagents, and apparatus. They were required to use them to respond to the following questions:

- (a) *Prepare the solutions from specimens O and M for the food test experiments, then outline the procedures used to prepare each solution.*
- (b) *Carry out experiments to identify the food substances present in specimens O and M. Your experimental report should be tabulated as shown in the following Table:*

*Identification of Food Substances in specimens O and M*

| <b>Food tested</b> | <b>Procedure</b> | <b>Observation</b> | <b>Inference</b> |
|--------------------|------------------|--------------------|------------------|
|                    |                  |                    |                  |

- (c) *State the function(s) of each food substance identified in 1(b) to the human body.*
- (d) *Apart from the specimen provided, give another one example of natural source from which the food substances identified in 1(b) could be obtained.*

Analysis shows that 72.92 per cent of the candidates who scored low marks (0 - 7) provided incorrect responses in all or most parts of the question. Candidates who scored 0 demonstrated a complete lack of understanding of the assessed practical skills and concepts. In part (a), many candidates failed to prepare solutions correctly from specimen O (castor seed) and specimen M (sucrose crystals). They were unable to describe appropriate procedures for preparing the solutions. For instance, some candidates incorrectly stated that *specimens O and M were mixed together to form one solution*, instead of preparing the solutions separately. Others demonstrated a lack of familiarity with the specimens by stating that *the outer covering of specimen M (sucrose) should be removed*.

In part (b), most of the candidates provided incorrect or incomplete procedures, with several steps interchanged. Common errors included the use of incorrect chemical reagents and inappropriate units of measurement. For example, some candidates used water rather than dilute hydrochloric acid when testing for non-reducing sugar. Others wrote incorrect procedures, such as *adding 1 ml of distilled water to 2 ml of mixtures of O and M in separate test tubes, boiling, cooling, and then adding reagents*, rather than correctly hydrolysing the non-reducing sugar with dilute

hydrochloric acid. Additionally, many candidates showed poor competence in the use of measurement units, for example, writing 2 cm instead of 2 cm<sup>3</sup>.

Furthermore, several candidates confused the procedures for testing different food substances. Some described the test for reducing sugars in place of non-reducing sugars, while others wrote the procedure for testing proteins instead of starch. In many cases, candidates treated solutions O and M as a single solution rather than as separate solutions. For example, some candidates stated that *2 drops of iodine solution were added to 2 ml of solution OM*, instead of testing each solution separately. In addition, some candidates demonstrated weak observational skills and inaccurate reporting of colour changes. For instance, some recorded *no colour change* instead of correctly noting the blue-black colour produced when iodine reacts with starch. Others incorrectly described the sequence of colour changes in Benedict's test, leading to an incorrect interpretation of results.

In part (c), some candidates incorrectly stated the functions of the identified food substances. For example, some wrote that *lipids are used for growth and repair, hormone formation, and clotting factor production*, while others stated that *proteins protect internal organs and provide insulation*. Likewise, in part (d), many candidates failed to provide appropriate examples of natural sources of the food substances identified in the specimens. Some of the candidates incorrectly listed *bananas, wheat, rice, and cassava* as sources of protein; *Irish potato and eggs* as sources of lipids; and *green vegetables* as sources of non-reducing sugars. Overall, the responses reflect poor practical skills, inadequate understanding of food tests, incorrect interpretation of observations, and confusion regarding the functions and sources of major food substances. Extract 12.1 is a sample of candidates' incorrect responses to question 1, paper 2A.

|                |                                                                                         |                                                                            |                                                  |  |
|----------------|-----------------------------------------------------------------------------------------|----------------------------------------------------------------------------|--------------------------------------------------|--|
| 1- b) FOOD     |                                                                                         |                                                                            |                                                  |  |
| TESTED         | PROCEDURE                                                                               | OBSERVATION                                                                | INFERENCE                                        |  |
| Reducing sugar | 2mlr of sample A solution were added into a hot tube with iodine solution.              | 2mlr of sample solution were poured into a test tube and become blue black | -Was absent (specimen) 0 -Specimen M was present |  |
| Starch sugar   | 2mlr of sample A solution were poured into a test tube by adding with benedict solution | 2mlr of sample solution A added into test tube change to yellow            | Specimen 0 was absent                            |  |

|  |                 |                                                                                                |                                                                      |                                     |
|--|-----------------|------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-------------------------------------|
|  |                 |                                                                                                | orange and                                                           | Specimen                            |
|  |                 |                                                                                                | comes to be                                                          | M was                               |
|  |                 |                                                                                                | black + blue                                                         | present                             |
|  |                 |                                                                                                | black                                                                |                                     |
|  |                 |                                                                                                |                                                                      |                                     |
|  | Protein         | 2mls of sample A solution were poured into a test tube by added with Hydrochloric Acid         | 2mls of sample A solution added into test tube change to yellow blue | Specimen O was absent M was present |
|  |                 |                                                                                                | orange and black red.                                                |                                     |
|  |                 |                                                                                                | 2mls of sample                                                       | Specimen                            |
|  | Reducing sugar. | 2mls of sample A solution were poured into a test tube by added with Sodium Hydrochloric Acid. | sample solution added into test tube change a colour                 | O was absent                        |
|  |                 |                                                                                                |                                                                      | Specimen                            |
|  |                 |                                                                                                |                                                                      | M was present.                      |

|    |                                        |  |
|----|----------------------------------------|--|
| 1. | C/O                                    |  |
|    | Used in food                           |  |
|    |                                        |  |
|    | M.                                     |  |
|    | Used in manufacture a body to be good. |  |
|    |                                        |  |
|    | Starch - Beans and meat                |  |
|    |                                        |  |
|    | Protein - Carrawa / rice               |  |
|    |                                        |  |
|    | Non-reducing sugar - rice.             |  |
|    |                                        |  |

**Extract 12.1:** Candidate's incorrect responses to question 1, paper 2A parts (a), (b) and (d)

In Extract 12.1, the candidate responded incorrectly to all parts of the question. For example, he/she identified *beans and meat* as natural sources of starch instead of protein. However, the foods tested were correct.

Candidates who scored high marks (16.5 - 25) demonstrated sufficient knowledge of the properties of food substances. Consequently, they were able to prepare solutions correctly from castor seeds and sucrose crystals and clearly outline the appropriate procedures used in their preparation. In part (a), the procedures for preparing solution O involved removing the hard seed coat, crushing the peeled seeds using a mortar and pestle to obtain a paste, adding a small amount of water, stirring the mixture, and then decanting or filtering to obtain the solution. For solution M, candidates correctly described adding water to specimen M in a beaker and stirring or shaking the mixture until the sucrose crystals dissolved completely.

Furthermore, these candidates used the correct chemical reagents in appropriate quantities and applied the relevant units of measurement for each food test carried out in the experiment. They also made accurate observations of colour changes and provided correct interpretations or inferences of the results. In addition, they demonstrated strong report-writing skills by organising their work clearly in a tabular format, including the food tested, procedure, observation, and inference, as required in part (b).

Similarly, in part (c), the candidates correctly stated the functions of the food substances identified in solutions O and M, namely non-reducing sugars, proteins, and lipids. They correctly indicated that non-reducing sugars provide energy, proteins are essential for body building and repair, and that they are also involved in the formation of enzymes, hormones, antibodies, clotting factors, and components of cell membranes. At the same time, lipids serve as a source of energy, provide insulation, protect delicate organs, and form part of cell membranes. In part (d), the candidates provided appropriate examples of other natural sources of the identified food substances, apart from castor seeds and sucrose crystals. Examples cited included milk, meat, beans, lentils, peas, termites, mushrooms, eggs, chicken, and fish as sources of proteins; sugar cane, beetroot, and unripe fruits as sources of non-reducing sugars; and coconut seeds, cashew nuts, groundnuts, sunflower seeds, avocados, sesame seeds, and oily fish as

sources of lipids. The performance demonstrates that the candidates were familiar with the natural sources of major food substances. Extract 12.2 is a sample of candidates' correct responses to question 1, paper 2A.

| (b) | Food tested        | Procedures                                                                                                                                                                                       | Observation                                                                                                                                                                              | Inference                                                  |
|-----|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------|
|     | Starch             | 2cm <sup>3</sup> of food sample solution O and M were kept in clean and dry test tubes, 2 drops of Iodine solution were added in each test tube and the mixtures were shaken gently.             | The mixtures retained the brown colour of Iodine solution                                                                                                                                | Starch was absent in solution O and M                      |
|     | Reducing sugar     | 2cm <sup>3</sup> of food sample solution O and M were kept in clean and dry test tubes, 2cm <sup>3</sup> of Benedict's solution were added and the mixtures were boiled.                         | Solutions O and M retained the blue colour of Benedict solution                                                                                                                          | Reducing sugar was absent in solution O and M              |
|     | Non-reducing sugar | 2cm <sup>3</sup> of food sample solution O and M were kept in clean and dry test tubes, 1cm <sup>3</sup> of dil. Hydrochloric acid was added then boiled. After cooling then 2cm <sup>3</sup> of | The mixture with solution M passed through a series of colour changes from blue to green to yellow to orange and finally to brick red precipitates. The mixture with solution O retained | Non-reducing sugar was present in solution M. Non-reducing |

| Food tested | Procedures                                                                                                                                                                                                    | Observation                                                                                                                                          | Inference                                                                 |
|-------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
|             | Sodium hydroxide were added then 2cm <sup>3</sup> of Benedict's solution were added and the mixture were boiled.                                                                                              | The blue colour of Benedict solution                                                                                                                 | sugar was absent in solution<br>O                                         |
|             |                                                                                                                                                                                                               |                                                                                                                                                      |                                                                           |
|             |                                                                                                                                                                                                               |                                                                                                                                                      |                                                                           |
| Proteins    | 2cm <sup>3</sup> of food sample solution O and M were kept into clean and dry test tubes, 2cm <sup>3</sup> of Sodium hydroxide were added followed by addition of 2 drops of copper 2 sulphate white shaking. | The mixture with solution O changed to purple colour<br><br>The mixture with solution M retained the blue colour of 1% copper (II) sulphate solution | Protein was present in solution O<br><br>Protein was absent in solution M |
|             |                                                                                                                                                                                                               |                                                                                                                                                      |                                                                           |
|             |                                                                                                                                                                                                               |                                                                                                                                                      |                                                                           |
| Lipids      | 2cm <sup>3</sup> of food sample solution O and M were kept into clean and dry test tubes, 2 drops of Sudan (III) solution were added and the mixture was                                                      | The mixture with solution O developed a red ring on top of it<br><br>The mixture with solution M retained                                            | Lipids was present in solution O<br><br>Lipids was                        |

|  |  |                                                           |                                              |                               |  |
|--|--|-----------------------------------------------------------|----------------------------------------------|-------------------------------|--|
|  |  | shaken thoroughly<br>and left to settle<br>for 5 minutes. | the red colour<br>of sudan (III)<br>solution | absent<br>in<br>solution<br>M |  |
|  |  |                                                           |                                              |                               |  |
|  |  | c) i) Non-reducing sugar                                  |                                              |                               |  |
|  |  | - It provides energy to the body                          |                                              |                               |  |
|  |  |                                                           |                                              |                               |  |
|  |  | ii) Proteins                                              |                                              |                               |  |
|  |  | - It repairs worn out tissues                             |                                              |                               |  |
|  |  |                                                           |                                              |                               |  |
|  |  | iii) Lipids                                               |                                              |                               |  |
|  |  | - It protects delicate organs like the heart              |                                              |                               |  |
|  |  |                                                           |                                              |                               |  |
|  |  | d) i) Non-reducing sugar                                  |                                              |                               |  |
|  |  | Natural source is sugarcane                               |                                              |                               |  |
|  |  |                                                           |                                              |                               |  |
|  |  | ii) Proteins                                              |                                              |                               |  |
|  |  | Natural source is meat                                    |                                              |                               |  |
|  |  |                                                           |                                              |                               |  |
|  |  | iii) Lipids                                               |                                              |                               |  |
|  |  | Natural source is groundnuts                              |                                              |                               |  |
|  |  |                                                           |                                              |                               |  |

**Extract 12.2:** Candidate's correct responses to question 1, paper 2A

In Extract 12.2, the candidate provided correct responses to all parts of the question by preparing sample solutions from castor seeds and sucrose crystals. Further described the correct procedures and used the given chemical reagents with appropriate measurement units to identify the food substances present in both the castor seed and sucrose solutions. Additionally, the candidate presented a well-organized food test report and explained the functions of each food substance identified in the human body, providing examples of other natural sources apart from castor seeds and sucrose.

### 3.1.2. 033/2B Biology 2B

Question 1 of the alternative 2B had five parts (a) to (e), which carried a total of 25 marks. The candidates were provided with solution P (Starch and glucose solution), solution Q (Egg albumen and starch solution), specimen N (Castor seeds) and the required apparatus. Candidates were required to use them to carry out a food test experiment and then respond to the following questions:

- (a) *You have been provided with solutions P and Q, each containing a mixture of food substances. Carry out the experiment to identify the food substances present in the solutions provided. Your experimental report should be tabulated as shown in Table 1.*

Table 1: Identification of food substances present in solutions P and Q

| Food tested | Procedure | Observation | Inference |
|-------------|-----------|-------------|-----------|
|             |           |             |           |

- (b) *Specimen N contains lipid among others. Prepare the specimen for the lipid test experiment using filter paper, then outline the procedure used to prepare it.*
- (c) *Use the filter paper provided to identify the presence of lipid in the specimen N. Present your findings as shown in Table 2.*

Table 2: Identification of Lipid in Specimen N

| Food tested | Procedure | Observation | Inference |
|-------------|-----------|-------------|-----------|
|             |           |             |           |

- (d) *State the function(s) of each food substance identified in the solutions and specimen N to the human body.*
- (e) *Why was boiling important in some procedures of the experiments conducted?*

The candidates who scored 0 to 7 marks wrote incorrect responses in all or most parts of the question. The candidate who scored 0 marks provided incorrect responses in all parts of the question. The failure implies that these candidates were not competent in the properties of food substances,

specifically in conducting food test experiments and in report writing. In part (a), most candidates provided incorrect or incomplete procedures, while others interchanged the steps. Other candidates used incorrect chemical reagents and inappropriate units of measurement. For example, some candidates used Benedict's solution instead of Iodine solution when testing for starch. Others wrote incorrect procedures, such as *2 ml of solution P and Q were put in separate test tubes, boiled and 2 ml of Sudan III were added and left to settle*. They failed to recognize that there was no boiling during lipid testing.

Additionally, many candidates showed poor competence in the use of measurement units, for example, writing *2 cm* instead of  $2\text{ cm}^3$ . In many cases, candidates treated solutions P and Q as a single solution rather than as separate solutions. For example, some candidates stated that *2 ml of solution OM were transferred in a test tube and 2 drops of iodine solution were added*, rather than testing each solution separately. In addition, some candidates demonstrated weak observational skills and inaccurate reporting of colour changes. Others incorrectly described the sequence of colour changes in Benedict's test, which led to an incorrect interpretation of the results.

Also, in part (b), some candidates failed to outline the procedures for preparing specimen N for the lipid test. For example, some candidates wrote, *I take the motor and pestle, I take the blander for cutting the specimen, I take the measure or apparatus such as test tube and prepared*. They failed to recognise that the procedures for preparing specimen N were: specimens were peeled to remove the hard coat, and the peeled samples were crushed using a mortar and pestle to make a paste.

In part (c), the candidates lacked sufficient knowledge of biochemical experiments as they failed to identify the presence of lipid in specimen N. Other candidates tried to identify lipids using Sudan (III) solution, which was not provided, instead of using filter paper as instructed. For example, some candidates wrote *'specimen N stored in the filter, closed, then melted and lipid formed in the filter paper.'* The other candidate failed to report the observed changes. For example, one candidate wrote, *'after rubbing the pastes of filter paper, the paper turned to opaque.'*

In part (d), some candidates failed to state the functions of each food substance identified in the solutions and specimen N to the human body. For example, some candidates wrote that *proteins are used in biological studies, starch is used to strengthen bones and teeth*. Moreover, some candidates interchanged the functions of food substances identified in solutions P and Q and specimen N in the human body. For example, some candidates wrote that *protein is used for insulation while lipids are used for body building and repair*. Other candidates failed to understand the demand of this part of the question, as they stated the properties of identified food substances rather than their functions. For example, some candidates wrote *starch is tasteless*.

In part (e), some candidates failed to explain the importance of boiling when testing for reducing and non-reducing sugar. For example, some candidates wrote that *boiling help to observe color change*. Another candidate wrote that *boiling help to determine the presence of food*. The candidates did not understand that boiling is important because it provides the heat required to reduce copper(II) ions to copper(I) oxide during Benedict's test. Extract 13.1 is a sample of candidates' incorrect responses to question 1, paper 2B.

| 1(a) | FOOD TESTED        | PROCEDURE                                                                                                                                                                        | OBSERVATION                                                                                        | INFERENCE                                       |
|------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|-------------------------------------------------|
|      | Protein            | 2ms of solution<br>p put into a dry<br>→ and clean test<br>st tube and add<br>2 drops of NaOH<br>and CuSO <sub>4</sub> sol<br>ution then the<br>mixture was<br>heated and boiled | The observed<br>Food substance<br>change in<br>purple<br>colour.                                   | protein<br>was pre<br>sent in<br>solution<br>P. |
|      | Reducing su<br>gar | 2ms of solution<br>were poured<br>put into a dry<br>and clean test<br>tube add 2 drop<br>s of Benedict's<br>solution were a<br>dded.                                             | The observe<br>d food sub<br>stance change<br>e blue, green,<br>yellow<br>and finally<br>brick-red | The red-<br>ucing<br>sugar was<br>present       |
|      | Starch             | 2ms of solution<br>on p put into<br>a dry<br>and clean test<br>tube add drops<br>of iodine solut<br>ion was adde<br>d and shaken                                                 | The obser<br>ved food<br>substance<br>change<br>dark blue<br>colour                                | The<br>starch<br>was<br>present.                |

| 1c | FOOD TESTED                                                   | PROCEDURE                                                                                                         | OBSERVATION                                      | INFERENCE                     |
|----|---------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------|-------------------------------|
|    | LIPID                                                         | 2m <sup>3</sup> solution<br>were poured put<br>into a dry and<br>clean the test<br>tube add 2 drops<br>were added | The observ<br>ed change<br>colour red<br>dropped | The lipi<br>d was<br>present. |
|    | d) Starch                                                     |                                                                                                                   |                                                  |                               |
|    | - It promote power in the human body.                         |                                                                                                                   |                                                  |                               |
|    | (ii) protein                                                  |                                                                                                                   |                                                  |                               |
|    | - It promote disease in the human body.                       |                                                                                                                   |                                                  |                               |
|    | (iii) Reducing sugar.                                         |                                                                                                                   |                                                  |                               |
|    | - It increase amount of glucose in the human body.            |                                                                                                                   |                                                  |                               |
|    | (iv) Non-reducing sugar                                       |                                                                                                                   |                                                  |                               |
|    | - It promote power in the human body.                         |                                                                                                                   |                                                  |                               |
|    | (v) Lipid                                                     |                                                                                                                   |                                                  |                               |
|    | - It protect with disease in the human body.                  |                                                                                                                   |                                                  |                               |
| e  | e) Because                                                    |                                                                                                                   |                                                  |                               |
|    | - It help to know the different colour in the food substance. |                                                                                                                   |                                                  |                               |

**Extract 13.1:** Candidate's incorrect responses to question 1, paper 2B

In extract 13.1, the candidate provided incorrect responses to all parts of the question. The candidates wrote incorrect procedures for testing the given food solution, leading to incorrect observations and inferences. For example, the candidate wrote, 2 m<sup>3</sup> was put into a dry and clean test tube, drops of iodine solution were added, and the mixture was shaken, instead of stating that, to 2 ml of solution P in a test tube, 2 drops of iodine solution were added.

Candidates who scored high marks demonstrated sufficient knowledge of the properties of food nutrients. They conducted the biochemical food tests competently and exhibited strong report-writing skills. They used the correct chemical reagents in appropriate quantities and reported relevant units of measurement for each food test performed in the experiment. They also made accurate observations of colour changes. They provided correct interpretations or inferences of the results, thereby correctly identifying the food substances present in solutions P and Q as starch, reducing sugars, non-reducing sugars, and proteins. In addition, they organised their work clearly in a tabular format, including the food tested, procedure, observation, and inference, as required in part (a). In part (b), the candidates correctly prepared specimen N by peeling the castor seeds and crushing them using a mortar and pestle. In part (c), they correctly performed the lipid biochemical test by rubbing the thick paste prepared from specimen N onto filter paper. They accurately observed the translucent mark on the filter paper and correctly recorded this observation in the table.

Similarly, in part (d), candidates correctly stated the functions of each food substance identified in the solutions and specimen N in relation to the human body. They indicated that starch, reducing sugars, and non-reducing sugars provide energy; lipids insulate the body, protect delicate organs, and form part of cell membranes. At the same time, proteins are required for body building and repair, the formation of enzymes, hormones, antibodies, clotting factors, and cell membranes, and also serve as a source of energy during starvation. In part (e), the candidates correctly explained that boiling facilitates the reduction of copper(II) ions to copper(I) ions, resulting in a colour change from blue to orange. They further explained that boiling is necessary during the hydrolysis of non-reducing sugars into reducing sugars. Extract 13.2 is a sample of candidates' correct responses to question 1, paper 2B.

| 1a) | FOOD TESTED    | PROCEDURE                                                                                                                                                                                                                                           | OBSERVATION                                                                                                                                              | INFERENCE                                                                   |
|-----|----------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------|
|     | STARCH         | To 2cm <sup>3</sup> of solution P and Q into two different test tubes, 2 drops of Iodine solution were added in each test tube.                                                                                                                     | Both solution P and Q turned into blue black.                                                                                                            | Starch was present in both solution P and Q.                                |
|     | PROTEIN        | To 2cm <sup>3</sup> of solution P and Q into two different test tubes 2cm <sup>3</sup> of Sodium Hydroxide was added in each test tube then shaken followed by addition of 2 drops of Copper(II) sulphate in each test tube and then shaken slowly. | Solution P retained the blue colour of Copper(II) Sulphate while solution Q turned into purple colour.                                                   | Protein was absent in solution P while Protein was present in solution Q.   |
|     | REDUCING SUGAR | To 2cm <sup>3</sup> of solution P and Q into two different test tubes, 2cm <sup>3</sup> of Benedict's solution was added in each test tube then boiled.                                                                                             | series of colour change from blue to green to yellow to orange and finally brick red was observed in solution P while blue colour of Benedict's solution | Reducing sugar was present in solution P while reducing sugar was absent in |

|                    |                                                                                         |                              |                            |             |
|--------------------|-----------------------------------------------------------------------------------------|------------------------------|----------------------------|-------------|
| 1a)                |                                                                                         |                              | was retained in solution Q | solution Q. |
|                    |                                                                                         |                              |                            |             |
|                    |                                                                                         | To 2cm <sup>3</sup> of solut |                            |             |
| NON-REDUCING SUGAR | ion P and Q in-                                                                         | Series of colour             | Non-reducing               |             |
|                    | to two different                                                                        | change from blue             | sugar was                  |             |
|                    | test tubes, 2cm <sup>3</sup>                                                            | to green to yellow           | present in                 |             |
|                    | of dilute Hydro-                                                                        | to orange and                | solution P                 |             |
|                    | chloric acid in each                                                                    | finally brick red            | or while                   |             |
|                    | test tube were                                                                          | was observed in              | Non-reducing               |             |
|                    | added then boiled                                                                       | solution P while             | sugar was                  |             |
|                    | and cooled, 2cm <sup>3</sup>                                                            | blue colour of               | absent in                  |             |
|                    | of sodium hydroxi                                                                       | Benedict's solution          | solution Q.                |             |
|                    | de were added in                                                                        | retained in soluti           |                            |             |
|                    | each test tube to                                                                       | on Q                         |                            |             |
|                    | neutralize the dilu                                                                     |                              |                            |             |
|                    | te hydrochloric acid                                                                    |                              |                            |             |
|                    | followed by addition                                                                    |                              |                            |             |
|                    | of 2cm <sup>3</sup> of Benedi                                                           |                              |                            |             |
|                    | ct's solution in ea                                                                     |                              |                            |             |
|                    | ch test tube                                                                            |                              |                            |             |
|                    | and then boiled                                                                         |                              |                            |             |
|                    |                                                                                         |                              |                            |             |
| b)                 | PROCEDURES USED TO PREPARE SOLUTION FOR SPECIMEN N.                                     |                              |                            |             |
|                    |                                                                                         |                              |                            |             |
| i)                 | Specimen N was peeled by using a knife to remove the outer cover                        |                              |                            |             |
|                    |                                                                                         |                              |                            |             |
| iii)               | Specimen N was kept in a mortar ready for grinding by mortar and pestle to obtain paste |                              |                            |             |

| c) FOOD TESTED                                                                                                                                  | PROCEDURE                                                                                                 | OBSERVATION                                     | INFERENCE          |
|-------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-------------------------------------------------|--------------------|
| LIPIDS                                                                                                                                          | A small amount of paste specimen N was rubbed on a filter paper, and left for few minutes about 2 minutes | The filter paper turned and became translucent. | Lipids was present |
| d) SOLUTIONS                                                                                                                                    |                                                                                                           |                                                 |                    |
| i) Starch                                                                                                                                       |                                                                                                           |                                                 |                    |
| - It is the chief source of energy.                                                                                                             |                                                                                                           |                                                 |                    |
| ii) Protein                                                                                                                                     |                                                                                                           |                                                 |                    |
| - Formation of enzymes                                                                                                                          |                                                                                                           |                                                 |                    |
| iii) Reducing sugar                                                                                                                             |                                                                                                           |                                                 |                    |
| - It is a chief source of energy                                                                                                                |                                                                                                           |                                                 |                    |
| iv) Non-reducing sugar                                                                                                                          |                                                                                                           |                                                 |                    |
| - It is a chief source of energy                                                                                                                |                                                                                                           |                                                 |                    |
| SPECIMEN N                                                                                                                                      |                                                                                                           |                                                 |                    |
| i) Lipids                                                                                                                                       |                                                                                                           |                                                 |                    |
| - It is a component of cell membrane.                                                                                                           |                                                                                                           |                                                 |                    |
| e) Boiling was important in some procedures of the experiments conducted in order to activate reduction of copper to cupric in Benedict's test. |                                                                                                           |                                                 |                    |

**Extract 13.2:** Candidate's correct responses to question 1, paper 2B

Extract 13.2, the candidate provided correct responses in all parts of the question. For example, the candidate wrote that the function of starch is the chief source of energy.

### 3.1.3. 033/2C Biology 2C

Question 1 of alternative 2C had five parts (a) to (e), each carrying 5 marks, for a total of 25 marks. The candidates were provided with solution A (Glucose and starch solution) and solution B (Starch solution), specimen C (Castor seeds), and the required apparatus. They were required to use them to respond to the following questions:

- (a) *You have been provided with solutions A and B, which contain a mixture of different food substances. Carry out an experiment to identify the food substances present in each solution. Your experimental report should be tabulated as shown in Table 1.*

*Table 1: Identification of Food Substances in solution A and B*

| Food tested | Procedure | Observation | Inference |
|-------------|-----------|-------------|-----------|
|             |           |             |           |

- (b) *Specimen C contains protein, among others. Prepare the solution from it for Biuret test experiment, then state the procedure followed to prepare it.*
- (c) *Carry out the Biuret test to identify food substances present in specimen C. Your experimental report should be tabulated as shown in Table 2.*

*Table 2: Identification of Biuret Test for Food in Specimen C*

| Food tested | Procedure | Observation | Inference |
|-------------|-----------|-------------|-----------|
|             |           |             |           |

- (d) *State the function(s) of each food substances identified in solution A, B, and specimen C to the human body.*
- (e) *“Sodium hydroxide” and “dilute hydrochloric acid” were important in some procedure of the experiments. Justify this statement.*

Candidates who scored from 0 to 7 marks provided incorrect responses in all or most parts of the question, indicating a limited understanding of the

assessed practical skills and concepts. This suggests that these candidates lacked knowledge of procedures for conducting food tests, identifying food substances, their functions, and the roles of chemical reagents used in the experiments. In part (a), several candidates demonstrated poor competence in conducting food test experiments. Many failed to quantify the reagents and solutions used. For example, in the test for starch, some candidates merely stated that *solution B was transferred into a test tube and iodine solution was added and shaken*, without specifying quantities. In many cases, candidates treated solutions A and B as a single solution rather than as separate samples. For instance, some candidates wrote that *2 ml of solution AB were transferred into a test tube and iodine solution was added*, instead of testing each solution independently.

Additionally, some candidates used incorrect reagents and inappropriate reporting language for specific procedures. For example, during the test for protein, some candidates reported that *2 cm<sup>3</sup> of solutions A and B were placed in a dry test tube and Benedicts solution was added*, which is incorrect. Others reported incorrect observations; for instance, one candidate stated that *the colour changed to brick red during the protein test*, which is characteristic of Benedict's test for reducing sugars.

In part (b), some candidates failed to prepare a solution from specimen C (castor seeds) and incorrectly described the preparation procedures. For example, some candidates outlined steps such as *putting the castor seeds into mortar and pestle small pieces, adding water into a test tube, followed by sodium hydroxide and copper (II) sulphate, and then reporting a purple colour change*. This response demonstrated confusion between solution preparation and the Biuret test procedure. In part (c), several candidates showed poor understanding of the Biuret test for proteins; instead, they performed tests for unrelated food substances such as reducing sugars, starch, and non-reducing sugars. Similarly, in part (d), candidates demonstrated limited knowledge of the functions of the identified food substances. Some incorrectly stated that *starch builds the body and provides immunity against diseases, that proteins help to regulate body temperature, and that reducing sugars maintain the level of sugar in the body*.

Furthermore, in part (e), many candidates failed to correctly explain the importance of sodium hydroxide and dilute hydrochloric acid in food testing. Some candidates stated that *both chemicals were used to identify non-reducing sugars*. In contrast, others claimed that *sodium hydroxide merely speeds up the reaction or that dilute hydrochloric acid is directly used to test for non-reducing sugars*. These responses indicate a lack of understanding of the specific roles of these reagents, particularly sodium hydroxide in the Biuret test and dilute hydrochloric acid in the hydrolysis of non-reducing sugars. Extract 14.1 is a sample of the candidates' incorrect responses to question 1, paper 2C.

4(a)

Table 1: To identify food substance in solution A and B.

| Food tested                            | Procedure                                                                                    | Observation                                                                           | Inference                                             |
|----------------------------------------|----------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|-------------------------------------------------------|
| Starch in solution A and B             | To put Agent solution into test tube and solution A then shade                               | The colour change into blue-black                                                     | The starch is present in solution A and B             |
| Reducing sugar in solution A and B     | To put the Agent solution which are benedict solution in solution A and B                    | The colour changed from blue to green, orange, yellow                                 | The reducing sugar is present in A and B              |
| Protein in solution A and B            | To put the Agent solution which are Hydrolytic solution and benedict's solution in test tube | The colour change from blue to purple<br>Purple                                       | The protein in the solution on A and B is present     |
| Lipids in solution A and B.            | To put the Agent solution which are Iodine solution into the solution giving A and B.        | In solution A the Red ring Present and solution B was Present                         | The Lipids in that solution A and B is Present        |
| Non-reducing Sugar in solution A and B | To put the Agent solution which are sodium solution and benedictor solution                  | The solution A and B After putting the Agent solution the colour change to Brink. red | The Non-reducing sugar in solution A and B are Absent |

1. (b)

The solution of it;

- Prepared Iodine solution and Hydrolic solution
- Then put into Biuret and destroyed it food test of specimen C and test by using the Agent solution known as Hydrolic and Benedict's Solution

So the PROTEIN are not present in this

Specimen C.

(c) Test for food in specimen C.

| Food tested    | Procedure                                                                                                                       | Observation                                    | Inference                                 |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-------------------------------------------|
| STARCH         | Putting food in specimen C into the Agent solution Iodine solution                                                              | The colour change into blue-black              | The starch in specimen C is present.      |
| PROTEIN        | Putting food solution in of specimen C in A and B put inside the Agent solution which are Hydrolic acid and Benedict's solution | The colour was changed into Purple from blue   | So the Protein in food test C is present. |
| REDUCING SUGAR | Putting food test in the Agent solution which is Benedict's solution as Agent solution                                          | The colour was not to change from any colour   | So the reducing sugar is Absent.          |
| LIPIDS         | Putting food specimen in Agent solution which are Iodine solution                                                               | both the red-ring appear up ward the test tube | Lipids The starch are Present.            |

|      |                                                                                    |  |
|------|------------------------------------------------------------------------------------|--|
| 1(d) | The following are function of each food substance of specimen C in the human body: |  |
|      | Function of starch                                                                 |  |
|      | i) It give the body disease.                                                       |  |
|      | Function of Lipids                                                                 |  |
|      | ii) It give body protect.                                                          |  |
|      | Function of Protein.                                                               |  |
|      | iii) It protect body due by disease.                                               |  |
|      | Function of Reducing Sugar.                                                        |  |
|      | iv) It help body to balance the presence of Glucose and sugar in body of human.    |  |

**Extract 14.1:** Candidate's incorrect responses to question 1, paper 2C

In Extract 14.1, the candidate failed to provide correct responses in most parts of the question. The candidate was unable to correctly identify the food substances present in solutions A and B and specimen C. In addition, the candidate described incorrect procedures, which led to inaccurate observations and, consequently, incorrect inferences. However, the candidate correctly identified the food substances tested as starch, reducing sugar, non-reducing sugar, and protein.

Candidates who scored high marks (16.5 to 25) marks responded correctly to all or most parts of the question. In part (a), these candidates demonstrated clear understanding of the procedures for carrying out food test experiments. They used the appropriate chemical reagents to identify the food substances present in the solutions, applied correct quantities of reagents, and presented accurate experimental reports. They also made accurate observations of colour changes and provided correct interpretations or inferences of the results, thereby correctly identifying the food substances present in solutions A and B as starch, reducing sugars and proteins.

In part (b), candidates correctly prepared a solution from castor seeds by removing the hard seed coat using a knife, crushing the seeds with a mortar

and pestle to form a paste, adding a small amount of water, stirring the mixture, and then decanting to remove the sediments. In part (c), the candidates demonstrated adequate knowledge of the procedures and expected observations in the Biuret test. They correctly used the required chemical reagents to identify the food substance present in specimen C, applied appropriate units of measurement, and accurately reported the experimental results.

Similarly, in part (d), candidates correctly identified the functions of the food substances in solutions A, B, and specimen C, including starch, reducing sugar, and protein. Furthermore, in part (e), they demonstrated understanding of the roles of chemical reagents used in food testing and appropriately justified the importance of sodium hydroxide and dilute hydrochloric acid. They correctly stated that dilute hydrochloric acid is used to hydrolyse non-reducing sugars into reducing sugars. In contrast, sodium hydroxide is used to neutralise hydrochloric acid before testing for reducing sugars. Extract 14.2 is a sample of the candidates' correct responses to question 1, paper 2C.

| 1. a) Table of food tested, procedures, observation, and inference. |                                                                                                                                                                                                               |                                                                                                                                                                                                                                   |                                                                                    |  |
|---------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|--|
| Food tested                                                         | Procedure                                                                                                                                                                                                     | Observation                                                                                                                                                                                                                       | Inference.                                                                         |  |
| STARCH                                                              | To 2cm <sup>3</sup> of each of the solutions A and B in separate test tubes, 2 drops of iodine solution were added to each and shaken.                                                                        | The colour of the mixtures of both solutions A and B turned blue black colour.                                                                                                                                                    | Starch was present in both solution A and solution B.                              |  |
| PROTEIN                                                             | To 2cm <sup>3</sup> of each of the solutions A and B in separate test tubes, 2cm <sup>3</sup> of NaOH were added to each test tube followed by 2 drops of Copper (II) Sulphate while shaking after each drop. | The colours of the mixtures of both solutions A and B retained the blue colour of Copper (II) Sulphate solution.                                                                                                                  | Protein was absent in both solutions A and Solution B.                             |  |
| REDUCING SUGAR                                                      | To 2cm <sup>3</sup> of each of the solutions A and B in separate test tubes, 2cm <sup>3</sup> of Benedict's solution were added to each and boiled.                                                           | In the test tube with solution A, the colour of the mixture changed from blue to green to orange, and finally brickred on cooling. In the test tube with solution B, the mixture retained the blue colour of Benedict's solution. | Reducing Sugar was present in solution A. Reducing sugar was absent in Solution B. |  |

|                                                                                                                                        |                    |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                     |                                             |
|----------------------------------------------------------------------------------------------------------------------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|
| ' a)                                                                                                                                   | NON-REDUCING SUGAR | To 2cm <sup>3</sup> of the solutions A and B in test tube, 1cm <sup>3</sup> of dilute HCl was added, then boiled and cooled, followed by the addition of 2cm <sup>3</sup> of NaOH, and lastly addition of 2cm <sup>3</sup> of Benedict's solution and the solution was each re-boiled. | In the test tube with solution A the colour of the mixture changed from blue to green to orange, and finally bricked. In the test tube with solution B the mixture retained the blue colour of Benedict's solution. | Non-reducing sugar was absent in solution B |
| The following are the procedures for preparation of solution of specimen C.                                                            |                    |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                     |                                             |
| i) The specimen C was initially peeled so as to remove the outer cover of the specimen.                                                |                    |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                     |                                             |
| ii) After the specimen C was peeled, it was cut into smaller pieces by using a knife and grinded in a mortar and pestle to make paste. |                    |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                     |                                             |
| iii) The grinded particles of specimen C were put into a beaker, and water was added into the beaker as well.                          |                    |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                     |                                             |
| iv) The mixture of specimen C and water was thoroughly stirred and decanted leaving behind the residue.                                |                    |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                     |                                             |

|    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                 |                                                   |                                               |
|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------|-----------------------------------------------|
| 1. | Table for Biuret test experiment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                 |                                                   |                                               |
|    | Food Tests                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Procedure                                                                                                                                                                                       | Observation                                       | Inference                                     |
|    | PROTEIN                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | To 2cm <sup>3</sup> of solution of specimen C, 2cm <sup>3</sup> of Sodium hydroxide were added followed by addition of two drops of Copper (II) Sulphate solution while shaking after each drop | The colour of the mixture turned to purple colour | Proteins was present in solution of sample C. |
|    | <p>d) The following are functions of the food substances identified in solutions A, B and specimen C.</p> <p>a) Reducing sugar has the function of providing energy to the human body.</p> <p>b) Starch has the function of providing energy to the body.</p>                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                 |                                                   |                                               |
|    | <p>a) The proteins have the function of enzyme and hormone synthesis.</p> <p>b) Proteins have the function of ensuring growth and repair of worn out body tissues. repair the worn out body tissues, and are also responsible for their growth.</p> <p>c) The following are reasons why Sodium hydroxide and dilute hydrochloric acid were important in same procedure.</p> <p>i) Sodium hydroxide was useful for neutralization of the dilute hydrochloric acid so as to create a favourable medium or environment for the Benedict's solution to work.</p> <p>ii) Dilute hydrochloric acid was useful to hydrolyse non-reducing sugar to reducing sugar for Benedict's test</p> |                                                                                                                                                                                                 |                                                   |                                               |

**Extract 14.2:** Candidate's correct responses to question 1, paper 2C

In Extract 14.2, the candidate provided correct responses in all parts of the question. For example, the candidate correctly identified the food

substances present in solutions A and B and in specimen C, and correctly identified the function(s) of these substances.

### 3.2. Question 2: Classification of Living Things

In all the papers 033/2A, 033/2B, and 033/2C, question 2 was based on the topic of Classification of Living Things.

Analysis of the candidates' performance for all alternatives shows that 553,733 candidates attempted question 2. It was revealed that 232,577 (42.00%) scored 0 to 7 marks, of whom 27,049 (4.88%) scored 0 marks. The candidates who scored 7.5 to 16 marks were 298,962 (53.99%), whereas 22,194 (4.01%) scored from 16.5 to 25 marks. Further, the analysis shows that 75 (0.01%) scored all 25 marks. The overall performance was average, with 58.00 per cent scoring from 7.5 to 25 out of 25 marks. Figure 12 summarises the candidates' performance on question 2 for all alternative papers.

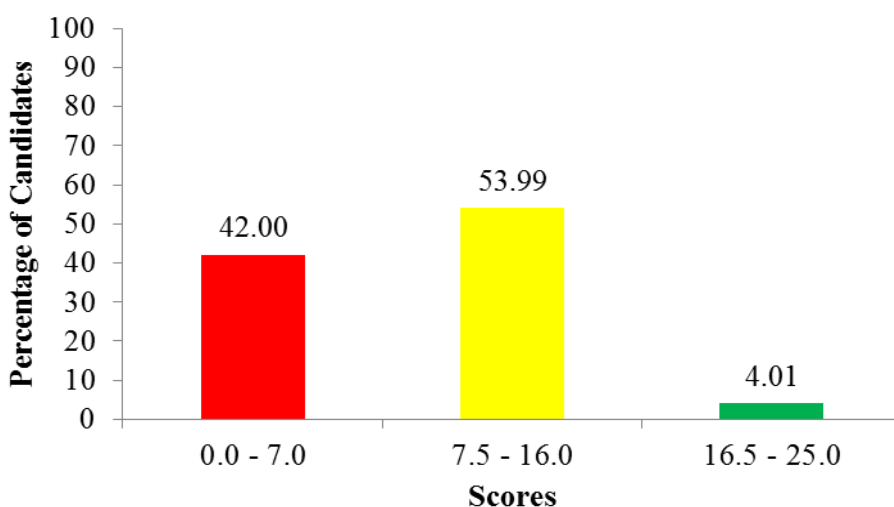


**Figure 12:** *Candidates' Performance on Question 2 Paper 2*

### 3.2.1. 033/2A Biology 2A

Question 2 in alternative 2A had five parts (a) to (e), carrying a total of 25 marks. The candidates were provided with specimens E (Cockroach), F (Bread mould), and G (Bean plant/seedling), obtained from different habitats. They were required to study them carefully, then answer the following questions:

- (a) *Identify the Phylum/Division and the Kingdom in which each specimen E, F and G belongs.*
- (b) *For each of specimens E and G state three observable features which are characteristics of its respective Phylum/Division.*
- (c) *Name the habitat of each specimens E, F and G*
- (d) *For each of specimens E, F and G state whether it is a producer, consumer or decomposer in its natural habitat. Give reason for each case.*
- (e) *State two advantages and one disadvantage of specimen E to other living organisms.*

The candidates who scored high marks demonstrated adequate competence in classifying organisms. Consequently, in part (a), they correctly identified the phylum/division and kingdom of the given specimens: specimen E (cockroach) was classified under phylum Arthropoda and kingdom Animalia; specimen F (bread mould) under phylum Zygomycota and kingdom Fungi; and specimen G (bean plant/seedling) under division Angiospermophyta and kingdom Plantae. In part (b), these candidates accurately stated three observable features characteristic of the respective phyla or divisions. For specimen E (cockroach), they identified features such as a segmented body, jointed appendages, and an exoskeleton. For specimen G (bean plant/seedling), they correctly described features including a well-developed root system, stem, and leaves; leaf venation, and the presence of cotyledons.

Furthermore, in part (c), the candidates correctly identified the habitats of the specimens. They stated that cockroaches are commonly found in environments such as kitchens, cupboards, toilets, pit latrines, and septic tanks; bread mould grows on the surfaces of rotten bread, cassava, stiff porridge, and ripe fruits; while bean seedlings grow in gardens, farms, and under hydroponic conditions. In part (d), the candidates correctly classified the organisms based on their modes of nutrition. They identified the cockroach as a consumer feeding on ready-made food, bread mould as a decomposer because it uses hyphae to feed on dead organic matter, and the bean seedling as a producer because it has green leaves that enable photosynthesis.

Finally, in part (e), the candidates clearly stated two advantages of the cockroach over other organisms, including its role as a food source for other organisms and its use in biological research. They also correctly identified one disadvantage of the cockroach: it acts as a vector for disease, contaminates food, and destroys property. Extract 15.1 is a sample of candidates' correct responses to question 2, paper 2A.

.

|      |                                                   |                  |          |  |  |
|------|---------------------------------------------------|------------------|----------|--|--|
| 2. a | Specimen                                          | Phylum/Division  | Kingdom  |  |  |
|      | E (cockroach)                                     | Arthropoda       | Animalia |  |  |
|      | F (Breadmould)                                    | Zygomycota       | Fungi    |  |  |
|      | G (Bean plant)                                    | Angiospermophyta | Plantae  |  |  |
|      |                                                   |                  |          |  |  |
| b.   | Specimen E (cockroach)                            |                  |          |  |  |
|      | - They have segmented body                        |                  |          |  |  |
|      | - They have exoskeleton                           |                  |          |  |  |
|      | - They have compound eyes                         |                  |          |  |  |
|      |                                                   |                  |          |  |  |
|      | Specimen G (Bean plant)                           |                  |          |  |  |
|      | - They have well developed roots, stem and leaves |                  |          |  |  |
|      | - They have cotyledons                            |                  |          |  |  |
|      | - They have variation in leaves.                  |                  |          |  |  |
|      |                                                   |                  |          |  |  |
| c.   | Specimen E (cockroach)                            |                  |          |  |  |
|      | - This specimen is found in pit toilets and areas |                  |          |  |  |
|      |                                                   |                  |          |  |  |
|      | Specimen F (Bread mould)                          |                  |          |  |  |
|      | - They are found on dead organic materials        |                  |          |  |  |
|      | rotten foods like breads.                         |                  |          |  |  |
|      |                                                   |                  |          |  |  |
|      | - Specimen G (Bean plant)                         |                  |          |  |  |
|      | They are found on farms and gardens               |                  |          |  |  |

|    |                                                        |  |  |  |  |
|----|--------------------------------------------------------|--|--|--|--|
| e. | Advantages of specimen E (cockroach).                  |  |  |  |  |
|    | i/ They are the source of food to other                |  |  |  |  |
|    | living organisms such as lizards.                      |  |  |  |  |
|    |                                                        |  |  |  |  |
|    | ii/ They are source of income. Some species are reared |  |  |  |  |
|    | and sold to schools for the teaching purposes.         |  |  |  |  |
|    |                                                        |  |  |  |  |
|    | Disadvantage of specimen E (Cockroach)                 |  |  |  |  |
|    | i/ They act as vectors for the transmission of         |  |  |  |  |
|    | different diseases especially to human                 |  |  |  |  |
|    | beings.                                                |  |  |  |  |

**Extract 15.1:** Candidate's correct responses to question 2, paper 2A

In Extract 15.1, the candidate correctly responded to all parts of the question by carefully identifying the given specimens and stating the organisms' characteristics. The candidate identified their habitats,

explained their position in natural habitats and provided the correct advantages and disadvantages of cockroaches.

However, analysis shows that 42.00 per cent of candidates who scored low marks (0 - 7) were found to be uninformed in the classification of organisms. Candidates who scored 0 provided incorrect responses in all parts of the question. In part (a), these candidates failed to correctly identify the phylum/division and kingdom of the given specimens, namely the cockroach, bread mould, and bean plant/seedling. Some candidates merely wrote the common names of the specimens instead of stating their respective phylum/division and kingdom. For example, they wrote *cockroach*, *bread mould*, and *bean plant* rather than classifying the organisms.

Other candidates incorrectly classified the specimens. For instance, some classified the cockroach *under the phylum Annelida and the kingdom Fungi*, while bread mould was incorrectly classified under the *kingdom Monera and phylum Ascomycota*. In addition, several candidates misspelt scientific terminologies, such as *Angiospemphyta* instead of Angiospermophyta and *Athropoda* instead of Arthropoda. These spelling errors and incorrect classifications resulted in loss of marks.

In part (b), many candidates were unable to state three observable features of the cockroach, bread mould, and bean plant/seedling that are characteristic of their respective phyla or divisions. Most candidates described features of classes within the phylum Arthropoda rather than its features. For instance, some candidates wrote *they have body divided into two parts*, *they have no antennae*, and *have one pair of wings*. Similarly, for the bean plant/seedling, candidates described features of the class Dicotyledonae, such as *broad leaves*, *autotrophy*, and *net-veined leaves*, rather than the characteristics of the division Angiospermophyta.

Similarly, in part (c), candidates failed to correctly state the habitats of the cockroach, bread mould, and bean plant/seedling. For example, some candidates stated that cockroaches live in *water*, bread mould grows in *moisture*, and bean plant/seedling is found in *darkness*, without specifying appropriate and accurate habitats. Consequently, in part (d), candidates were unable to correctly classify the organisms as producers, consumers, or

decomposers, and the reasons provided were largely incorrect. For instance, some candidates stated that the *cockroach is a producer because it is herbivorous*, that bread mould *is a consumer because it is autotrophic*, and that the bean plant/seedling *is a decomposer because it is heterotrophic*.

Finally, in part (e), misconceptions were also evident in the stated advantages and disadvantages of the cockroach. Some candidates listed the *source of the bad smell* and *cause of tuberculosis* as advantages, while stating the *source of laboratory specimens* as a disadvantage. These responses reflect a lack of understanding of the classification and economic importance of organisms. Extract 15.2 is a sample of candidates' incorrect responses to question 2, paper 2A.

2. ⑤ i) Specimen E

- i) They have three pair of walking legs
- ii) They have bodies divided into three parts
- iii) They have one pair of antennae

ii) Observable features of specimen F

- i) They have taproot system
- ii) They have leaves with net venation
- iii) They have two pairs of dicotyledons.

iii) Observable features of specimen G

- i) They have main root system
- ii) They have two dicotyledons
- iii) They have vascular system

⑥

| Specimen | Habitats            |
|----------|---------------------|
| E        | Water               |
| F        | Waste and the dam   |
| G        | On the land surface |

|    |                                                                                              |  |
|----|----------------------------------------------------------------------------------------------|--|
| 2. | (d) - This specimen decompose because found in the dead area in order to decompose dead logs |  |
|    | This specimen is producer because found in that land they facilitate growth                  |  |
|    | This specimen is consumer because it feed other organism in order to survive.                |  |
|    | (e) Advantage                                                                                |  |
|    | i. They are facilitate growth                                                                |  |
|    | ii. Used in decomposer                                                                       |  |
|    | Disadvantage.                                                                                |  |
|    | i. It can cause disease like stomach pain.                                                   |  |

**Extract 15.2:** Candidate's incorrect responses to question 2, paper 2A

In Extract 15.2, the candidate responded incorrectly to all parts of the question, providing the disadvantages of cockroaches: as they *can cause disease* rather than spreading/transmitting it.

### 3.2.2. 033/2B Biology 2B

Question 2 of alternative 2B had five parts (a) to (e), carrying a total of 25 marks. The candidates were required to study specimens I (Bee), J (Millipede), K (Centipede), and L (Earthworm), then answer the following questions.

- State two distinctive features of each specimen I, J and K at class level
- Specimens I and J belong to the same major group. State two characteristics they have in common.
- How do the specimen I and L adapted to survive in their natural habitats? Give one point for each.
- State two ways the farmers benefit from the availability of the specimen L in their farms.
- Outline three advantages and one disadvantage of the specimen I in nature.

The analysis reveals that candidates who scored high marks demonstrated adequate competence in classifying living organisms. In part (a), candidates correctly stated two distinctive features of each specimen. For specimen I (bee), they identified characteristics such as a body divided into three regions (head, thorax, and abdomen), three pairs of jointed legs, wings, compound eyes, and a tracheal system for respiration. For specimen J (millipede), the candidates correctly described features including a cylindrical, segmented body, two pairs of jointed legs per body segment, and a herbivorous feeding mode. Similarly, for specimen K (centipede), candidates accurately stated that it has a dorsoventrally flattened, segmented body, one pair of jointed legs per segment, a distinct head, poisonous claws, and a carnivorous and nocturnal mode of life.

In part (b), candidates correctly stated that bees and millipedes belong to the same major group, Kingdom Animalia. They also accurately identified common features, including a well-developed nervous system, locomotory structures, and a heterotrophic mode of nutrition.

In part (c), candidates competently explained the adaptations of the bees and the earthworm to their natural habitats. They stated that the bee possesses a proboscis adapted for sucking nectar from flowers, wings for flight, compound eyes for vision, a small body size that facilitates movement within flowers and hives, and a poisonous sting for defence. For earthworms, candidates correctly explained that the earthworm has a tapering body for burrowing, a hydrostatic skeleton for flexibility, chaetae for locomotion, thin moist skin for gaseous exchange, nephridia for excretion, and a clitellum that secretes mucus for cocoon formation and protection of developing embryos.

In part (d), candidates correctly stated the benefits of earthworms to farmers. They explained that earthworms improve soil fertility by mixing soil with organic matter, enhance soil aeration and drainage through burrowing, improve soil structure, help remove pollutants from the soil, and serve as indicators of healthy soil.

Finally, in part (e), candidates accurately outlined three advantages and one disadvantage of bees in nature. They identified advantages such as pollination of crops, production of honey for food, medicinal and cosmetic use, production of beeswax, and use in scientific research. They also correctly stated the bee's disadvantage: its ability to cause harm through its

poisonous sting. Extract 16.1 is a sample of the candidates' correct responses to question 2, paper 2B.

|   |                                                                                            |  |
|---|--------------------------------------------------------------------------------------------|--|
| 2 | (4) Specimen I bee                                                                         |  |
|   | Distinctive features                                                                       |  |
|   | (i) They have three pairs of walking legs                                                  |  |
|   | (ii) Their bodies are divided into three major parts namely, the head, thorax and abdomen. |  |
|   | Specimen J millipede                                                                       |  |
|   | Distinctive features                                                                       |  |
|   | (i) They have elongated, cylindrical and segmented bodies                                  |  |
|   | (ii) They have two pairs of walking legs in each segment.                                  |  |
|   | Specimen K centipede                                                                       |  |
|   | Distinctive features                                                                       |  |
|   | (i) They have flattened segment bodies                                                     |  |
|   | (ii) They have one pair of walking legs in each segment                                    |  |

|   |                                                                                                             |  |
|---|-------------------------------------------------------------------------------------------------------------|--|
| 2 | Specimen I and J belong to kingdom Animalia                                                                 |  |
|   | Common characteristics:                                                                                     |  |
|   | (i) Both have a well developed nervous system.                                                              |  |
|   | (ii) Both have locomotory structures such as a pair of walking legs.                                        |  |
|   | (c) Specimen I has poisonous sting to protect itself against predators.                                     |  |
|   | While                                                                                                       |  |
|   | Specimen L has chaetae for locomotion                                                                       |  |
|   |                                                                                                             |  |
|   | (d) (i) Specimen L is ecological decomposer hence increase fertility in the soil for proper growth of crops |  |
|   | (ii) Specimen L improve soil drainage and aeration which enables proper growth of crops in the farm.        |  |
|   | (e) Advantages of Specimen I                                                                                |  |
|   | (i) It is used as a source of food for other organisms in the ecosystem.                                    |  |
|   | (ii) It is used in biological studies and researches                                                        |  |
|   | (iii) It is used in production of useful products such as honey                                             |  |
|   | (e) Disadvantage of Specimen I                                                                              |  |
|   | It causes painful stings and bites to human being because it has poisonous sting.                           |  |

**Extract 16.1:** Candidate's correct response to question 2, paper 2B

In Extract 16.1, the candidate correctly responded to all parts of the question. The candidate stated the distinctive features of the bee, millipede, centipede, and earthworm at the class level, as well as the characteristics that the bee and millipede have in common at the kingdom level. They also explained how the bee and the earthworm are adapted to survive in their natural habitats. Additionally, the candidate stated how farmers benefit from earthworms and correctly outlined the advantages and disadvantages of the bee.

The analysis shows that candidates who scored 0 to 7 marks wrote incorrect responses in all or most parts of the question. Those who scored from 1 to 7 marks provided correct responses to only some parts, while candidates who scored 0 marks failed to respond correctly in any part of the question. In part (a), many candidates classified the specimens instead of describing their distinctive features. For example, some candidates wrote that the *bee belongs to the Kingdom Animalia* and the *Phylum Arthropoda*. In contrast, the *millipede and centipede* belong to the *Kingdom Animalia* and the *Phylum Arthropoda*. Others provided general features of the phylum Arthropoda, such as *having an exoskeleton, segmented body, jointed appendages, and undergoing molting*, instead of specifying characteristics of the classes to which the bee, centipede, and millipede belong.

In part (b), the candidates demonstrated insufficient knowledge of taxonomic ranks and failed to recognise that the major taxonomic rank of both the bee and millipede is the Kingdom. Consequently, they provided incorrect responses. For instance, some stated general characteristics of the phylum Arthropoda including *having jointed appendages and an exoskeleton*. In contrast, others described general characteristics of animals, such as *multicellularity, eukaryotic, and bilaterally symmetrical*, rather than correctly identifying features of the Kingdom Animalia, which include a well-developed nervous system, heterotrophic nutrition, and the presence of locomotory structures.

In part (c), the candidates lacked an understanding of the anatomical features and their functions in the bee and the earthworm. They listed features without explaining their functional significance. For example, some wrote that the *earthworm has nephridia and chaetae, and the bee has wings and legs*, without describing how these structures enable the organisms to perform specific functions efficiently. The failure indicates a lack of understanding that adaptation refers to structural or functional traits that allow organisms to survive and perform effectively in their environments.

In part (d), candidates were unfamiliar with the role of annelids in agriculture and gave responses unrelated to farming benefits. For example, some candidates wrote that *earthworms are used in biological studies or as*

fishing bait. Others incorrectly associated earthworm benefits with features of other phyla, such as *silk production*, or *as medicinal uses*. Moreover, these candidates were unable to identify the advantages and disadvantages of Class Insecta. Some listed characteristics of the class, such as *having three body parts, three pairs of walking legs, and one or two pairs of wings*, while others described features of other classes within Phylum Arthropoda in part (e). Extract 16.2 is a sample of candidates' incorrect responses to question 2, paper 2B.

|    |    |                                                                                                                                                                                                            |                               |                     |         |
|----|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|---------------------|---------|
| 02 | a/ | Specimens                                                                                                                                                                                                  | Class level                   | Phylum              | Kingdom |
|    |    | I                                                                                                                                                                                                          | Kingdom animalia<br>Lipropoda | Angiospermophyta    | Fungi   |
|    |    | J                                                                                                                                                                                                          | Kingdom animalia<br>Lipropoda | Angiospermophyta    | Fungi   |
|    |    | K                                                                                                                                                                                                          | Kingdom animalia<br>Phlopora  | Angiospermophyta    | Fungi   |
|    | b/ | Specimens                                                                                                                                                                                                  | Common name                   | Characteristics     |         |
|    |    | I                                                                                                                                                                                                          | Bee                           | - Head<br>- Eye     |         |
|    |    | J                                                                                                                                                                                                          |                               | - Length<br>- Mouse |         |
|    | c/ | <p>✓ Specimen I and J adopted to survive in their natural habitats this is their cue a adopted to their supported for the growth in our the plantae. For each point in their are a garden in the soil.</p> |                               |                     |         |

|       |                                                                                                                                        |
|-------|----------------------------------------------------------------------------------------------------------------------------------------|
| d/ i/ | It has a gardient in our the soul, Their are a soul it is gardient to their farmers benefit from the environment                       |
| ii/   | It has a supported for the gardient in their water flow to their are a support it helping for the farmers benefit from the environment |
| e/ i/ | Source of helping flower                                                                                                               |
| ii/   | It help for the making money of honey it is markets                                                                                    |
| iii/  | It help for the tourism                                                                                                                |
| iv/   | It help for the making money is their are a support for their medicine in the human body                                               |
| v/    | Honey it help for the surching of product in industry                                                                                  |

**Extract 16.2:** Candidate's incorrect responses to question 2, paper 2B

In Extract 16.2, the candidate incorrectly responded to all parts of the question. For example, in part (b), instead of stating two distinctive features of the bee, millipede, and centipede at the class level, the candidate incorrectly classified the organisms that were not part of the question.

### 3.2.3. 033/2C Biology 2C

Question 2 in alternative 2C had four parts (a) to (d), carrying a total of 25 marks. The candidates were provided with specimens W (Housefly), X (Millipede), Y (Spider), and Z (Maize plant/seedling). They were required to study them carefully, then answer the following questions.

- Identify the Kingdom, Phylum/Division and Class in which each specimen W, X, Y and Z belongs.
- For each specimen W, X, Y and Z, State three visible features which are the characteristics of the respective Class it belongs.
- Specimens W and X belong to the same Kingdom and Phylum. Which characteristics they have in common to represent those groups?
- For each specimen W and Y state two advantages and one disadvantage they have for other living organism

The candidates who scored high marks demonstrated competence in classifying various organisms. In part (a), they correctly identified the Kingdom, Phylum/Division, and Class to which specimens W (housefly), X (millipede), Y (spider), and Z (maize plant/seedling) belong. In part (b), the candidates correctly stated three visible features of the respective classes of the specimens. For specimen W (housefly), they identified features of Class Insecta, including a body divided into three regions (head, thorax, and abdomen), three pairs of jointed walking legs, and the presence of one or two pairs of wings, with some species lacking wings. For millipedes, candidates correctly described features of Class Diplopoda, such as a cylindrical, segmented body with a long trunk and two pairs of jointed walking legs per segment. Similarly, a spider was correctly classified under Class Arachnida, characterised by a body divided into two parts (cephalothorax and abdomen) and four pairs of jointed walking legs. Lastly, for maize seedling, candidates correctly stated features of Class Monocotyledonae, including parallel leaf venation, a fibrous (adventitious) root system, and long, narrow leaves.

In part (c), candidates correctly stated the characteristics that place the housefly and millipede within the same Kingdom and Phylum. They demonstrated awareness that both organisms belong to the Kingdom Animalia and Phylum Arthropoda. At the kingdom level, candidates shared characteristics such as a heterotrophic mode of nutrition, a complete digestive system, a well-developed nervous system, and the presence of locomotory structures. At the phylum level, they correctly identified features including a chitinous exoskeleton, jointed appendages, and body segmentation.

In part (d), the candidates demonstrated knowledge of the economic importance of members of Class Insecta and Class Arachnida. They correctly stated two advantages of the housefly, such as serving as a source of food for other organisms, a source of income, and being used in biological study and research, as well as one disadvantage, namely acting as a vector for diseases such as cholera and diarrhoea. Similarly, candidates correctly stated the advantages of spiders, including their role as food for other organisms, their use in biological research, silk production for surgical threads, bulletproof vests, and clothing, as well as their use in biological control and a source of income. The disadvantages of spiders were also

correctly identified, including the production of toxins by some species and the accumulation of webs that may dirty homes. Extract 17.1 is a sample of the candidate's correct responses to question 2, paper 2C.

| 2(a)                                      | SPECIMEN                                                                                 | KINGDOM  | PHYLUM / DIVISION | CLASS.          |
|-------------------------------------------|------------------------------------------------------------------------------------------|----------|-------------------|-----------------|
|                                           | W(housefly)                                                                              | Animalia | Arthropoda        | Insecta         |
|                                           | X (Millipede)                                                                            | Animalia | Arthropoda        | Diplopoda       |
|                                           | Y (Spider)                                                                               | Animalia | Arthropoda        | Arachnida       |
|                                           | Z (Maize plant)                                                                          | Plantae  | Angiospermophyta  | Monocotyledonae |
| (b) Visible characteristics of specimen W |                                                                                          |          |                   |                 |
|                                           | (i) Have three(03) pairs of jointed legs.                                                |          |                   |                 |
|                                           | (ii) It has two(02) pairs of wings.                                                      |          |                   |                 |
|                                           | (iii) Its body is divide into three parts- These are head, thorax and abdomen.           |          |                   |                 |
| Visible characteristics of specimen X     |                                                                                          |          |                   |                 |
|                                           | (i) It has the cylindrical segmented body.                                               |          |                   |                 |
|                                           | (ii) It has two pairs of legs per each segment                                           |          |                   |                 |
|                                           | (iii) It is having the long trunk with numerous segments                                 |          |                   |                 |
| Visible characteristics of specimen Y     |                                                                                          |          |                   |                 |
|                                           | (i) Its body is divided into two(02) parts which conta in the cephalothorax and abdomen. |          |                   |                 |
|                                           | (ii) It has four pairs of legs which are attached on The cephalothorax.                  |          |                   |                 |
|                                           | (iii) It has a pair of Pedipalps and use it to detect changes.                           |          |                   |                 |
| Visible characteristics of specimen Z.    |                                                                                          |          |                   |                 |
|                                           | (i) It contains the adventitious roots.                                                  |          |                   |                 |
|                                           | (ii) It has parallel leaf venations.                                                     |          |                   |                 |
|                                           | (iii) It has one cotyledon.                                                              |          |                   |                 |

|      |                                                                                    |  |
|------|------------------------------------------------------------------------------------|--|
| (c)  | The characteristics of specimen W and X that make them to be in Kingdom Animalia.  |  |
| (i)  | Both undergo heterotrophic mode of feeding.                                        |  |
| (ii) | Both can locomote                                                                  |  |
|      | The characteristics of specimen W and X that make them to be in Phylum arthropoda. |  |
| (i)  | Both have jointed legs.                                                            |  |
| (ii) | Both have segmented bodies.                                                        |  |
| (d)  | Advantages of specimen W.                                                          |  |
| (i)  | Specimen W is used by scientists for study                                         |  |
| (ii) | It is used to provide food to other organisms.                                     |  |
|      | Disadvantage of specimen W.                                                        |  |
| (i)  | It is a vector, hence transmit diseases like cholera.                              |  |
|      | Advantages of specimen Y                                                           |  |
| (i)  | It is used as a source of food.                                                    |  |
| (ii) | It is used for studies.                                                            |  |
|      | Disadvantage of specimen Y                                                         |  |
| (i)  | It makes our houses dirty.                                                         |  |

**Extract 17.1:** Candidate's correct responses to question 2, paper 2C

In Extract 17.1, the candidate correctly responded to all parts of the question. In part (a), the candidate correctly identified the Kingdom, Phylum/Division, and Class of housefly, millipede, spider, and maize plant/seedling, and correctly stated the visible features that characterize the respective Classes to which they belong. In part (b), the candidate correctly stated the common characteristics shared by the housefly and millipede that represent the Kingdom and Phylum to which they belong. Additionally, in parts (c) and (d), the candidate stated two advantages and one disadvantage of the housefly and spider to other living organisms.

On the other hand, candidates who scored 0 to 7 marks demonstrated incompetence in classifying organisms. In part (a), these candidates incorrectly classified the housefly, millipede, spider, and maize seedling. For example, some candidates classified the housefly as belonging to the *Kingdom Monera*, *Phylum Annelida*, and *Class Oligochaeta*. The maize seedling was incorrectly classified under *Kingdom Fungi*, *Phylum Coniferophyta*, and *Class Dicotyledonae*. In addition, several candidates misspelt scientific terminologies, such as *Ammalia* instead of *Animalia* and *Monocotledonae* instead of *Monocotyledonae*. Others confused taxonomic

ranks by stating *Phylum Chordata* or *Class Arachnida* in place of Kingdom Animalia, Phylum Arthropoda, and Class Insecta. Similarly, millipedes and spiders were misclassified *under Kingdom Animalia, Phylum Anthropoda, and Class Insect and Arachnids* instead of Kingdom Animalia, Phylum Arthropoda, and Classes Diplopoda and Arachnida, respectively. These spelling errors and incorrect classifications resulted in a significant loss of marks.

In part (b), candidates failed to state visible features of the classes to which the housefly, millipede, spider, and maize seedling belong. For example, some candidates described the housefly as *having a mouth, legs, and eyes* rather than identifying features of the Class Insecta. For the millipede, responses such as *has a mouth, has legs, and has a tail* were given instead of the visible features of Class Diplopoda. Similarly, the spider was described as *having a mouth, legs, eyes, and antennae*, indicating a lack of understanding of the features of the Class Arachnida. For the maize plant/seedling, candidates wrote that *it is green and has long veins, rather than* identifying its visible features as those of Class Monocotyledonae.

In part (c), candidates incorrectly stated the common characteristics shared by the housefly and millipede at both the kingdom and phylum levels. At the kingdom level, some candidates stated that *both organisms have an endoskeleton or antennae*, rather than the correct characteristics of possessing a well-developed nervous system, locomotory structures, a mouth for heterotrophic feeding, bilateral symmetry, and storage of food as glycogen. They stated incorrect characteristics at the phylum level. They did not recognise that these have a chitinous exoskeleton, jointed appendages, segmented bodies, and growth through moulting.

In part (d), candidates incorrectly stated the advantages and disadvantages of the housefly and spider. For instance, some candidates claimed that the *housefly is a source of chemical medicines for humans or helps in honey production*. Others stated incorrect disadvantages, such as *increasing death among living organisms or producing wax*. Regarding the spider, some candidates listed advantages such as *acting as a pollinator or being a source of medical materials*, while stating *environmental conservation* as a disadvantage. These responses indicate a limited understanding of the tested concepts. Extract 17.2 is a sample of candidates' incorrect responses to question 2, paper 2C.

| 2. e/a | common name     | kingdom  | phylum/division |
|--------|-----------------|----------|-----------------|
|        | w (Housefly)    | Animalia | Arthropoda      |
|        | x (paramecium)  | Animalia | Amoebozoa       |
|        | y (Spider)      | Animalia | Arthropoda      |
|        | z (Maize plant) | Plantae  | Angiosperms     |

| b/ | common name     | characteristics                                  |
|----|-----------------|--------------------------------------------------|
|    | w (Housefly)    | - Has legs in one pair.                          |
|    | x (paramecium)  | - It help in plant in farmer to give nutrient    |
|    | y (Spider)      | - It help in deringer collection in paint        |
|    | z (maize plant) | - It help human body in nutrients in blood cell. |

|                                                                              |                                                   |                                                  |
|------------------------------------------------------------------------------|---------------------------------------------------|--------------------------------------------------|
| a) specimen w and x are characteristic<br>& they same represent those group. |                                                   |                                                  |
| y/ It help in nutrient especially in<br>farmer.                              |                                                   |                                                  |
| y/ It help in experiment in laboratory.                                      |                                                   |                                                  |
| d) specimen      advantages      disadvantages                               |                                                   |                                                  |
| w                                                                            | - It help in pla-<br>ntation by give<br>nutrient. | - It can give<br>more chlorine in<br>human body. |
| specimen<br>y                                                                | advantages<br>- It help in decora-<br>-tion       | disadvantages<br>- It cause death                |

**Extract 17.2:** Candidate's correct responses to question 2, paper 2C

In Extract 17.2, the candidate incorrectly responded to all parts of the question. For example, instead of describing the characteristics of the kingdom and phylum to which the housefly and millipede belong, the candidate stated an advantage of these organisms, such as *helping in an experiment in the laboratory*, which was not required by the question.

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

The Biology examination 2025 covered 15 topics in papers 1 and 2. The analysis of the candidates' performance indicates that the topics of *Introduction to Biology*, *Balance of Nature*, *Gaseous Exchange and Respiration*, *Reproduction*, *Regulation*, *Health and Immunity*, *Safety in Our Environment*, *Movement*, *Genetics*, and *Classification of Living Things* had a good performance of 76.68 per cent. These topics were examined in question 1, which was a multiple-choice question.

The topics with average performance were *Classification of Living Things* (58.00%), *Coordination* (52.15%), *Genetics* (39.56%), *Nutrition* (32.54%), and *Health and Immunity* (30.78%). However, the topics with weak performance were *Transport of Materials in Living Things* (13.64%),

*Reproduction* (9.90%), *Movement* (7.30%), *Growth* (2.48%) and *Evolution* (1.13%). A summary of the candidates' performance on each topic in 033/1 Biology 1 and 033/2 Biology 2, CSEE 2025, is presented in Appendix I.

A comparison of candidates' performance by topic across Papers 1 and 2 on 2024 and 2025 indicates some significant trends. In the 2025 CSEE, performance in the Coordination topic improved from weak in 2024 to average in 2025, suggesting that efforts were made to enhance teaching and learning in this area. The topics of Classification of Living Things, Genetics, Nutrition and Health, and Immunity maintained an average performance across both years. However, performance in the Movement topic declined from average in 2024 to weak in 2025. Additionally, the topics of Transport of Materials in Living Things and Reproduction continued to maintain weak performance in both years. The comparison of performance in the CSEE 2025 and 2024 is summarised in Appendix II

## **5.0. CONCLUSION AND RECOMMENDATIONS**

### **5.1. Conclusion**

The analysis of candidates' performance in the Biology CSEE 2025 indicates an overall good level of achievement, with 65.68 per cent of candidates scoring 30 or more marks. Further analysis shows that candidates performed well in question 1 of the theory paper, demonstrating a strong understanding of the tested concepts. Questions that recorded average performance included question 2 of the practical paper and questions 2, 3, 7, 9, and 10 of the theory paper. Conversely, weak performance was observed in question 1 of the practical paper and questions 4, 5, 6, 8, and 11 of the theory paper.

The good performance in certain topics was attributed to candidates' adequate understanding of the examined concepts, their ability to interpret and respond appropriately to the questions, and their competence in drawing accurate biological diagrams. On the other hand, weak performance was associated with inadequate conceptual understanding, failure to comprehend the requirements of the questions, insufficient drawing skills, misspelling of scientific terminology, and limited proficiency in English.

Unlike the general weaknesses observed in other poorly performed questions, the poor performance in practical question 1 was mainly attributed to specific practical and procedural challenges. These included inadequate preparation of solutions, failure to follow proper experimental procedures, use of incorrect reagents, inappropriate units of measurement, and improper sequencing of steps, all of which resulted in inaccurate outcomes. Additionally, limited understanding of the relevance of experimental procedures, weak knowledge of human nutrition, and the use of inappropriate scientific reporting language further contributed to the weak performance.

## 5.2. Recommendations

Based on the findings from the Candidates' Item Response Analysis (CIRA), it is recommended that, teachers should:

- (a) use a fresh leafy shoot, potometer, beaker of water, fan, rubber tubing, glass capillary tube, stopwatch/clock, ruler (to measure the movement of the air bubble), petroleum jelly/Vaseline (to make joints airtight), stand and clamp to guide students, working in groups, to carry out an experiment to investigate the factors affecting the rate of transpiration in plants in the teaching of the topic of *Transport of Materials in Living Things*.
- (b) use a variety of organisms and pictures or photographs of plants that reproduce asexually and sexually to guide students, working in groups, to observe different plants and discuss the merits and demerits of asexual and sexual reproduction in the teaching of the topic of *Reproduction*.
- (c) use models, pictures, or diagrams of muscles to guide students, working in groups, to observe the different types of muscles and to discuss the structural adaptations of each muscle type to its specific functions in the teaching of the topic of *Movement*.
- (d) use charts, models, photographs, diagrams, slides showing the stages of mitosis, microscope slides and a microscope, to guide students working in groups as they discuss the stages of mitosis and to illustrate them diagrammatically. At the same time, the teacher

observes the students' drawings and provides clarifications as the Growth topic is taught.

- (e) promote regular use of the English language to enhance students' speaking proficiency and improve their ability to comprehend classroom instruction and examination questions.

**Appendix I**

**Summary of the Candidates' Performance Per Topic in CSEE 2025**

| S/N | Topic                                                                                                                                                                                                           | CSEE 2025       |                                                       |                                   |         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------------------------|-----------------------------------|---------|
|     |                                                                                                                                                                                                                 | Question Number | Percentage of Candidates with a Score of 30% or Above | Average Performance Per Topic (%) | Remarks |
| 1.  | Introduction to Biology, Balance of Nature, Gaseous Exchange and Respiration, Reproduction, Regulation, Health and Immunity, Safety in Our Environment, Movement, Genetics, and Classification of Living Things | 1               | 76.68                                                 | 76.68                             | Good    |
| 2.  | Classification of Living Things                                                                                                                                                                                 | 2 Practical     | 58.00                                                 | 58.00                             | Average |
| 3.  | Coordination                                                                                                                                                                                                    | 2               | 57.33                                                 | 52.15                             | Average |
|     |                                                                                                                                                                                                                 | 9               | 46.96                                                 |                                   |         |
| 4.  | Genetics                                                                                                                                                                                                        | 7               | 39.54                                                 | 39.54                             | Average |
| 5.  | Nutrition                                                                                                                                                                                                       | 3               | 38.00                                                 | 32.54                             | Average |
|     |                                                                                                                                                                                                                 | 1 Practical     | 27.08                                                 |                                   |         |
| 6.  | Health and Immunity                                                                                                                                                                                             | 10              | 30.78                                                 | 30.78                             | Average |
| 7.  | Transport of Materials in Living Things                                                                                                                                                                         | 11              | 13.64                                                 | 13.64                             | Weak    |
| 8.  | Reproduction,                                                                                                                                                                                                   | 6               | 9.90                                                  | 9.90                              | Weak    |
| 9.  | Movement                                                                                                                                                                                                        | 5               | 7.30                                                  | 7.30                              | Weak    |
| 10. | Growth                                                                                                                                                                                                          | 4               | 2.48                                                  | 2.48                              | Weak    |
| 11. | Evolution                                                                                                                                                                                                       | 11              | 1.31                                                  | 1.13                              | Weak    |

## Comparison of Candidates' Performance Per Topic in CSEE 2025 and 2024

| SN  | Topic                                                                                                                                                                                                           | CSEE 2025           |                                                       |         | CSEE 2024           |                                                       |         |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-------------------------------------------------------|---------|---------------------|-------------------------------------------------------|---------|
|     |                                                                                                                                                                                                                 | Question number     | Percentage of Candidates With a Score of 30% or Above | Remarks | Question number     | Percentage of Candidates With a Score of 30% or Above | Remarks |
| 1.  | Introduction to Biology, Balance of Nature, Gaseous Exchange and Respiration, Reproduction, Regulation, Health and Immunity, Safety in Our Environment, Movement, Genetics, and Classification of Living Things | 1                   | 76.68.66                                              | Good    | 1                   | 83.04                                                 | Good    |
| 2   | Classification of Living Things                                                                                                                                                                                 | 2<br>Practical      | 58.00                                                 | Average | 2<br>Practical      | 56.60                                                 | Average |
| 3.  | Coordination                                                                                                                                                                                                    | 2<br>9              | 52.15                                                 | Average | 5                   | 8.11                                                  | Weak    |
| 4.  | Genetics                                                                                                                                                                                                        | 7                   | 39.54                                                 | Average | 8                   | 48.85                                                 | Average |
| 5.  | Nutrition                                                                                                                                                                                                       | 3<br>1<br>Practical | 32.54                                                 | Average | 3<br>1<br>Practical | 48.83                                                 | Average |
| 6.  | Health and Immunity                                                                                                                                                                                             | 10                  | 30.78                                                 | Average | 4<br>11             | 51.77                                                 | Average |
| 7.  | Transport of Materials in Living Things                                                                                                                                                                         | 11                  | 13.64                                                 | Weak    | 9                   | 26.97                                                 | Weak    |
| 8.  | Reproduction                                                                                                                                                                                                    | 6                   | 9.90                                                  | Weak    | 6                   | 26.64                                                 | Weak    |
| 9.  | Movement                                                                                                                                                                                                        | 5                   | 7.30                                                  | Weak    | 7                   | 34.03                                                 | Weak    |
| 10. | Growth                                                                                                                                                                                                          | 4                   | 2.48                                                  | Weak    |                     |                                                       |         |
| 11. | Evolution                                                                                                                                                                                                       | 11                  | 1.31                                                  | Weak    |                     |                                                       |         |

