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) 2023

BIOLOGY

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033 BIOLOGY

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FOREWORD

This report presents Candidates' Item Response Analysis (CIRA) on the Certificate of Secondary Education Examination (CSEE) in Biology which was conducted in November 2023. The Certificate of Secondary Education Examination marks the end of four years of secondary education. It is a summative evaluation which, among other aspects, assesses the knowledge and skills acquired by the candidates in ordinary secondary education level. The report aims to provide feedback to education stakeholders on the candidates' performance in the question items in Biology.

The report reveals that the performance in Biology CSEE 2023 was good as 70.09 per cent of the candidates passed the examination. The report shows that the candidates who attained high scores had adequate knowledge of the concepts examined, exhibited ability to understand the demands of the questions, and had adequate drawing skills of the biological diagrams. However, 29.91 per cent of the candidates did not reach a pass mark of the examination. It was established that, factors such as inadequate knowledge of the concepts examined, failure to meet the demands of the questions, lack of adequate drawing skills, misspelling of scientific words and poor proficiency in the English language contributed to weak performance of the candidates in Biology subject.

The National Examinations Council of Tanzania (NECTA) expects that the feedback provided in this report will enable the education stakeholders to identify proper measures to improve teaching and learning of Biology subject. Consequently, this will enable the candidates acquire knowledge, skills and competences indicated in the syllabus for better performance in future examinations.

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

Dr. Said Ally Mohamed
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report focuses on the Candidates' Item Responses Analysis (CIRA) on the candidates who sat for Certificate of Secondary Education Examination (CSEE) in Biology paper in November 2023. The examination intended to measure 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 had two papers, namely 033/1 Biology 1 (Theory paper) and 033/2 Biology 2 (Actual practical paper). The theory paper consisted of eleven (11) questions divided into sections A, B and C with a total of 100 marks. The practical paper had three (3) alternative papers: 033/2A Biology 2A, 033/2B Biology 2B, and 033/2C Biology 2C. Each alternative paper consisted of two structured questions, each weighing 25 marks thus making a total of 50 marks.

A total of 529,395 candidates sat for the Biology CSEE 2023 where 244,572 (46.20%) were male and 284,823 (53.80%) were female. The analysis shows that the general performance in this subject was good because 369,772 (70.09%) candidates passed the examination. The summary of the candidates' performance based on Sex and Grades is presented in the following Table:

The Candidates' Performance in Biology CSEE 2023

	Grades				
Sex	**A**	**B**	**C**	**D**	**F**
Male	6,987	17,885	77,486	81,413	59,880
Female	4,847	12,739	66,629	101,786	97,922
Total	11,834	30,624	144,115	183,199	157,802

The Table shows that most of the candidates (193,196) attained D grade which is a marginal pass. A few of them (11,834) attained A grade, the majority (6,987) of whom being males. The candidates' performance in this year has increased by 2.25 per cent when compared to 2022 Biology

CSEE in which 521,963 sat for the paper and 353,046 (67.84%) candidates passed the examination.

The analysis of candidates' performance on each question in Biology examination begins by indicating the topic, demand of the question and the percentage of the candidates who attempted the question. It also highlights misconceptions observed on candidates' responses and spots some possible reasons for the observed misconceptions. The samples of the candidates' responses have been inserted as extracts to illustrate correct and incorrect responses. In addition, some charts and graphs have been used to illustrate candidates' performance on each question. The performance is considered to be good, average or weak if the percentage of the candidates who scored at least 30 per cent of the marks allocated in a question fall within the range of 65 to 100, 30 to 64, and 0 to 29, respectively. In addition, green, yellow and red colours have been used in charts and appendices to indicate good, average and 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 sections A, B and C.

2.1 SECTION A: Objective Questions

The section consisted of multiple choice and matching items in question 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 10 multiple-choice items. In each item, the candidates were instructed to choose the correct answer from among the given five alternatives and write its letter besides the item number in the answer booklet which was provided. The items were set from ten topics,

namely Evolution, Gaseous Exchange and Respiration, Movement, Health and Immunity, Reproduction, Genetics, Regulation, Introduction to Biology, Balance of Nature and Excretion.

The analysis shows that 529,395 (100%) candidates responded to this question. Among them, 97,076 (18.34%) candidates scored from 0 to 2 marks out of whom, 9,162 (1.73%) scored 0 in this question. Candidates who scored from 3 to 6 marks were 322,416 (60.90%), whereas 109,903 (20.76%) scored from 7 to 10 marks. Further analysis shows that a few 2,449 (0.46%) candidates scored all the 10 marks. The general performance was good since 81.66 per cent of the candidates scored from 3 to 10 marks. Figure 1 summarises the candidates' performance on question 1.

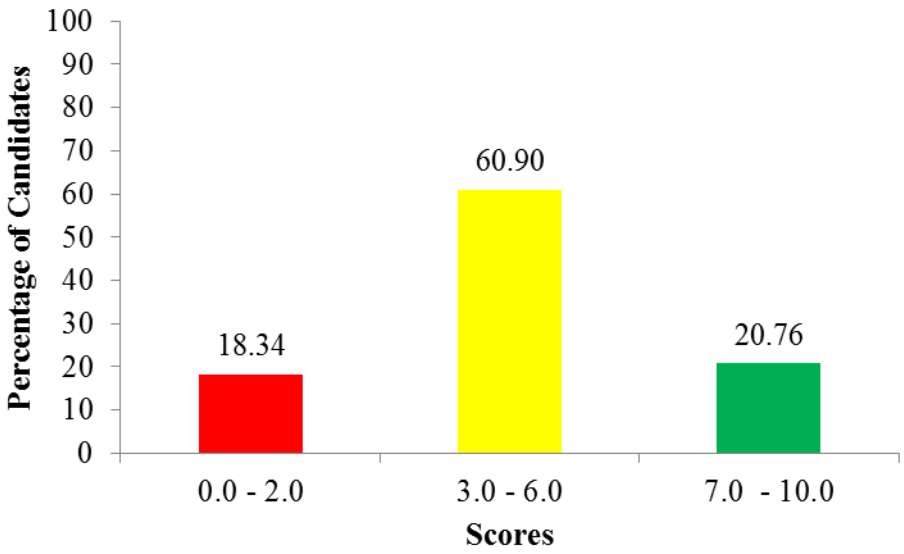


Figure 1: *Candidates' Performance on Question 1*

The candidates who scored high marks (7 - 10) were knowledgeable about the concepts tested. Therefore, they provided correct responses to all or most of the items. Those who scored average marks (3 - 6) provided correct responses to between 3 and 6 items, hence could not score full marks. Furthermore, those who scored low marks (0 - 2) either provided correct responses to either 1 or 2 items, or provided incorrect responses to all items, thus scored 0. These candidates showed

to have inadequate knowledge of the tested concepts. The following is the analysis of candidates' responses in each item.

Item (i) *Which theory postulates that living organisms originated from non-living organisms?*

A	*Chemical evolution*	*B*	*Cosmozoan*
C	*Steady state*	*D*	*Special creation*
E	*Spontaneous generation*		

The correct response was alternative *E, Spontaneous generation.* Candidates who chose *E, Spontaneous generation* had adequate knowledge about theories of origin of life. However, those who chose alternative *A, Chemical evolution,* did not realise that the theory suggests that, life arose from the evolution of simple organic molecules into more complex life forms. Those who opted for *B, Cosmozoan,* were not aware that the theory postulates that life arose somewhere else in the universe and arrived on the earth from the outer space by some means. Those who chose *C, Steady state,* were not aware that the theory suggests that the planet earth and all organisms on it have always been there, and hence, life has no origin. Similarly, those who chose alternative *D, Special creation,* did not understand that the theory postulates that the earth and all the organisms on it were created on a single event by a super-being or God.

Item (ii) *Which part protects lungs from injury and shock?*

A	*Trachea*	*B*	*Rib*	*C*	*Bronchus*
D	*Epiglottis*	*E*	*Diaphragm*		

The correct response was alternative *B, Rib*. The candidates, who chose alternative *B, Rib*, had adequate knowledge about gaseous exchange in mammals. Therefore, they understood that ribs are made of hard bone tissue whose function is to protect the internal organs in the thoracic cavity such as lungs and heart. On the other hand, those who opted for *A, Trachea* and *C, Bronchus*, did not recognize that trachea allows passage of air into the lungs while bronchus connects the trachea to the bronchioles. Likewise, those who chose alternative *D, Epiglottis* and *E, Diaphragm* were not aware that epiglottis closes the trachea during swallowing to prevent food from entering it while diaphragm is a muscular sheet of tissue which separates the thorax from abdomen.

Item (iii) *A boy climbed a coconut tree to harvest coconuts. Unfortunately, he fell down and broke his upper arm. Which bone was broken?*

A	*Ulna*	*B*	*Humerus*	*C*	*Radius*
D	*Femur*	*E*	*Tibia*		

The correct response was alternative *B, Humerus*. The candidates who chose alternative *B, Humerus* had adequate knowledge about the structure of the human skeleton. Therefore, they understood that, humerus is found in the upper part of the arm. Conversely, candidates who chose alternative *A, Ulna,* and *C, Radius*, were not aware that radius and ulna are bones of the lower arm. Similarly, those who chose alternative *D, Femur* and *E, Tibia* did not understand that femur is a long bone found in the thigh between the hip and the knee while tibia is a long bone of the lower hind limb which forms part of the knee joint at its top.

Item (iv) *A patient was confirmed suffering from Meningitis at Maweni hospital. How can the disease be prevented from spreading?*

A	*Eliminating fleas*	*B*	*Abstaining from sex*
C	*Isolating the patients*	*D*	*Killing water snails*
E	*Cutting long grasses*		

The correct response was alternative *C, Isolating the patients.* Candidates who chose alternative *C, Isolating the patients* had adequate knowledge about preventive measures of common infections and diseases. They understood that isolating the patients prevents further spreading of meningitis. However, those who chose alternative *A, Eliminating fleas* did not realise that this prevents plague. Those who chose *B, Abstaining from sex,* did not realise that this prevents sexually transmitted diseases such as HIV/AIDS, syphilis, gonorrhea and genital herpes. Candidates who opted for *D, Killing water snails,* did not realise that this prevents the spreading of Bilharzia. Likewise, those who chose *E, Cutting long grasses,* were not aware that this prevents the spread of malaria.

Item (v) *If a girl had the menstruation on 12th August 2023, when would she experience the ovulation period, if she has 28 days' cycle?*

A	*21st September 2023*	*B*	*8th September 2023*
C	*20th August 2023*	*D*	*25th August 2023*
E	*31st August 2023*		

The correct response for this item was *D, 25th August 2023*. The candidates who chose correct response had adequate knowledge about menstrual cycle. They were aware that for females whose menstrual cycle is 28 days, it takes fourteen days from the onset of menstruation for ovulation to take place. Conversely, those who chose *A, 21st September 2023* were not aware that, on this date the next ovulation could take place if fertilization did not happen in the August ovulation. Likewise, those who chose *B, 8th September 2023* missed the calculation since on this date the next menstruation could take place. However, those who chose alternative *C, 20th August 2023* were not aware that this was the beginning of the fertile period while those who chose *E, 31st August 2023,* were not informed about menstrual cycle particularly the length of the ovulation phase as they failed to depict the days of ovulation.

Item (vi) *What will be the genotype of the offsprings that would be produced in the first filial generation from a cross between parents of blood group with I^AI^O and I^AI^B genotypes?*

A	*I^AI^A, I^BI^B, I^BI^O, I^AI^O*	*B*	*I^AI^A, I^AI^B, I^AI^O, I^BI^O*
C	*I^AI^B, I^OI^O, I^AI^O, I^AI^A*	*D*	*I^BI^O, I^AI^O, I^BI^B, I^AI^B*
E	*I^AI^A, I^AI^B, I^OI^O, I^BI^B*		

The correct response was *B, I^AI^A, I^AI^B, I^AI^O, I^BI^O*. The candidates who opted for the correct response had adequate knowledge about Non-Mendelian Inheritance specifically codominance. Therefore, they were aware that ABO blood group is a form of inheritance in which both alleles from the parents are equally shown and that alleles A and B are codominant while allele O is recessive. On the other hand, those who chose *A, I^AI^A, I^BI^B, I^BI^O, I^AI^O, C, I^AI^B, I^OI^O, I^AI^O, I^AI^A, D, I^BI^O, I^AI^O, I^BI^B, I^AI^B* and *E, I^AI^A, I^AI^B, I^OI^O, I^BI^B* were not conversant with the Non-Mendelian inheritance thus failed to depict the genotypes of the offspring from a cross of parents with I^AI^O and I^AI^B genotypes.

Item (vii*) Which control measure would you recommend to a patient diagnosed with diabetes mellitus?*

A Reducing intake of sugary foods
B Limiting amount of water intake
C Reducing intake of cholesterol foods
D Eating enough starch and water
E Consuming a high fat food

The correct response was *A, Reducing intake of sugary foods*. The candidates who chose the correct response had adequate knowledge about blood sugar regulation in mammals. Therefore, they were aware that diabetes mellitus is characterized by very high amount of blood glucose thus reducing the intake of sugary foods will eventually reduce the blood sugar. Conversely, those who chose alternative *B, Limiting amount of water intake* did not know that this causes constipation and severe dehydration which can lead to dizziness. Candidates who opted for *C, Reducing intake of cholesterol foods,* did not recognize that this is a control measure for high blood pressure. Similarly, those who chose *D, Eating enough starch and water* were not aware that the end product of digestion of starch is glucose which will raise the blood sugar. Moreover, those who opted for alternative *E, Consuming a high fat food* did not know that this fat reserve interferes with the body ability to absorb and utilize glucose therefore raises the level of blood sugar in the body.

Item (viii) *Which group represents only the living things?*

A Dog, frog, stone and lizard
B Soil, water, mushroom and bee
C Bee, moss, mushroom and frog
D Moss, soil, mushroom and lizard
E Lizard, mushroom, water and soil

The correct response was *C, Bee, moss, mushroom and frog*. The candidates who chose the correct response had sufficient knowledge about the characteristics of living things. Therefore, they understood that living organisms are characterized by growth, reproduction, nutrition, respiration and excretion which differentiate them from non-living things. Those who chose alternatives *A, Dog, frog, stone and lizard, B, Soil, water, mushroom and bee, D, Moss, soil, mushroom and lizard;* and *E, Lizard, mushroom,*

water and soil did not realise that stones, soil and water do not possess characteristics of living things and therefore they are non-living things.

Item (ix) *Which food chain represents the correct flow of energy in the ecosystem?*

A *Hawk* → *Grasses* → *Grasshopper* → *Lizard*
B *Grasses* → *Hawk* → *Lizard* → *Grasshopper*
C *Lizard* → *Grasses* → *Grasshopper* → *Hawk*
D *Grasses* → *Hawk* → *Grasshopper* → *Lizard*
E *Grasses* → *Grasshopper* → *Lizard* → *Hawk*

The correct response for this item was alternative *E,* $Grass \rightarrow grasshopper \rightarrow Lizard \rightarrow Hawk$. The candidates who selected the correct response had adequate knowledge about food chain and food web. Therefore, they realised that energy flow begins with producers, the organisms which can manufacture their own food specifically the green plants. The producers are eaten by primary consumers while the primary consumers are eaten by secondary consumers. When primary and secondary consumers die, they are acted upon by decomposers which are the bacteria and fungi. Those who chose alternatives A, *B, C* and *D* were not informed that food chain begins with producers. Therefore they were not aware that grasses are the producers, grasshopper is a primary consumer, and lizard is a secondary consumer while hawk is a tertiary consumer.

Item (x) *A blood vessel which takes away blood from the glomerulus is narrower than the blood vessel which enters blood into the glomerulus. What does it imply with respect to urine formation?*

A *Creates low pressure for efficient filtration of blood*
B *Increases surface area for selective reabsorption*
C *Builds up high pressure for ultra-filtration of blood*
D *Reduces diffusion distance for faster filtration*
E *Creates high pressure for ultra-filtration of urine*

The correct response for this item was *C, Builds up high pressure for ultra-filtration of blood.* The candidates who responded correctly had adequate knowledge about process of urine formation in human. Therefore they

understood that afferent arteriole is wider so as to allow large volume of blood to enter into the glomerulus while efferent arteriole is narrower in order to reduce the amount of blood leaving the glomerulus. In this way, high pressure is created inside the glomerulus for maximum ultra-filtration of blood during the process of urine formation. Those who opted for *A, Creates low pressure for efficient filtration of blood,* were not aware that filtration of blood needs high pressure. Those who chose *B, Increases surface area for selective reabsorption,* did not know that selective reabsorption occurs at the proximal and distal convoluted tubules. Those who chose *D, Reduces diffusion distance for faster filtration* were not aware that diffusion distance is achieved through thinness of the wall of glomerulus. Moreover, those who chose *E, Creates high pressure for ultra-filtration of urine* failed to understand that it is the blood which is filtered to get urine.

2.1.2 Question 2: Matching items

The question comprised six (6) matching items. The candidates were required to match the functions of parts of the ear in **List A** with their corresponding parts in **List B** by writing the letter of the correct response beside the item number in the answer booklet which was provided.

List A	***List B***
(i) *Maintains body posture and balance.*	*A Pinna*
(ii) *Carries nerve impulses from the inner ear to the brain*	*B Eustachian tube*
(iii) *Transmits and magnifies sound vibrations*	*C Eardrum*
(iv) *Converts sound vibrations to nerve impulses*	*D Auditory nerve*
(v) *Collects sound waves from the environment*	*E Auditory meatus*
(vi) *Balances pressure on both sides of the tympanic membrane*	*F Ossicles*
	G Cochlea
	H Semicircular canal

This question was attempted by 529,395 (100%) candidates. Among them, 214,993 (40.61%) candidates scored from 0 to 1 marks out of whom, 80,193 (15.15%) scored 0 in this question. Candidates who scored from 2 to 3 marks were 223,762 (42.27%), whereas 90,640 (17.12%) scored from 4 to 6 marks, out of whom 16,631 (3.14%) scored all the 6 marks. Generally, the candidates' performance on this question was average as 59.39 per cent of the candidates scored from 2 to 6 marks. Figure 2 summarises the candidates' performance on question 2.

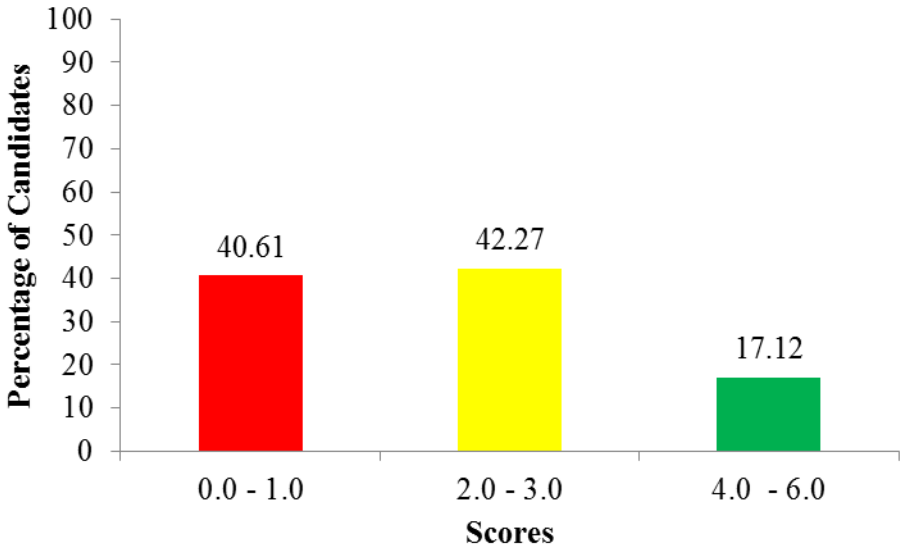
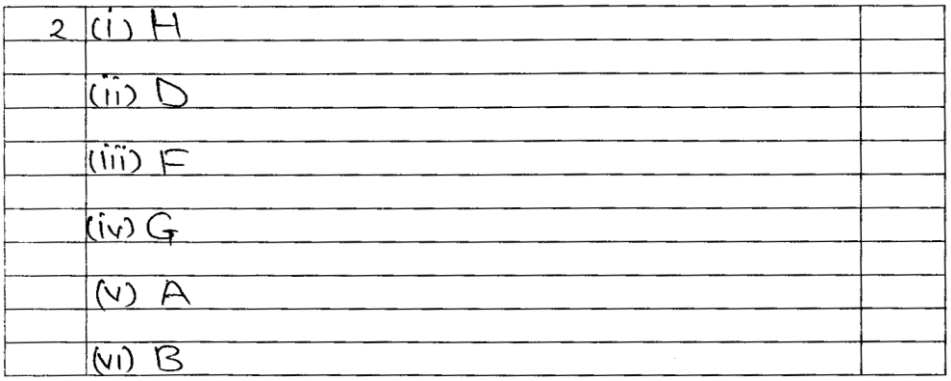


Figure 2: *Candidates' Performance on Question 2*

The candidates who scored high (4 - 6) marks demonstrated sufficient knowledge about sense organs especially the functions of parts of the ear. Therefore, they matched most of the items given correctly. Extract 1.1 is a sample of the candidates' correct responses to question 2.



Extract 1.1: Candidate's correct response to question 2

In Extract 1.1, the candidate matched all the items correctly, thus scored all 6 marks allocated to this question.

On the other hand, 40.61 per cent of the candidates scored low marks (0 - 1). They either gave incorrect responses to all the items or gave correct response to one item, hence loss of marks. This indicates that the candidates were not conversant with the functions of parts of the ear. The analysis of the candidates' responses in each item is presented as follows:

Item (i) required the candidates to select a response which correctly matches the description of part of the ear that maintains body posture and balance. The correct answer was *H, Semicircular canal.* However, some candidates chose *Eustachian tube*. They were not aware that Eustachian tube balances pressure on both sides of the tympanic membrane.

Item (ii) required the candidates to select a response which correctly matches the description of a part of the ear that carries nerve impulses from the inner ear to the brain. The correct answer was *D, the auditory nerve.* Most of the candidates matched it correctly signifying adequate knowledge about sense organs.

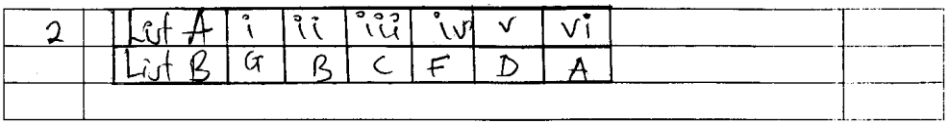
Item (iii) required the candidates to select a response which correctly matches the description of a part of the ear that transmits and magnifies sound vibrations. The correct answer was *F, Ossicles.* However, those who opted for *C, Eardrum*, failed to understand that eardrum vibrates when hit by sound waves.

Item (iv) required the candidates to select a response which correctly matches the description of part of the ear that converts sound vibrations to

nerve impulses. The correct answer was *G, Cochlea.* Conversely, those who chose *E, Auditory meatus* failed to recognize that auditory meatus passes sound waves to the middle ear.

Item (v) required the candidates to select a response which correctly matches the description of part of the ear which collects sound waves from the environment. The correct response was *A, Pinna*. Most of the candidates matched it correctly as it is a flap of skin supported by cartilage which is externally exposed for collection of sound waves.

Item (vi) required the candidates to select a response which correctly matches the description of part of the ear that balances pressure on both sides of the tympanic membrane. The correct answer was *B, Eustachian tube*. Conversely, those who matched it with *H, Semicircular canal* were not aware that this maintains body posture and balance. Extract 1.2 is a sample of the candidates' incorrect responses to question 2.



Extract 1.2: Candidate's incorrect response to question 2

In Extract 1.2, the candidate matched incorrectly all the items of the question.

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 that "Suppose your friends have been diagnosed with indigestion problem". They were required to provide the major possible causes of indigestion in part (a), and suggest measures to avoid the problem of indigestion in future in part (b).

The question was attempted by 529,395 (100%) candidates. Analysis shows that 405,739 (76.64%) candidates scored from 0 to 2.5, out of whom, 248,302 (46.90%) scored 0 in this question. The candidates who scored from 3 to 5.5 were 107,108 (20.23%), whereas 16,548 (3.13%)

candidates scored from 6 to 9 marks, out of whom, 1,056 (0.20%) candidates scored all the 9 marks. The general performance was weak as 76.64 per cent of the candidates scored from 0 to 2.5 out of 9 marks. Figure 3 summarises the candidates' performance on question 3.

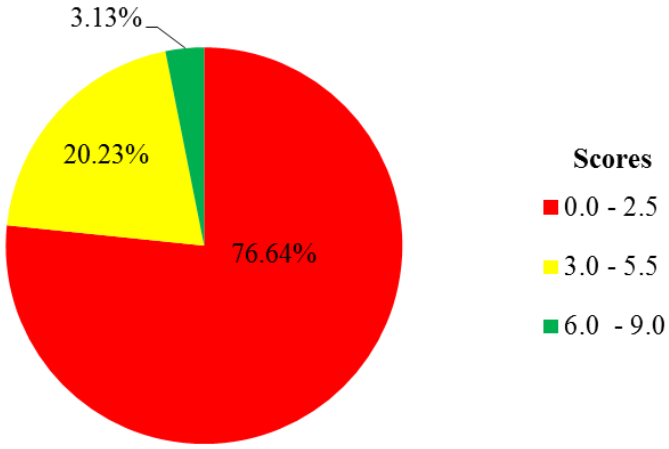
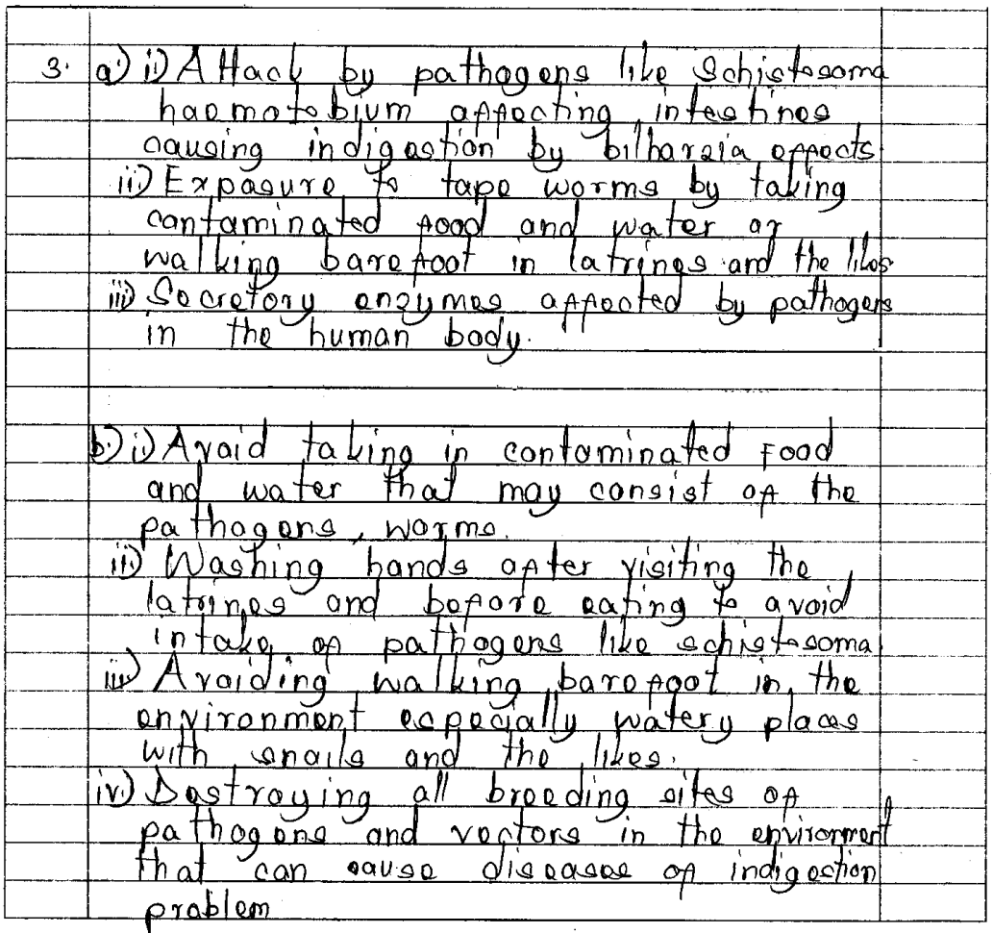


Figure 3: *Candidates' Performance on Question 3*

The candidates who scored low (0 - 2.5) marks lacked adequate knowledge of the common disorders and diseases of the human digestive system. Some of them provided one cause and one measure to control indigestion hence scored low marks. Those who scored zero mark gave incorrect responses in all parts of the question. For example, in part (a) most of them stated the causes of constipation instead of indigestion as *low intake of liquids; ignoring the urge for long call and low intake of roughages.* There were other candidates who wrote factors limiting intake of balanced diet as *poverty, taboos, religion* and *unavailability of the food in the market.* Other examples of incorrect responses found in candidates' scripts were *failure of functioning of enzymes, failure of gastric gland to produce gastric juices and abnormal coiling of the ileum.*

Similarly, in part (b) they suggested the preventive measures of other disorders of the digestive system such as heartburn and constipation. For example, some of them wrote preventive measures for constipation such as *eating food with enough fibers, going for long call when the urge is felt and take enough drinking water*. Others wrote the preventive measures of heartburn such as *drink enough water to dilute the acids, minimize intake of*

food that can cause heartburn and use pillow to raise the head while sleeping. There were other candidates who wrote preventive measures of communicable diseases. For instance one wrote *vaccination, isolating the patients and cover food when not in use.* These incorrect responses indicate that these candidates were not aware about causes and preventive measures of various disorders and diseases of the human digestive system. Extract 2.1 is a sample of the candidates' incorrect responses to question 3.

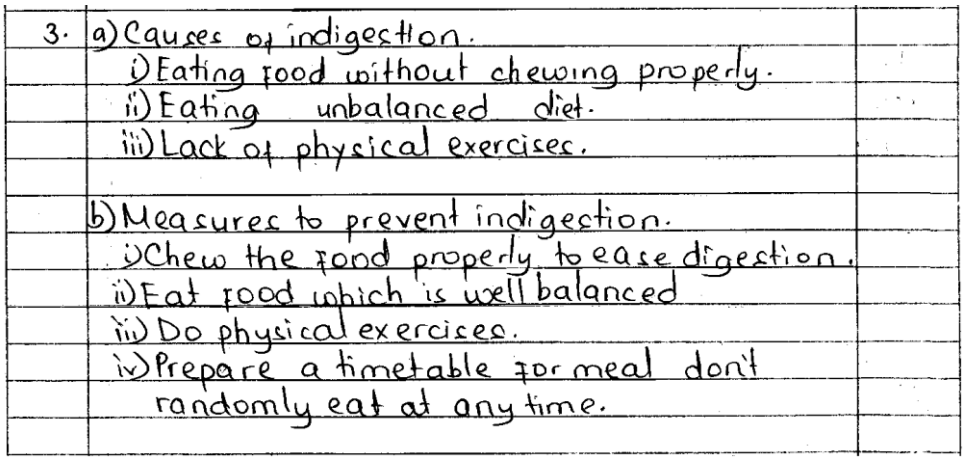

3. a) i) Attack by pathogens like Schistosoma haematobium affecting intestines causing indigestion by bilharzia effects
ii) Exposure to tape worms by taking contaminated food and water or walking barefoot in latrines and the likes
iii) Secretory enzymes affected by pathogens in the human body.

b) i) Avoid taking in contaminated food and water that may consist of the pathogens, worms.
ii) Washing hands after visiting the latrines and before eating to avoid intake of pathogens like schistosoma
iii) Avoiding walking barefoot in the environment especially watery places with snails and the likes.
iv) Destroying all breeding sites of pathogens and vectors in the environment that can cause diseases of indigestion problem

Extract 2.1: Candidate's incorrect response to question 3

In Extract 2.1, the candidate provided the source of disease such as *exposure to tapeworms by taking contaminated food* instead of causes of indigestion in part (a). Also he/she suggested measures to control cholera and bilharzia such as *washing hands after visiting the latrines* instead of measures for controlling indigestion in part (b).

Conversely, the candidates who scored high marks (6 - 9) were informed about common disorders and diseases of the digestive system in human. Therefore, they correctly stated the major possible causes of indigestion problem in part (a). Also they suggested measures to prevent indigestion problem in future such as avoiding too spicy and fatty foods, avoiding stress, ensuring a good work plan and eating balanced diet in part (b). Extract 2.2 is a sample of the candidates' correct responses to question 3.


3. a) Causes of indigestion.
i) Eating food without chewing properly.
ii) Eating unbalanced diet.
iii) Lack of physical exercises.

b) Measures to prevent indigestion.
i) Chew the food properly to ease digestion.
ii) Eat food which is well balanced
iii) Do physical exercises.
iv) Prepare a timetable for meal don't randomly eat at any time.

Extract 2.2: Candidate's correct response to question 3

In Extract 2.2, the candidate correctly stated the causes of indigestion and provided measures to be taken to avoid it in the future.

2.2.2 Question 4: Reproduction

The question required the candidates to suggest six ways to minimise the occurrence of miscarriage to the pregnant woman.

The analysis shows that 529,395 (100%) candidates responded to this question. Among them, 306,459 (57.89%) candidates scored from 0 to 2.5 marks out of whom, 261,390 (49.38%) scored 0 in this question. Candidates who scored from 3 to 5.5 marks were 96,517 (18.23%), whereas 126,419 (23.88%) scored from 6 to 9 marks, out of whom 23,979 (4.53%) candidates scored all the 10 marks. Generally, the candidates' performance on this question was average as 42.11 per cent of the candidates scored from 3 to 9 marks. Figure 4 summarizes the candidates' performance on question 4.

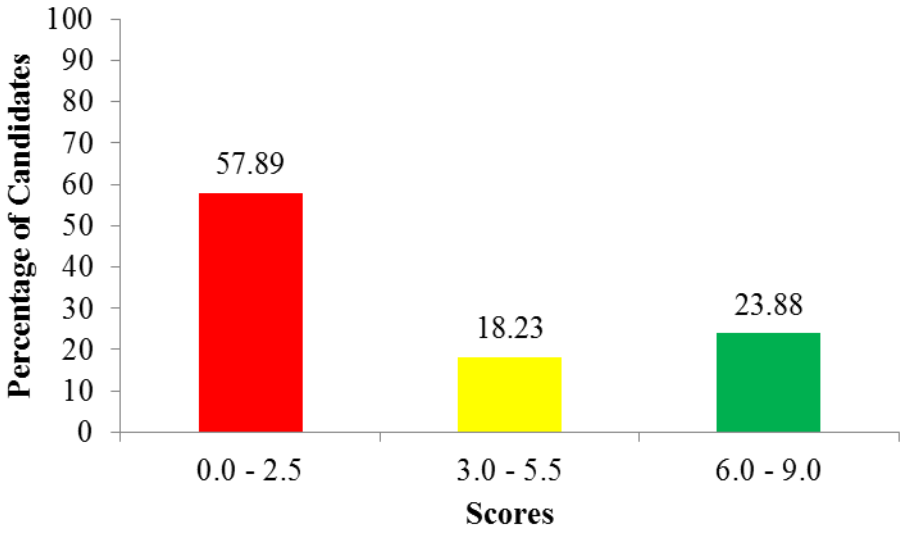


Figure 4: *Candidates' Performance on Question 4*

The candidates who scored high marks (6 - 9) were aware of the complications of the reproductive system. Therefore, they suggested six ways to minimise the occurrence of miscarriage to the pregnant woman such as avoiding multiple sexual partners to reduce sexually transmitted infections (STIs) and sexually transmitted diseases (STDs), maintaining personal hygiene, attending pre-natal clinic services regularly and avoiding use of alcohol. Extract 3.1 is a sample of the candidates' correct responses to question 4.

4. Six ways to avoid occurrence of miscarriage are :-

i) Pregnant women should avoid doing heavy duties or heavy physical activities.

ii) They should avoid having extreme stress.

iii) They should avoid taking any medicine which is not prescribed by the doctor.

iv) They should avoid travelling long distances by either walking or using vehicle as it may lead to shock.

v) They should eat a well balance diet ie meal with all nutrients especially protein and iron for the growth of the baby.

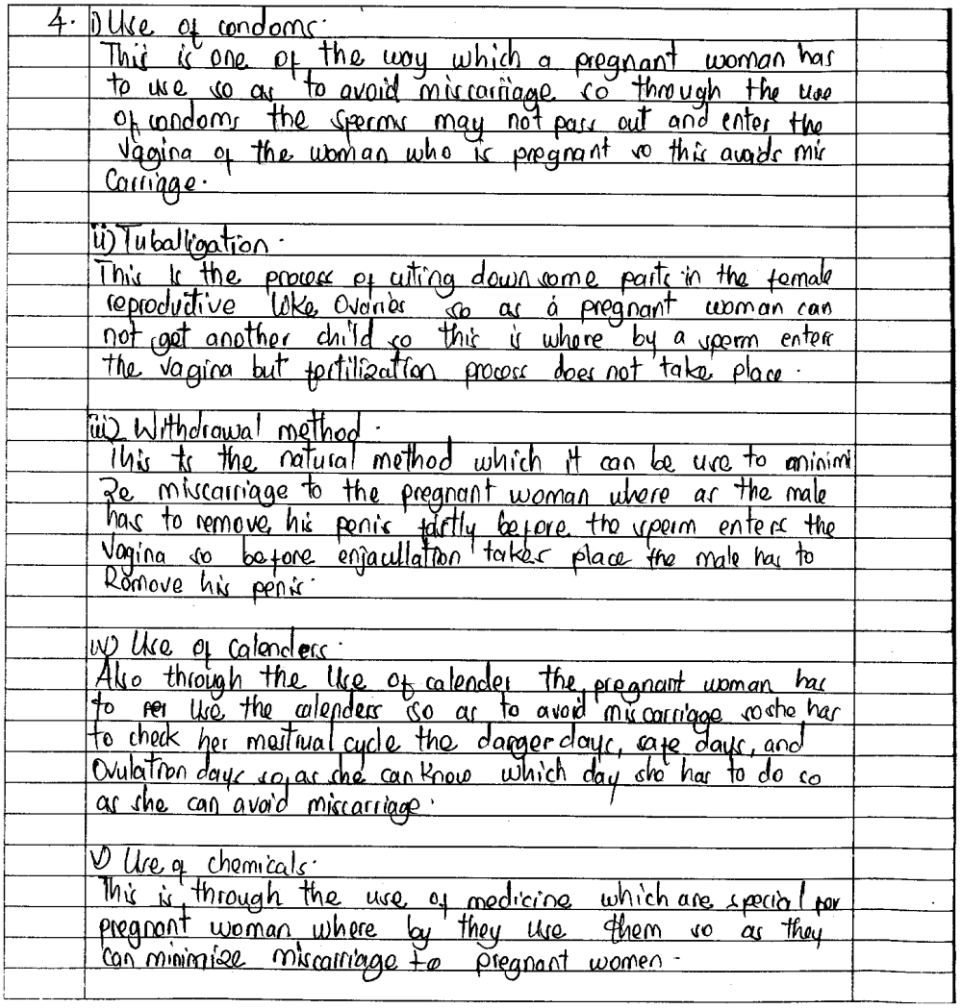
vi) They should have a regular body check up so as to know the development of the baby. This enable them to find if there is any problem to the baby thus take specific measures to save their lives.

Extract 3.1: Candidate's correct response to question 4

In Extract 3.1, the candidate correctly suggested the ways to minimise the occurrence of miscarriage to the pregnant woman.

On the other hand, 57.89 per cent of the candidates who scored low (0 - 2.5) marks exhibited inadequate knowledge of the complications of reproductive system. Those who scored zero gave responses which were contrary to the demand of the question. Some of them mistook the causes of miscarriage as the ways to minimise the occurrence of miscarriage. Thus, gave causes of miscarriage. For example, some candidates wrote *miscarriage can be caused by engaging in strenuous physical activities, injury, emotional stress, shock, diseases and infections.* Others stated ways to prevent disorders of the reproductive system. For instance, one of the candidates

wrote diseases as *diabetes, old age and under production of testosterone hormone.* Moreover, some of them stated that *avoiding eating vegetables and getting proper education* can minimize miscarriage. There were other candidates who wrote ways to prevent pregnancies among adolescents such as *good parental care whereby parents should be careful to their children to teach them good behaviuor, avoiding peer pressure whereby children should avoid bad influence from other people, use mass media to provide education about effects of childhood pregnancies and religious leaders should teach children about avoiding bad behaviours which can lead to pregnancy.* Extract 3.2 is a sample of the candidates' incorrect responses to question 4.


4. i) Use of condoms:
This is one of the way which a pregnant woman has to use so as to avoid miscarriage. so through the use of condoms the sperms may not pass out and enter the vagina of the woman who is pregnant so this avoids miscarriage.

ii) Tubaligation:
This is the process of cuting down some parts in the female reproductive like Ovaries so as a pregnant woman can not get another child so this is where by a sperm enter the vagina but fertilization process does not take place.

iii) Withdrawal method:
This is the natural method which it can be use to minimize miscarriage to the pregnant woman where as the male has to remove his penis fastly before the sperm enters the vagina so before enjacullation takes place the male has to Remove his penis.

iv) Use of calenders:
Also through the Use of calender the pregnant woman has to her use the calenders so as to avoid miscarriage so she has to check her mestrual cycle the danger days, safe days, and Ovulation days so as she can know which day she has to do so as she can avoid miscarriage.

v) Use of chemicals:
This is through the use of medicine which are special for pregnant woman where by they use them so as they can minimize miscarriage to pregnant women.

Extract 3.2: Candidate's incorrect response to question 4

In Extract 3.2, the candidate suggested the methods of birth control such as *use of condoms and tubal ligation* instead of ways to minimise the occurrence of miscarriage to the pregnant woman.

2.2.3 Question 5: Coordination

The question had two parts, (a) and (b). In part (a), the candidates were required to draw a diagram of the human body and show the locations of the thyroid gland, adrenal gland, pancreas gland and pituitary gland. In part (b), they were required to explain the roles of two hormones produced by the pancreas.

A total of 529,395 (100%) candidates responded to the question. Among them, 280,019 (52.89%) scored from 0 to 2.5 marks out of whom, 132,232 (24.98%) scored 0 in this question. Candidates who scored from 3 to 5.5 marks were 212,050 (40.06%) while 37,326 (7.05%) scored from 6 to 9 marks, out of whom, 1,565 (0.30%) candidates scored all the 9 marks. The performance of the candidates on this question was average as 47.11 per cent of the candidates scored from 3 to 9 marks. Figure 5 summarises the candidates' performance on question 5.

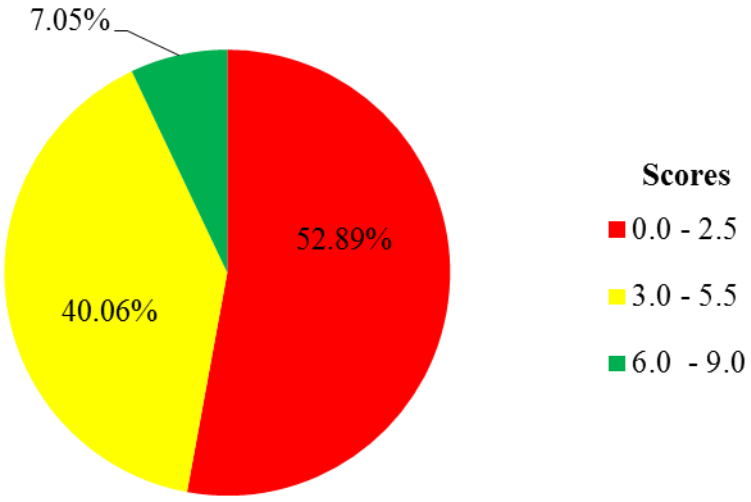
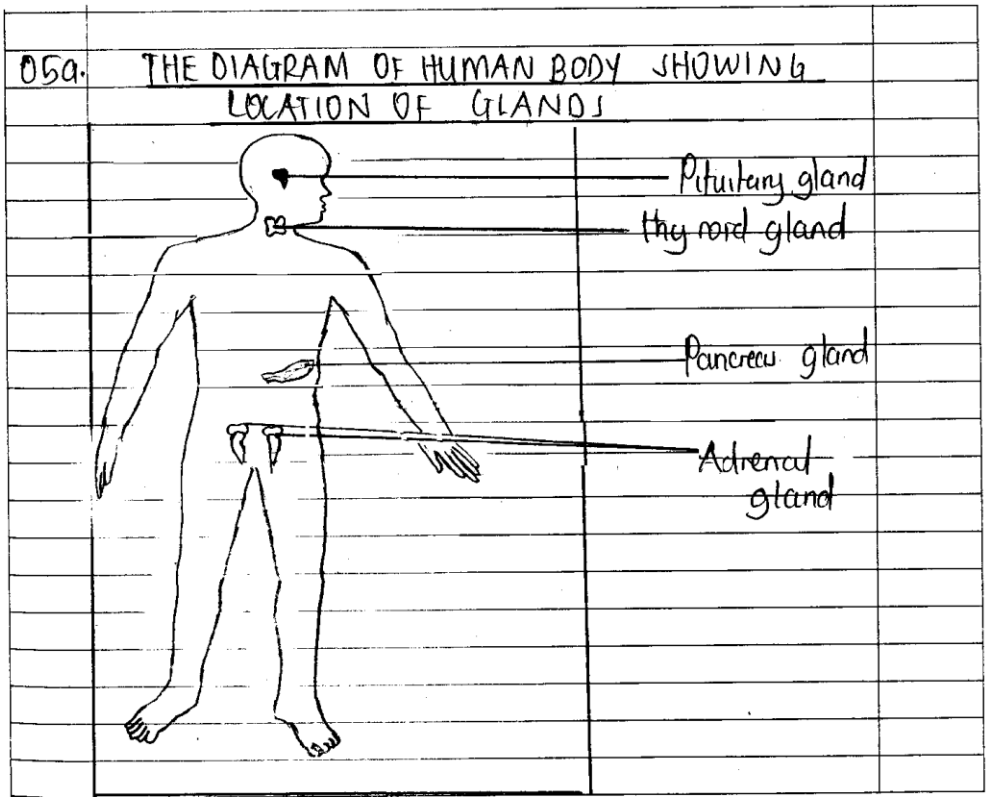
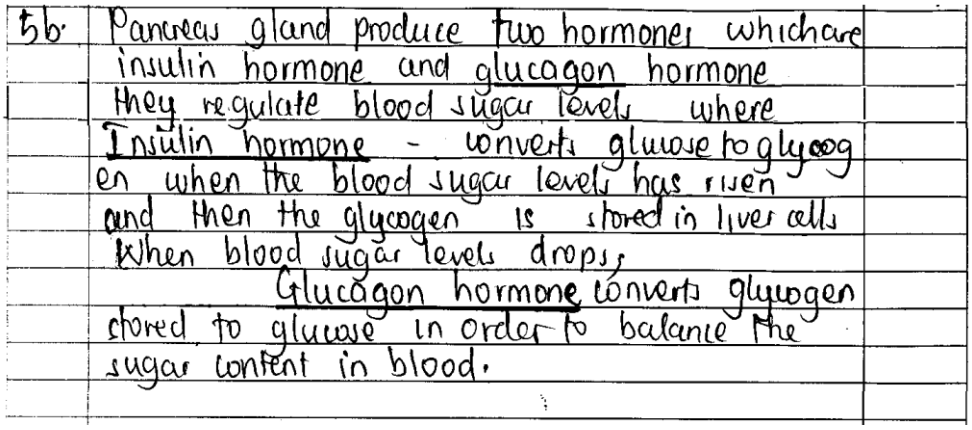


Figure 5: *Candidates' Performance on Question 5*

The candidates who scored high marks (6 - 9) had sufficient knowledge about endocrine glands and the roles of hormones produced by various

glands in the human body. Therefore, they drew a diagram of the human body and located correctly the positions of the thyroid gland, adrenal gland, pancreas gland and pituitary gland in part (a). Also, they explained correctly the roles of the two hormones produced by pancreas in part (b). They were aware of the two hormones produced by pancreas which are insulin and glucagon. Also, they understood that the two hormones regulate blood sugar levels where insulin converts excess glucose into glycogen, and glucagon converts glycogen into glucose. Extract 4.1 is a sample of the candidates' correct responses to question 5.





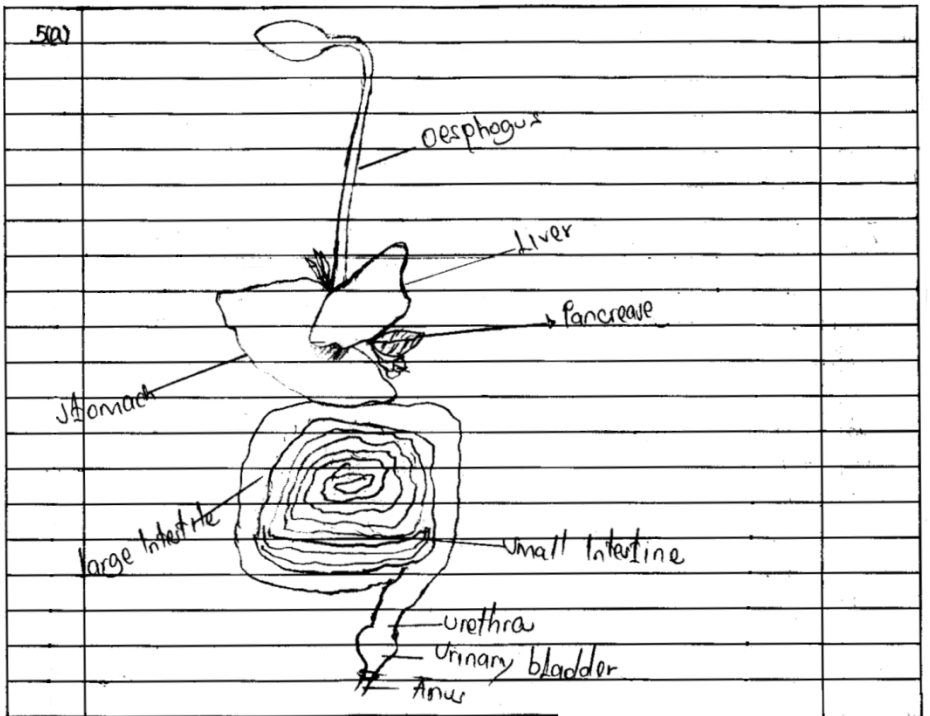
Extract 4.1: Candidate's correct response to question 5

In Extract 4.1, the candidate correctly drew the human body and indicated the location of thyroid, adrenal, pancreas and pituitary glands in part (a). Also, he/she explained the roles of insulin and glucagon hormones in part (b).

Conversely, 280,019 (52.89%) candidates scored from 0 to 2.5 marks. Some of the candidates who scored 2.5 marks drew correct diagrams of the human body but located one to two glands thus lost some marks. Others failed to draw and locate the positions of all endocrine glands, thus they scored zero mark. Additionally, some candidates drew labeled diagrams of various systems in the human body. For example, some drew urinary system, human skeleton, respiratory system and brain. This shows that, these candidates lacked knowledge about the endocrine glands in the mammalian body.

Similarly, in part (b) some of the candidates failed to explain the roles of the two hormones secreted by the pancreas, hence scored zero mark. Some candidates wrote the roles of enzymes produced by the gastric gland in the stomach. For instance, one candidate wrote *pepsin breakdown protein into peptides and rennin coagulates milk.* Others wrote the roles of hormones produced by glands other than the pancreas such as *adrenaline hormone, aldosterone hormone and thyroxine hormone*. Additionally, some of the candidates mentioned parts of the digestive system and their function

instead of the roles of the hormones produced by pancreas. Extract 4.2 is a sample of the candidates' incorrect responses to question 5.



b) The role of hormones produced by the pancreas gland:
i) pancreatic juice
ii) peptides

Roles:
i) pancreatic juice
- The pancreatic juice is the hormone that is produced in the body for it used in digestion process

ii) peptides
- The peptides are used in conversion of protein

Extract 4.2: Candidate's incorrect response to question 5

In Extract 4.2, the candidate drew a digestive system instead of human body showing the location of glands in part (a). Also, he/she incorrectly explained the roles of pancreatic enzymes instead of the roles of the hormones (insulin and glucagon) produced by the pancreas.

2.2.4 Question 6: Genetics

The question had two parts, (a) and (b). In part (a), the candidates were required to explain briefly the term sex limited characters, sex linked characters and sex influenced characters as used in genetics. In part (b), they were required to differentiate incomplete dominance from codominance.

The question was attempted by all candidates 529,395 (100%). The analysis indicates that 506,421 (95.66%) scored from 0 to 2.5 marks, out of whom, 481,278 (90.91%) scored 0. Candidates who scored from 3 to 5.5 marks were 16,295 (3.08%) whereas 6,679 (1.26%) scored from 6 to 9 marks, out of whom, 1,860 (0.35%) scored all the 9 marks. The general performance on this question was weak as 95.66 per cent of the candidates scored 0 to 2.5 out of 9 marks. Figure 6 summarises the candidates' performance on question 6.

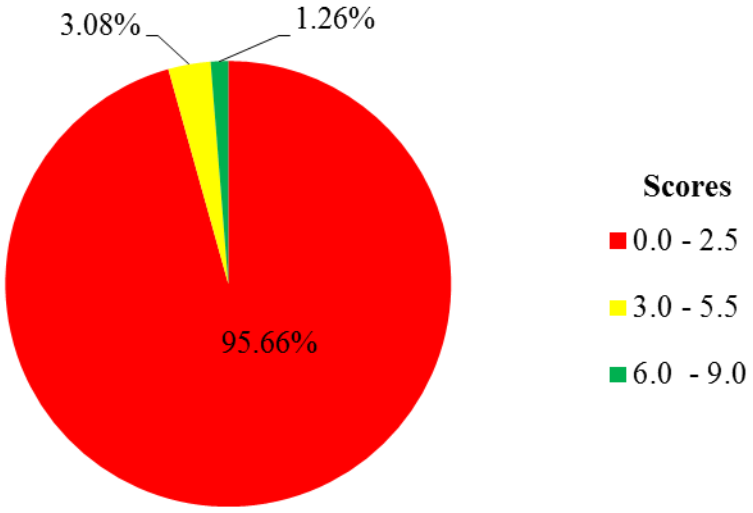
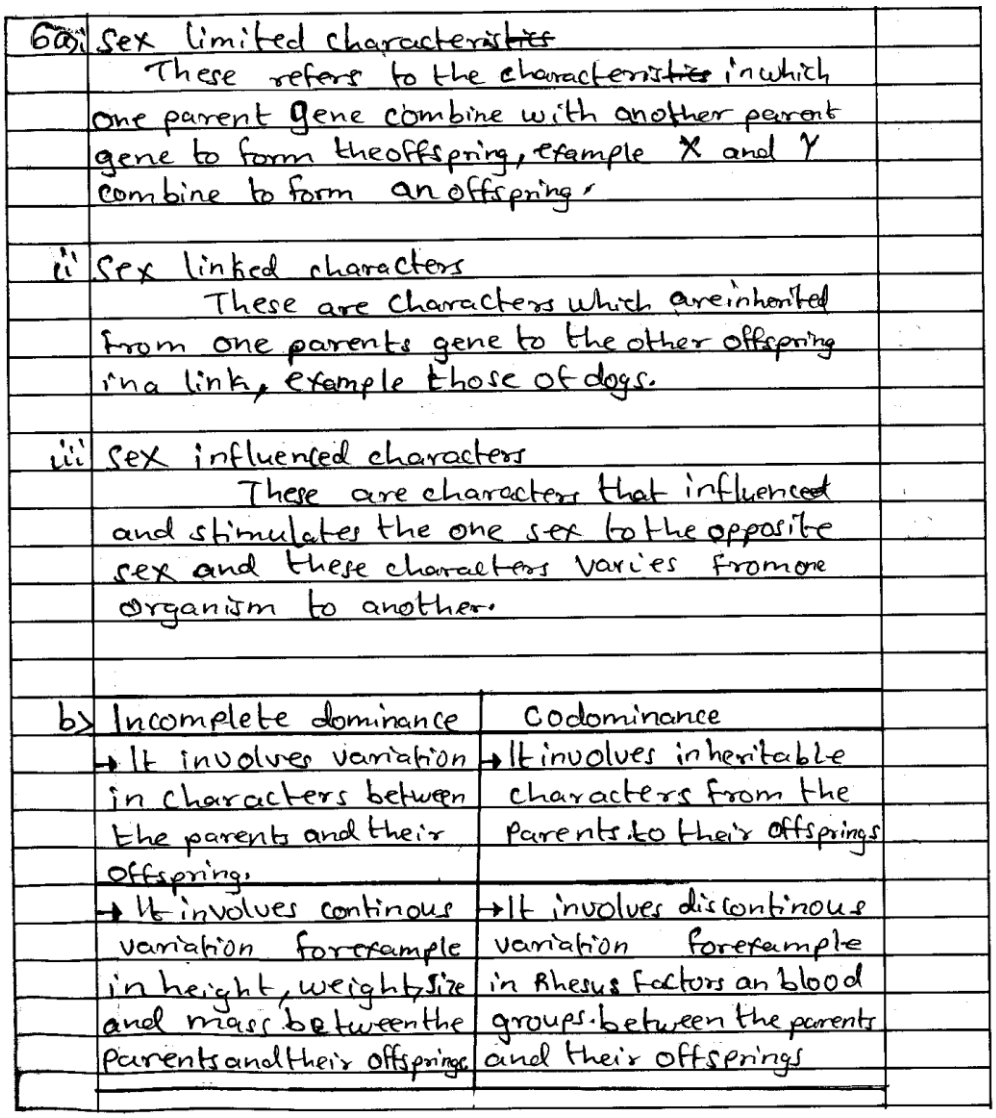


Figure 6: *Candidates' Performance on Question 6*

The candidates who scored low marks (0 - 2.5) either gave correct meaning of one terminology or explained all the terms incorrectly in part (a). Some candidates interchanged the explanations of the terms. For example, some of the candidates wrote that *sex limited characters are characters which are controlled by genes located on the sex chromosomes* instead of characters that are restricted to only one sex. Another candidate wrote *sex linked characters are characters that tend to be more conspicuous in one sex than the other* instead of characters which are controlled by genes located on sex chromosomes; and one of the candidate wrote *sex influenced characters are characters which are restricted to only one sex* instead of characters that tend to be more conspicuous in one sex than the other. Some examples of incorrect responses found on candidates' scripts are *sex limited characters are characters which are inherited from the parents to the offspring, sex linked characters are behaviour which are inherited by an individual from their environment and sex influenced characters are habits which an organism get due to adaptation in the environment.* Others gave explanations of genetics terminologies not related to this question. For example, some explained phenotype and genotypes.

Likewise, in part (b), the candidates were not aware about the meaning of incomplete dominance and codominance so they failed to differentiate the two terms. For example, some of these candidates interchanged the explanation of codominance and complete dominance. Others wrote incomplete dominance as first filial generation and others incorrectly differentiated the terms as type of fertilization. One of them wrote responses such as *codominance is a type fertilisation whereby gametes fuse to form complete development of an organism* while *incomplete dominance is type of fertilisation whereby gametes do not fuse leading to incomplete development of an organism*. There were other candidates who used genetic symbols to illustrate the cross contrary to the demand of the question. This shows that the candidates had inadequate knowledge about the non Mendelian inheritance. Extract 5.1 is a sample of the candidates' incorrect responses to question 6.

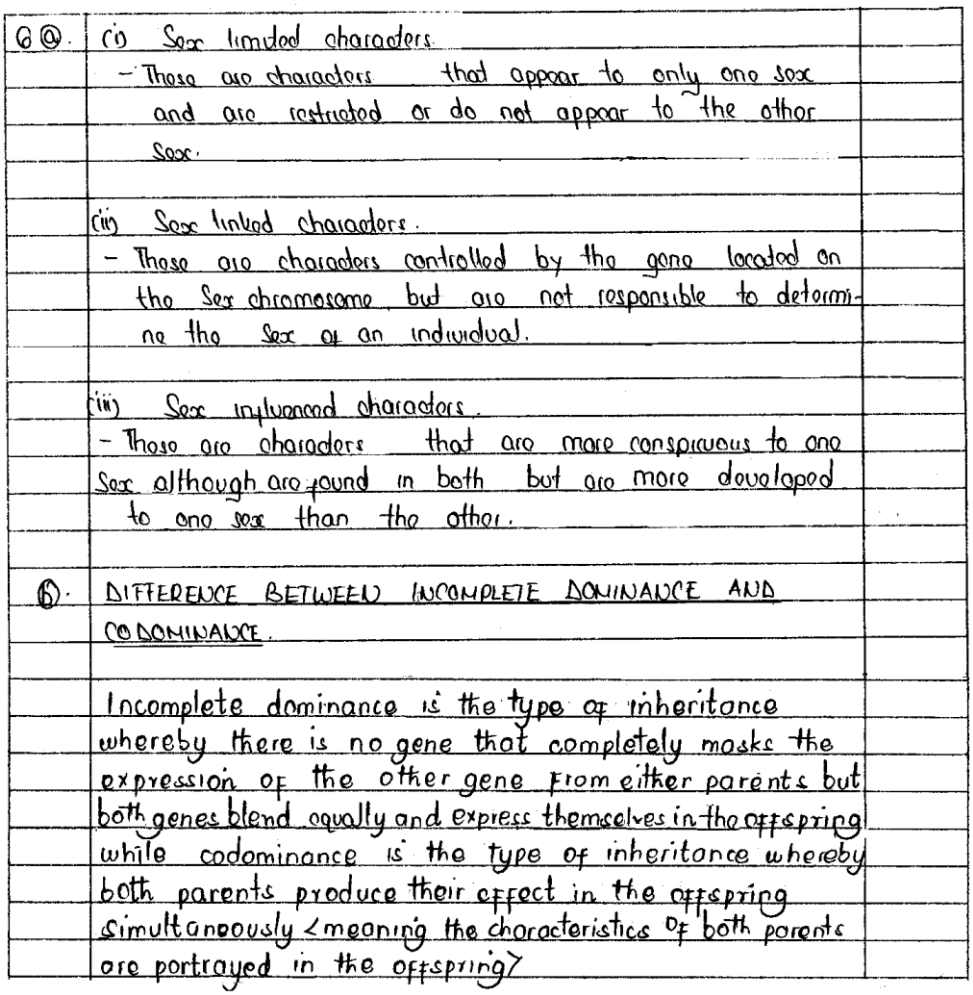


Extract 5.1: Candidate's incorrect response to question 6

In Extract 5.1, the candidate incorrectly explained the terms sex limited characters, sex linked characters and sex influenced characters in part (a). Also, he/she incorrectly differentiated continuous and discontinuous variation instead of incomplete dominance from codominance in part (b).

On the other hand, candidates who scored high marks (6 - 9) were aware of the sex determination and inheritance in part (a). The candidates explained correctly the terms sex limited characters, sex linked characters and sex influenced characters. Similarly, in part (b) they were aware of the meaning

of incomplete dominance and codominance as they are used in genetics. Therefore, they correctly differentiated the terms. Extract 5.2 is a sample of the candidates' correct responses to question 6.


6 @. (i) Sex limited characters
- Those are characters that appear to only one sex and are restricted or do not appear to the other Sex.

(ii) Sex linked characters.
- Those are characters controlled by the gene located on the Sex chromosome but are not responsible to determine the Sex of an individual.

(iii) Sex influenced characters.
- Those are characters that are more conspicuous to one Sex although are found in both but are more developed to one sex than the other.

(b). DIFFERENCE BETWEEN INCOMPLETE DOMINANCE AND CODOMINANCE.

Incomplete dominance is the type of inheritance whereby there is no gene that completely masks the expression of the other gene from either parents but both genes blend equally and express themselves in the offspring while codominance is the type of inheritance whereby both parents produce their effect in the offspring simultaneously <meaning the characteristics of both parents are portrayed in the offspring>

Extract 5.2: Candidate's correct response to question 6

In Extract 5.2, the candidate correctly explained the terms in part (a) and gave correct differences between incomplete dominance and codominance in part (b).

2.2.5 Question 7: Growth

The question required the candidates to explain the six factors which affect the rate of physical deterioration of human being.

This question was attempted by 529,395 (100%) candidates. Among them, 434,374 (82.05%) candidates scored from 0 to 2.5 marks out of whom, 141,133 (26.66%) scored 0 in this question. Candidates who scored from 3 to 5.5 marks were 67,479 (12.75%), whereas 27,542 (5.20%) scored from 6 to 9 marks, out of whom 4,580 (0.27%) candidates scored all the 9 marks. The performance of the candidates on this question was weak as the majority (82.05%) of them scored from 0 to 2.5 marks. Figure 7 summarises the candidates' performance in question 7.

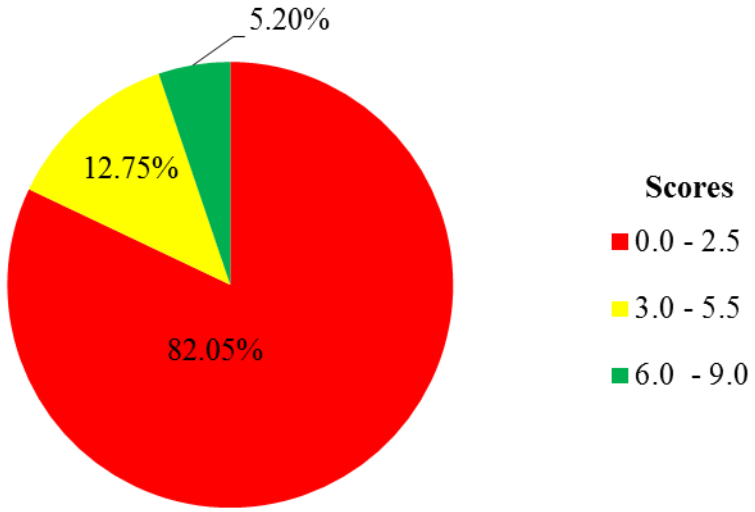
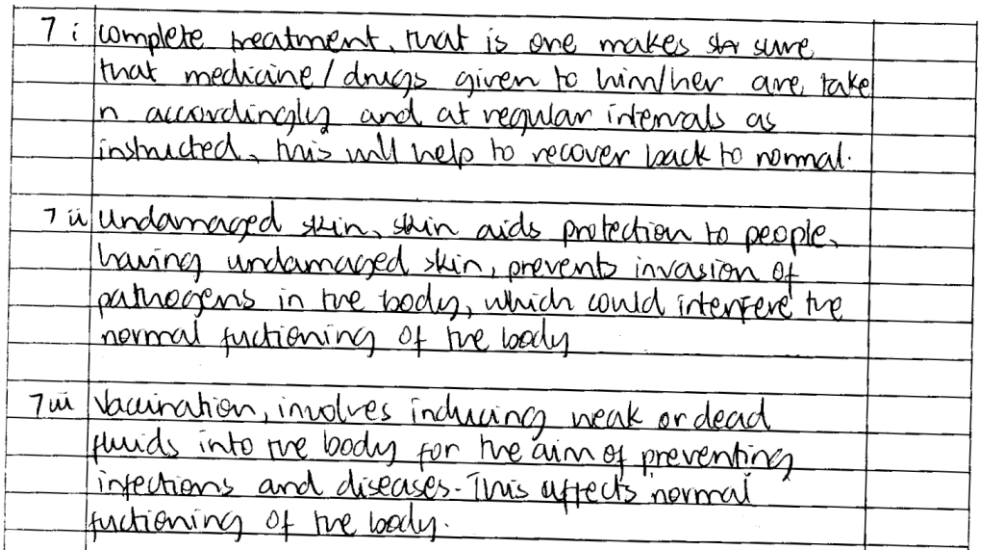


Figure 7: *Candidates' Performance on Question 7*

The candidates who scored low (0 - 2.5) marks had insufficient knowledge about growth and developmental stages in human. They ether listed three to four correct factors but failed to give explanation or gave correct explanation to one of the factors hence losing marks. The candidates who scored zero marks gave incorrect responses in all parts of the question. Some of them explained the characteristics of an old age such as *graying and loss of hair, loss of muscular strength, stiffening of joints, weakening of bones, lowered resistance to diseases, wrinkled skin and degeneration of nervous system*. Others explained the mechanisms of temperature

regulation in homoiotherms such as *shivering, contraction of hair erector muscles, increase of metabolic rate, vasoconstriction and behavioural modifications.* Moreover, some of the candidates explained the factors affecting gaseous exchange in mammals such as *altitude, carbon dioxide concentration, haemoglobin concentration, availability of oxygen* and *breathing rate* instead of factors which affect the rate of physical deterioration of human being. There were other candidates who wrote factors which affect the rate of growth and development in plants such as *light, temperature, water, amount of carbon dioxide and oxygen gas* instead of factors which affect the rate of physical deterioration of human being. Extract 6.1 is a sample of the candidates' incorrect responses to question 7.


7 i complete treatment. that is one makes sure that medicine / drugs given to him/her are take n accordingly and at regular intervals as instructed. this will help to recover back to normal.

7 ii Undamaged skin, skin aids protection to people. having undamaged skin, prevents invasion of pathogens in the body, which could interfere the normal functioning of the body

7iii Vaccination, involves inducing weak or dead fluids into the body for the aim of preventing infections and diseases. This affects normal functioning of the body.

Extract 6.1: Candidate's incorrect response to question 7

In Extract 6.1, the candidate explained the factors that affect body immunity such as *complete treatment* instead of the factors which affect the rate of physical deterioration of human being.

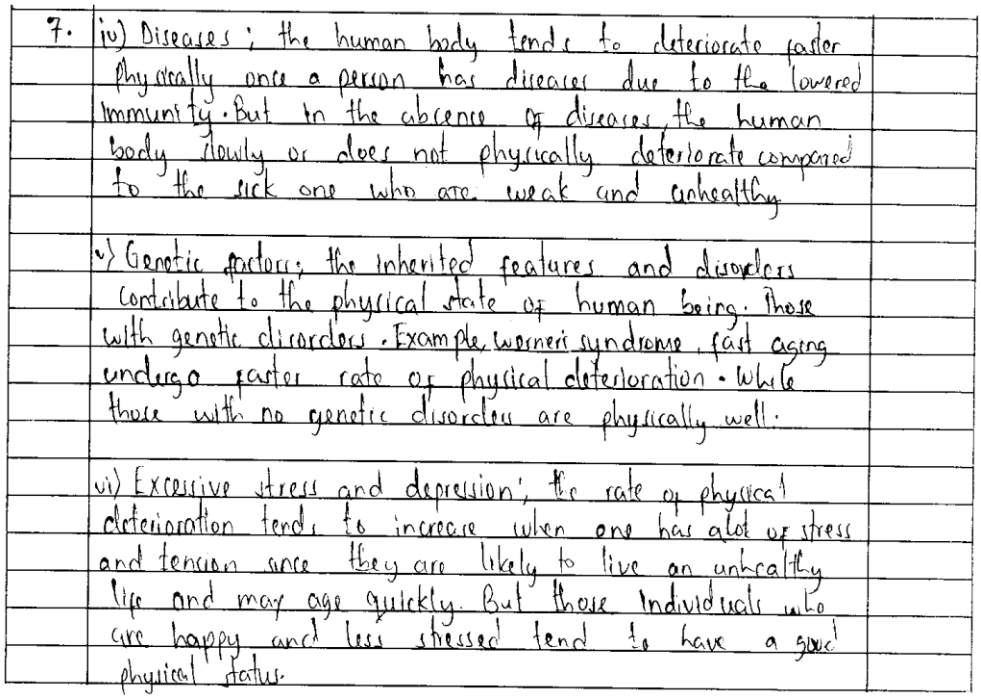
Conversely, candidates who scored high marks (6 - 9) were aware of growth and developmental stages in humans. They explained correctly the factors affecting the rate of physical deterioration of human body. Extract 6.2 is a sample of candidates' correct responses to question 7.

7. Factors which affect the rate of physical deterioriation of human being are;

i) Aging; the physical status of humans body depends on their age and number of years they have survived. Young people with small age tends to have a good and strong physical status. But old people of about 50 years and above, have poorly physical status due to wearing out and losing of strength of most of the organs and features in the body. Example, as one grows old, calcium production reduces in the bones hence one can not properly walk or stand

ii) Physical exercises; physical activities ~~of~~ strengthen the body of human beings and make them healthier. Thus, those who do physical exercises regularly have good physical status. But those who do not perform any physical exercises deteriorate faster.

iii) Food and nutrition; the food that a person takes into the body contributes alot to the physical state of human body. Intake of balanced diet and nutritious food strengthens the body immunity and improves physical status. But poor diet tends to increase the rate of physical deterioration.



Extract 6.2: Candidate's correct response to question 7

In Extract 6.2, the candidate correctly explained the factors which affect the rate of physical deterioration of the human body.

2.2.6 Question 8: Classification of Living Things

The question had two parts, (a) and (b). In part (a), the candidates were required to draw a diagram of the reproductive structures on a branch of pine tree and label its two parts. In part (b), they were required to explain the advantages of the pine trees.

The question was attempted by 529,395 (100%) candidates. Analysis shows that 243,214 (45.94%) candidates scored from 0 to 2.5 out of whom, 151,205 (28.56%) scored 0 in this question. The candidates who scored from 3 to 5.5 were 188,745 (35.65%) whereas 97,436 (18.41%) candidates scored from 6 to 9 marks, out of whom, 1,586 (0.30%) candidates scored all the 9 marks. The general performance was average since 54.06 per cent of the candidates scored from 3 to 9 marks. Figure 8 summarises the candidates' performance on question 8.

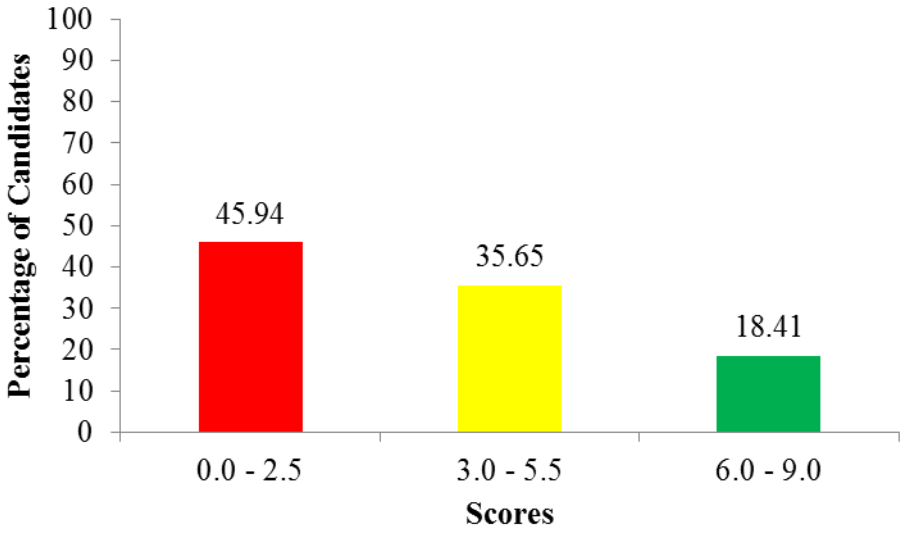
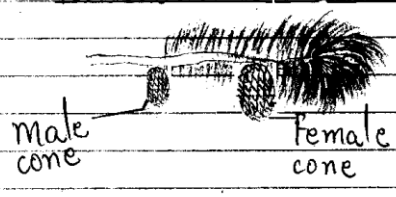


Figure 8: *Candidates' Performance on Question 8*

The candidates who scored high marks (6 - 9) had good drawing skills and were well informed about the Division Coniferophyta. Therefore, they drew correctly a labeled diagram of a pine tree showing male and female cones. In part (b), they explained correctly the advantages of pine trees. Extract 7.1 is a sample of candidates' correct responses to question 8.

8a: A DIAGRAM OF A BRANCH OF PINE TREE SHOWING REPRODUCTIVE STRUCTURES



8b: Three advantages of pine trees

i) They are used as a source of timber
Pine trees contain timbers which are used in various construction activities such as building

ii) They are used for decoration
Pine trees have good structures such as the Christmas trees and also produce cones which can be used for decorative purposes

iii) They are used to provide oxygen and eliminate carbondioxide in the environment
Pine trees help to absorb the carbon dioxide in the environment through photosynthesis and produce oxygen thus assist the life on earth

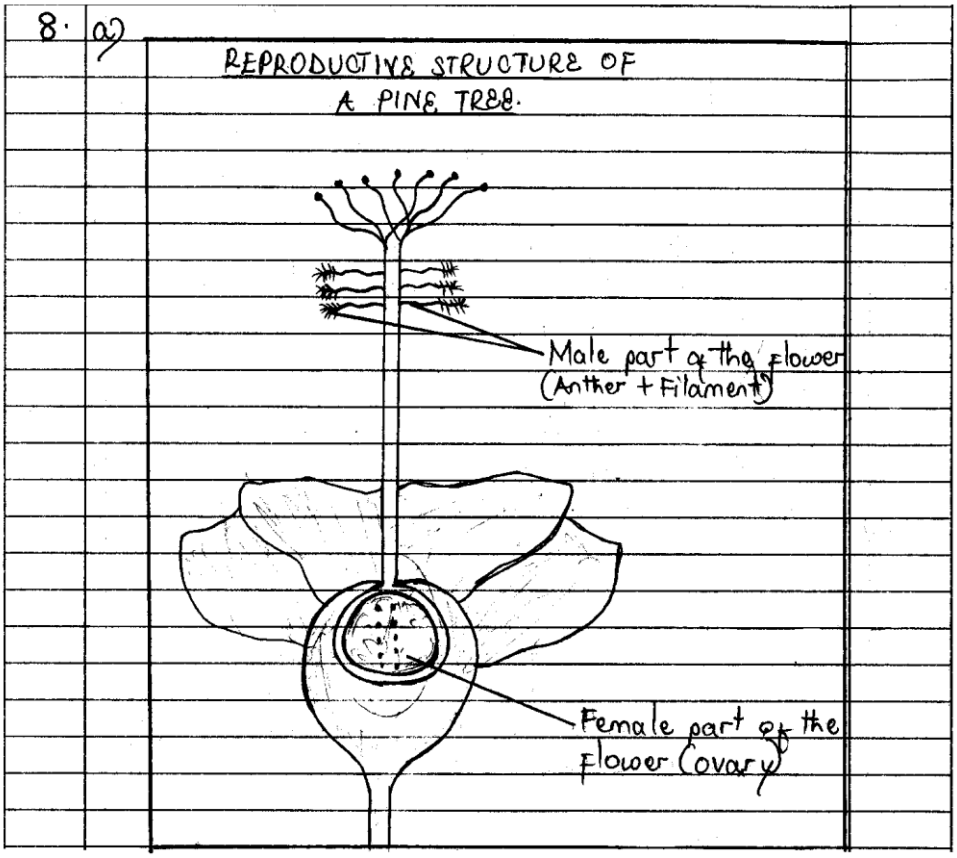
Extract 7.1: Candidate's correct response to question 8

In Extract 7.1, the candidate correctly drew a well labeled diagram of the pine tree consisting of male and female cones in part (a) and explained correctly the advantages of pine trees in part (b).

Conversely, 45.94 per cent of the candidates scored from 0 to 2.5 marks. These candidates either gave wrong responses in both parts thus losing all marks or drew wrong diagram but explained one advantage of the pine trees instead of three points or drew a right diagram but gave wrong advantages, hence loss of marks. The candidates who scored zero marks were not informed about Division Coniferophyta as most of them gave responses which were contrary to the demand of the question. In part (a),

some of the candidates drew reproductive structures of other organisms. For example, some drew a diagram of a frond leaf of a fern plant with sori. Others drew male and female reproductive systems of human being. There were other candidates who drew diagrams of bread mould, mushrooms, moss plant and cactus stem. Moreover, other candidates drew the branch of a pine tree but failed to locate the reproductive structures which were the male and female cones. This shows that these candidates were not exposed to either actual or picture of the pine plants.

In part (b), some of the candidates wrote general features of the Division Coniferophyta such as *they are non-flowering seed bearing plants, they have needlelike leaves and they produce naked seeds* instead of explaining the advantages of pine trees. Others outlined the disadvantages of pine trees such as *they are invasive with their massive roots* and *they have high concentration of resins which cause forest fire*. Moreover, other candidates explained the characteristics of Division Angiospermophyta such as *they have well developed leaves, stem and root system* and *they have enclosed seeds*. These candidates were not aware that pine trees have various uses such as source of food for animals, ornaments, source of timbers, provision of wood pulp and good windbreakers. Extract 7.2 is a sample of the candidates' incorrect responses to question 8(a).



Extract 7.2: Candidate's incorrect response to question 8(a)

In Extract 7.2, the candidate drew a diagram of a flower which is a reproductive structure of flowering plants instead of a diagram of the male and female cones on a branch of pine tree in part (a).

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 carried 15 marks, making a total of 30 marks.

2.3.1 Question 9: Safety in Our Environment

The question required the candidates to justify the statement: "poor waste disposal creates problems in the environment."

The question was attempted by 516,878 (97.64%) candidates. Analysis of the candidates' performance shows that, 296,237 (57.31%) scored from 0 to 4 marks, out of whom 56,886 (11.01%) scored 0 marks. The candidates

who scored from 4.5 to 9.5 marks were 73,930 (28.39%), whereas 24,336 (14.30%) scored from 10 to 15 marks, out of whom, 793 (1.12%) candidates scored all the 15 marks in this question. The performance of the candidates on this question was average as 42.69 per cent of the candidates scored 4.5 to 9.5 marks. Figure 9 summarises the candidates' performance on question 9.

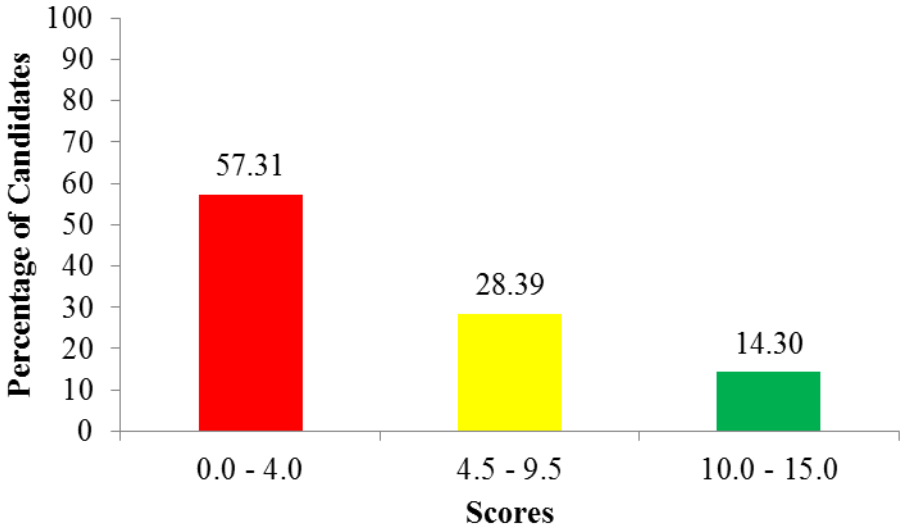


Figure 9: *Candidates' Performance on Question 9*

Figure 9 indicates that, the general performance on this question was average because 42.69 per cent scored from 4.5 to 15 marks. The candidates explained correctly the effects of poor waste disposal in the environment. This indicates that they were aware of the effects of poor waste disposal including accidental injuries, blockage of drainage systems and pollution. Also, they had a well organized essay with relevant introduction, main body and conclusion. Extract 8.1 is a sample of the candidates' correct responses to question 9.

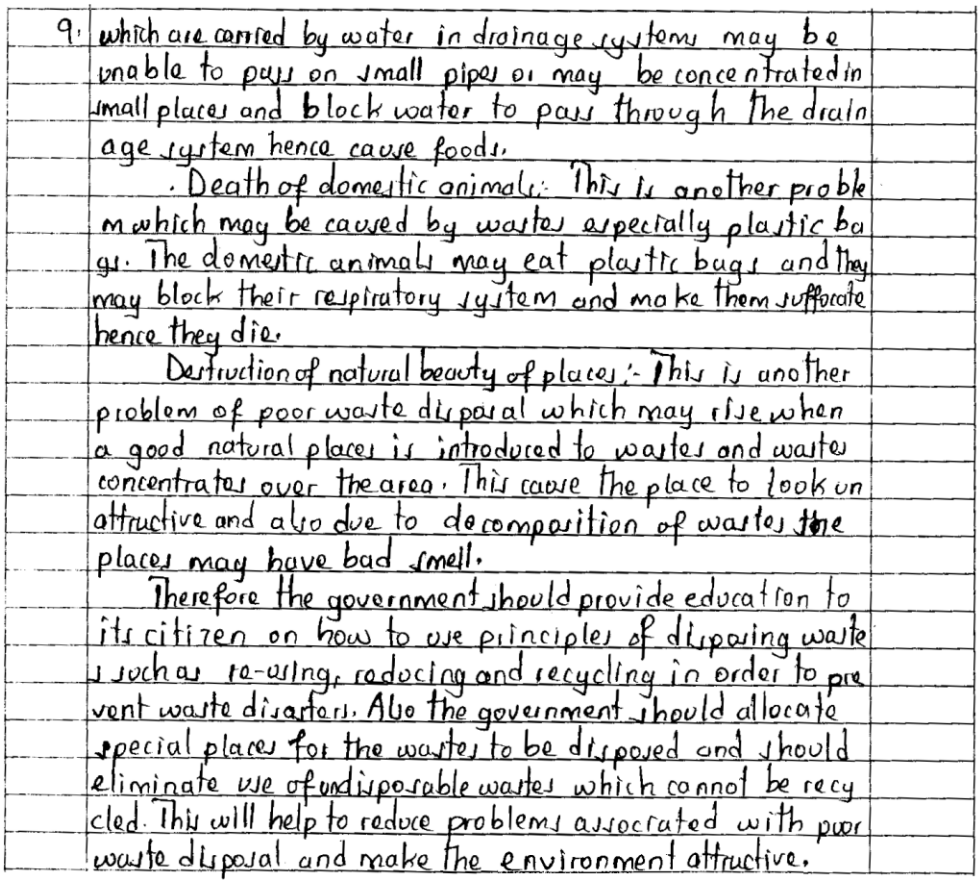
9 Poor waste disposal is the practice of disposing waste materials in wrong places. This occour when people are unable to remove wastes from the environment. It is accompanied with various problems which may result to environmental pollution. The following are the problems of poor waste disposal

Provide habitat for vectors of diseases:- Poor waste disposal results to the concentration of wastes in various places. This results to rise of vectors of diseases since they provide breeding site to the vectors such as mouse, cockroach, houseflies, and other dangerous animals such as snakes, scorpions and among others. These vectors like mosquito carries plasmodium which can cause malarial and tranimit to the people.

Water pollution:- This is the introduction of wastes to the water sources like rivers, dams, ponds, lakes and oceans. This cause death of aquatic animals since some of wastes contains poisonous substance and also concentration of wastes cause low oxygen level in water hence cause death to aquatic animals.

Air pollution:- This refers to the introduction of harmful gases into the air. This is through burning of hazardous wastes and those which cannot be decomposed such as plastics because when they are burnt they produce harmful gases which may result to air pollution and formation of acidic rain.

Blockage of drainage systems:- Also this is another problem which can be caused by waste materials whereby waste materials such as bottles and plastic bags


9. which are carried by water in drainage systems may be unable to pass on small pipes or may be concentrated in small places and block water to pass through the drainage system hence cause foods.

. Death of domestic animals: This is another problem which may be caused by wastes especially plastic bags. The domestic animals may eat plastic bags and they may block their respiratory system and make them suffocate hence they die.

Destruction of natural beauty of places:- This is another problem of poor waste disposal which may rise when a good natural places is introduced to wastes and waste concentrates over the area. This cause the place to look unattractive and also due to decomposition of wastes the places may have bad smell.

Therefore the government should provide education to its citizen on how to use principles of disposing waste such as re-using, reducing and recycling in order to prevent waste disasters. Also the government should allocate special places for the wastes to be disposed and should eliminate use of undisposable wastes which cannot be recycled. This will help to reduce problems associated with poor waste disposal and make the environment attractive.

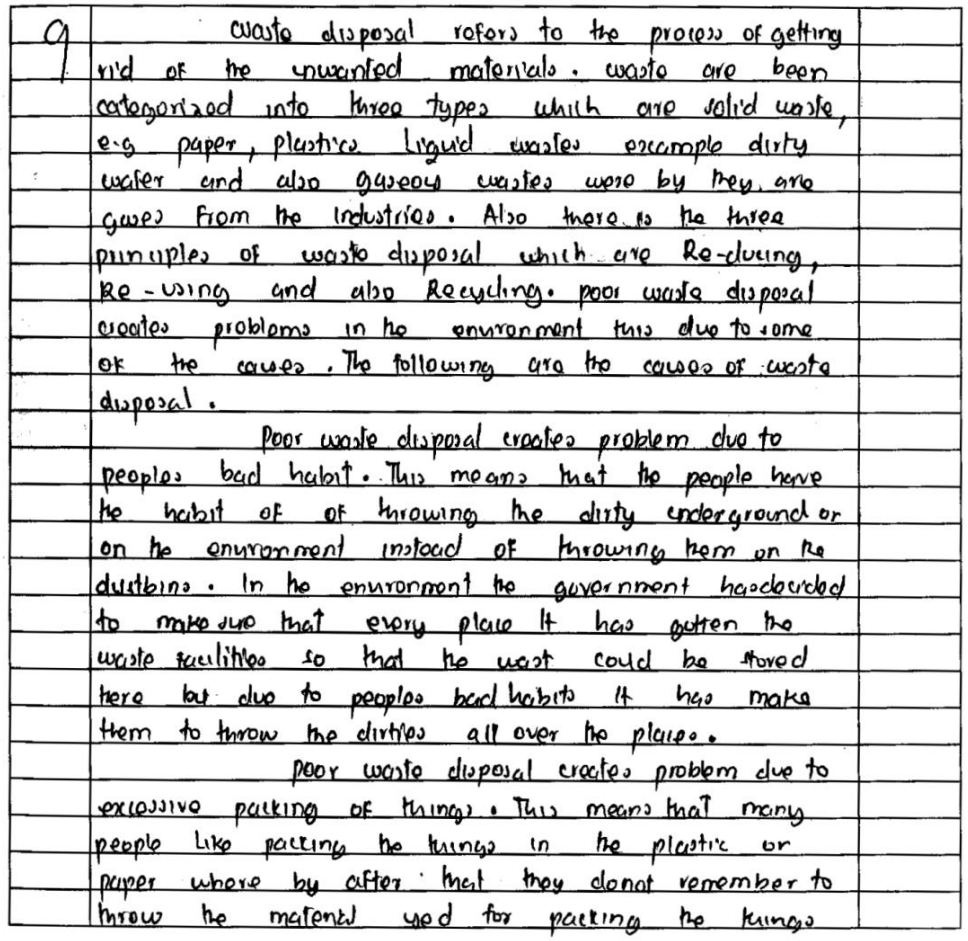
Extract 8.1: Candidate's correct response to question 9

In Extract 8.1, the candidate explained correctly the effects of poor waste disposal in the environment and gave relevant introduction and conclusion.

The candidates who scored low marks (0 - 4) were not conversant with the effects of poor waste disposal in the environment. Some candidates who scored 2 to 4 marks provided one to two correct effects of poor waste disposal and missed some points. Also, some failed to organize their ideas into introduction, main body and conclusion while others wrote incorrect introduction, main body and conclusion. For example, in the introduction the meaning of waste disposal lacked clarity. Other candidates defined environment instead of poor waste disposal.

In the main body, most of the candidates who scored low marks outlined the methods of waste disposal instead of the effects of poor waste disposal.

For example, some of them wrote *recycling, incineration, burying, composting animal feeding, and land filling.* Other candidates wrote the principles of proper waste disposal as *reducing, recycling* and *re-using* while others wrote the types of wastes based on physical state as *gaseous, liquid and solid*. There were other candidates who stated the effects of HIV/AIDS to the community such as *separation of families, poverty, and increased number of street children, school dropouts and depopulation* instead of the effects of poor waste disposal. Moreover, these candidates lacked appropriate essay writing skills as their essay were not well organized into introduction, main body and conclusion. This indicates that, the candidates were not conversant with waste disposal especially the effects of poor waste disposal in the environment. Extract 8.2 is a sample of the candidates' incorrect responses to question 9.

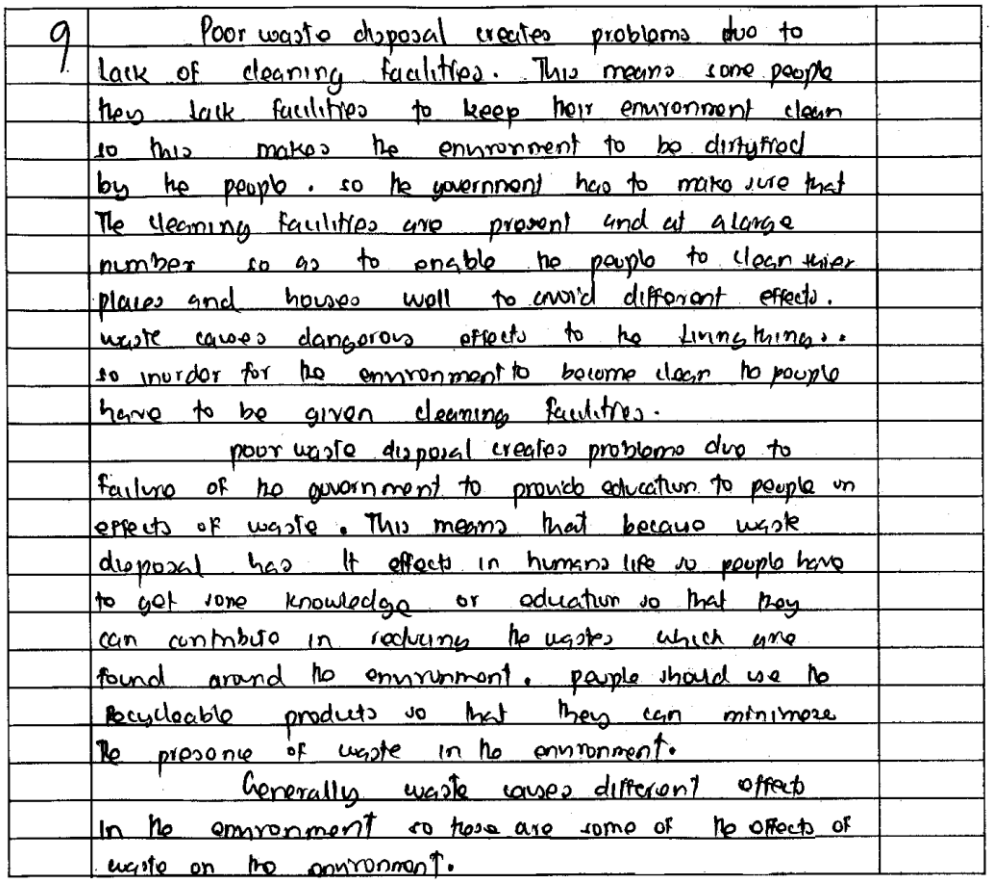


9 waste disposal refers to the process of getting rid of the unwanted materials. waste are been categorized into three types which are solid waste, e.g paper, plastics Liquid wastes example dirty water and also gaseous wastes were by they are gases from the industries. Also there is the three principles of waste disposal which are Re-cleving, Re-using and also Recycling. poor waste disposal creates problems in the environment this due to some of the causes. The following are the causes of waste disposal.

Poor waste disposal creates problem due to peoples bad habit. This means that the people have the habit of of throwing the dirty underground or on the environment instead of throwing them on the dustbins. In the environment the government has decided to make sure that every place it has gotten the waste facilities so that the waste could be stored there but due to peoples bad habits it has make them to throw the dirties all over the places.

poor waste disposal creates problem due to excessive packing of things. This means that many people like packing the things in the plastic or paper where by after that they donot remember to throw the material used for packing the things

9	In he dustbin. Therefore he people have to stop using many things inorder to pack few thing this is simply because it causes he environment to be destroyed and to become dirty. so excessive packing causes a problem in he environment. Poor waste disposal creates problems due to failure of he cleaners in town to get rid of waste. This means That in he towns there special peoples who are assigned in cleaning them. due to failure of he town cleaners to clean he towns it causes he environment to be distirbed by he people. so he government should make a follow up to he town cleaners if they clean he town daily. In our towns he government has tried its Level best to keep he specific day of cleaning he whole town which is only on saturday so he people who are responsible they deal with activities which helps in making he environment clean. so due to this it makes people to creates problem in he environment. poor waste disposal creates problems due to failure of he government to provide strict punishment to people. This means that when people do not follow he laws and instructions which are been given by he government They make he environment to become more dirty so The government should also play its part in making he people to stop he people to make them cause he environment to become very dirty. so The government has decided to keep punishment to he people so that they can follow and make sure that all he people they follow it and make he environment clean.	


9. Poor waste disposal creates problems due to lack of cleaning facilities. This means some people they lack facilities to keep heir environment clean so this makes he environment to be dirtyfied by he people. so he government has to make sure that The cleaning facilities are present and at a large number so as to enable he people to clean their places and houses well to avoid different effects. waste causes dangerous effects to he living things. so inorder for he environment to become clean he people have to be given cleaning facilities.

poor waste disposal creates problems due to failure of he government to provide education to people on effects of waste. This means that because waste disposal has it effects in humans life so people have to get some knowledge or education so that they can contribute in reducing he wastes which are found around he environment. people should use he Recycleable products so that they can minimize The presence of waste in he environment.

Generally waste causes different effects In he environment so these are some of he effects of waste on he environment.

Extract 8.2: Candidate's incorrect response to question 9

In Extract 8.2, the candidate defined waste disposal instead of poor waste disposal in the introduction. Also, he/she explained the causes of poor waste disposal such as *lack of cleaning facilities* in the main body instead of problems caused by poor waste disposal. The conclusion was incorrect as well.

2.3.2 Question 10: Transport of Materials in Living Things

The question required the candidates to analyse the features that make the human heart to pump blood efficiently.

The analysis show that this question was the least opted compared to question 9 and 11 as a total of 77,937 (14.72%) candidates responded to the question. Analysis of the candidates' performance shows that, 61,316 (78.67%) scored from 0 to 4 marks among whom, 52 367 (67.19%) scored 0 marks in this question. The candidates who scored from 4.5 to 9.5 marks were 6,166 (7.92%), whereas 10,455 (13.41%) scored from 10 to 15 marks, out of whom 2,503 (3.21%) candidates scored all the 15 marks. Figure 10 summarises the candidates' performance on question 10.

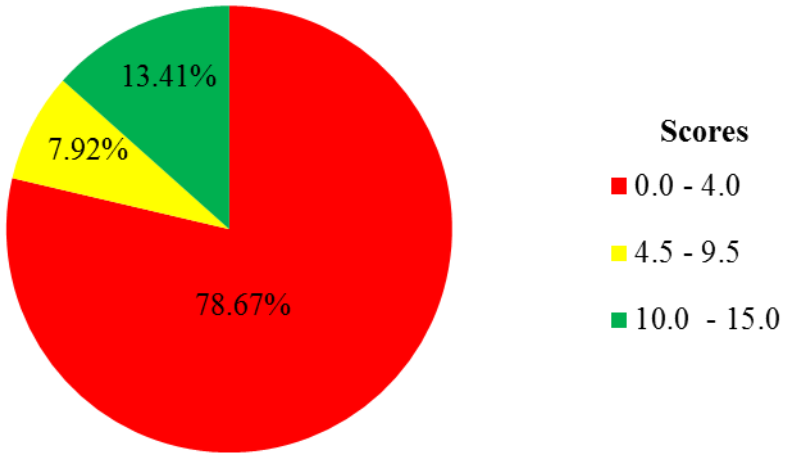
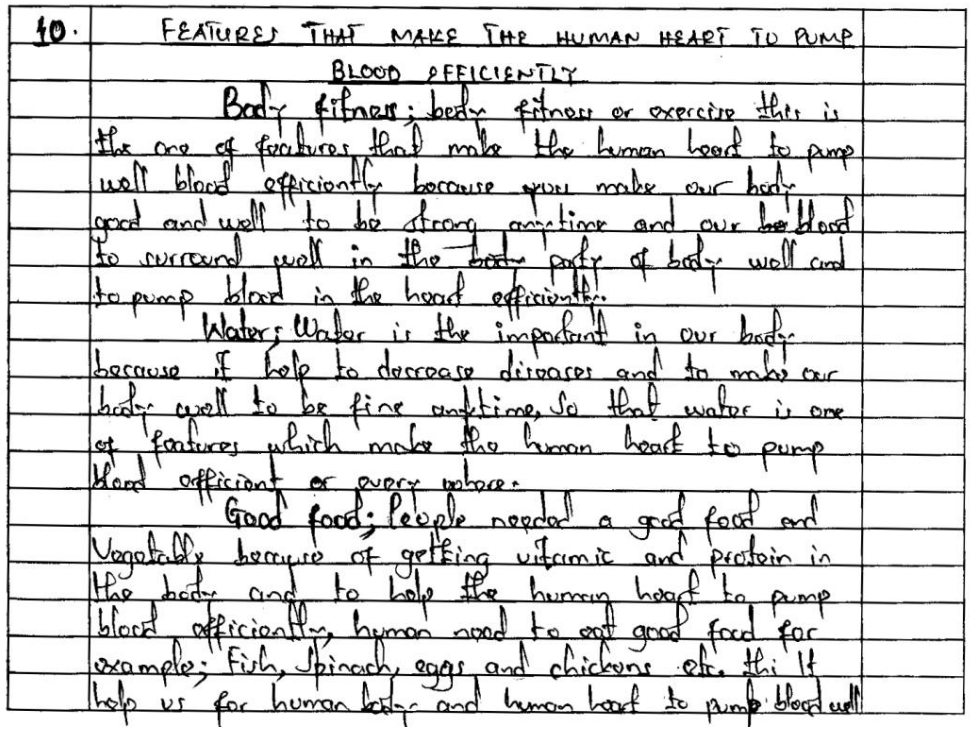


Figure 10: *Candidates' Performance on Question 10*

The candidates who scored low marks (0 - 4) were not aware of the structure and functions of the mammalian heart. Most of them wrote correct introduction and mentioned only three to four features which enable the heart to pump blood efficiently. Those candidates who scored 0 marks wrote incorrect introduction, body and conclusion. For example, some candidates wrote *heart is an organ which carries blood; Is an organ which*

produces blood instead of the organ which pumps blood in the human body.

In the main body, some of the candidates drew a diagram of the mammalian heart and labeled it instead of explaining how the parts of the human heart enable it to pump blood efficiently. Others mistook the function of the blood with the features which make the heart to pump blood. For instance, one candidate wrote *it transport hormones to the target organs, initiates blood clotting, distribute heat to the body, transport nutrients and transport wastes such as urea.* This shows that, the candidates had inadequate knowledge about structure and function of the mammalian heart or they did not understand the demand of question due to language problem. Extract 9.1 is a sample of candidates' incorrect responses to question 10.

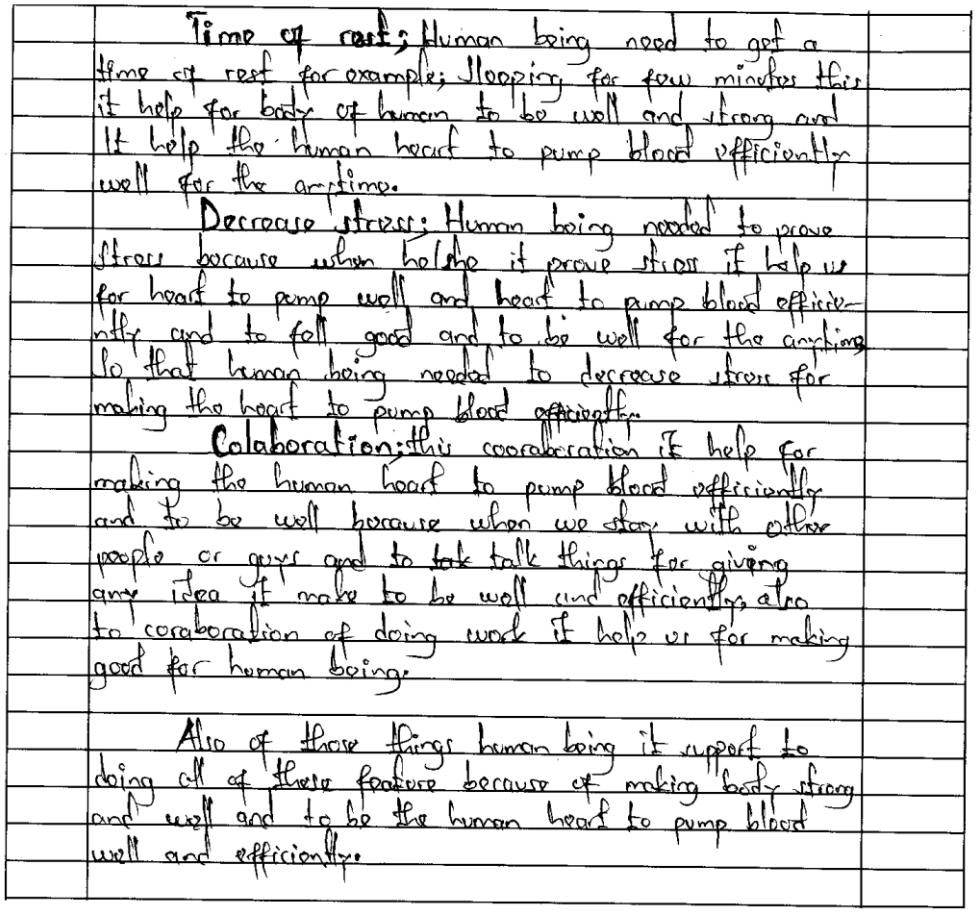


10. FEATURES THAT MAKE THE HUMAN HEART TO PUMP BLOOD EFFICIENTLY

Body fitness; body fitness or exercise this is the one of features that make the human heart to pump well blood efficiently because you make our body good and well to be strong anytime and our the blood to surround well in the body parts of body well and to pump blood in the heart efficiently.

Water; Water is the important in our body because it help to decrease diseases and to make our body well to be fine anytime, so that water is one of features which make the human heart to pump blood efficient or every where.

Good food; people needed a good food and Vegetable because of getting vitamin and protein in the body and to help the human heart to pump blood efficiently, human need to eat good food for example; Fish, Spinach, eggs and chickens etc. this it help us for human body and human heart to pump blood well


Time of rest; Human being need to get a time of rest for example; Sleeping for few minutes this it help for body of human to be well and strong and It help the human heart to pump blood efficiently well for the anytime.

Decrease stress; Human being needed to prove Stress because when he/she it prove stress if help us for heart to pump well and heart to pump blood efficiently and to feel good and to be well for the anytime so that human being needed to decrease stress for making the heart to pump blood efficiently.

Colaboration; this coorabaration it help for making the human heart to pump blood efficiently and to be well because when we stay with other people or guys and to talk talk things for giving any idea it make to be well and efficiently also to corabaration of doing work it help us for making good for human being.

Also of these things human being it support to doing all of these feature because of making body strong and well and to be the human heart to pump blood well and efficiently.

Extract 9.1: Candidate's incorrect response to question 10

In Extract 9.1, the candidate gave factors which a person has to consider for staying healthy such as *water, time to rest, good food, and decrease stress* instead of analyzing the features which enable the heart to pump blood efficiently.

The candidates who scored high marks (10 - 15) had adequate knowledge about the structure of the mammalian heart. Therefore, they analysed correctly the features which facilitate the human heart to pump blood efficiently. The candidate also had good command of the English language and good essay writing skills. Extract 9.2 is a sample of the correct responses from one of the candidates to question 10.

10. Human heart is a pumping organ in the body. This is a very important organ in human body which acts as the centre of the circulatory (blood) system as it pumps blood to all parts of the body. The human heart here is said to be the size of a folded fist. It has four chambers, the auricles and ventricles which are left and right auricles and left and right ventricles.

For the heart to perform its functions efficiently it has the following features:

Muscular walls. The human heart is made up of muscles in its walls which are very strong and can allow contraction and relaxation of the heart as it pumps blood. Such muscles contracts without being fatigued easily.

Cardiac muscles. The human heart is made up of specialized muscles which have the unique characteristic and ability of contracting and relaxing to pump blood without being fatigued. Such muscles are always working throughout the lifetime of an organism and can only be found in the heart. They are interconnected muscles which have nucleus and mitochondria for ATP provision of sufficient energy to contract and relax without being fatigued.

10. Septum. This refers to a thick wall which separates the heart into two parts which is the left side and right side. This wall plays a great role in separation of oxygenated blood from the deoxygenated blood so as to prevent the blood from mixing up inorder to facilitate circulation of oxygenated and deoxygenated blood separately within the heart to the body and back.

Valves. These refers to specialized flaps which are found within the human heart so as to ensure blood flow in one direction. They ensure that the blood does not alternate or flow in the opposite direction as it may cause death.

Sinoatrial node. This is the feature in the human heart which sets a specific time and rate for the contraction and relaxation of the heart when pumping blood. This results into set of pulse rate which can be felt on the arm of humans. It enables the heart not to pump blood randomly but at a specific time and rate. It functions similarly to a device known as pacemaker which is usually used once the sinoatrial node can not function in poor heart conditions.

Blood capillaries and vessels. The human heart is well supplied with a network of blood cappillaries and vessels which are responsible for transportation of deoxygenated blood from body to heart, oxygenated blood from the heart to the body, they also supply the heart with nutrients for its nourishment and supply the heart with all requirements. Example, aorta which carries oxygenated blood from the heart to the body

In conclusion, the human heart is very essential and an important organ to the body once the heart stops pumping blood there will be no circulation or movement of the blood in the body which may lead to death once the brain is deprived of oxygen. Human beings should take care of the heart by reducing intake of foods with fats that cause cholestrol and blood pressure.

Extract 9.2: Candidate's correct response to question 10

In Extract 9.2, the candidate correctly analysed the features that make the human heart to pump blood efficiently and gave a good introduction and conclusion.

2.3.3 Question 11: Health and Immunity

The question required the candidates to suggest five measures to be taken by the malaria victim to avoid the disease in future.

The analysis shows that 463,975 (87.64%) candidates responded to this question. About, 218,137 (51.33%) candidates scored from 0 to 4 marks, out of whom, 75,021 (16.17%) scored 0 in this question. Candidates who scored from 4.5 to 9.5 marks were 143,871 (31.00%), whereas 81,967 (17. 67%) scored from 10 to 15 marks, out of which, 10,414 (2.24%) candidates scored all the 15 marks. The general performance was average since 48.67 per cent of the candidates scored from 4.5 to 15 marks. Figure 11 summarizes the candidates' performance on question 11.

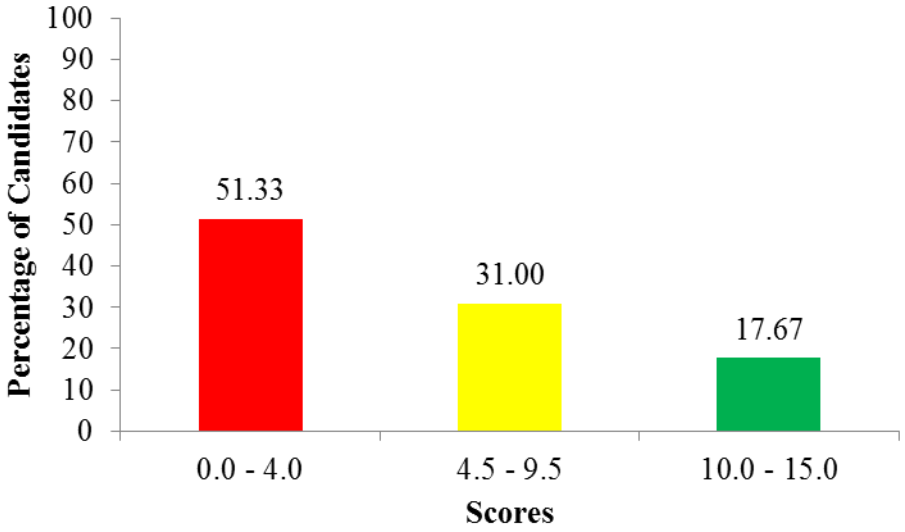
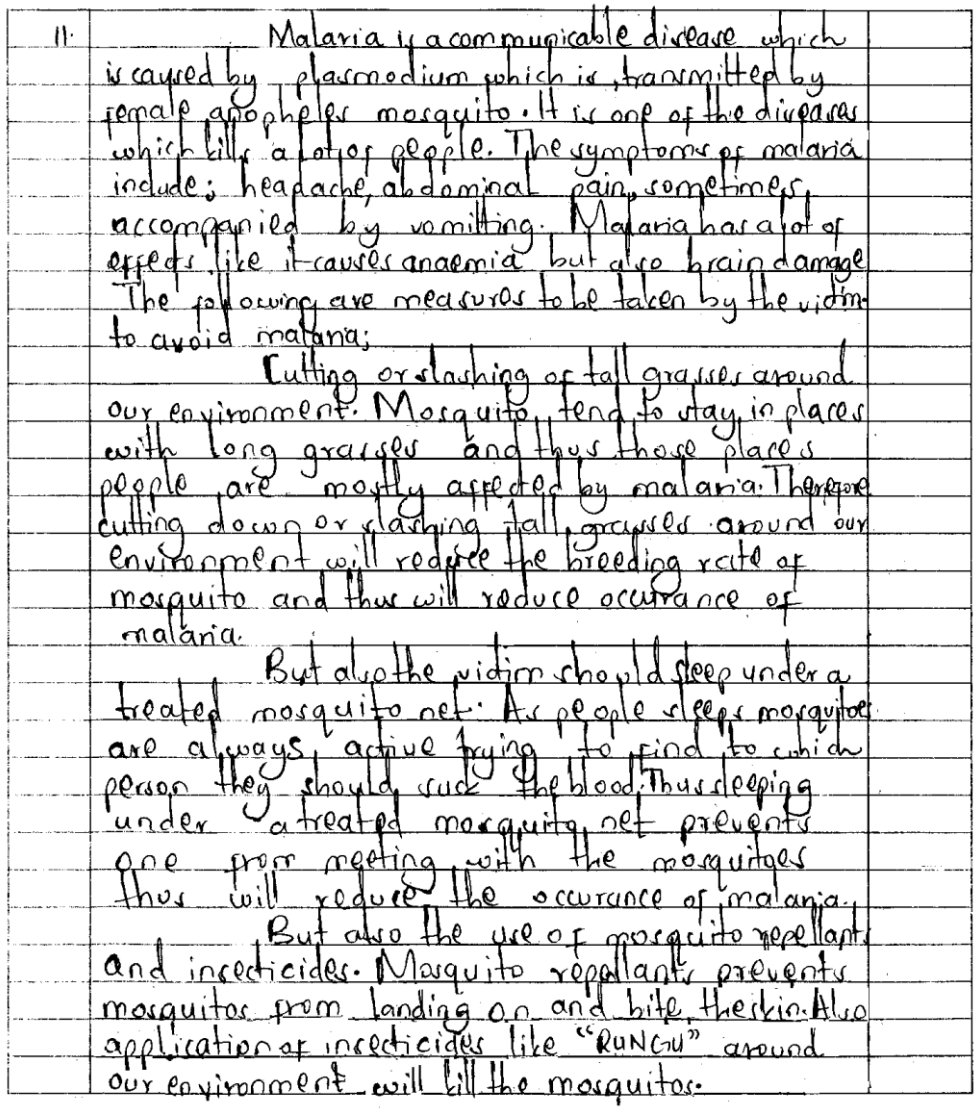


Figure 11: *Candidates' Performance on Question 11*

The candidates who scored high marks had adequate knowledge about infections and diseases specifically on the ways of preventing diseases. Thus, they correctly suggested five measures to be taken by the malaria victim to avoid the disease in future. The candidates also organised their responses in an essay form as they provided introduction, main body and

conclusion. This indicates that the candidates were competent in essay writing and aware of the appropriate preventive and control measures for common infections and diseases, particularly malaria. Extract 10.1 is a sample of the candidate's correct responses to question 11.

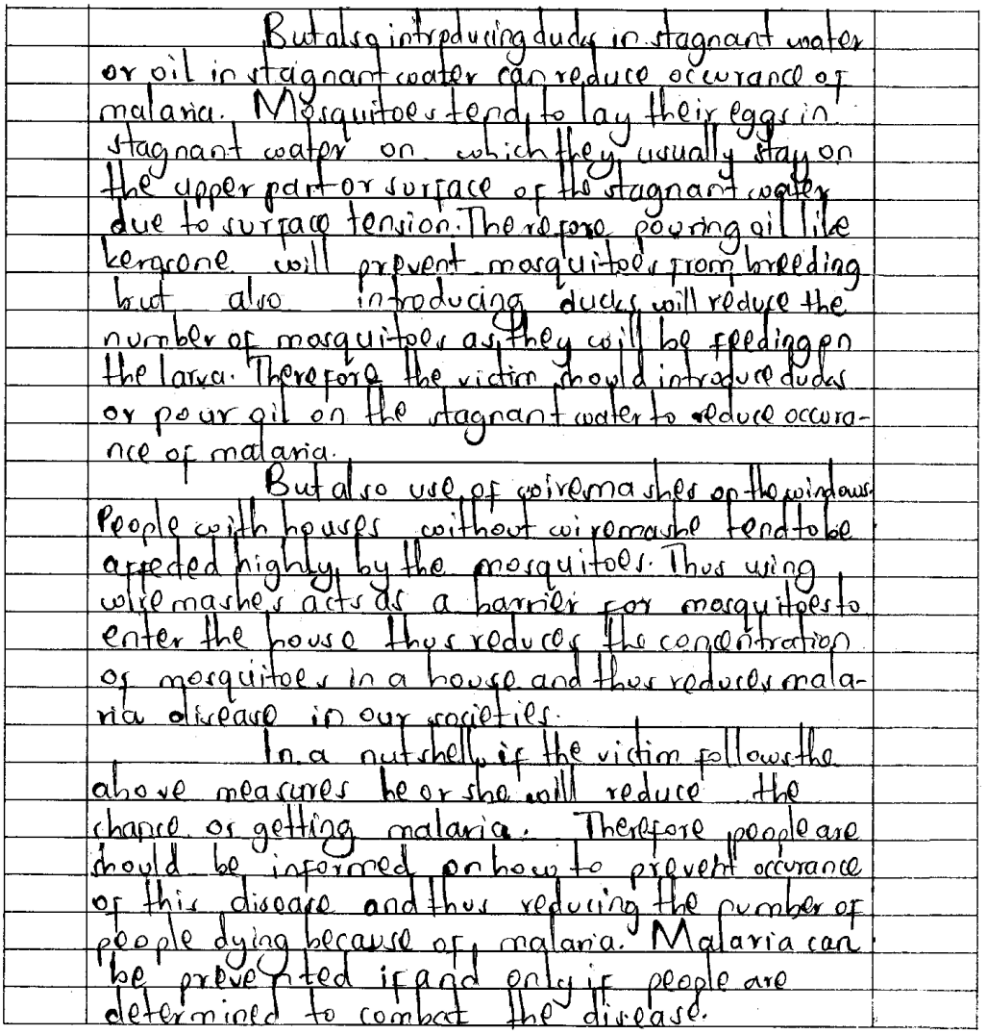


11. Malaria is a communicable disease which is caused by plasmodium which is transmitted by female anopheles mosquito. It is one of the diseases which kills a lot of people. The symptoms of malaria include; headache, abdominal pain, sometimes accompanied by vomiting. Malaria has a lot of effects like it causes anaemia but also brain damage. The following are measures to be taken by the victim to avoid malaria;

Cutting or slashing of tall grasses around our environment. Mosquito tend to stay in places with long grasses and thus those places people are mostly affected by malaria. Therefore cutting down or slashing tall grasses around our environment will reduce the breeding rate of mosquito and thus will reduce occurance of malaria.

But also the victim should sleep under a treated mosquito net. As people sleeps mosquitoes are always active trying to find to which person they should suck the blood. Thus sleeping under a treated mosquito net prevents one from meeting with the mosquitoes thus will reduce the occurance of malaria.

But also the use of mosquito repellants and insecticides. Mosquito repellants prevents mosquitos from landing on and bite the skin. Also application of insecticides like "RUNGU" around our environment will kill the mosquitos.


But also introducing ducks in stagnant water or oil in stagnant water can reduce occurance of malaria. Mosquitoes tend to lay their eggs in stagnant water on which they usually stay on the upper part or surface of the stagnant water due to surface tension. Therefore pouring oil like kerosene will prevent mosquitoes from breeding but also introducing ducks will reduce the number of mosquitoes as they will be feeding on the larva. Therefore the victim should introduce ducks or pour oil on the stagnant water to reduce occurance of malaria.

But also use of wiremashes on the windows People with houses without wiremashe tend to be affected highly by the mosquitoes. Thus using wiremashes acts as a barrier for mosquitoes to enter the house thus reduces the concentration of mosquitoes in a house and thus reduces malaria disease in our societies.

In a nutshell, if the victim follows the above measures he or she will reduce the chance of getting malaria. Therefore people are should be informed on how to prevent occurance of this disease and thus reducing the number of people dying because of malaria. Malaria can be prevented if and only if people are determined to combat the disease.

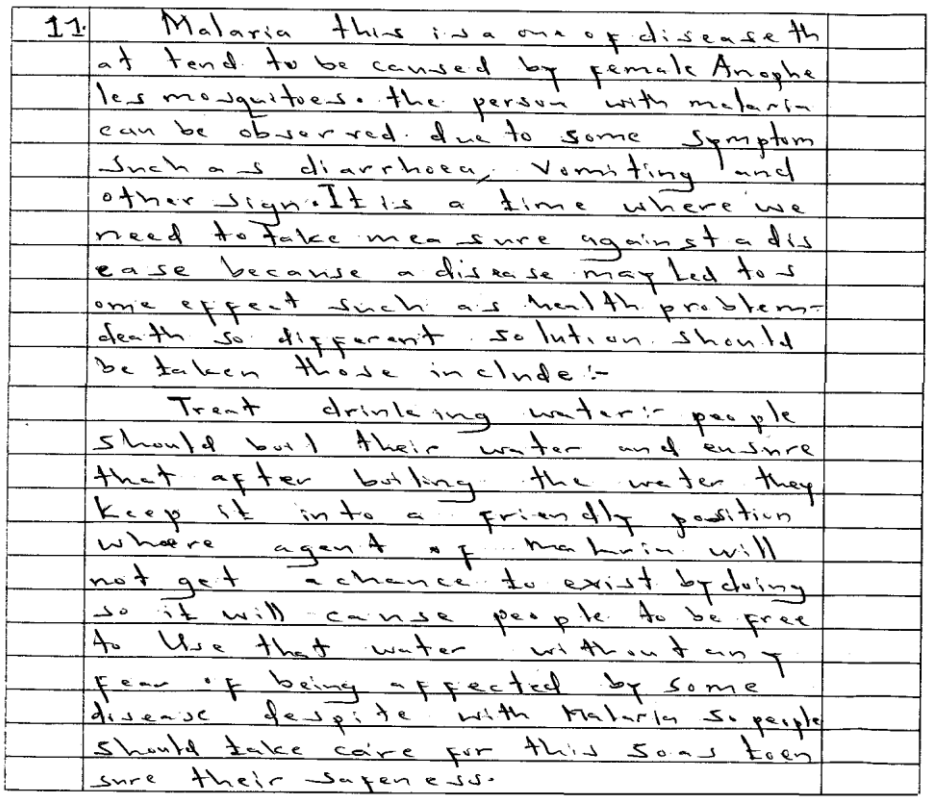
Extract 10.1: Candidate's correct response to question 11

In Extract 10.1, the candidate correctly explained the preventive measures against malaria, thus scoring high marks. The candidate also had good essay writing skills.

The candidates who scored low marks (0 - 4) were not aware of the preventive and control measures for common infections and diseases, particularly malaria. Most of the candidates who scored 1 to 4 marks wrote either correct introduction and outlined three to four preventive measures of malaria and lacked skills on essay writing as they just outlined the points. For the candidates who scored 0 wrote incorrect answers and others wrote irrelevant points for the preventive measures of malaria. For

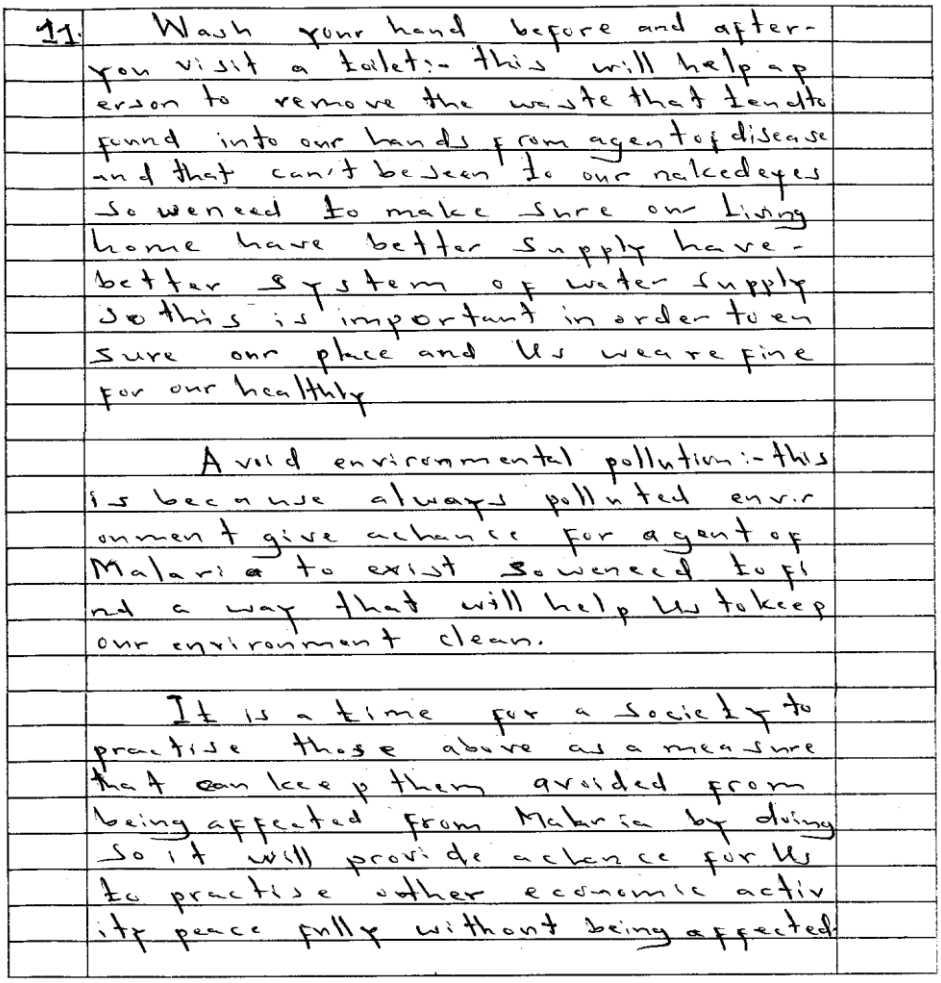
example, some of them wrote that *malaria is caused by female anopheles mosquito and bacteria* instead of a plasmodium. Others wrote *malaria is a non-communicable disease* instead of communicable.

In the main body, most of the candidates explained preventive measures of other diseases such as tuberculosis instead of malaria. For instance one candidates wrote that malaria can be prevented by *living in well ventilated rooms; avoid overcrowded areas* and *isolating the patients*. Others stated preventive measures of HIV/AIDS such as *avoid transfusion of unscreened blood, avoid drug abuse* and *avoid unsafe sexual intercourse*. There were other candidates who stated the symptoms of malaria such as *headache, increase of temperature, loss of appetite and feeling cold* instead of preventive measures of malaria. Such candidates did not understand that the preventive measures against malaria were sleeping under treated mosquito net, draining stagnant water, cutting long grass in residential areas, using mosquito repellents and seeking immediate medical treatment. Extract 10.2 (a) is a sample of candidates' incorrect responses to question 11.



11. Malaria this is a one of disease th
at tend to be caused by female Anophe
les mosquitoes. the person with malaria
can be observed due to some symptom
such as diarrhoea, vomiting and
other sign. It is a time where we
need to take measure against a dis
ease because a disease may led to s
ome effect such as health problem-
death so different solution should
be taken those include:-

Treat drinking water: people
should boil their water and ensure
that after boiling the water they
keep it into a friendly position
where agent of malaria will
not get a chance to exist by doing
so it will cause people to be free
to use that water without any
fear of being affected by some
disease despite with malaria so people
should take care for this so as to ens
sure their safeness.


11. Wash your hand before and after-
you visit a toilet:- this will help a p
erson to remove the waste that tend to
found into our hands from agent of disease
and that can't be seen to our naked eyes
So we need to make sure our Living
home have better supply have -
better System of water supply
So this is important in order to en
Sure our place and us we are fine
for our healthly

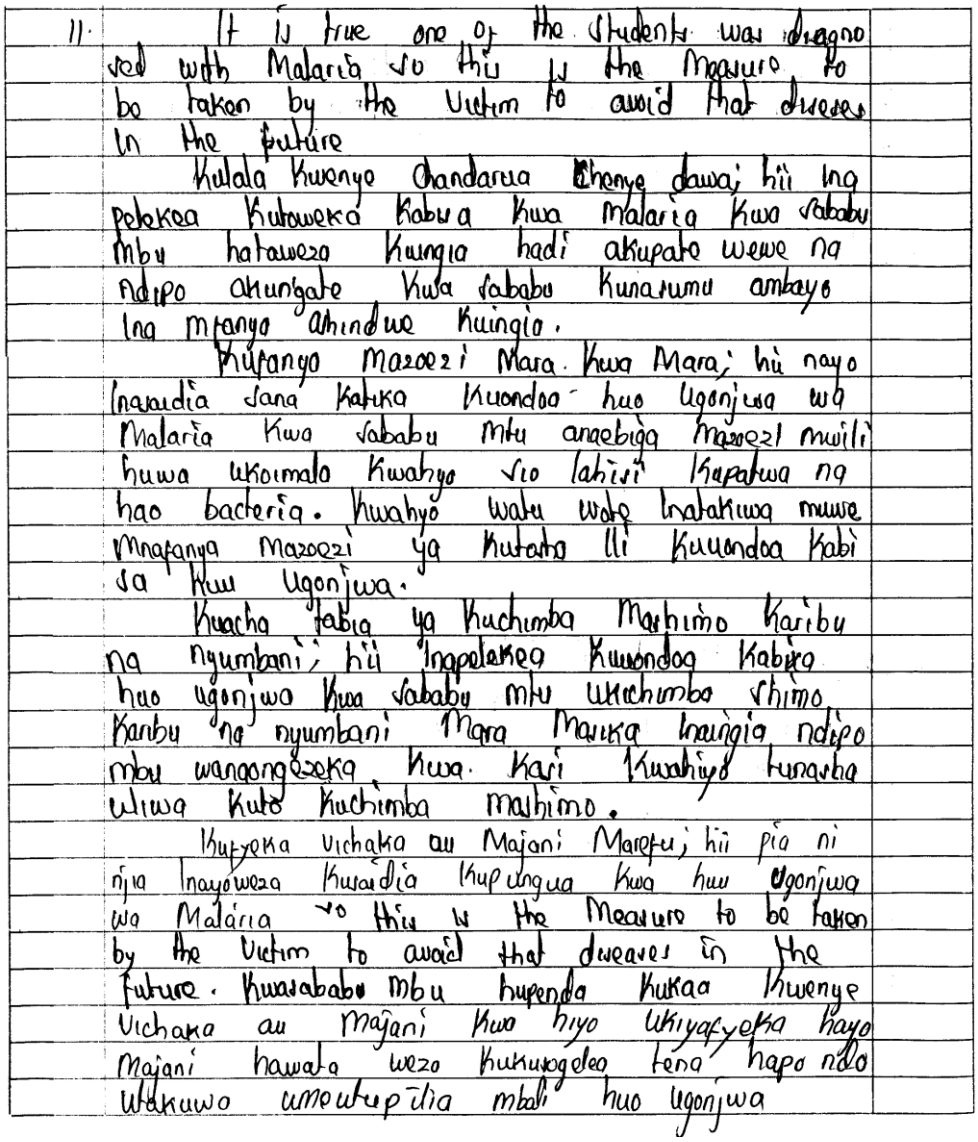
Avoid environmental pollution:- this
is because always polluted envir
onment give achance for agent of
Malaria to exist So we need to fi
nd a way that will help us to keep
our environment clean.

It is a time for a Society to
practise those above as a measure
that can keep them avoided from
being affected from Malaria by doing
So it will provide achance for us
to practise other economic activ
ity peace fully without being affected.

Extract 10.2 (a): Candidate's incorrect response to question 11

In Extract 10.2 (a), the candidate wrote incorrect introduction. For example he/she wrote *malaria is caused by female anopheles mosquito* instead of plasmodium. Also, he/she suggested the preventive measures for cholera such as *treat drinking water* instead of preventive measures for malaria. The conclusion was incorrect as well.

Further analysis of the candidates' responses reveals that some of the candidates failed to express their responses in English language instead they used Kiswahili language, contrary to the language of instruction. This implies that candidates had poor mastery of the language of instruction. Extract 10.2 (b) is a sample of candidates' incorrect response to question 11.


11. It is true one of the students was diagnosed with Malaria so this is the measure to be taken by the Victim to avoid that diseases in the future

Kulala kwenye chandarua chenye dawa; hii ina pekeka kutoweka kabisa kwa malaria kwa sababu mbu hataweza kuingia hadi akupate wewe na ndipo akuingate kwa sababu kunatumu ambayo ina mfanya ahindwe kuingia.

Kufanya mazoezi Mara kwa Mara; hii nayo inasaidia sana katika kuondoa huo ugonjwa wa Malaria kwa sababu mtu anaebiga mazoezi muili huwa ukoimalo kwahyo vio lahisi kupatwa na hao bacteria. kwahyo watu wote inatakiwa muwe mnafanya mazoezi ya kutosha ili kuondoa kabisa ha kuu ugonjwa.

Kuacha tabia ya kuchimba mashimo karibu na nyumbani; hii inapelekea kuondoa kabisa huo ugonjwa kwa sababu mtu akichimba shimo karibu na nyumbani Mara maiska kuingia ndipo mbu wanaongezeka kwa. Kazi kwahiyo kunasaba ukiwa kuto kuchimba mashimo.

Kufyeka vichaka au majani marefu; hii pia ni njia inayoweza kusaidia kupunguza kwa huu ugonjwa wa Malaria so this is the measure to be taken by the victim to avoid that diseases in the future. kwasababu mbu hupenda kukaa kwenye vichaka au majani kwa hiyo akiyafyeka hayo majani hawata wezo kukuogolea tena hapo ndo atakuwa ameukupitia mbali huo ugonjwa

Extract 10.2 (b): Candidate's incorrect responses to question 11

In Extract 10.2 (b), the candidates used English and Kiswahili in responding to the question. However, the introduction and some points on preventing malaria such as *kufanya mazoezi* (exercises) were incorrect. On the other hand, the points such as *kulala kwenye chandarua chenye dawa* (sleeping under treated mosquito nets) and *kufyeka vichaka au majani marefu* (Slashing bushes or long grasses) were correct but lost marks due to the use of Kiswahili which is not the language of instruction. Also he/she did not provide a conclusion.

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

This section presents the analysis of practical examination which had three alternative papers, 033/2A Biology 2A, 033/2B Biology 2B and 033/3C Biology 2C. The candidate had to do only one of these alternatives. Each paper comprised of two (2) questions. Question 1 was set from the topic of Movement while question 2 was set from Classification of Living Things. Each question carried 25 marks.

The analysis of the candidates' performance on each paper in Biology 2 starts by giving the general 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 in each question.

3.1 Question 1: Movement

In all the three alternatives, this question came from the topic of Movement. Analysis of the candidates' performance for the question from each alternative is presented as follows:

The question was attempted by 526,907 candidates. Analysis shows that 351,198 (66.65%) candidates scored from 0 to 7 marks, out of whom 47,940 (9.10%) scored 0 in this question. The candidates who scored from 7.5 to 16 marks were 157,393 (29.87%) whereas 18,316 (3.48%) scored from 16.5 to 25 marks, out of whom 25 853 candidates scored all the 25 marks in this question. The general performance was average because 33.35 per cent of the candidates scored from 7.5 to 25 marks. Figure 12 summarises the candidates' performance on question 1 for all alternative papers, namely 2A, 2B and 2C.

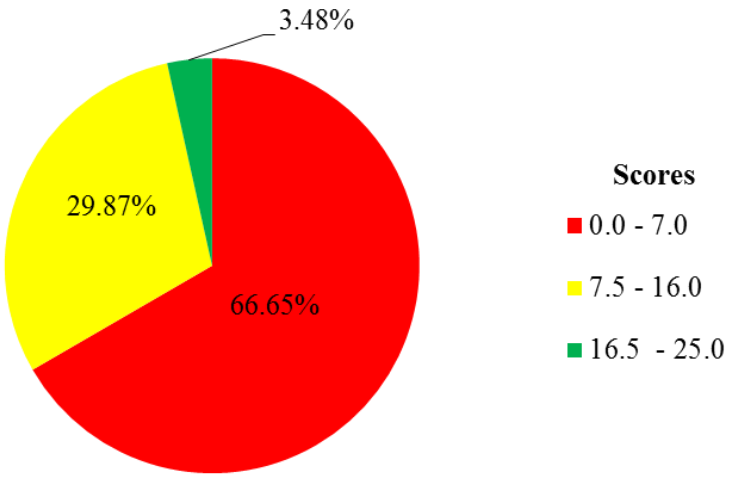


Figure 12: *Candidates' Performance on Question 1 Paper 2*

3.1.1 033/2A Biology 2A

Question 1 in alternative 033/2A Biology 2A had four parts (a) - (d), carrying a total of 25 marks. The candidates were provided with specimen J (femur), X (tilapia fish), Y (thoracic vertebra) and Z (bird). Then, they were required to observe the specimens carefully and then answer the following questions:

(a) (i) Draw a well labeled diagram of specimen X with locomotory structures intact.

(ii) Why specimen X must have locomotory structures? Give four reasons.

(iii) Use a knife to cut and totally remove the scales and fins from specimen X and explain seven activities that will be impaired, if the specimen is returned to its habitat alive.

(b) (i) Study specimen Y and J and give their common names and the part of the skeleton from which each specimen were taken.

(ii) Briefly explain the function performed by specimen Y in the human body.

(iii) Explain four adaptive features of specimen Y which help it to perform its function to the human body.

(c) (i) Carefully observe the structure of specimen J and identify the type of joint(s) that would be formed to the body of the animal.

(ii) Explain how the specimen J is adapted for formation of the

joint(s) identified in (i).

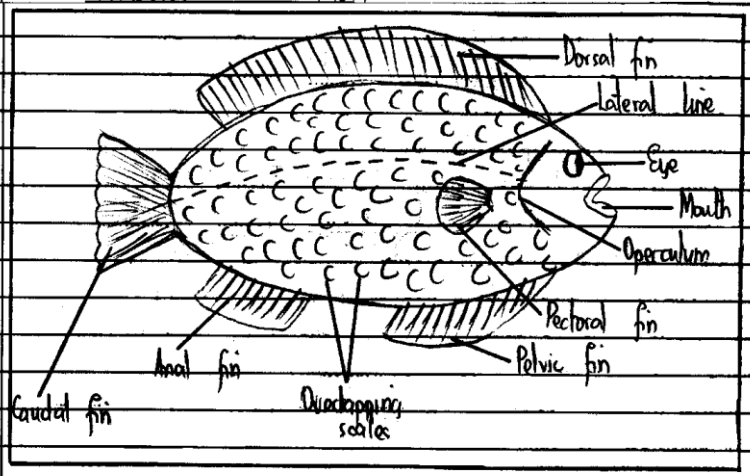
(d) Closely observe specimen Z and explain three characteristic features which help it to move in its habitat easily.

The candidates who scored high marks (16.5 - 25) had sufficient knowledge about movement of the human body specifically the human skeletal system. They were aware of the adaptive features of locomotory structures in various animals. They had good drawing skills therefore drew large, neat, correct diagrams and labeled different types of fins of specimen X (tilapia fish) and gave reasons for the presence of fins to tilapia fish in part (a) (i) and (ii). Also, the candidates were able to state clearly the activities which would be impaired if the tilapia fish without fins and scales was returned to its aquatic habitat in part (a) (iii). They realised that scales protect the fish from physical damage, thus their absence would cause damage by predators, pathogens and toxins. Also, they were aware that if the fish lacks fins, the entire movement would be impaired.

In part (b) (i), the candidates correctly gave the common names of specimen Y, (thoracic vertebrae) and J (femur) and their locations in the human skeleton. Also in part (b) (ii) and (iii), the candidates stated the functions of thoracic vertebrae in the human body and correctly explained the adaptive features of the thoracic vertebrae such as long neural spine with large surface area for muscle attachment, wide neural canal for passage of spinal cord and presence of cartilage for reduction of friction.

In part (c) (i), most of the candidates in this category managed to identify the femur for formation of the ball and socket and hinge joints at its upper and lower ends respectively. In part (c) (ii), the candidates explained correctly the adaptive feature of femur for formation of joints such as round head for articulation with socket in pelvis, condyles for articulation with tibia and cartilage to reduce friction. Also in part (d) the candidates explained correctly the adaptive features of the bird which enable it to move easily in its habitat. Extract 11.1 is a sample of the candidates' correct responses to question 1 paper 2A.

01. a/ i/ A DIAGRAM OF SPECIMEN "X" WITH LOCOMOTARY STRUCTURES INTACT;



1. (a) ii) Specimex X must have locomotary structures because;
- It enables a specimen x to escape from danger.
- It enables a specimen x to search for food..
- It enables a specimen x to find their shelter
- It enables a specimen x to look for mate for reproduction processes

iii) The seven activities that will be impaired if fins and scales are removed are;
- There will be no balance of the body to specimen x if the pectoral fins were removed.
- Specimen x will fail to yaw or roll if the ventral fins were removed.
- There will high friction that will hinder a specimen x to move freely due to the removal of the overlapping scale.
- Specimen x will fail to have forward propulsion and bouyancy due to the removal of the caudal fins.
- Specimen x will fail to change direction to its movement due to the removal of pelvic fins.

1. (a) iii) • Specimen X will fail to overcome water resistance hence it can not move forward due to the removal of the overlapping scales.
• Specimen X will lack protection against predators if scales are removed

(b) i) The common names of Y and J and the part of skeleton from which each specimen were taken are:

SPECIMENS	COMMON NAMES	PART OF SKELETON
Y	THORACIC VERTEBRAE	VERTEBRAL COLUMN
J	FEMUR	LOWER LIMB

ii) The function performed by specimen Y in the human body:
• Thoracic vertebrae provides support to the ribs (articulation with the rib).

iii) The adaptive features of specimen Y which help it to perform its functions.
• It has large and wide neural cavity for passage of spinal cord.

1. (a) iii) • Specimen X will fail to overcome water resistance hence it can not move forward due to the removal of the overlapping scales.
• Specimen X will lack protection against predators if scales are removed

(b) i) The common names of Y and J and the part of skeleton from which each specimen were taken are;

SPECIMENS	COMMON NAMES	PART OF SKELETON
Y	THORACIC VERTEBRAE	VERTEBRAL COLUMN
J	FEMUR	LOWER LIMB

ii) The function performed by specimen Y in the human body;
- Thoracic vertebrae provides support to the ribs (articulation with the rib).

iii) The adaptive features of specimen Y which help it to perform its functions.
• It has large and wide neural cavity for passage of spinal cord.
• It has cartilage to reduce friction.
• It has facets for articulation with ribs.

1. (b) • It has long neural spines to offer large surface area for attachment of muscles.

(c) i) The types of joints that would be formed to the body are
• Ball and socket joint
• Hinge joint

ii) The adaptations for the formation of the joints are;
• Femur has cartilage to reduce friction.

• Femur (specimen I) has condyles for articulation with the tibia at the knee to form hinge joint for movement in one direction.

1. (d) The characteristics features helps specimen z to move in its habitat easily are;
i) Specimen z has hind limb for walking in its habitat.
ii) Specimen z has eye for vision while flying.
iii) Specimen z has keel sternum for attachment of muscles.
iv) Specimen z has webbed feet for swimming.

Extract 11.1: Candidate's correct response to question 1 paper 2A

In Extract 11.1, the candidate gave the correct responses in all parts of the question, hence scored all the marks.

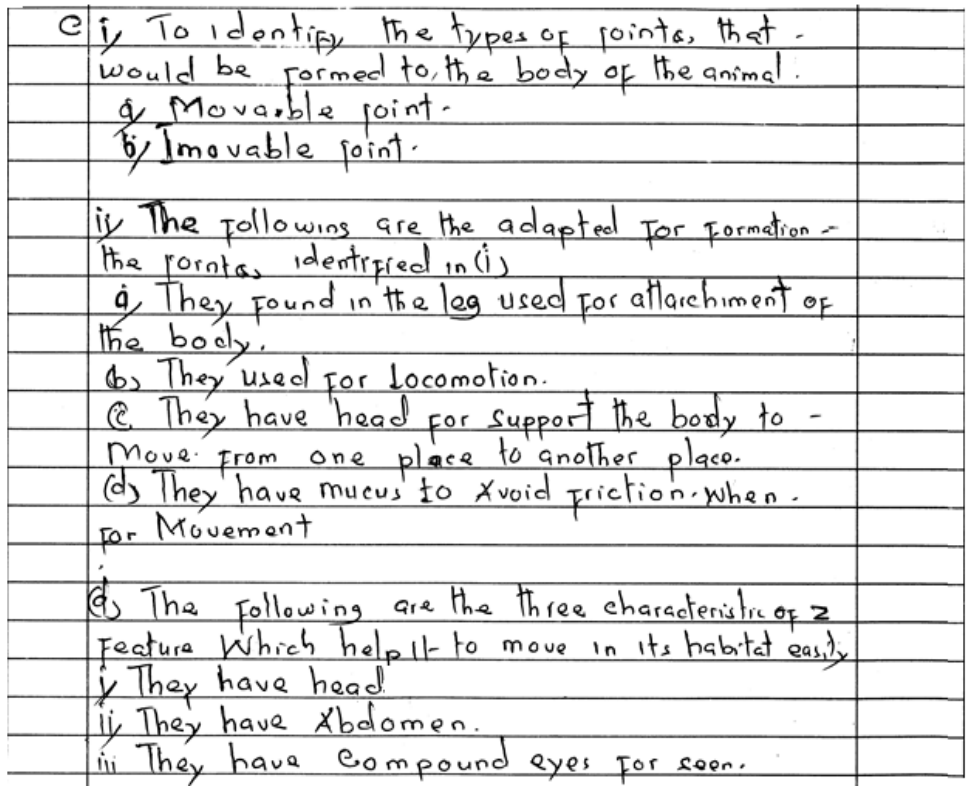
Despite the average performance in this question analysis shows that more than half (64.65%) of the candidates scored low (0 - 7) marks. These candidates provided incorrect responses in all or most parts of the question signifying that they had insufficient or lacked knowledge about the topic of Movement. In part (a) (i), some of them drew a diagram of tilapia but labelled one to two parts while others drew the diagram of a shark instead

of the tilapia fish hence loss of marks. There were other candidates who drew the diagram of the gills instead of a diagram of a tilapia fish. In part (a) (ii), some of the candidates gave the types of fins such as *pectoral fins, pelvic fins, dorsal fins, caudal fins and anal fins* instead of stating the importance of the fins to the tilapia fish. In part (a) (iii), some of the candidates stated the characteristics of living things such as *nutrition, growth, movement, respiration, excretion and sensitivity* instead of explaining the activities which will be impaired to the tilapia fish if the scales and fins were removed.

In part (b) (i), some candidates identified specimen Y as *rib* and *patella* instead of thoracic vertebra and specimen J as *humerus* and ulna instead of femur. Furthermore, in part (b) (ii) and (iii) the candidates failed to explain the functions of thoracic vertebra and its adaptive features.

In part (c) (i), some candidates failed to identify the correct types of joints formed by femur bone in the human body. For example, some of them identified incorrect types of joints as *pivot joint and gliding joint* instead of ball and socket joint and hinge joint. Others stated wrong types of joints such as *hard joints and soft joint*. There were other candidates who listed parts found in a joint such as *cartilage, tendon* and *ligament,* and *synovial fluid* instead of stating the types of joint which are formed by femur. In part (c) (ii), most of the candidates failed to explain the adaptive features of the bone for the formation of ball and socket joint. For example, some of them stated the features of the bone such as, *head, shaft* and *condyle* without explaining how they adapt it for the formation of ball and socket joint.

Finally, in part (d), some candidates failed to explain the characteristic features which enable the bird to move easily in its habitat. For example, some of them wrote that *the legs are covered by scales for protection and beak is modified for picking food.* These incorrect responses signify that the candidates were not aware of the birds' movement in its habitat. Extract 11.2 is a sample of the candidates' incorrect responses to question 1 paper 2A.



Extract 11.2*:* Candidate's incorrect response to question 1 paper 2A parts (c) and (d)

In Extract 11.2, the candidate wrote incorrect responses in all parts. For example, he/she identified the type of joint that would be formed by the specimen J (femur) as *movable joint and immovable joint* instead of hinge and ball and socket joints in part (c) (i). Also, he/she incorrectly wrote specimen Y (bird) *have compound eyes* which are found in insects and not in birds in part (d).

3.1.2 033/2B Biology 2B

Question 1 of the alternative 033/2B Biology 2B, had four parts (a) - (d), which carried a total of 25 marks. The candidates were provided with specimens A (rat), B (grasshopper), C (bird), D (femur) and E (humerus*)*. Then, they were required to observe and answer the following questions:

(a) With example of food source in the ecosystem, account for the types of locomotion exhibited by each specimen A, B and C in search of those foods.

(b) "Specimen B and C could escape from your stretch effortlessly through air". Give three reasons for each.

(c) (i) Study specimens D and E and give the type of joint(s) that would be formed by each specimen in the animal body.

(ii) Name the parts of the animal body from which specimen D and E have been taken.

(iii) Explain one adaptive feature of each specimen D and E which facilitate the formation of joint(s) you identified in (i).

(d) (i) Using scalpel, take out the hind limbs from specimen B and explain two problems which the specimen will face if returned to its natural habitat.

(e) (ii) Draw a diagram of one of the limbs detached from specimen B and label the part which perform the following:

- *Articulate with patella-like to form hinge joint*
- *Articulate with tarsal*

The candidates who scored high marks (16.5 - 25) gave correct responses to all or most parts of the question. In part (a), they were able to account for the types of locomotion which are exhibited by rat, grasshopper and bird in search for food. Also, they gave correct examples of food sources searched by each organism. In part (b), the candidates were aware of the features which enable grasshopper and bird to move. Therefore, they gave correct features which enable the grasshopper and bird to escape effortlessly through air. They mentioned features such as wings, eyes for the bird and hind limbs for the grasshopper.

In part (c) (i), they managed to state ball and socket and hinge joints as joints which are formed by femur and humerus while in part (c) (ii) they named the parts of the body from which femur and humerus were taken. In part (c) (iii), they explained correctly the adaptive features of femur and humerus that facilitate the formation of the ball and socket and hinge joints. This implies that, they had adequate knowledge about the femur and humerus bones as components of the human skeleton.

Furthermore, in part (d) (i) they explained correctly the problems which the grasshopper would face in its natural habitat without the hind limbs. In part (d) (ii), they drew a diagram of the hind limb of the grasshopper and labeled the femur which articulates with patella to form hinge joint and tibia which articulates with tarsal to form hinge joint. This indicates that the candidates were competent with the tested concepts. Extract 12.1 is a sample of the candidates' correct responses to question 1 paper 2B.

1. a)

Specimen	Locomotion	Food source.
A	Walking	meat and cereals.
B	Hopping	Grasses
C	Flying and walking	Cereals like Maize

b) Reasons for B

- It has wings for which it can use to fly away from the enemies.

- It has powerfull hind limbs necessary for jumping away from the predator and fly away.

- It has a streamlined body for flying in the air.

Reasons for C

- It has streamlined body shape that helps to cut resistant air and move forward.

- It has light hollow bones which helps to reduce weight thus can fly easily.

- It has wings which has feather where the quill feathers helps for flying.

1. c) i) Specimen D (Femur)
a) Ball and socket joint at its head part.
b) Hinge joint at its lower part.

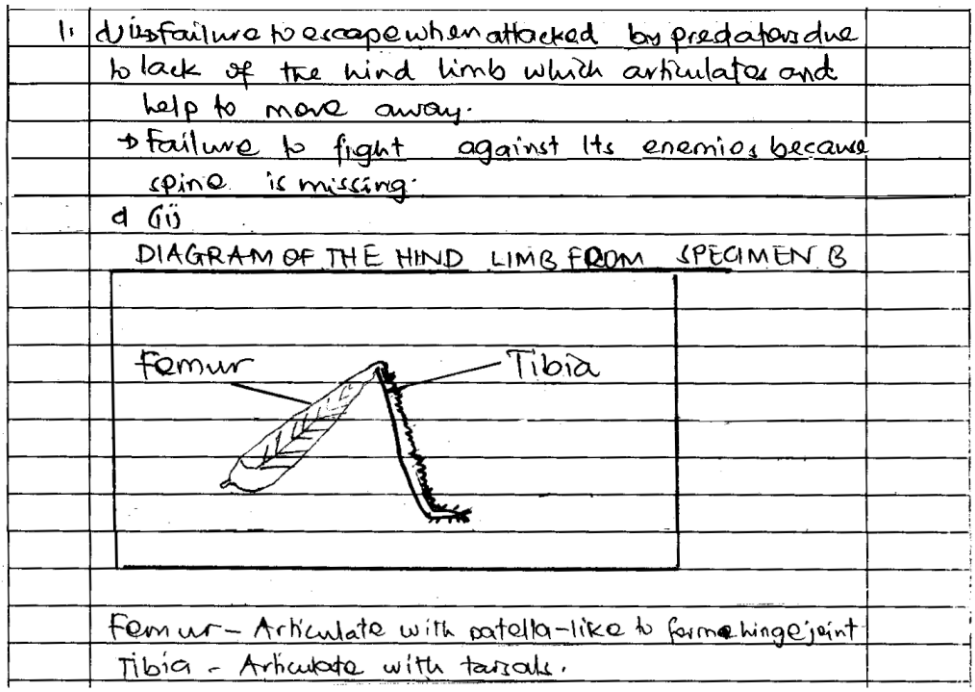
Specimen E (Humerus)
a) Ball and socket joint at its head part
b) Hinge joint

ii) Specimen D – Hind limb around the thigh region.

Specimen E – Fore limb around the upper arm region.

iii) Specimen D adaptations for the formation of ball and socket joint
It has round head with smooth cartilage which helps to reduce friction.
adaptations for the formation of hinge joint:
It has cartilage to reduce frictions

Specimen E, adaptations for the formation of ball and socket joint
It has round end which fits into glenoid cavity allowing movement in all direction
adaptations for the formation of hinge joint:
It has cartilage to reduce frictions



Extract 12.1: Candidate's correct response to question 1 paper 2B

In Extract 12.1, the candidate provided correct responses in all parts of the question. This shows that the candidate was well informed about locomotory structures of different organisms.

The candidates who scored low marks (0 - 7) wrote incorrect responses in all or most parts of the question. For instance, in part (a), some of them wrote incorrect types of locomotion exhibited by rat, grasshopper and bird. Some of the candidates named the locomotory structures such as *legs*, *wings* and *flagella* instead of walking, jumping and running exhibited by the specimens. Others wrote the types of locomotion exhibited by the specimens interchangeably. For example, they wrote flying to rat. Also, they failed to state the relevant food sources which are searched by the specimens. This shows that, they were not aware of the various types of locomotion and food sources for the animals.

In part (b), some candidates failed to give correct explanation on how the locomotory structures of grasshopper and bird enable them to escape through air instead they listed the locomotory structures of the organisms. For example, some candidates listed the body parts of the organisms as

eyes, feathers and limbs hence losing some marks. This indicates that, they were not aware of the adaptive features of grasshopper and bird for locomotion.

In part (c) (i), most of the candidates gave incorrect type of joints which are formed by femur and humerus in the body of the animal. For instance one candidate wrote specimen D forms *pivot joint* instead of ball and socket joint and hinge joint. In part (c) (ii), they failed to name the parts of the body from which femur and humerus were taken. For instance, some of them wrote femur was taken from *hand* and *arm* while others wrote *rib* and *backbone* instead of the upper hind limb/leg. In part (c) (iii), they explained the adaptive features of the joints in the animal body instead of the adaptive features of femur and humerus. This implies that, the candidates did not understand about the human skeletal system especially the structure, functions and adaptations of its major components.

Furthermore, in part (d) (i), they failed to explain the problems which the grasshopper would face if it was to be returned to its natural habitat after detaching its hind limbs. In part (d) (ii), some could draw well a diagram of the hind limb of the grasshopper but failed to label parts for articulation to patella and tarsal. This indicates that, they were not conversant with the structure and functions of the components of the animal's skeleton. Extract 12.2 is a sample of the candidates' incorrect responses to question 1 in paper 2B.

1(a) i) Carbohydrate
ii) Vitamin
iii) Protein

b) i) Specimen B used for gas exchange used spiracle for effortlessly through air
ii) Specimen C used beak for effortlessly through air

c i) Specimen D - Movable joint
Specimen E - pivot joint

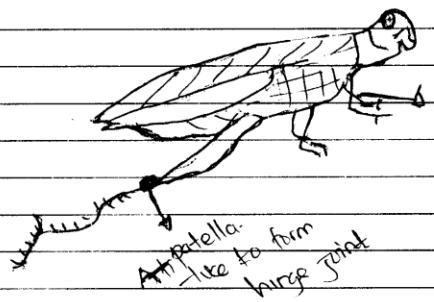
ii) Specimen D - femurus
Specimen E - Humerous

~~(A)~~

iii) Specimen D and E adaptive feature
i) The specimen D and E helps to muscles for Biceps and Triceps in strong for can be contract and relax.

d) i) I/ Specimen D can broken environment natural habitant
II/ Specimen D can be infertile soil.

ii)



Extract 12.2: Candidate's incorrect response to question 1 paper 2B

In Extract 12.2, the candidate drew a diagram of *grasshopper* instead of the hind limb of grasshopper in part (d)(ii). Also, in part (a), he/she wrote types of food nutrient such as *vitamin and protein* as the food source for grasshopper instead of grasses. The candidate also wrote the type of joints that would be formed by each specimen D and E in the animals body as

movable and pivot joint instead of ball and socket and hinge joint in part (c)(i). The candidate provided wrong responses in all parts of the question.

3.1.3 033/2C Biology 2C

Question 1 in alternative 033/2C Biology 2C had four parts (a) - (d), carrying a total of 25 marks. The candidates were provided with specimen A_1 (rib), B_1 (femur), C_1 (humerus) and D_1 (tibia and fibula). Then, they were required to observe it and answer the following questions:

(a) Specimens A_1, B_1, C_1 and D_1 were obtained from the skeleton. Name a part from which each has been taken.

(b) Explain two functions performed by ach of the specimens A_1, B_1, C_1 and D_1 to the human body.

(c) Closely observe specimen C_1 and D_1 and state observable features relevant to form the following joint(s) in the human body:

(i) Ball and socket joint

(ii) Hinge joint

(d) With the aid of labeled diagram, describe how the structures of specimen B_1 are adapted for formation of hip and knee joint.

The candidates who scored high marks (16.5 - 25) gave correct responses to most or all the parts of the question. In part (a), they correctly named the parts of the body from which the rib, femur, humerus, tibia and fibula were taken. In part (b), they were able to explain correctly the functions performed by the rib, femur, humerus and tibia and fibula to the human body. In part (c), they correctly stated the observable features relevant for humerus to form ball and socket joint at the shoulder, and tibia and fibula for the formation of hinge joint at the knee.

Furthermore, in part (d) they correctly drew the diagram of femur and described how it is adapted for the formation of hip and knee joints. These responses indicate that the candidates were aware of the structures and functions of the major components of the human skeleton. Extract 13.1 is a sample of the candidates' correct responses to question 1 paper 2C.

Q1. (a). i/. Specimen A,
- It is obtained from the chest region.

ii/. Specimen B,
- It is obtained from the upper part of the hind limb or leg

iii/. Specimen C,
- It is obtained from the upper part of the arm or fore limb in other animals.

iv/. Specimen D,
- It is obtained from the lower part of leg or hind limb in other animals.

(b). i/. Specimen A,
- Helps in protection of delicate organs such as blood vessels and the heart.
- Helps to determine the shape of the chest.

ii/. Specimen B,
- Helps to give support of the weight of the human body.
- It has rounded head to bring about flexible movement to human.

iii/. Specimen C
- Helps to provide surface area for attachment of biceps and triceps muscles.
- It allows movement of the arm.

iv). Specimen D_1

- They are strong enough and thus support the weight of the leg.
- They are long thus provide large surface area for muscle attachment.

(c): Specimen C_1 (femur) to form the joint

i). Specimen C_1 has rounded like structure at its upper end that articulates with scapula to form ball and socket joint that allows movement of the arm.

ii). Specimen C_1 has cartilage which reduce frictions.

Specimen D_1 to form hinge joint

i). Specimen D_1 at the lower end it articulates with tarsal bones to form hinge joint that allow movement in one direction.

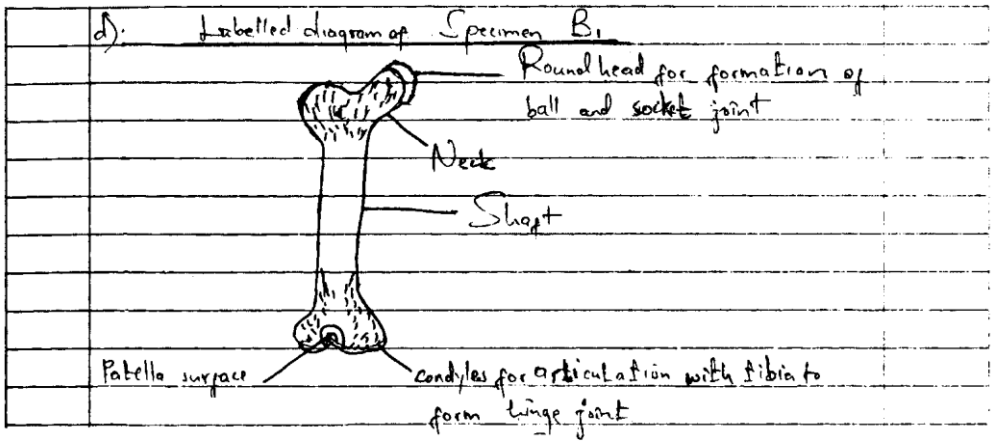
ii). The top end is curved which articulates with femur at the knee to form hinge joint that allow movement in one direction.

(d) Adaptation of specimen B_1 femur for formation of the hip joint

- Specimen B_1 has rounded head at its upper part thus articulates with pelvic girdle to form ball and socket joint that allow movement in all directions.

Adaptation of specimen B_1 femur for formation of the knee joint

- The lower end has condyles which articulates with tibia at the knee to form hinge joint for movement in one direction.



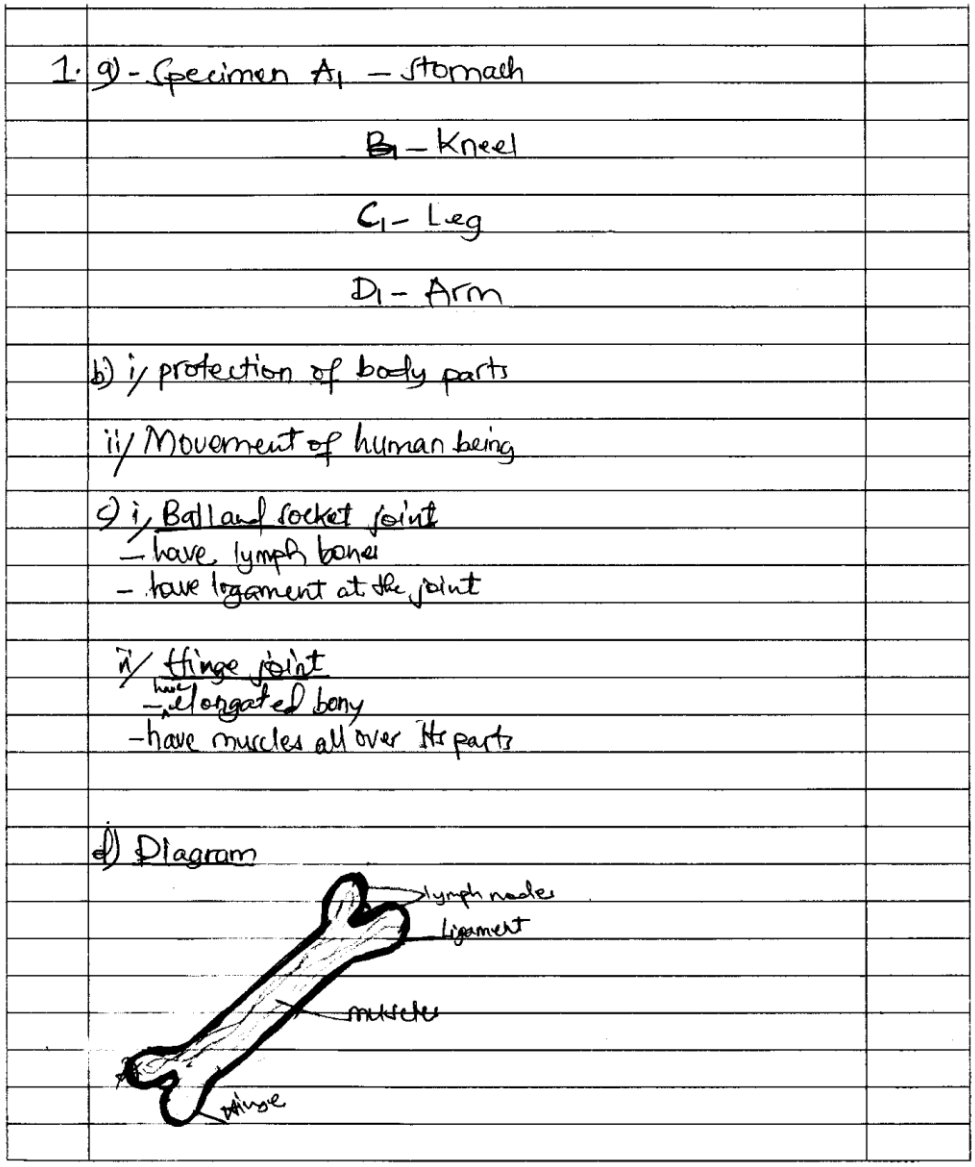
Extract 13.1: Candidate's correct response to question 1 paper 2C

In Extract 13.1, the candidate provided correct responses in parts (a), (b), c and (d) as required by the question.

On the other hand, the candidates who scored low marks (0 - 7) provided incorrect responses to some or most parts of the question. For the candidates who scored 0 marks, they provided incorrect responses in all parts of the question. For example in part (a), some of the candidates gave the names of the specimens such as *rib, femur, humerus and tibia and fibula* instead of giving the names of the body parts from which the specimens were taken. Others wrote incorrect locations of bones like; *femur is found on arm, humerus is located in the leg and tibia and fibula are found in the hand*. In part (b), they failed to explain the functions performed by rib, femur, humerus and tibia and fibula. For example, some of the candidates stated incorrect functions of the bones such as *rib is used for gaseous exchange* instead of allowing breathing to take place when the intercostal muscles contract and relax while *humerus transports blood in the body* instead of the formation of red blood cells.

Likewise, in part (c), the candidates provided incorrect adaptations of the bones for the formation of ball and socket, and hinge joints such as *they are hollow to reduce density, they have large surface area for attachment of muscles.* Others stated the characteristics of ball and socket and hinge joints such as *ball and socket allows rotation in all directions and hinge joint allows movement in one plane only* instead of adaptations of the bones for the formation of the joints.

In part (d), most of the candidates gave incorrect description for the adaptive features of femur bone for the formation of a hip and knee joint. Also, some of them either drew an incorrect diagram or completely failed to draw it. Others drew the correct diagram but wrote incorrect labels and captions. For example, some candidates wrote caption of their drawing as *the diagram showing the knee, hip joint*. Extract 13.2 is a sample of the candidates' incorrect responses to question 1 paper 2C.



Extract 13.2: Candidate's incorrect response to question 1 paper 2C

In Extract 13.2, the candidate incorrectly drew the diagram of specimen B_1 (femur) in part (d)(ii). Also he/she wrote functions as *protection of body parts and movement of human being* without specifying the function to the specimens in part (b)(i). All the responses given in other parts of the question were incorrect.

3.2 Question 2: Classification of Living Things

In all the papers, the question 2 was drawn from a topic of Classification of Living Things. Analysis of the candidates' performance on question 2 for all alternatives shows that the question was attempted by 526,907 candidates.

It was revealed that 180,976 (34.35%) candidates scored from 0 to 7 marks, out of whom 24,691 (4.69%) scored 0. The candidates who scored from 7.5 to 16 marks were 256,286 (48.64%) whereas 89,645 (17.01%) scored from 16.5 to 25 marks, out of whom 191 candidates scored all the 25 marks. The general performance in this question was good because 65.65 per cent of the candidates scored from 7.5 to 25 marks. Figure 13 summarises the candidates' performance on question 2 for all alternative papers, namely A, B and C.

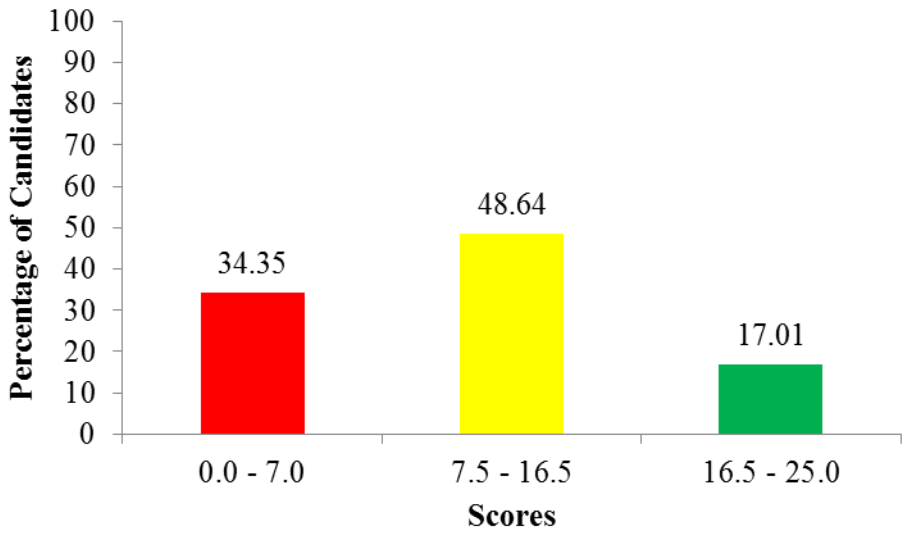


Figure 13: *Candidates' Performance on Question 2 Paper 2*

3.2.1 `033/2A Biology 2A

Question 2 in alternative 033/2A Biology 2A had three parts (a) - (c), carrying a total of 25 marks. The candidates were provided with specimens G (pea plant), H (lizard) and K (spider). Then, they were required to study the specimens and answer the following questions:

(a) (i) Identify one feature which may influence the artificial classification system to place both specimens K and H into the same taxonomic group.

(ii)Why scientists may not concur with the use of artificial classification system for grouping specimens K and H into the same taxonomic group? Give a reason.

(b) (i) Classify each of the specimens G, H and K to class level.

(ii) Account for the features used in the natural classification system to place specimens G and H to their classes.

(iii) Name four organisms which share the same phylum with the specimen K.

(iv) In what ways members that are placed together with specimen K in the same class are advantageous in our daily life?

(c) (i) Draw a diagram of specimen H and label external features.

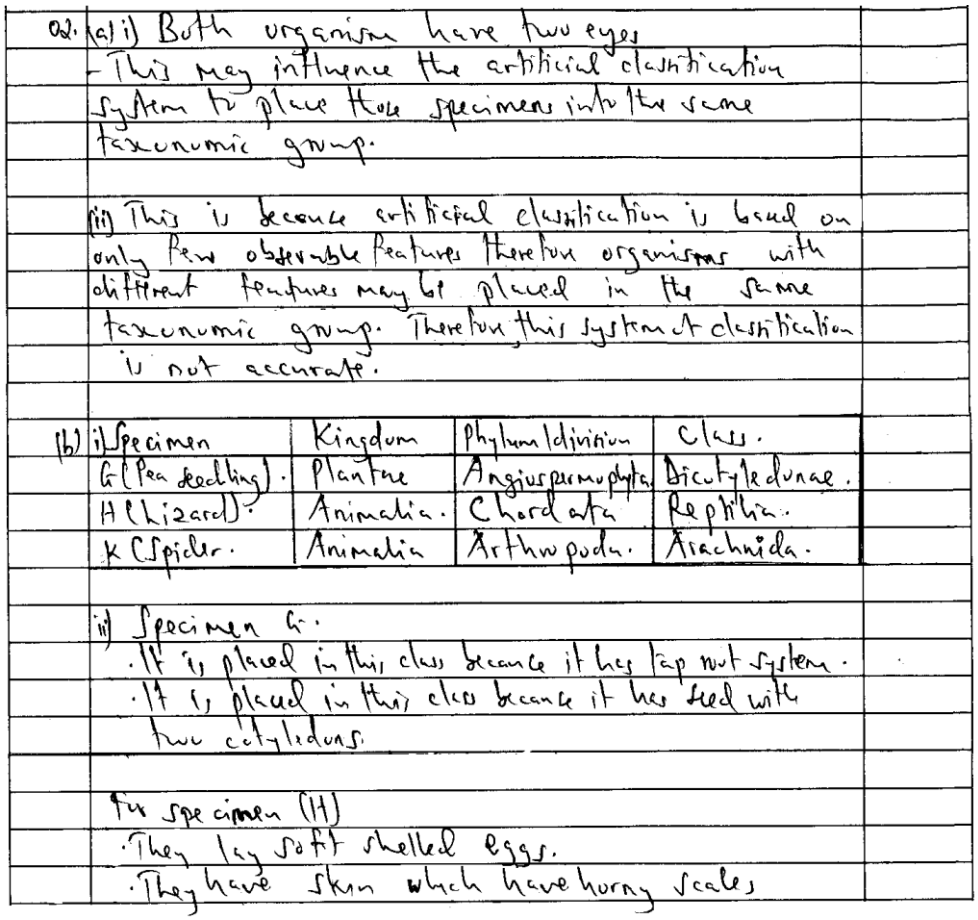
(ii)Identify two observable features of specimen H at the Kingdom level.

Analysis shows that the candidates who scored high marks (16.5- 25) were conversant with the topic of Classification of Living Things. In part (a) (i), they correctly identified the features which influenced the artificial classification system to place spider and lizard into the same taxonomic group such as having legs, mouth and eyes. In part (a) (ii), they gave reasons as to why scientists may not concur with use of the artificial classification system for grouping spider and lizard into the same taxonomic group.

In part (b) (i), the candidates correctly classified the organisms pea plant, lizard and spider as well as in part (b) (ii), they accounted the features used in the natural classification system to place pea plant to Class Dicotyledoneae and lizard to Class Reptilia. In part (b) (iii), they correctly named the organisms which share the same phylum with spider such as lobster, dragonfly, centipede and millipede while in part (b) (iv), they

stated the advantages of members of the class Arachnida in our daily life such as source of food to other organisms, produces silk for making fabrics and biological control.

In part (c), the candidates correctly drew a diagram of lizard and labeled its external features and identified the observable features of lizard at the kingdom level such as it possess the mouth for feeding, legs for locomotion and sense organs. This indicates that, the candidates were familiar with classification of living things. Extract 14.1 is a sample of the candidates' correct responses to question 2 paper 2A.



02. (a) i) Both organism have two eyes
- This may influence the artificial classification system to place these specimens into the same taxonomic group.

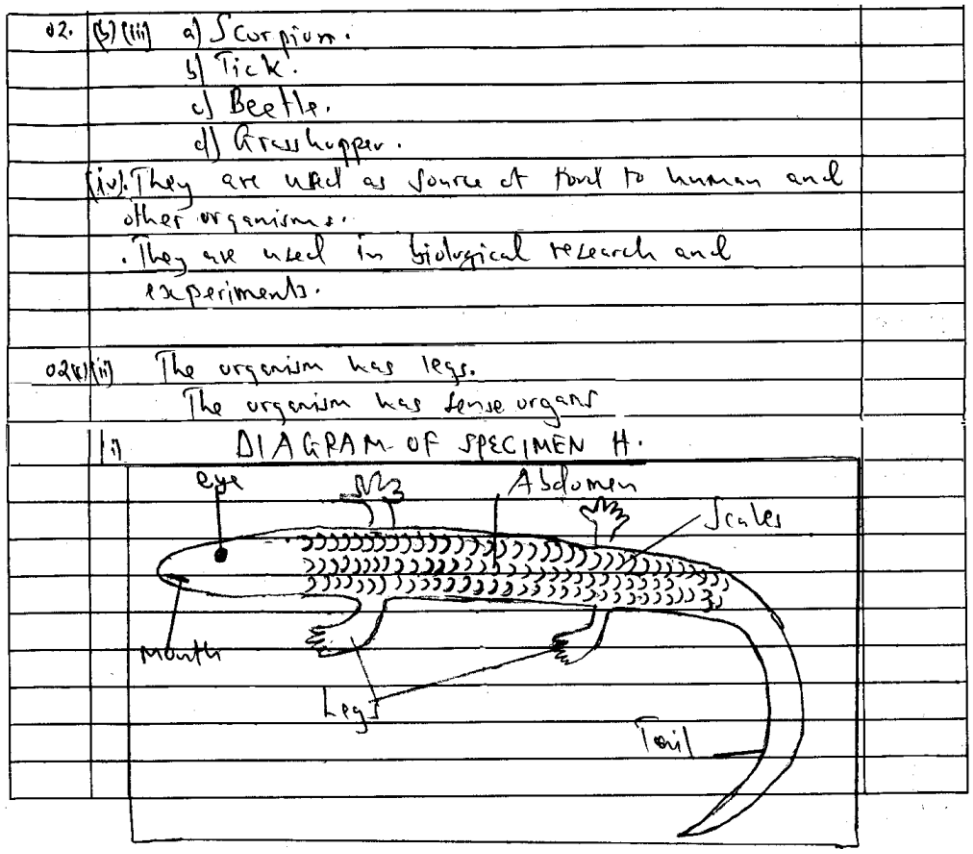
(ii) This is because artificial classification is based on only few observable features therefor organisms with different features may be placed in the same taxonomic group. Therefor this system of classification is not accurate.

(b) i)

Specimen	Kingdom	phylum/division	Class.
G (Pea seedling).	Plantae	Angiospermophyta.	Dicotyledonae.
H (Lizard).	Animalia.	Chordata	Reptilia.
K (Spider.	Animalia	Arthropoda.	Arachnida.

ii) Specimen G.
- It is placed in this class because it has tap root system.
- It is placed in this class because it has seed with two cotyledons.

For specimen (H)
- They lay soft shelled eggs.
- They have skin which have horny scales



Extract 14.1: Candidate's correct response to question 2 paper 2A

In Extract 14.1, the candidate wrote correct responses in all the parts. For example he/she classified specimens G, H and K from Kingdom to class level and accounted for the features used in the natural classification system to place the specimens G and H to their class Dicotyledoneae and Reptilia respectively.

The candidates who scored low marks (0 - 7) provided either, incorrect responses to all points and got zero or to some parts of the question, hence scored from 1 to 7 marks. Those who scored 0 marks wrote incorrect responses to all parts. In part (a)(i), some candidates gave the merits of artificial classification system instead of giving features of spider and lizard. For example, some of them wrote; *use of few observable features, less time consuming, stable* and *does not need expertise.* Also, in part (a) (ii) some candidates gave the importance of spider and lizard. For example, they wrote that *spider and lizard are used in biological research* instead of

giving reasons to why scientists may not concur with the use of artificial classification to group the organisms.

In part (b) (i), some candidates classified pea plant, lizard and spider based on their modes of nutrition. For example, they classified pea plant as an *autotroph* while lizard and spider as *heterotrophs* instead of stating their respective kingdoms, phylum/division and classes. In part (b) (ii), they accounted for general features of Kingdom Animalia and Plantae. For example, some candidates wrote that *pea plant reproduces sexually* while *lizard is a cold blooded animal and it lays eggs.* In part (b) (iii), they gave organisms from other phyla other than Phylum Arthropoda. For example, some candidates included *earthworm, ascaris, tapeworm and frog* which are members from phylum Annelida, Nematoda, Platyhelminthesis and Chordata. In part (b) (iv), they gave advantages of kingdom Fungi. For example, some candidates wrote that the *organisms decompose dead organic matter and help the fermentation process.* This shows that they were not conversant with Division Angiospermophyta and Phylum Chordata.

In part (c) (i), the candidates drew diagrams of other animals instead of lizard. For example, some drew a diagram of a snake and others drew diagram of rat. In part (c) (ii), they gave features of lizard at class level instead of the kingdom. For example, some of them wrote that *lizard has a body covered with scales; it is poikilothermic and it lays eggs.* Others wrote the advantages of lizard instead of observable features at kingdom level. For example, some of them wrote that *lizard feeds on houseflies which are vectors of diseases like cholera; lizard is used in biological studies* and *lizard is a source of food to other organisms.* This indicates that the candidates had inadequate knowledge about the characteristic features of Class Reptilia. However, some of them did not understand the question demand. Extract 14.2 is a sample of the candidates' incorrect responses to question 2, paper 2A.

2. a) i) They are most found in a rock places or areas in the environment

ii) Because they are belonging on the same kingdom and class and they are used in abiological research

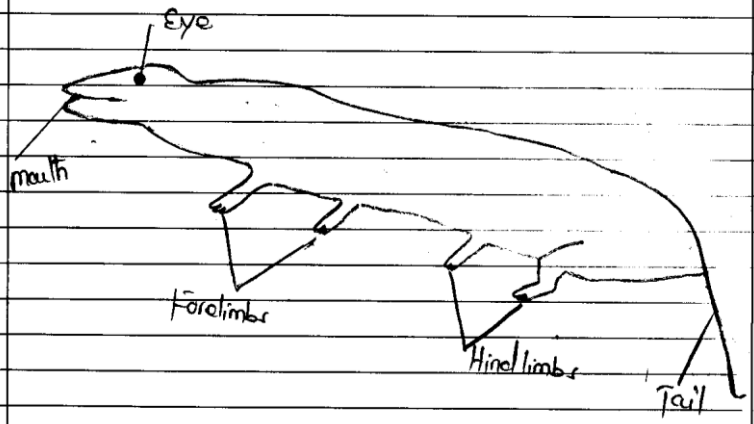
b) i)

specimen	class level
G	Dicotyledon
H	Arthropod
K	Arachnid

ii) • They belong in a different kingdom
• presence of the different Habitat

iii) • Lizard
• Bird
• Tilapia fish

c) i) A DIAGRAM OF SPECIMEN H.



Extract 14.2: Candidate's incorrect response to question 2 paper 2A

In Extract 14.2, the candidate wrote incorrect responses in all parts of the question. For example, he/she wrote the habitat and uses of lizard and

spider instead of identifying the features which influenced the artificial classification system to place spider and lizard into the same taxonomic group in part (a). Also, the candidate named members of phylum Chordata such as *lizard and bird* instead of members found in phylum Arthropoda in part (b), and drew an incorrect diagram of a lizard in part (c).

3.2.2 033/2B Biology 2B

Question 2 in alternative 033/2B Biology 2B had five parts (a) - (e), carrying a total of 25 marks. The candidates were provided with specimens A (rat), C (bird) and F (cockroach). Then, they were required to observe them carefully and answer the following questions:

(a) (i) Identify each of the specimens A, C and F by its common name.
(ii) Why scientists worldwide never use the common names of the specimens A, C and F for communication purposes?
(b) (i) Classify the specimens A, C and F from Phylum/Division to class level.
(ii) Why specimen F is a typical representative member of the class it belongs? Give two reasons.
(c) Which two features place specimens A and C together in the following taxonomic groups?
(i) Kingdom
(ii) Phylum
(d) Differentiate specimens A and C at class level by using their observable features.
(e) State two advantages and disadvantages of specimen A to human being.

The candidates who scored high marks (16.5 - 25) had sufficient knowledge about the topic of Classification of Living Things. In part (a), they identified correctly the common names of specimens A, C and F and stated the disadvantages of using common names of organisms for communication purposes among scientists worldwide.

In part (b), the candidates correctly classified rat to class Mammalia, bird to class Aves in the phylum Chordata while cockroach was classified to the phylum Arthropoda and class Insecta. Also, they gave the reasons as to why cockroach is a typical representative member of the class insecta.

They justified it by explaining the distinctive features of class Insecta such as possession of three body parts, three pairs of jointed legs and a pair of antennae. In part (c), the candidates identified correctly the features of rat and bird which place them in the kingdom Animalia and stated the features of rat and bird which place them in phylum Chordata.

In part (d), the candidates provided observable distinctive features regarding the classes where rat and bird belong while in part (e), they stated the advantages and disadvantages of rat to human beings. These responses imply that the candidates were aware of the features of various organisms in phylum Chordata and phylum Arthropoda. Extract 15.1 is a sample of the candidates' correct responses to question 2, paper 2B.

26 (i) Specimens, A, C and F by its common names.

	Specimen	Common name
i.	A.	A rat.
ii.	C	A birds.
iii.	F	COCKroach.

I) It is because the common names are different due to the individual basis hence language barrier.

II) Common names do not show scientific names as genus and species.

III) Also, it is because of using different languages across the globes or world hence making it to be difficult interms of communication purpose.

(b) i. Classification of specimen A, C and F from phylum / Division to class level.

Specimen	Phylum/Division	Class
A	Chordata	Mammalia.
C	Chordata	Aves.
F	Arthropoda	Insecta.

ii. Specimen F, it is divided into three body parts Head, thorax and Abdomen.

Specimen F, has three pairs of jointed legs.

2 (c) i Specimen A and C belong to kingdom Animalia because:
- they have sense organs
- they have mouth for heterotrophic feeding that is they do not manufacture their own food.

ii/ Specimen A and C belong to phylum chordata because:
specimen A and C have their vertebral column or back bone.
specimen A and C posses endoskeleton

	d/. specimen C	specimen A
i	- it has no pinna	- it has external pinna
ii	- it has body covered by feathers	it has body covered by hairs
iii	- it has no mammary gland	- it has mammary gland
iv	it has heterodont teeth	- it has no teeth

2 (e) Advantage
(i) Specimen A it is used for different research and scientific field studies.
(ii) Specimen A it is used as source of food.

Disadvantage.
(iii) Specimen A destroys people's properties example clothes; plastic materials like plates.
(iii) it is a vector of disease such as plague.

Extract 15.1: Candidate's correct response to question 2, paper 2B

In Extract 15.1, the candidate wrote correct responses in all parts of the question, indicating that she/he understood the topic of Classification of Living Things.

The candidates who scored low marks (0 - 7) provided incorrect responses to some or most parts of the question. Those who provided correct responses to some parts of the question, scored from 1 to 7 marks. For the candidates who scored zero marks, they wrote incorrect responses in all parts of the question. In part (a) (i), some of them misspelled the common

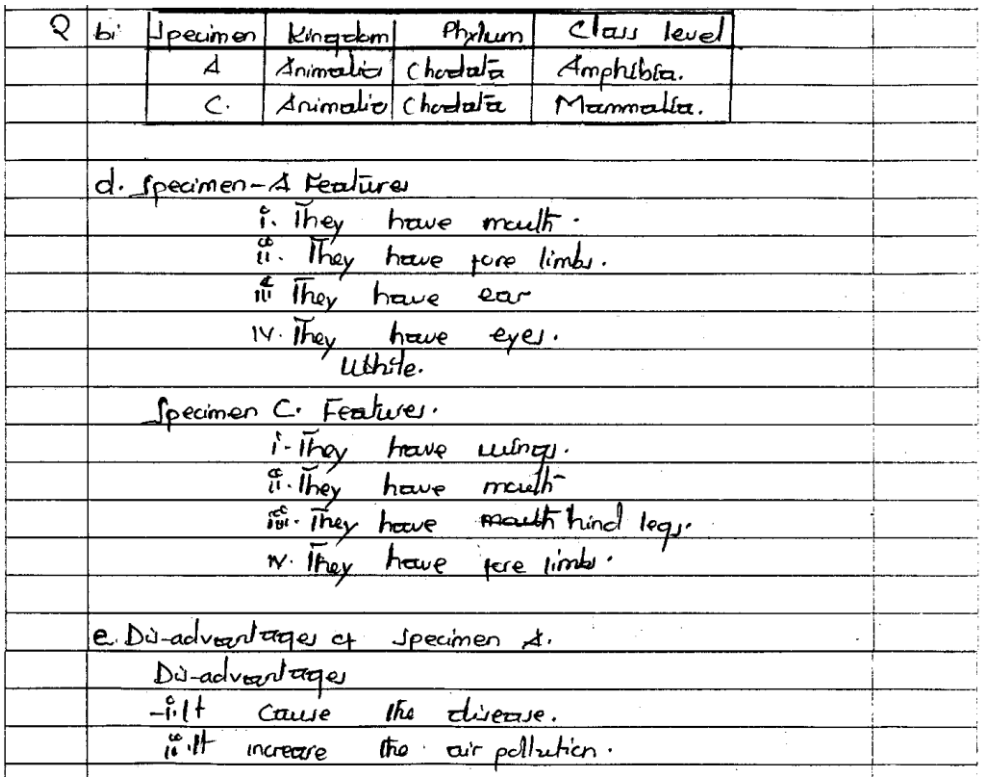
names of specimens A, C and F (rat, bird and cockroach). For example, some of them wrote the names such as *ret* instead of rat, *bad* instead of bird and *cokroch* instead of cockroach while in part (a) (ii), some candidates stated the rules of assigning scientific names to organisms instead of the disadvantages of using common names of organisms for communication among scientists worldwide. For example, some of them wrote that *common names have genus and species parts*; *they must be written in Latin language and must begin with capital letters.*

In part (b) (i), some of the candidates interchanged the classes and phyla of the specimens as they classified rat to class Chordata and phylum Mammalia while cockroach was placed to phylum Insecta and class Arthropoda. Others misspelt the words. For example, some of the candidates incorrectly classified rat to phylum *Chordates* instead of Phylum Chordata, cockroach to phylum *Athropoda* instead of Phylum Arthropoda. In part (b) (ii), they explained the general features of the phylum Arthropoda such as *their bodies are covered with exoskeleton and they have segmented bodies* instead of the distinctive features of class Insecta.

In part (c), the candidates gave general features of the rat and bird with respect to their kingdom and phylum levels instead of their distinctive features. For example, some of them gave the features of Kingdom Animalia that *they are mobile; they have asexual and sexual reproduction; they are multicellular and they are eukaryotes* in part (c) (i) while in part (c) (ii), they gave general features of Phylum Chordata such as *they carry out gaseous exchange through lungs*; *they are heterotrophs; they are made up of bony skeleton.* This indicates that these candidates were not aware of characteristics of Kingdom Animalia.

In part (d), the candidates gave internal features of rat and bird instead of observable distinctive features. For example, some of these candidates wrote that *rat has placenta while bird does not have placenta; rat has a diaphragm while bird has no diaphragm*. They wrote such features that cannot be observed externally. This indicates that the candidates did not understand the characteristics of classes of Phylum Chordata, particularly the observable differences between class Mammalia and class Aves.

In part (e), some candidates provided advantages and disadvantages of other organisms instead of rat. For example, one of them wrote that *rat is a predator to other animals* and another candidate wrote *rat spread cholera* and *causes diseases*. This implies that the candidates were not aware of the advantages and disadvantages of members of Class Mammalia. Extract 15.2 is a sample of the candidates' incorrect responses to question 2, paper 2B.


Q

b.

Specimen	Kingdom	Phylum	Class level
A	Animalia	Chodata	Amphibia.
C.	Animalia	Chodata	Mammalia.

d. Specimen-A Features

i. They have mouth.
ii. They have fore limbs.
iii. They have ear
iv. They have eyes.
while.

Specimen C. Features.

i. They have wings.
ii. They have mouth
iii. They have ~~mouth~~ hind legs.
iv. They have fore limbs.

e. Dis-advantages of Specimen A.

Dis-advantages

i. It cause the diseases.
ii. It increase the air pollution.

Extract 15.2: Candidate's incorrect response to question 2, paper 2B

In Extract 15.2, the candidate classified the specimens (rat and bird) from kingdom to class instead of phylum/division to class level in part (b)(i). Also, he/she misspelt the scientific words as phylum *Chodata* instead of Chordata and incorrectly classified rat and bird into *class Amphibia and Mammalia* instead of class Mammalia and Aves. Moreover, the responses given in other parts were incorrect.

3.2.3 033/2C Biology 2C

Question 2 in alternative 033/2C Biology 2C had five parts (a) - (e), carrying a total of 25 marks. The candidates were provided with specimens S_1 (Tilapia fish), S_2 (Rat/mouse/guinea pig) and S_3 (Butterfly). The candidates were required to observe them carefully and answer the following questions:

(a) *What would be the disadvantage for Biologist to classify the specimens S_1, S_2 and S_3 by using their common names?*
(b) *Which classification system was used to place both specimens S_1 and S_2 to the same Phylum? Give three reasons to support your answer.*
(c) *With the help of a well labeled diagram, describe four observable characteristics that represent the distinctive features of the Class to which specimen S_1 belongs.*
(d) *Account for five distinctive features of the class to which specimen S_2 belongs.*
(e) *In what ways specimen S_3 is advantageous in our daily life? Give three points.*

The candidates who scored high marks 16.5 to 25 were competent in classification of various organisms. In part (a), they explained correctly the disadvantages for Biologist to classify specimens S_1, S_2 and S_3 (tilapia fish rat and butterfly) by using their common names. In part (b), they correctly identified the features considered in the natural classification system to place the tilapia fish, rat and butterfly to the Phylum Chordata. These features include possession of backbone, endoskeleton, ventral heart, post anal tail, notochord, dorsal hollow nerve cord and gill slits.

In part (c), the candidates stated correctly the distinctive characteristics of class Osteichthyes as observed in a tilapia fish. These features include cycloid scales, homocercal tail, terminal mouth, bony skeleton and lateral line. Also, they supported their response by drawing a diagram of the tilapia fish showing the respective features. In part (d), the candidates were aware that rat belongs to Class Mammalia, therefore, they explained correctly the distinctive features of the class Mammalia while in part (e), the candidates explained the advantages of butterfly in our daily life such as pollination, using in scientific research, tourism and decoration. The correct responses of the candidates signify that they were conversant with classification of

kingdom Animalia, especially phylum Arthropoda. Extract 16.1 is a sample of candidates' correct responses to question 2, paper 2C.

02. (a) The following are the disadvantages to classify the specimens S_1 and S_2 and S_3 by using their common names?

. Difficult in communication among biologists all over the world since common names vary from one place to another.

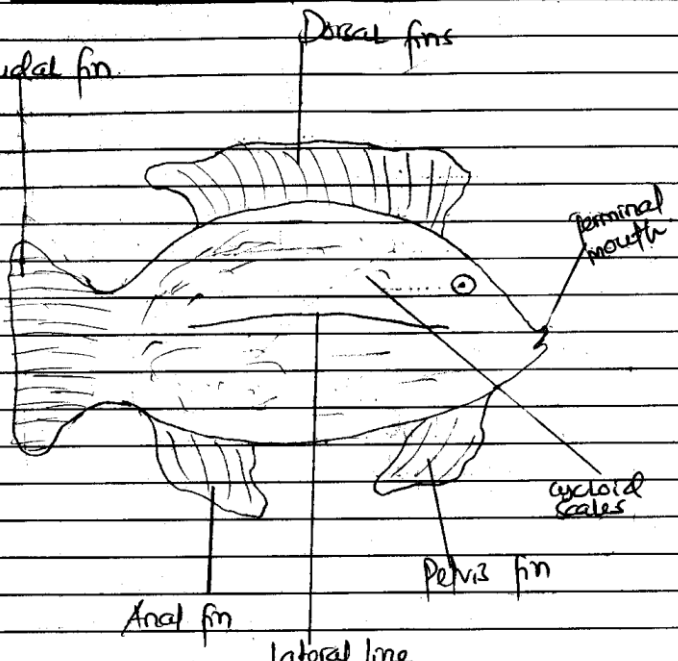
(b) classification system which was used to place both specimens S_1 and S_2 to the same phylum is Natural classification system. Due to the following reasons:

(i) They have vertebral column
(ii) They have post-anal tail
(iii) They have ventral heart

(c) Distinctive feature of the class to which specimen S_1 belongs.

(i) They have gills covered by operculum
(ii) They have lateral line to prevent the fish against vibrations
(iii) They have terminal mouth
(iv) They have cycloid scale.

A DIAGRAM OF S_1 (TILAPIA FISH)



(d) Distinctive feature of the class to which specimen S_2 belongs are:
(i) They have mammary glands.
(ii) They have sweat glands.
(iii) They have four chambered heart
(iv) The body is covered with hair.
(v) They have heterodont dentition.

(e) Advantages of specimen S_3 in our daily life.
(i) Specimen S_3 helps in pollination of insect pollinated flowers.
(ii) Specimen S_3 are used in biological studies
(iii) Specimen S_3 are used for decorations at homes and offices.

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

In Extract 16.1, the candidate wrote correct responses, signifying that, the candidate had skills of identifying and classifying various organisms to their taxonomic groups based on their characteristics.

On the other hand, the candidates who scored 0 - 7 marks provided incorrect responses in all or some parts of the question. In part (a), some candidates explained incorrect disadvantages for Biologist to use common names in classifying specimens S_1, S_2 and S_3 (tilapia fish, rat and butterfly). For example, some candidates outlined the disadvantages of artificial classification system such as *unrelated organisms may be classified into the same group; similar organisms may be placed into different groups; only limited information is made available and it is less accurate* instead of the disadvantages of using common names such as bringing confusion among scientists due language barrier. Others wrote the disadvantages of the specimens such as *tilapia can easily die when they get out of water; rat destroys the environment by eating crops and clothes and butterfly dies easily because it has short life span.* This indicates that, the candidates were not aware of the type of classification systems and their advantages and disadvantages. In addition, they were not conversant with disadvantages of using common names in classification of living organisms and for communication purposes among biologist worldwide.

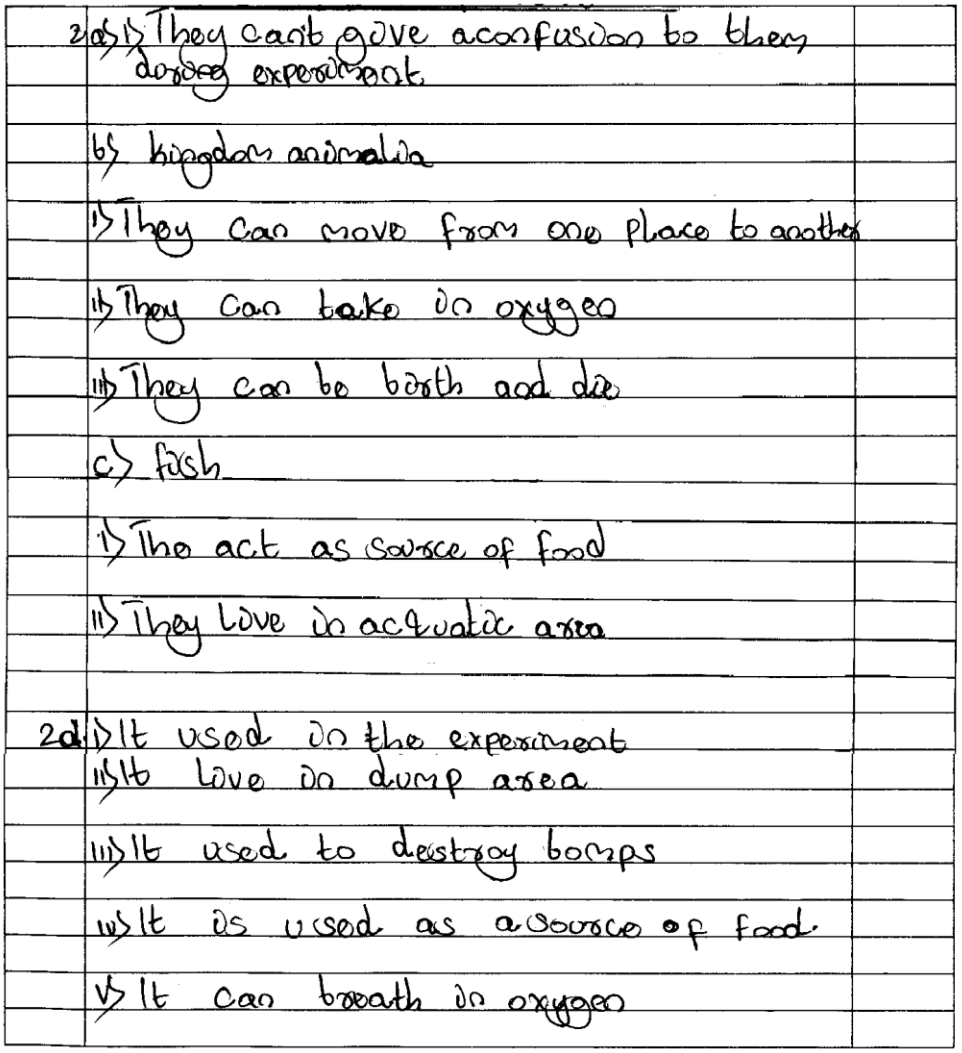
In part (b), most of the candidates mentioned *artificial classification* system as a system that places tilapia fish and rat to the Phylum Chordata instead of natural classification system which considers many features. Also, they gave incorrect reasons to justify the placement of tilapia fish and rat into the Phylum Chordata. For example, some of them wrote merits of artificial classification such as *it considers few observable features; it is less time consuming; it requires simple skills and it is based on an individual's interest*. Such responses indicate that, the candidates were aware of classification systems but failed to recognize that considerably many features were used to place members in their respective taxon as per natural system of classification.

In part (c), some candidates described distinctive features of the Class Chondrichthyes such as *they have heterocercal tails*; *they have ventral mouth and they have cartilaginous skeleton* instead of the correct observable distinctive features of the class Osteichthyes such as body is

covered with cycloid scales, gills covered by operculum, terminal mouth and homocercal tail fins. Consequently, some of the candidates drew a diagram of shark with a ventral mouth and heterocercal tail fin instead of a tilapia fish. Others drew the correct diagram but labeled features which are not distinctive of the Class Osteichthyes such as endoskeleton, backbone, head and thorax. Their responses indicate that they confused the features of class Osteichthyes with those of class Chondrichthyes.

In part (d), some of the candidates gave one to two correct distinctive features of the Class Osteichthyes hence loss of marks. For the candidates who scored 0 they wrote features of other classes. For instance some candidate wrote the features of Class Insecta such as *they have three pairs of legs; they have body divided into three parts; have a pair of antennae and two pairs of wings.* This implies that the candidates were not aware of the characteristics of Class Osteichthyes.

In part (e), some candidates gave features of butterfly. For example, some of them wrote *its body has three parts, head, thorax and abdomen; it has one pair of antennae and two pairs of wings* instead of advantages of butterfly in our daily life such as pollination, serves for decorative purposes and attracts tourists. This indicates that, the candidates knew the characteristics of the members of the Class Insecta but were not aware of the advantages of the butterfly to human life. Extract 16.2 is a sample of the candidate's incorrect responses to question 2, paper 2C.



Extract 16.2: Candidate's incorrect response to question 2, paper 2C

In Extract 16.2, the candidate wrote incorrect responses in all parts of the question. For example, he/she wrote the classification system used to place both tilapia fish and rat to the same phylum is *Kingdom Animalia* instead of natural classification system in part (b). Also, he /she incorrectly wrote advantages of rat such *it used to destroy bombs* instead of the distinctive characteristics of the class in which rat belong.

4.0 ANALYSIS OF CANDIDATES' PERFORMANCE ON EACH TOPIC

The Biology examination covered 16 topics in papers 1 and 2. The analysis of the candidates' performance indicates that, the topics of *Evolution, Gaseous Exchange and Respiration, Movement, Health and Immunity, Reproduction, Genetics, Regulation, Introduction to Biology, Balance of Nature* and *Excretion* had good performance of 81.66 per cent. These topics were examined in question 1 which was multiple choices.

The topics with average performance were *Classification of Living Things* (59.86%), *Coordination* (53.25%), *Health and Immunity* (48.67%), *Safety in Our Environment* (42.69%), *Reproduction* (42.11%) and Movement (33.35%). These topics were examined in questions 2, 4, 5, 9, and 11 for the theory paper and question 1 and 2 for practical paper. In the theory paper, question 2 was a matching item, question 9 and 11 were essay while the other questions were short answer.

The topics with weak performance were *Nutrition* (23.36%), *Transport of Materials in Living Things* (21.33%), *Growth* (17.95%) and *Genetics* (4.34%). These topics were examined in questions 3, 10, 7 and 6, respectively. Questions 3, 6 and 7 were short answer while question 10 was an essay. A summary of the candidates' performance on each topic in 033/1 Biology 1 and 033/2 Biology 2, CSEE 2023 is presented in the appendix.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Analysis of the candidates' performance in the Biology CSEE 2023 showed that the performance was good since 70.09 per cent of the candidates scored from 30 marks or above. Further the analysis of the candidates' performance revealed that the candidates had good performance on questions 1 theory paper and 2 from practical paper. The questions with average performance were 2, 4, 5, 8, 9 and 11 and 1 from practical paper. On the other hand, the candidates had weak performance on questions 3, 6 7 and 10.

The good performance in some topics was attributed to candidates adequate knowledge of the concepts examined; ability to understand the demands of

the questions and adequate drawing skills. It was established that factors such as inadequate knowledge of the concepts examined, failure to meet the demands of the questions, lack of adequate drawing skills, misspelling of scientific words and poor proficiency in the English language contributed to weak performance in some of the candidates.

5.2 Recommendations

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

(a) use charts, pictures, photographs showing animals of different sex e.g. long horned goat/cow big comb and plumage of hen to guide students in groups to observe and discuss on the meaning of the terms *sex linked, sex limited* and *sex influenced characters.* Also, should use pictures/ photographs showing animals with different colours such as black, white, brown and dotted cow, cat, goat or hen to guide student in groups to discuss on the meaning and differences between incomplete dominance and co-dominance in the teaching and learning of the topic of *Genetics*.

(b) use photographs/ charts/ diagrams showing human developmental stages and varieties of food to guide students in groups to discuss on the factors affecting the rate of physical deterioration of human body in the teaching and learning of the topic of *Growth*.

(c) use models/charts and the preserved or fresh specimen of mammalian heart to guide students in small groups through questions and answers to list the external and internal parts of the mammalian heart. Then discuss on the functions of the external and internal parts of the mammalian heart in the teaching and learning of the topic *Transport of Materials in Living Things.*

(d) invite a guest speaker (health specialist) to talk on causes, symptoms, effects and control measures of the common disorders/ diseases of the digestive system in the teaching and learning of the topic of *Nutrition.*

(e) promote the use of English language in order to improve students' proficiency in the English language and enable them to

understand what is taught in the class as well as the questions in examinations.

(f) give practices to students about principles of drawing biological diagrams in order to develop their drawing skills.

(g) ensure availability of laboratories and lab equipment to help students get hand on experiences.

Appendix: A summary of the Candidates' Performance Topic-wise in CSEE 2023

S/N	Topics	QuestioNumber	Percentage of Candidates With a Score of 30% or Above	Average Performance Per Topic (%)	Remarks
1.	Evolution, Gaseous Exchange and Respiration, Movement, Health and Immunity, Reproduction, Genetics, Regulation, Introduction to Biology, Balance of Nature and Excretion	1	81.66	81.66	Good
2.	Classification of Living Things	8	54.06	59.86	Average
		2 *Practical*	65.65		
3.	Coordination	2	59.39	53.25	Average
		5	47.11		
4.	Health and Immunity	11	48.67	48.67	Average
5.	Safety in Our Environment	9	42.69	42.69	Average
6.	Reproduction	4	42.11	42.11	Average
7.	Movement	1 *Practical*	33.35	33.35	Average
8.	Nutrition	3	23.36	23.36	Weak
9.	Transport of Materials in Living Things	10	21.33	21.33	Weak
10.	Growth	7	17.95	17.95	Weak
11.	Genetics	6	4.34	4.34	Weak