THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2018

031 PHYSICS

THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

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031 PHYSICS 1

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

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FOREWORD

The Certificate of Secondary Education Examination (CSEE) marks the end of four years of secondary education. As a summative evaluation, it gives a picture of the effectiveness of the education system in general and the education delivery system in particular. The candidates' responses to the examination questions is a strong indicator of what the education system was able or unable to offer to the students in their four years of secondary education.

This candidates' items response analysis report in Physics subject for CSEE 2018 has been prepared in order to give feedback to students, teachers, parents, policy makers and the public in general on how the candidates responded to the examination questions.

The analysis presented in this report will help various stakeholders to understand some of the reasons that led to the performance shown in Physics subject. It also points out some factors that partly contributed to candidates' poor performance. These factors include; failure to identify task of the question, inability to follow instructions, lack of mathematical skills, lack of skills in sketching and drawing diagrams, poor English Language Proficiency and candidates' inadequate knowledge of various topics in Physics. The recommendations provided intends to help the educational administrators, school managers, teachers and students to identify proper ways to improve the candidates' performance in the future examinations administered by the Council.

The National Examinations Council of Tanzania will highly appreciate comments and suggestions from teachers, students and the public in general, to improve future analysis reports and candidates' performance.

The Council is also indebted to staff members who were involved in processing the data used in this report. Finally, the Council would like to thank all the examination officers, examiners and all others who participated in preparation of this report.

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report presents analysis of the performance of candidates who sat for Physics 1 Certificate of Secondary Education Examination (CSEE) in 2018. This paper intended to assess the competencies acquired by the candidates as stipulated in the 2010 Ordinary Level Physics Syllabus for Secondary Schools.

The paper consisted of three (3) sections, namely A, B and C. Section A comprised of three (3) Objective Questions, section B had six (6) Short Answer Questions while section C consisted of two (2) Short Answer Questions. Each question in sections B and C had either two or three parts namely (a), (b) and (c). The candidates were required to answer all questions in sections A and B and one question in section C.

The number of the candidates who sat for Physics in CSEE 2018 was 133,616, of which 45.5 percent passed and 54.5 percent failed. In the year 2017 the candidates who sat for this subject were 131,243, of which 42.17 percent passed and 57.83 percent failed. This indicates that, candidates' performance in Physics for the year 2018 increased by 3.33 percent as compared with the performance in the year 2017.

This report analyses the performance of the candidates in each question. It begins by indicating the question demand and then provides the analysis of candidates' performance. It also highlights some misconceptions observed and outlines some reasons behind the candidates' performance.

The candidates' performance is considered to be good, average or weak if the percentage of the candidates scored marks 65 – 100 (green), 30 – 64 (yellow) and 0 – 29 (red) respectively. The samples of candidates' responses are inserted as extracts to represent good and weak cases. Some graphs and charts are used to summarize the candidates' performance for each question. Appendix I indicates the general performance in each topic and Appendix II shows comparison of the candidates' performance between CSEE 2017 and 2018 in terms of topics.

Finally, recommendations are presented to educational stakeholders to improve candidates' performance in future.

2.0 ANALYSIS OF CANDIDATES' PERFORMANCE PER QUESTION

This part describes performance of the candidates in each question. The description included; section, question number, type of question, topic/subtopic (s) from which the question was constructed, demands of the question as well as the performance in percentage of candidates on that particular question. The candidates' score in a question was considered as weak, average or good as follows: For objective questions (Section A) the score ranges were: 0 to 2 marks (weak), 3 to 6 marks (average) and 7 to 10 marks (good) whereas for subjective questions (sections B and C) the ranges for weak, average and good scores were 0 to 2.5 marks, 3 to 6 marks and 6.5 to 10 marks respectively.

2.1 Section A: Objective Questions

This section comprised of three compulsory objective questions. Each question carried a weight of ten (10) marks distributed equally to ten question items.

2.1.1 Question 1: Multiple Choice Items

This question required the candidates to choose the correct answer from among the given five alternatives A to E under each of the question items (i) to (x) and write the letter of the correct answer against the item number on the answer booklet provided. The question items were constructed from the following topics: *Structure and Properties of Matter*; *Light; Waves; Measurement of Thermal Energy; Electronics; Applications of Vectors; Optical Instruments; Elementary Astronomy* and *Current Electricity*.

The question was attempted by 133,579 (100%) candidates, of whom 35.5 percent scored from 0 to 2 marks, 55.1 percent scored from 3 to 6 marks and 9.4 percent scored from 7 to 10 marks as summarized in Figure 1.

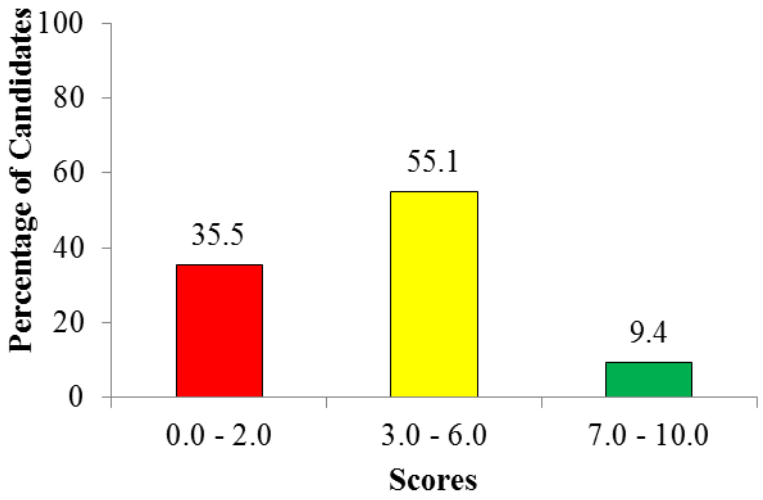


Figure 1: *A Summary of Candidates' Performance in Question 1*

The scores in the figure 1 indicate that, performance of the candidates in this question was average as 64.5 percent of them managed to score marks above the pass mark. The following is a detailed analysis of candidates' responses in each question item.

Item (i) required the candidates to identify the correct formula for elastic force constant (k) of a spring among the given alternative answers. Most of the candidates were able to choose the correct answer which was A, $\frac{\text{tension}}{\text{extension}}$. Candidates who selected incorrect alternatives, opted for alternative B, $\frac{\text{mass}}{\text{extension}}$. This indicates that, these candidates failed to distinguish between elastic mass constant and elastic force constant which are closely related but are not the same. Similarly, few candidates who chose alternatives C, $\frac{\text{extension}}{\text{mass}}$ D, $\frac{\text{extension}}{\text{tension}}$ and E, $\frac{\text{tension}}{\text{mass}}$ lacked the content knowledge about Hooke's law on the context of Structure and Properties of Matter.

Item (ii) required the candidates to choose an alternative which described the reason why oil is used as a lubricant. The correct response was B, *it is high viscous* and most of the candidates managed to choose the correct response. This implies that these candidates had insight on the characteristics of the lubricant. On the other hand, most of the candidates

who chose incorrect answer opted for alternative E, *it is less viscous* showing that, they did not understand that, less viscous liquids are not used as lubricant because they flow fast hence cannot form suitable layer between machine parts for lubrication. In addition, there were few candidates who chose alternatives A; *has low density*, C; *it is flammable* and D; *it is inflammable*. These candidates failed to realise that, the properties density, flammable and inflammable has nothing to do with lubrication of a liquid.

Item (iii) required the candidates to choose one of the characteristics of a plane mirror. The alternatives were: A, *it forms an image which is real and opaque*; B, *it forms an image which is larger than the object*; C *it forms an image which is real and laterally inverted*; D, *it forms an image which has the same size as the object;* and E*, it forms an image which is small in size than the object.* Most of the candidates chose the correct response D indicating that; they were knowledgeable on the position, size and nature of an image formed by a plane mirror. Few candidates who chose alternative A, B, C and E lacked the knowledge of the characteristics of the image formed by a plane mirror.

In item (iv) the candidates were required to choose an alternative which does not represent a region of electromagnetic spectrum. The responses were: A, *radio waves;* B, *x- rays*; C, *infrared light*; D, *ultraviolet light;* and E, *invisible light waves*. A few candidates chose the correct answer which was represented by option E. These candidates recognized that since visible light is a member of electromagnetic spectrum, then the counterpart, invisible light cannot also be a member of electromagnetic spectrum. Most of the candidates who opted for incorrect answer chose option B, x-rays. This could partly be attributed to the fact that, the term x - rays is common to most of the people due to its application. This also implies that, these candidates had little knowledge on electromagnetic spectrum.

Item (v) required the candidates to choose the alternative which represented the quantity of heat needed to raise the temperature of 25 kg of the sample of mercury from 20 ^{o}C to 30 ^{o}C. The responses were A, *1,743,750 J*; B, *348, 750 J;* C, *345,750 J*; D, *1,550,750 J;* and E, *413,750 J*. According to the given data the correct answer was presented by option B. In order to identify this answer, the candidates were required to calculate the quantity of heat which is the product of mass, specific heat capacity and the change

in temperature, then compare the answer with the values given in the alternatives. Unfortunately, majority of candidates chose incorrect alternatives implying that they used incorrect formula for calculating the quantity of heat. They also, lacked appropriate knowledge on the factors which determine the quantity of heat of a substance or rather lacked computational skills.

In item (vi), the candidates were required to identify the product of doping silicon element with phosphorus atoms from among the given alternatives. The responses were: A, *a p-type semiconductor;* B, a *p-n junction diode;* C, *an intrinsic semiconductor;* D, *a bipolar semiconductor*; and E, *an n-type semiconductor*. A good number of candidates managed to choose the correct response E, suggesting that most of them were able to recall the contention which states that "when silicon (group four element) is doped with phosphorus (group five element) produces excess electrons which results into the formation of an n-type semiconductor". However, those who chose incorrect responses opted for distracter C indicating that, they lacked knowledge of doping, because a doped material will no longer be a pure semiconductor as its electrical properties will be drastically influenced by introducing impurities.

In item (vii) the candidates were required to identify an example of a scalar quantity from the given physical quantities. The responses were: A, *Electric current;* B, *force*, C; *Velocity*; D, *Displacement;* and E, *Acceleration*. Most of the candidates managed to identify from among the given physical quantities that *electric current* is a scalar quantity hence chose the correct answer. The rest of the candidates were distracted by option D showing that they considered displacement which is a vector quantity as a distance which is scalar quantity. Consequently, few candidates chose incorrect responses B, C, D or E. This is an indicator that they lacked the knowledge of properties of vectors hence failed to identify that, these options represented vectors quantities.

Item (viii) required the candidates to identify among the given alternatives the role of iris in human eye. The options were: A, *to hold the lens in position;* B, *to prevent internal reflection*; C, *to control the size of the pupils*; D, *to control the thickness of the lens;* and E, *to protect the eye from light*. The correct answer was C and it was correctly identified by few candidates. Options D and E attracted many candidates in this item

showing that the majority failed to distinguish the functions of Iris with those of Ciliary muscles and Cornea.

Item (ix) required the candidates to identify the name given to asteroids that reaches the earth surface. The options for the answer were: A *stars*; B, *meteors*; C, *meteorites*; D, *constellations;* and E, *comets*. Analysis of candidates' responses showed that although in Tanzania there are two meteorites sites one located in Mbozi district (Mbeya region) and the other in Shinyanga district (Shinyanga region), most of the candidates failed to use this information to identify the correct answer. A high proportion of candidates chose incorrect options A or B.

In item (x); the candidates were required to choose the option which corresponds to the value of resistivity of a wire of length 2 metres, cross sectional area of 0.5 mm^2 and a resistance of 2.2 Ohms. The responses were: A, 5.5×10^{-7} Ωm; B, 6.5×10^{-7} Ωm; C, 2.3×10^{-7}; D, 1.1×10^{-6} ;and E, 5.5×10^{-7} Ωm. The candidates were required to calculate the resistivity of a wire using the formula $\rho = \frac{RA}{L}$ where ρ, R, A and L stand for the resistivity, resistance, cross sectional area and length of the wire respectively. Then, they were supposed to compare the value of the calculated resistivity with those given in the options. The analysis based on performance scores showed that, most of the candidates chose incorrect responses implying that, they were not able to perform the calculations for resistivity in a solid conductor.

2.1.2 Question 2: Matching Items

This question required the candidates to match the ten (10) items on list A (Phrases) with responses on list B by writing the letter of the correct response beside the item number. The items and the responses were constructed from the topic of Magnetism. The premises and responses of the question are given in the following table.

List A		List B	
(i)	Material that can strongly be magnetized.	A.	Paramagnetic
		B.	Temporary magnets
(ii)	Substances which are made up of soft iron.	C.	Zinc and Copper
		D.	Permanent Magnets
(iii)	Materials that cannot be	E.	Magnetic Domains

	affected by magnets.	F.	Earth's Magnetic field
(iv)	Objects which are made up of steel.	G.	Induced magnetism
		H.	Magnetization
(v)	Groups of magnetic dipoles arranged themselves in a magnetized object.	I.	Demagnetization
		J.	Permeable
		K.	Neutral point
(vi)	Field lines of forces used for finding locations of different places.	L.	Ferromagnetic
		M.	Magnetic field
(vii)	The process of aligning the domains of atoms in one direction.		
(viii)	The process of destroying the alignment in a magnetized material.		
(ix)	Materials that can redirect field lines of force.		
(x)	The regions around a magnet in which magnetic materials are attracted.		

A total of 133,581 (100%) candidates attempted this question and their scores were as follows: 47.6 percent scored from 0 to 2 marks, 43.8 percent scored from 3 to 6 marks and 8.6 percent scored from 7 to 10 marks. These scores indicate that the candidates' performance was average as 52.4 percent of candidates scored from 3 to 10 marks. Figure 2 summarizes the candidates' performance in this question.

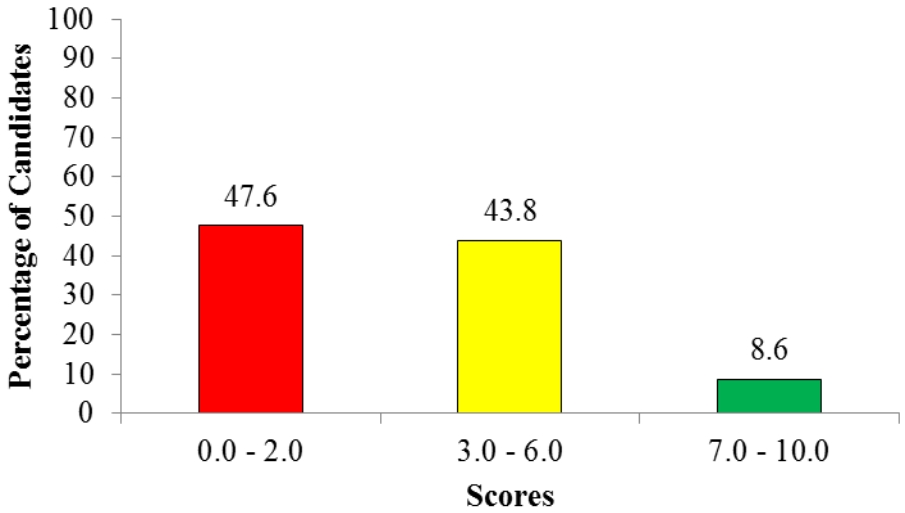


Figure 2: *A Summary of Candidates' Performance in Question 2*

The analysis of the performance of the candidates in each of the items in this question is as follows:

Item (i), required the candidates to give a suitable response which matched correctly the statement *materials that can strongly be magnetized*. The appropriate response was option L which reads *Ferromagnetic*. Most of the candidates identified the correct answer in this item indicating that they had knowledge on the concept of properties of magnetic materials. However, some candidates who failed to match it correctly opted for response A, *paramagnetic*. The possible reason for this choice was that they failed to distinguish different types of magnetic materials with their respective properties. They were supposed to know that paramagnetic materials are the ones which are weakly magnetized.

Item (ii) required the candidates to match correctly the sentence *substance which is made up of soft iron*. Most of the candidates selected the appropriate response B which reads *temporary magnets*. These candidates were knowledgeable on the types, examples and differences of magnets. Conversely, the candidates who failed to match it correctly opted for response D, *permanent magnets*. The reason for this misconception is that both permanent and temporary magnets are types of magnets, but once the permanent magnets are magnetized they retain a certain degree of magnetism. Such materials consist of atoms and molecules that each have a magnetic field and are positioned to reinforce each other. On the contrary, temporary magnets unlike permanent magnets loose their magnetism when the magnetic field disappears.

Item (iii) required the candidates to identify the correct term which match correctly the sentence *materials that cannot be affected by magnets*. The correct response was C, *zinc and copper*. The majority of the candidates selected the correct response. However, a few candidates who provided the incorrect response were distracted by response E, *magnetic domains*. These candidates failed to recognize that zinc and copper are non-magnetic materials and hence cannot be affected by the magnets while magnetic domains are regions in which the magnetic fields of atoms are grouped together and aligned in a uniform direction.

Item (iv) required the candidates to correctly select the response which match with *"objects which are made up of steel"*. The correct response was D, *permanent magnets*. Most of the candidates provided the correct response. Nevertheless, some candidates selected A, *temporary magnets* as it is closely related to the permanent magnets. Others selected L, *ferromagnetic*. All these lacked knowledge about different examples of strongly and weakly magnetized substances. Permanent magnets are made of steel because steel is an alloy of iron and small amounts of carbon. Thus, it is much harder metal than pure iron and difficult to demagnetize it.

Item (v) required the candidates to find the best response which matched precisely the sentence *groups of magnetic dipoles arranged themselves in a magnetized objec*t. The correct response was E, *magnetic domains.* Most of the candidates failed to match it correctly. Some candidates selected option G, *induced magnetism*. These candidates did not understand that induced magnetism occurs only when a piece of unmagnetized magnetic material touches or is brought near to the pole of a permanent magnet. But for the case of magnetic domains, they are regions within a magnetic material in which the magnetization is in a uniform direction, that is, the individual magnetic moments of the atoms are aligned with one another and they point in the same direction. In general, these candidates lacked knowledge of the concept of domain theory of magnetic materials.

Item (vi) required the candidates to correctly select the response which match with the phrase *field lines of force used for finding locations of different places*. The correct response was F, *earth's magnetic field*. Few candidates matched it accurately. Nonetheless, others wrote option M *magnetic field*. These candidates failed to comprehend that the earth's magnetic field, also known as the geomagnetic field, is the magnetic field that extends from the Earth's interior out into space, where it interacts with the solar wind, a stream of charged particles emanating from the sun. The Earth's field lines of force can therefore be used to find locations of different places. On the contrary, the magnetic field is a vector field that describes the magnetic influence of electrical currents and magnetized materials and serves as a region around a magnet in which magnetic materials are attracted.

In item (vii) the candidates were required to choose the response which matched correctly with "the process of aligning the domains of atoms in

one direction. The correct response was H *magnetization*. Most of the candidates matched it correctly. Some candidates selected wrong option I *Demagnetization*. These candidates failed to differentiate the process of magnetization from that of demagnetization as the two processes oppose each other. They failed to remember that magnetization refers to a process of making a substance temporarily or permanently magnetic, as by insertion in a magnetic field which results into aligning the domains of atoms in one direction. But demagnetization is a process of reducing or removing the magnetism of a ferromagnetic material resulting into the destruction of the alignment of atoms in a magnetized material.

Item (viii) required the candidates to choose the response which matched correctly with the sentence *the process of destroying the alignment in a magnetized material*. The correct response was I, *Demagnetization*. Most of the candidates matched it correctly. However, some candidates selected option H, *magnetization*. As stated in item (vii), these candidates could not make a distinction between the process of making and that of destroying the alignment of atoms or magnetic moments in the magnetized materials. In general they responded to items (vii) and (viii) interchangeably.

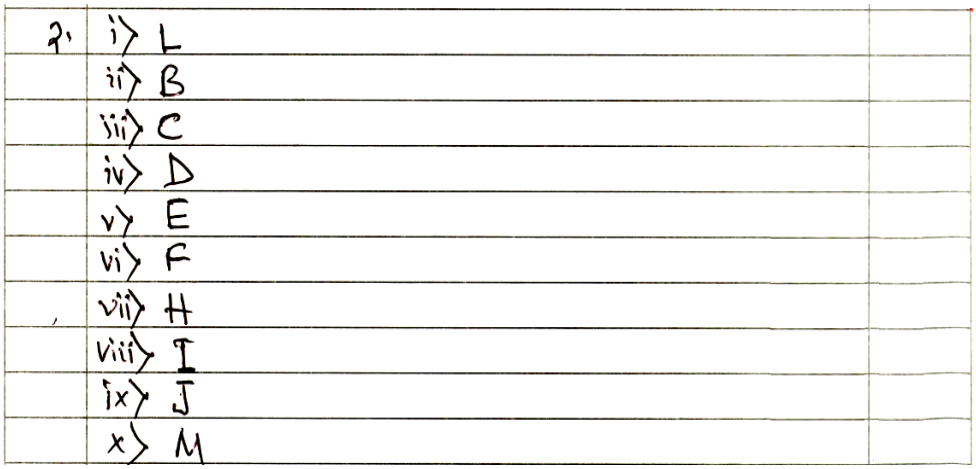
Item (ix) required the candidates to select the correct response which accurately match with the phrase *materials that can redirect field lines of force*. The correct response was J, *permeable*. Most of the candidates failed to select the correct response. This explicates therefore that they lacked knowledge on the properties of magnetic lines of force in response to different magnetic materials. Similarly, these candidates lacked insight on the concept of permeability. They were supposed to know that in magnetism, permeability is a measure of the ability of a material to support the formation of a magnetic field within itself of which can redirect field lines of force.

Item (x) required the candidates to choose the correct response which match correctly with the sentence *the region around a magnet in which magnetic materials are attracted*. The correct response was M, *magnetic field.* Majority of candidates managed to select the correct response. On the contrary, few candidates failed to select the correct answer. These candidates failed to recall that in everyday life, the effects of magnetic fields are often seen in permanent magnets, which pull on magnetic

materials such as iron and attract or repel other magnets. Generally, they lacked the general knowledge on the concepts of magnetic fields.

Extract 2.1 shows a sample of responses from one of the candidates who matched correctly each item of the question.

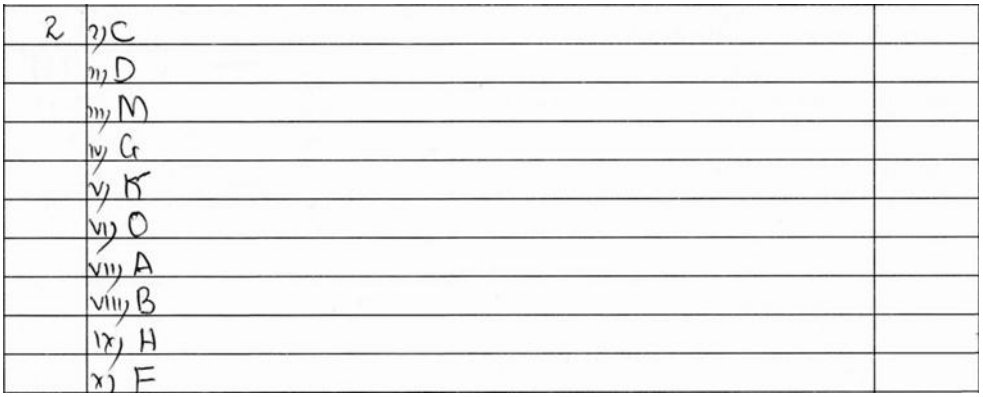
Extract 2.1



In extract 2.1 the work of the candidate was correct implying that he/she had adequate knowledge on the concept of Magnetism.

Extract 2.2 depicts the sample of answers from the script of one of the candidates who matched the premises and responses incorrectly.

Extract 2.2



In extract 2.2, the candidate provided incorrect answers to each item of the question.

2.1.3 Question 3: Fill in the Blank Items

This question comprised of ten (10) question items numbered (i) to (x) which were constructed from the topics of *Simple Machines; Measurement of Thermal Energy; Work, Energy and Power; Electronics; Radioactivity; Electromagnetism; Newton's laws of Motion; Waves and Elementary Astronomy*. In each of the items the candidates were required to fill in the blank spaces by writing the suitable answer for the item in the given answer sheet (s).

A total of 133,584 (100%) candidates attempted this question whereby 44,664 (33.4%) candidates scored from 0 to 2 marks, 63,162 (47.3%) candidates scored from 3 to 6 marks and 25,758 (19.3 %) scored from 7 to 10 marks. These scores indicate that the performance was good as 66.6 percent of the candidates scored 3 marks and above of the allotted marks. Figure 3 depicts the performance of the candidates in this question.

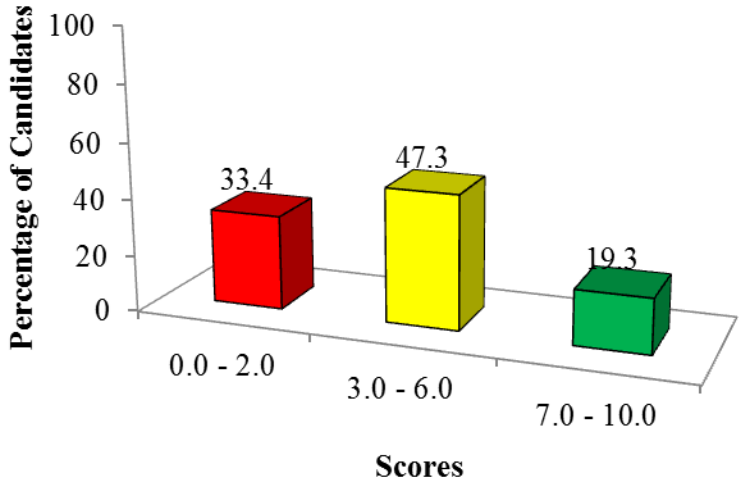


***Figure 3**: Candidates' Performance in Question 3*

The following is the description of the demands and responses of the candidates on each item:

Item (i) required the candidates to write the term used to name the ratio of distance moved by effort to the distance moved by load. The appropriate

term was *Velocity Ratio (V.R*). Most of the candidates managed to write the correct answer. The few who provided incorrect answers either wrote *Mechanical Advantage (M.A), Effort* or *Load* suggesting that, they lacked adequate knowledge on basic concepts in the topic of *Simple Machines.*

In item (ii), the candidates were required to provide the term used to name the heat needed to raise the temperature of a body by 1k. The correct answer was *Heat capacity*. The performance of candidates in this item was moderate since an average number of candidates provided correct answers and other candidates wrote incorrect answers. One of the most observed incorrect response written by some candidates was *Specific Heat Capacity.* This suggested that these candidates did not know that *Specific Heat Capacity* refers to the heat required to raise the temperature of a body of unit mas by 1k and not the heat needed to raise the temperature of a body of any mass by 1k.

Item (iii) required them to give the term used to present the work done produced when a force of 1N moves a distance of 1m in the direction of force. Most of the candidates failed to write or name the correct term. Obviously, the stem of the question carried the meaning of Joule; therefore, the appropriate response for this item was *Joule*. Unfortunately, majority of the candidates wrote *Newton Metre (1Nm)* which is not correct because Nm does not always stand for work done as it also represents moment of force.

In item (iv) the candidates were required to write the name of a crystal formed when a p-type and n-type semiconductors are bounded together. Most of the candidates failed this item as they wrote *Transistor* while the correct answer was *PN Junction*/ *Junction Diode*. The challenge in this item was that many candidates failed to understand that a transistor (n-p-n transistor) is a crystal formed when an extremely thin p-semiconductor sandwiched between two outer n-semiconductors or when an extremely thin n-semiconductor sandwiched between two p-semiconductors (p-n-p transistor). In other words, transistor consists of two p-n junctions while the question requires the candidates to give the name of the crystal formed by joining a p-type and n-type.

Item (v) required the candidates to name the nuclear reaction which involves joining of lighter nuclei into heavier nucleus. The required answer was *Nuclear Fusion*/*Fusion*. The performance in this item was moderate as

a good number of candidates provided the correct answer while others failed to retrieve properly the correct name for the reaction among other nuclear reactions hence they wrote either Nuclear fission or Chain reaction. This suggests that, these candidates had little understanding of nuclear reactions

Item (vi) required the candidates to write a device which produces electricity on the basis of electromagnetic induction. The appropriate answer was *a generator*/ *Dynamo or Alternator*. Most of the candidates did not understand the demand of the question and therefore wrote various devices which are susceptible to the production of electricity such as *battery, dry cell* and *solar Panel*. These devices are sources of electric current which produces electricity but not on the basis of electromagnetic induction.

Item (vii) required the candidates to write the term used to describe the type of collision in which kinetic energy changes. The required response was *Inelastic/ Non-elastic collision.* The performance in this item was good as majority of the candidates provided correct answer showing that they had adequate knowledge on Newton's Law of Motion, preferably the types of collision. However, some candidates failed to supply the anticipated response. Some wrote *Mechanical energy* and others wrote *Potential energy* while the question required them to give the type of collision.

Item (viii) required the candidates to write the name of the particle found in the nucleus of an atom and carries no charge. The appropriate answer was *Neutron.* Most of the candidates responded correctly. Good response in this item was partly attributed to the fact that the tested concept is very basic on the study of structure of the nucleus of an atom. In addition, the concept is also found in Chemistry subject, so the candidates would have transferred knowledge to give the correct response. However, few candidates who failed to get marks from this item lacked knowledge on the composition of the nucleus and the type of charges they carry.

In item (ix) the candidates were required to state the type of wave which makes the particles of the medium vibrate in a direction perpendicular to the direction of movement of the wave. The correct type of wave was *Transverse wave*. In this item, the performance was average. One of the challenges which affected the performance was that, most of candidates

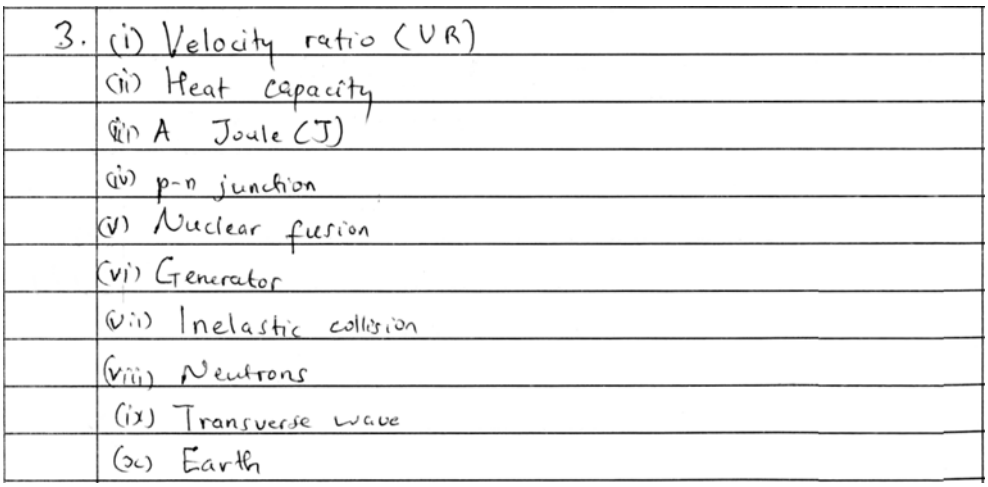
failed to identify different modes of vibrations of the particles of the waves which could guide them to give the type of wave required.

Item (x) required the candidates to name the heavenly body which is nearer to the sun than other stars for which the sun looks bigger and hotter than other stars. Most of the candidates were able to write appropriate response *Earth/Earth Surface*. This shows that, many candidates had adequate knowledge about solar system as described in the topic of *Elementary Astronomy*. It is clearly stated that, there are bigger stars than the sun but the sun is the closest star to the Earth's surface at a mean distance of 149.6 Million Kilometres. Obviously, other stars look smaller than the sun because they are far from the point of sight (The earth).

However, *Mercury* was one of the incorrect responses written by a number of candidates. These candidates were convinced by the fact that it is the closest planet to the sun but they failed to identify that; mercury is too hot such that it is difficult to look at the sun and compare with other stars.

Extract 3.1 portrays the work of one of the candidates who performed the question well.

Extract 3.1

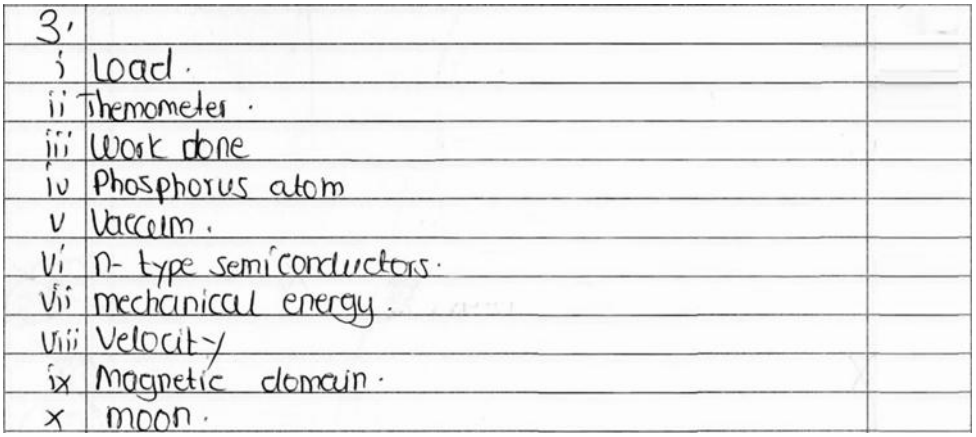


Extract 3.1 shows responses given by one of the candidates who had adequate knowledge on each of the items.

Unfortunately, 12,738 (9.5%) candidates did not score any mark in this question either due to provision of incorrect answers to each question item or skipping to attempt all the items of the question. This is an implication

that these candidates lacked knowledge or did not understand the demands of the question. Extract 3.2 shows an example of responses from one of the candidates who responded incorrectly to each part of the question.

Extract 3.2



In extract 3.2 the candidate provided incorrect answers to each part of the question. For instance, in (i) he/she wrote load instead of velocity ratio.

2.2 Section B: Short Answer Questions

This section comprised of six (6) compulsory questions each carrying 10 marks. The questions required brief explanation and/or calculations and were constructed from the topics of *Archimedes' Principle and Law of Flotation; Vapour and Humidity*; *Waves*; *Radioactivity*; *Light* and *Elementary Astronomy*.

2.2.1 Question 4: Archimedes' Principle and Law of Flotation

This question consisted of two parts namely (a) and (b). In part (a), the candidates were required to explain why hydrometer (i) is weighed with lead shots and (ii) has a narrow stem. In part (b), they were given data for a piece of rubber of volume 100 cm^3 and the density of 0.45 g/cm^3 which floats in water. Basing on these data, they were required to calculate (i) the volume of rubber that was partially immersed in water, and; (ii) the force required to immerse the rubber completely in water.

The question was attempted by 133,567 (100%) candidates, whereas 18 candidates failed to give any response on it. Analysis of performance of the candidates showed that 97.4 percent of them scored from 0 to 2.5 marks, 2.3 percent scored from 3 to 6 marks and 0.3 percent scored from 6.5 to 10

marks. Generally, the performance of the candidates in this question was weak since only 2.6 percent of candidates managed to score marks from 3 to 10 as depicted in Figure 4.

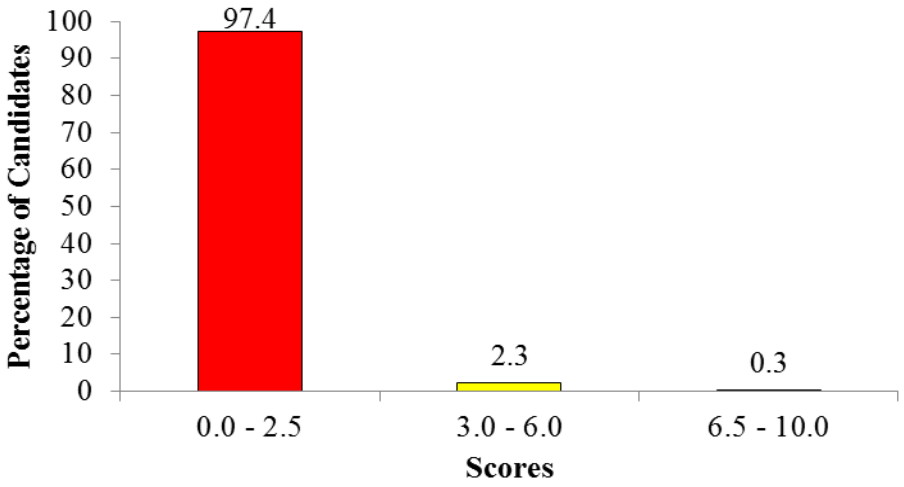
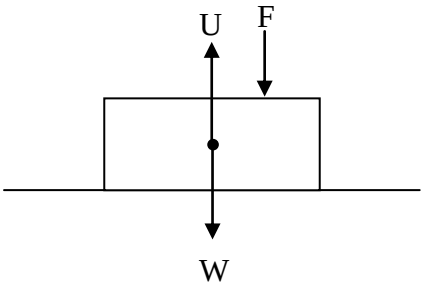


***Figure 4**: A Summary of Candidates' Performance in Question 4*

The group of weak performers in this question, comprised of 78,538 (58.8%) candidates who scored 0 marks and 51,600 (38.6%) who scored some marks within a range of 0.5 to 2.5 marks. Some of the factors which led to this great failure include; inability of many candidates to provide conceptual reasons on why hydrometer is weighed with lead shots as well as on why it has a narrow stem. Also, most of them were not able to apply the law of flotation and Archimedes' Principle to determine the part of volume of rubber immersed as well as the force required to immerse the rubber completely in water.

The challenge in part (b) (i) was that most of the candidates had wrong interpretation of the demand of the statement *"calculate the volume of rubber that partially immersed in water"*. Analysis of performance scores revealed that most candidates understood that, the required volume was that of the rubber contrary to demand of the question. The question required the candidates to calculate the volume of the portion of the rubber which sunk in the water.

In (b) (ii) most of the candidates were not able to identify the forces acting on the immersed rubber. To answer this part, they were also required to illustrate the question in a diagram as shown below;



Where U stands for up thrust, F is the applied force to immerse the rubber and W is the weight of the rubber. The illustration above imply that, $W+F = U$. Then, since the volume, density of the rubber and the value of g were given, the value of W could be obtained. Also, the value of U could be determined by applying Archimedes' Principle since according to it, up thrust (U) is equal to the weight of fluid displaced and the volume of water displaced is the same as the volume of the rubber. Extract 4.1 shows an example of responses from one of the candidates who performed this question poorly.

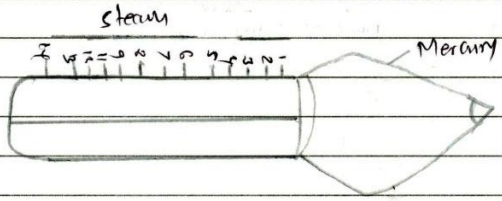
Extract 4.1

4 To explain why hydrometer
i) Is weighed with Lead shots
ii) has a narrow stem.

Mode of action of the hydrometer

The hydrometer is made to sink on the relative density - of the liquid which has to be determine. So that the relative density of the liquid which has to be determined is powered in a tall jar and the hydrometer started - to sink at the different rate depending on the level of the liquid in a tall jaw until it final rise above the surface - of the liquid the point, which the surface of the liquid touch to the steam it indicate the relative density of the - liquid

The structure of the hydrometer.



i) It weighed with lead shots so as to facilitate to sink at the different level of liquid
ii)
ii) It has a narrow stem so as to facilitate / to indicate the relative density of the liquid which has to be measured by

4 b) Data

Volume of rubber (V_b) = 100 cm^2

The density of the floating water (ρ_{wd}) = 0.45 g/cm^3

Solution

Note for the any body to floating the weight immersed in liquid is equal to zero

Weight of water displaced = Weight of a body in air

$W_{wd} = W_b$

But Note

Weight = Mass × Accelleration due to gravity

$W = Mg$.

$M_w \times g = M_b \times g$

$M_w = M_b$

Note.

Mass = density × volume

$M = \rho V$

$\rho = \frac{M}{V}$

$M = \rho V$

$\rho_w v_w = \rho_b v_b$ —— (1)

But the density of water = 1 g/cm^3.

So

Let the $\rho_w \times v_w$ be ρ of rubber × volume of rubber

$\rho_r v_r = \rho_w v_w$

$\rho_r v_r = \rho_w v_w$

Volume of rubber = $\frac{\text{density of water} \times \text{volume of water}}{\text{Density of rubber}}$

Volume of rubber = $\frac{1\ g/cm^3 \times 100\ cm^3}{0.45\ g/cm^3}$

$= \frac{100 \times 100}{0.45 \times 100}$

$= \frac{10000}{4500}$

$= \frac{10000}{45}$

Volume of rubber = $222.22\ cm^3$

ii) The Force required to immerse the rubber completely

W of water displaced = Real weight

$W_{wd} = W_b$

$W_{wd} =$

But

W = Mass × acceleration

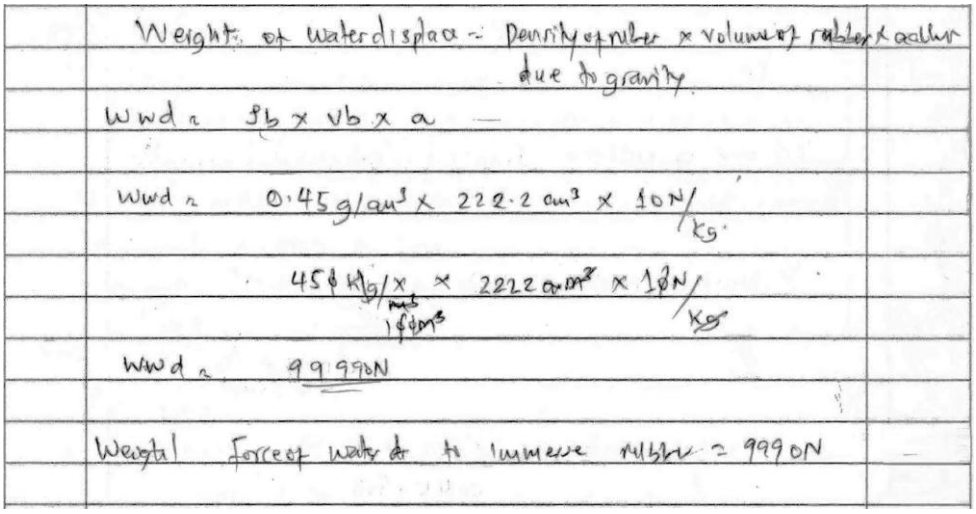
Weight = Mg.

W_{wd} = Mass × acceleration due to gravity

W_{wd} = But

Mass = Density × volume

lets Substitute.



In extract 4.1 the candidate explained incorrectly the mode of action of hydrometer and the reason why it's weighed with lead shoots. Similarly, he/she failed to explain why it has a narrow stem. Finally, the candidate applied incorrect formula to perform calculations.

Nevertheless, 2.6 percent of the candidates who passed this question included 30 candidates who answered correctly each part of the question hence scored all the 10 marks of this question. The work of these candidates was systematically presented and free from both grammatical and mathematical errors. These candidates managed to explain correctly why the hydrometer is weighed with lead shots and also has a narrow stem. For example, one candidate explained the reason for weighing the hydrometer with lead shots as: *"to increase its weight so as to make it float upright when immersed in a fluid"*.

Consequently, these candidates were able to calculate the volume of rubber which was partially immersed in water. They also managed to compute the force required to immerse the rubber completely. Extract 4.1 provides an example of a sample of responses of one of the candidates who correctly attempted this question.

Extract 4.2

4. a) i) A hydrometer is weighed with lead shots to make it float upright when immersed in a liquid. This is because the lead shots, lower the center of gravity of the hydrometer to make it attain stable equilibrium or stability and hence measure a liquid's relative density accurately.

ii.) A hydrometer has a narrow stem so as to increase sensitivity of any change in relative density of a liquid it is immersed in so that small changes in the liquid's relative density show large differences on the hydrometer.

b.) Soln: Data Given: Volume (V) = $100cm^3$
Density (ρ) = $0.45g/cm^3$

i.) From Law of flotation: ∴
Real weight = Upthrust

4. b.) i) $\rho = \frac{\text{Mass}}{\text{Volume}}$

$\text{Mass} = \rho \times V$

$= 0.45 g/cm^3 \times 100 cm^3$

$= 45 g.$

Since Real weight = Weight of water displaced

$45 g$ = Weight of water displaced.

But $\rho = \frac{\text{Mass}}{\text{Volume}}$

$\text{Volume} = \frac{\text{Mass}}{\rho}$

$= \frac{45 g}{1 g/cm^3}$

$= 45 cm^3$

$\therefore$ Volume of water displaced $= 45 cm^3$

But Volume of part of object submerged = Volume of water displaced

$\therefore$ Volume of immersed part $= 45 cm^3$

$\therefore$ Volume partially immersed $= \underline{45 cm^3}$.

4. b) ii) To immerse the body completely:

Volume of body = Volume of water.

$100cm^3$ = Volume of water.

but $\rho = \frac{Mass}{Volume}$

$1g/cm^3 = \frac{Mass}{100cm^3}$ x

Mass = 100g.

But 45g is already displaced.

= (100g - 45g)

= 55g has not been displaced.

1 g = 0.01 N

55g = ?

$= \frac{55g \times 0.01N}{1g}$

= 0.55 N.

∴ Force required to immerse fully = 0.55 N.

In extract 4.2 the candidate explained correctly the reason for loading the hydrometer with load shots and why it possesses a narrow stem. He/she applied proper mathematical procedures to calculate the volume and force required to immerse the rubber in water.

2.2.2 Question 5: Vapour and Humidity

This question had parts (a), (b) and (c) which required the candidates to (a) list four factors which affect the rate of evaporation of liquids; (b) (i) define relative humidity; and (ii) calculate the relative humidity given that the readings on dry bulb hydrometer is 24^{o}C and that of wet bulb is 16 ^{o}C and; (c) explain with aid of a sketched graph how temperature affect the saturated vapour pressure of water.

The question was attempted by 133,583 (100%) candidates who sat for this examination, whereby 85.8 percent of them scored from 0 to 2.5 marks, 13.8 percent scored from 3 to 6 marks and 0.4 percent scored from 6.5 to 10 marks. These scores are illustrated in Figure 5 which infers that performance of the candidates in this question was weak as only 14.2 percent of the candidates were able to score marks above the range of failure marks.

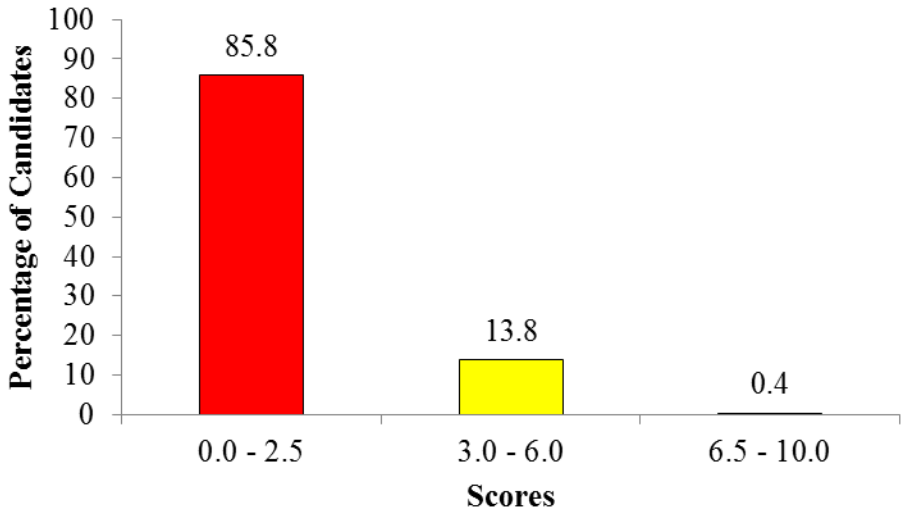
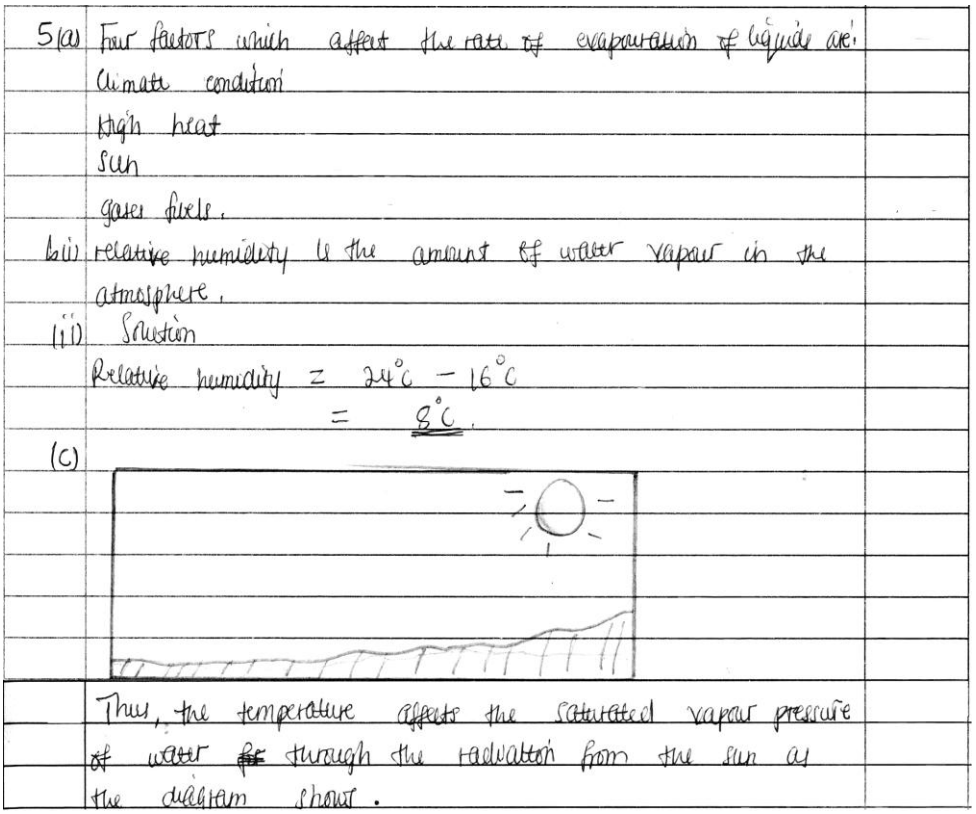


Figure 5: *A Summary of Candidates' Performance in Question 5*

Analysis of candidates' responses revealed that, one of the factors that led to poor performance in this question was inadequate knowledge especially on relative humidity. Likewise, lack of substantial knowledge and drawing skills in illustrating the effect of temperature on saturation vapour pressure of water, was another factor for this failure. Extract 5.1 shows an example of a sample of poor responses to this question.

Extract 5.1



Responses in extract 5.1 indicate that; the candidate lacked adequate knowledge in all assessed concepts. For instance in (a) he/she listed causes of evaporation of water instead of the factors affecting the rate of evaporation.

Although the question was performed poorly, four (4) candidates managed to provide correct responses to each part of the question hence scored all the marks allotted to this question. These candidates demonstrated a clear understanding on the concepts of Vapour and Humidity. Extract 5.2 shows an example of such good responses.

Extract 5.2

5. a) Factors that affect the rate of evaporation in liquids;
   i) Wind.
   ii) Humidity.
   iii) Temperature.
   iv) Surface area.

b) i) Relative humidity is the humidity expressed in percentage of the ratio of the actual humidity present in the atmosphere to the normal humidity found in the atmosphere when air is saturated.

$$\text{Relative humidity} = \frac{\text{Actual water vapour in the atmosphere}}{\text{Water vapour when air is saturated}} \times 100\%$$

ii) Soln:

Data given;

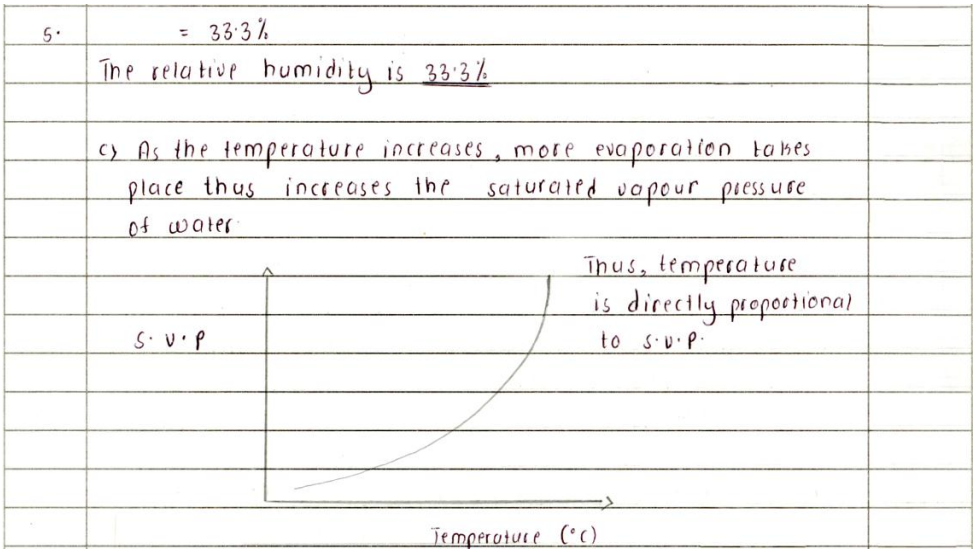
Reading on the dry bulb hydrometer = 24°C

Reading on the wet bulb hydrometer = 16°C

$$\text{R. Humidity} = \frac{\text{D. B. H reading} - \text{W. B. H reading}}{\text{D. B. H reading}} \times 100\%$$

$$= \frac{24^\circ C - 16^\circ C}{24^\circ C} \times 100\%$$

$$= \frac{8^\circ C}{24^\circ C} \times 100\%$$



In extract 5.2, the candidate provided good responses to all parts of the question.

2.2.3 Question 6: Waves

This question required candidates to (a) define (i) audibility range (ii) ultrasonic sound, (b) explain why notes of the same pitch played on a violin and flute has different quality and (c) calculate the frequency of the first and third harmonics of a string of length 75 cm, mass of 8.2 g under a tension of 18 N.

The question was attempted by 133,571 (100%) candidates and 14 candidates did not attempt the question. Analysis of candidates' performance in this question showed that 95.2 percent of them scored from 0 to 2.5 marks, 4.1 percent scored from 3 to 6 marks and 0.7 percent scored from 6.5 to 10 marks as presented in Figure 6. These scores portray that the performance of candidates in this question was weak since only 4.8 percent of the candidates managed to score marks above the failure boundary.

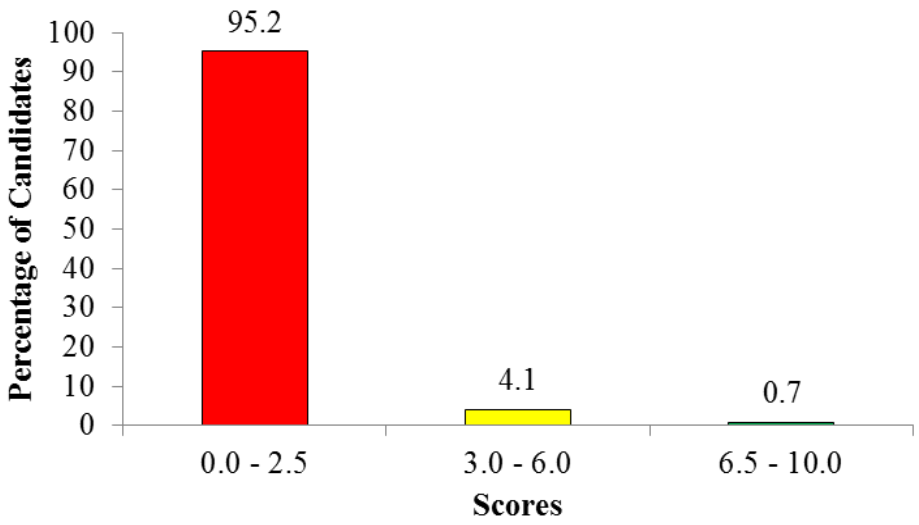


Figure 6: *A Summary of Candidates' Performance in Question 6*

Also, it was noted that there were a number of factors which contributed to poor performance in this question, including lack of knowledge on the concept of audibility range and ultrasonic sound and failure of many candidates to understand the meaning of violin and flute as well as their mechanisms. Furthermore, most of candidates failed to recall the correct formula for calculating frequency of the first and third harmonics. Extract 6.1 illustrates an example of poor response to this question.

Extract 6.1

QUESTION SIX

6 a) i) Audibility range. – refers to the ~~rang~~ wave range that move by deflection.

ii) ultrasonic sound – is the ability of wave sound to reflected by sound.

b) Because notes of the same pitch played on a violin to form a different quality of violin and flute in the same.

c) Data given

string length = 75cm

mass string = 8.2g

tension string = 8N

Require frequency of the first and third harmonics?

solution

$F = \frac{\text{mass string}}{\text{length string}}$

$F = \frac{8.2\,g \times 10}{75\,cm \times 10}$

$F = \frac{82\,g}{750\,cm}$

$F = 0.184\,g/cm^3$

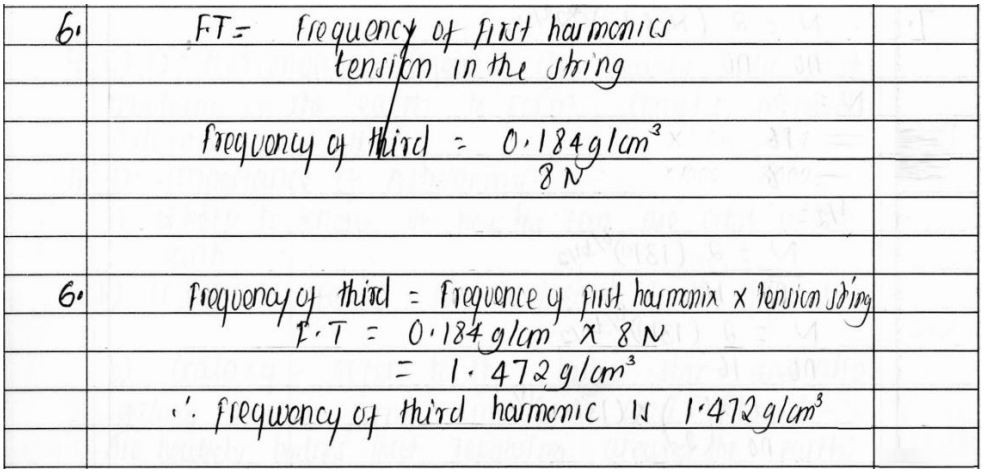
∴ Frequency of the first harmonics is $0.184\,g/cm^3$

2nd Frequency of the third harmonics.

Data

First harmonics = $0.184\,g/cm^3$

tension of string = 8 N



In extract 6.1 the candidate provided irrelevant definitions of audibility range and ultrasonic sound. The candidate used the formula $F = \frac{\text{mass}}{\text{Length}}$ instead of $f_n = \frac{n}{2l}\sqrt{\frac{T}{\mu}}$ to calculate the frequency f of the harmonics.

The few candidates (0.7%) who performed well in this question provided correct responses to many parts of the question. Some of the strengths observed from their responses in this question included adequate knowledge on the tested concepts, systematic calculations and good organization of work. However, some of them lost marks in parts of the question which required explanations due to language barriers. Extract 6.2 shows an example of good response from candidates who answered each part of the question correctly.

Extract 6.2

6 (a) (i) Audibility range is the interval of sound waves that can be perceived by human ear. (20Hz - 20KHz)

(ii) Ultrasonic sound is the sound with the frequency above 20 kilo Hertz (20KHz) which cannot be perceived by human ear.

(b) Notes of the same pitch played on a violin and flute has different quality because the number of overtones produced by a violin and flute differs.

(c) Data

Length of the string (L) = 75cm = 0.75M.

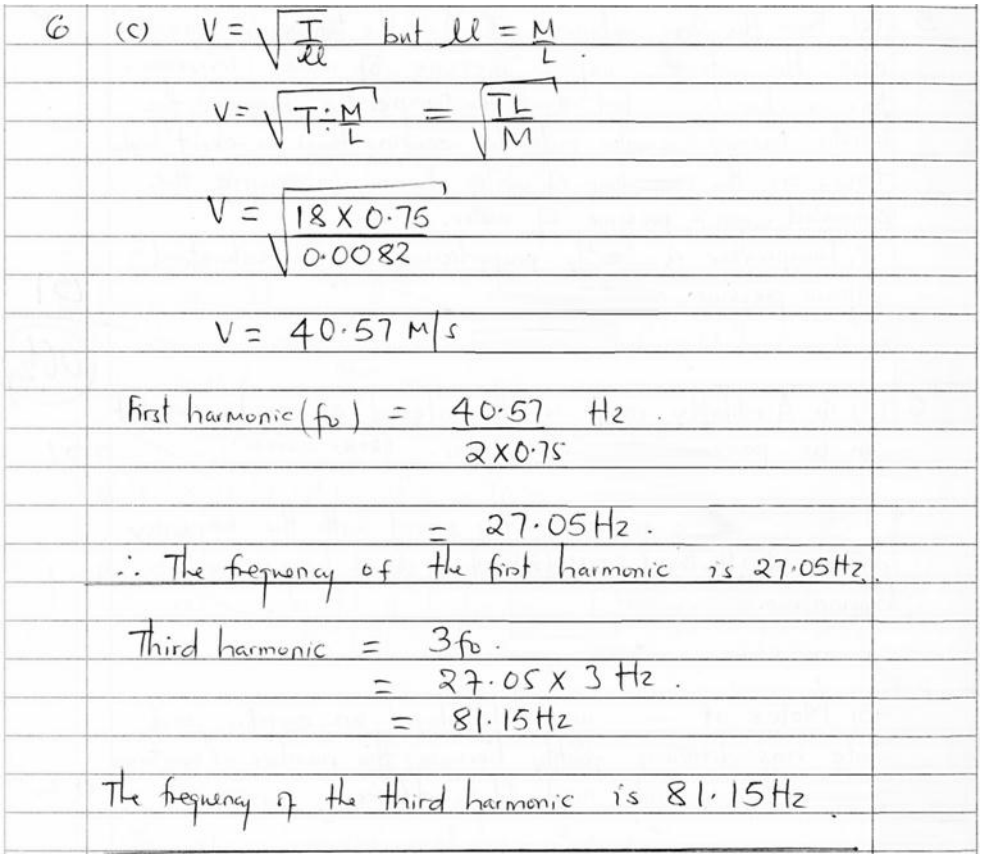
Mass of the string (M) = 8.2g = 0.0082kg

Tension of the stmg (T) = 18N

soln

(i) Required to find the fregwency of the first and third harmonics

from $f_0 = \frac{V}{2L}$ but $V = \sqrt{\frac{T}{\mu}}$



In extract 6.2 the candidate's work was correct and systematically arranged. The candidate also followed all the required steps in performing the calculations.

2.2.4 Question 7: Radioactivity

This question required the candidates to (a) give the meaning of radioactive decay, (b) (i) write an expression to show the decay process of the sample and (ii) use an expression in (b) (i) to sketch the decay graph for a sample with half-life of 8 days containing 16 g of iodine 131 and use it to estimate the mass of the sample which will remain after 20 days. In part (c) they were required to describe the use of Geiger-Muller (G-M) tube in detecting nuclear radiations.

The question was attempted by 133,578 (100%) candidates and 7 candidates did not respond on it. Among those who attempted it, 92.3 percent scored from 0 to 2.5 marks, 7.1 percent scored from 3 to 6 marks and 0.6 percent scored from 6.5 to 10 marks. Therefore, performance of the candidates in this question was weak since only 7.7 percent of the

candidates scored marks within the range of pass marks as indicated in figure 7.

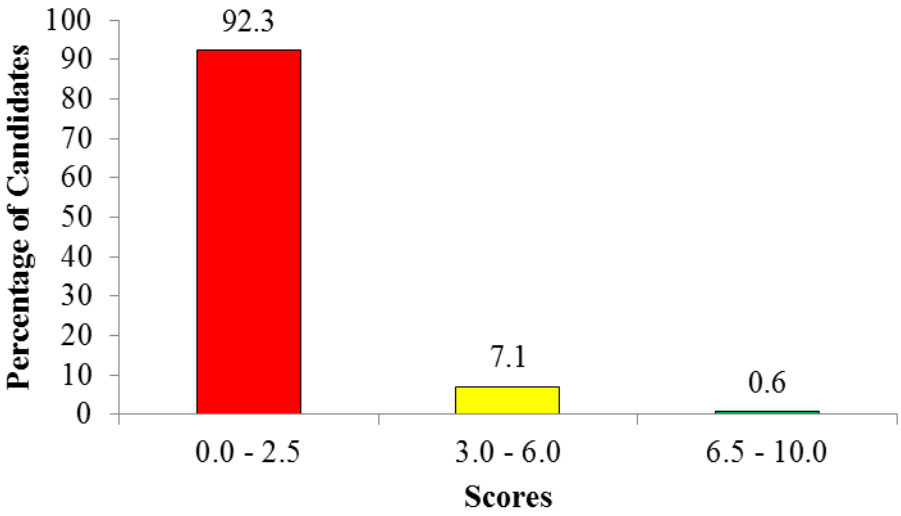


Figure 7: *Candidates' Performance in Question 7*

Analysis of candidates' responses on this question revealed that 92.3 percent who were in failure group comprised of 76,833 (57.5%) candidates who scored zero marks due to incorrect answers. The responses of the rest candidates in this group were characterized with many errors and incorrect concepts except in part (a) where most of them defined well the term "radioactive decay though they failed to write correctly the decay equation.

Other observed errors and mistakes which affected the performance in this question included; wrong interpretation of the data in (b) (ii), poor sketching of a graph representing the decay of the given sample and failure to understand the demand of the question in part (c). For instance in part (b) (ii) most of the candidates estimated the mass which would remain undecayed after 20 days by using origin sample mass of 131 instead of the given 16 g and in (c) many candidates mentioned uses of Geiger Muller (G-M) tube instead of describing its mode of action. Extract 7.1 shows the responses given by one of the candidates who attempted this question poorly.

Extract 7.1

7. a) Radioactive decay - are the ~~radi~~ materials that involve half-life of atom to decay.

b) Data given
half-life = 8days
Iodine = 16g
Iodine contain = 131

i) $t/t_{1/2}$

$$\frac{N}{n0} = \frac{2}{n0} (N \times 1)^{t/t_{1/2}}$$

N = ?
n0 = 16
t = 8
$t_{1/2}$ = ?

$$\frac{N}{n0} = \frac{2}{16} (131 \times 1)^{8/t_{1/2}}$$

$$\frac{N}{n0} = \frac{2}{16} (131 \times 1)^{8/t_{1/2}}$$

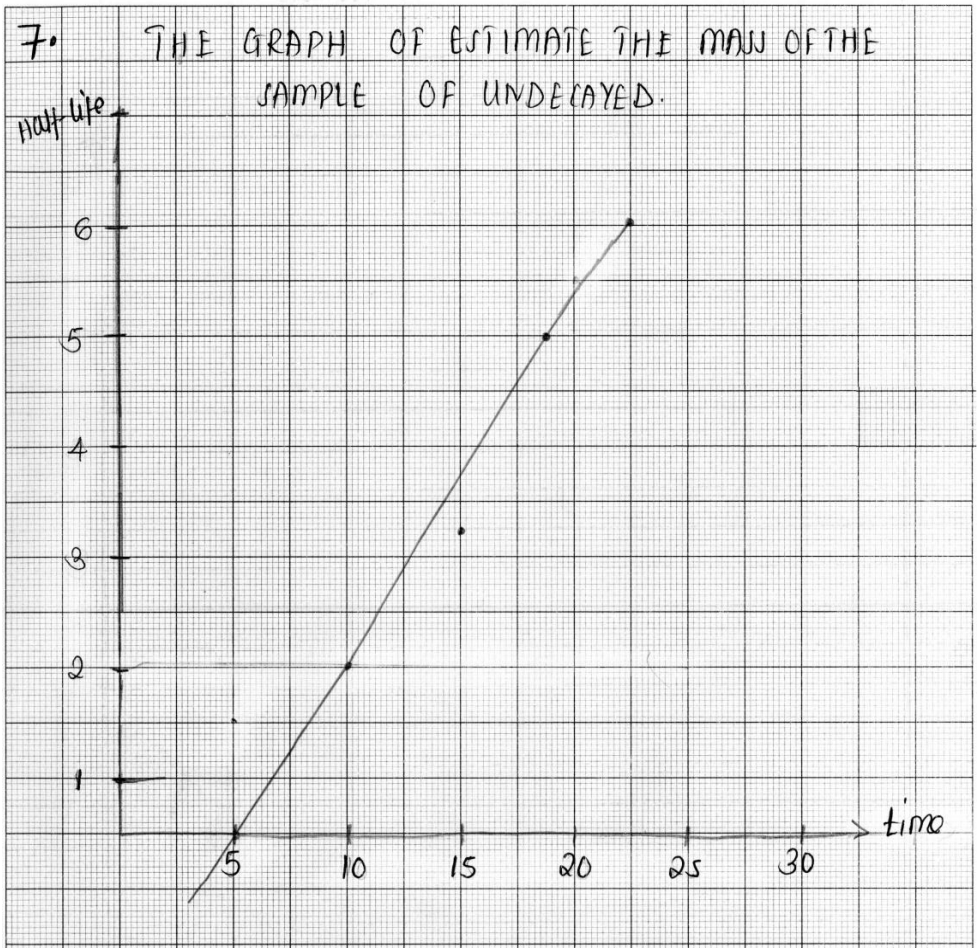
$$\frac{N}{n0} = \left(\frac{1}{2}\right) \times (131 \times 1)^{(1/2)}$$

$$\frac{N}{n0} = \left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)$$

$$\frac{1}{8} = \frac{N}{n0} \times \left(\frac{1}{2}\right)$$

$$\left(\frac{1}{2}\right) = \left(\frac{1}{2}\right)$$

$t = 0.5 \times 2 = 10$



In extract 7.1 the candidate wrote incorrect definition, formula for radioactive decay and drew a linear graph instead of exponential decay curve for the given data.

Contrary to those who performed poorly, the 0.6 percent of the candidates who had good performance defined well the term radioactive decay, wrote the correct decay equation and drew accurately the decay curve. They managed to estimate correctly the remaining mass of the given sample after 20 days. Finally, they drew and described properly the mode of action of G-M tube. Extract 7.2 illustrates a sample of good responses to this question.

Extract 7.2

7. (a) Radioactive decay is the disintegration or decomposition of large unstable (radioactive) material to produce stable substances by emission of particles such as alpha and beta particles and electromagnetic radiations such as gamma rays as the forms of energy released.

7. (b)(i) Data;

Half life ($t_{1/2}$) = 8 days
Original mass (N_0) = 16 g
Remaind mass (N_n) = ?
Time taken (t) = ?
Number of half-lives (n) = ?

∴ Expression is as follows

$$\frac{\text{Mass remained } (N_n)}{\text{Original mass } (N_0)} = \left(\frac{1}{2}\right)^n$$

where;

n is number of half-lives;

$$\therefore n = t/t_{1/2}$$

∴ The expression is; $\frac{\text{mass remained } (N_n)}{\text{original mass } (N_0)} = \left(\frac{1}{2}\right)^{t/t_{1/2}}$

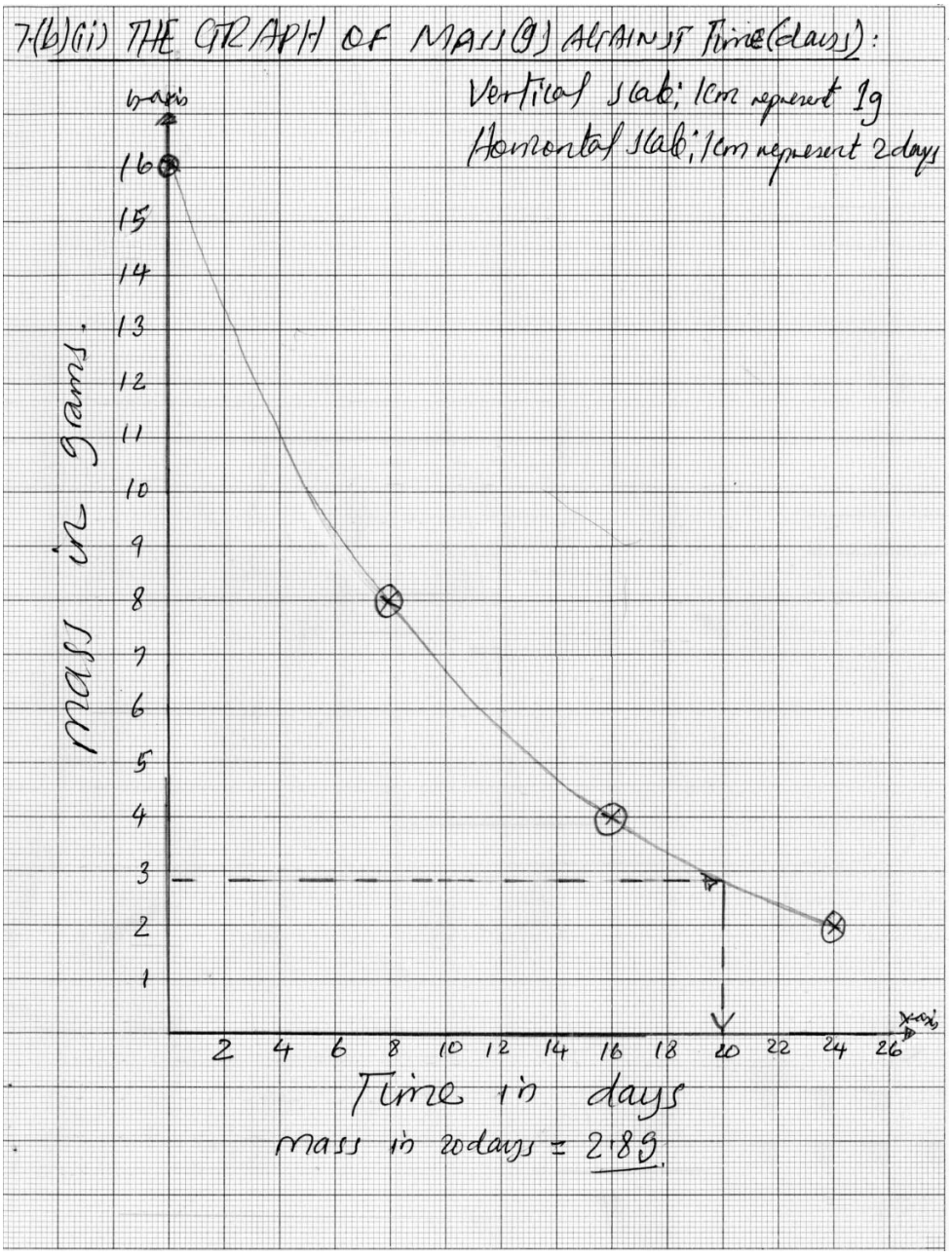
b (ii) from;

$$\frac{N_n}{N_0} = \left(\frac{1}{2}\right)^n$$

Hence, the table;

Mass (g)	time (days)
16	0
8	8
4	16
2	24

7.(b)(i) THE GRAPH OF MASS(g) AGAINST Time(days):



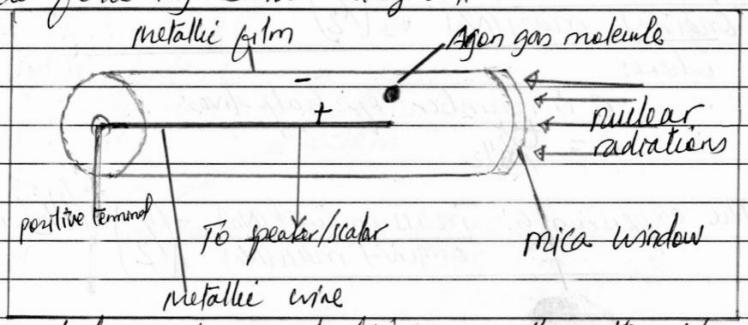
mass in 20days = 2·89.

7. (b) (ii) Hence the graph;

From the graph;

After 20 days the mass remained undecayed was equal to 2·8 grams.

(C) = Geiger-Muller (GM) tube is the tube which has metal film with high negative voltage (−), and the metallic wire which runs through the middle of the tube and it's connected to positive terminal (+). The tube has also the mica window and it's filled with noble (rare) gases like Argon. It's detects the nuclear radiations. But the following is the diagram.

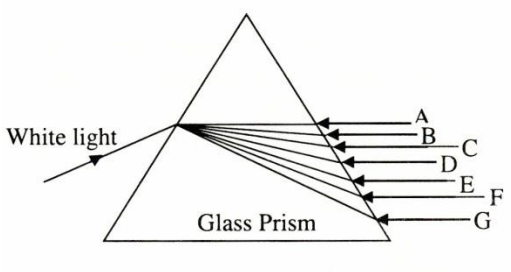


When the radiations pass through the mica window into the tube the gas molecules are ionized and negative charges (ions) move to the positive wire, As the electrons reaches the wire sound is produced by a speaker or counts are detected by the scaler.

In extract 7.2 the candidate managed to provide appropriate responses to all parts of the question including correct estimation of the remaining mass of the sample.

2.2.5 Question 8:Light

The question required the candidates to (a) give two examples which illustrate the rectilinear propagation of light, (b) (i) calculate the critical angle when refractive index of light passing from water to air is $\frac{3}{4}$ (ii) outline two differences between the primary and secondary rainbows and (c) identify the names of colours labelled A, B, C, D, E, F, and G shown in the following figure.



A total of 133,581 (100%) candidates attempted this question, whereas 102,211 (76.5%) candidates scored from 0 to 2.5 marks, 29,816 (22.3%) candidates scored from 3 to 6 marks and 1,554 (1.2%) candidates scored from 6.5 to 10 marks. Therefore, a total of 31,370 (23.5%) candidates scored marks above the pass mark of this question implying that performance in this question was weak. Pictorial illustration of the performance of the candidates in this question is presented in Figure 8.

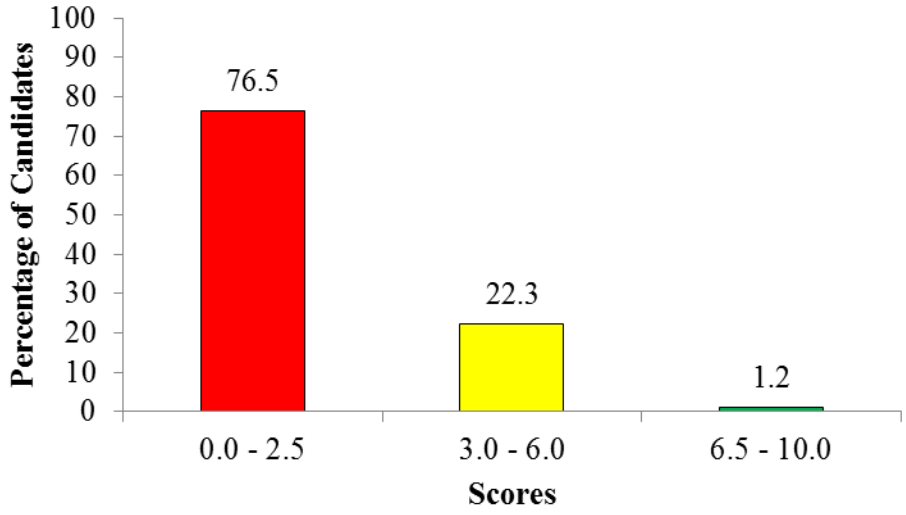


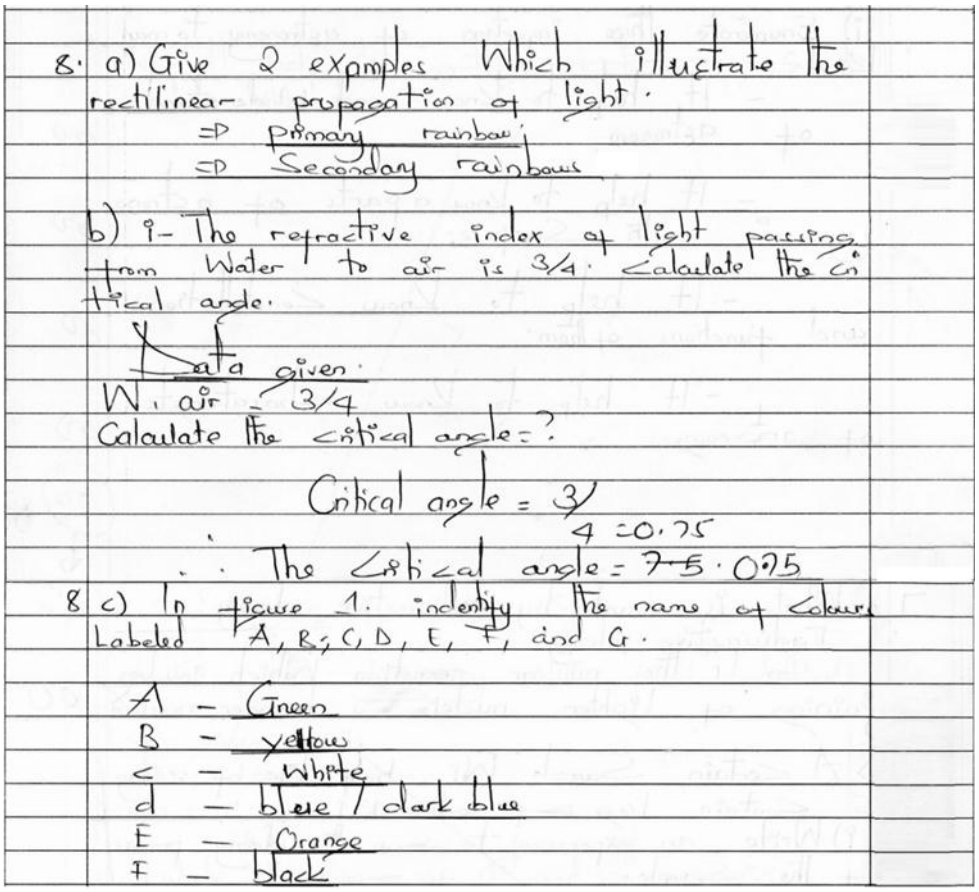
Figure 8: *Percentage of Candidates' Performance per Score*

The weak performance in this question was contributed by various factors including language barrier, lack of knowledge concerning the concepts of rectilinear propagation, critical angle and dispersion of colours as well as lack of mathematical skills. For instance, most of the candidates did not understand the demand of the question in part (a). Instead of giving examples which illustrate rectilinear propagation of light, they drew various diagrams of devices which produce light, such as torch and sun.

Moreover, the majority of candidates lacked the knowledge of dispersion of white and hence, failed to identify correctly the colours labelled A to G in part (c). The expected colours to be produced as a result of splitting of white light were *red*, *orange*, *yellow*, *green*, *blue*, *indigo* and *violet* in accordance with decreasing wavelengths. These candidates were supposed to know that colours results from reflection and absorption of certain colours by objects. Due to splitting of white light into its component colours, a spectrum of colours is formed. In general, these candidates lacked knowledge on the concept of dispersion of colours.

In calculating the critical angle, most candidates failed to apply the formula for Snell's law; $\eta = \frac{\sin i}{\sin r}$ with the concept of critical angle to identify that when i is equal to the critical angle, $r = 90^o$ and $\eta = \frac{3}{4}$ hence use this formula to determine the required value of the critical angle. In addition, some candidates failed to use mathematical table to calculate the required critical angle. Extract 8.1 shows an example of poor responses in this question.

Extract 8.1


8. a) Give 2 examples which illustrate the rectilinear propagation of light.
=> primary rainbow
=> Secondary rainbows
b) i- The refractive index of light passing from water to air is 3/4. Calculate the critical angle.
Data given.
W. air = 3/4
Calculate the critical angle = ?
Critical angle = 3/4 = 0.75
∴ The Critical angle = 7-5 · 075
8 c) In figure 1. indentify the name of colours Labeled A, B, C, D, E, F, and G.
A - Green
B - yellow
C - White
d - blue / dark blue
E - Orange
F - black

In extract 8.1 the candidate's responses were incorrect, for example, he/she cited incorrect examples of rectilinear propagation as primary and secondary rainbow.

On the other hand, responses of the candidates who performed well in this question showed that, most of them had sufficient knowledge on the concept of rectilinear propagation. They managed to cite evidences to the formation of shadows and eclipses as vivid examples which illustrate the property of light to travel in straight line. They were also able to apply Snell's law for light travelling from water to air in order to determine the critical angle. Furthermore, these candidates were familiar with the process of dispersion of white light in water and glass prism. Therefore, they were able to state the difference between primary and secondary rainbows. Extract 8.2 shows a sample response from one of the candidates who provided good responses to this question.

Extract 8.1

8(a) (i) Shadow and.
(ii) Eclipse.

(b) (i) Given refractive index is 3/4.
Critical angle occur at refracted ray of angle 90°.

from

refractive index $({}^{a}\eta_{w}) = \frac{\text{Sine of } r^\circ}{\text{Sin of } i^\circ}$

$\frac{3}{4}$ But from water to air $({}^{w}\eta_{a}) = \frac{\sin i^\circ}{\sin r^\circ}$

$\frac{3}{4} = \frac{\sin i}{\sin 90^\circ}$

$\sin i = \frac{3}{4} \times 1$

$\sin i = 0.75$

$\sin^{-1}(0.75) = i^\circ$

$= 48^\circ 35'$

∴ From incidence angle that produce ~~critic~~ 90° angle of r is the critical angle.

∴ Critical angle is 48°35'

(ii)

Primary rainbow.	Secondary rainbow
(i) Undergoes only single total internal reflection.	(i) Undergo double ~~int~~ total internal reflection
(ii) It is more bright and easily seen with red colour on the outside curve.	(ii) It faintly coloured and not easily seen with red forming the inner curve.

C
A – Red.
B – Orange
C – Yellow
D – Green
E – Blue
F – Indigo
G – Violet

Extract 8.2 shows correct responses from one of the candidates who had adequate knowledge on each of the tested parts of the question.

2.2.6 Question 9: Elementary Astronomy

This question required the candidates to (a) (i) define the term astronomy (ii) enumerate three importance of astronomy to mankind, (b) (i) specify the difference between galaxy and planet, (ii) outline three defining characters of a planet and (c) explain the importance of stratosphere to living things on the earth's surface.

The number of the candidates who attempted this question was 133,525 (100%) while 60 candidates did not attempt the question. Among those who attempted, 61.4 percent scored from 0 to 2.5 marks, 28.4 percent scored from 3 to 6 marks and 10.2 percent scored from 6.5 to 10 marks. According to these scores, it is obvious that the question was averagely done since a total of 38.6 percent of candidates performed above the failure mark by scoring from 3 to 10 marks. Figure 9 illustrates the performance of the candidates in this question.

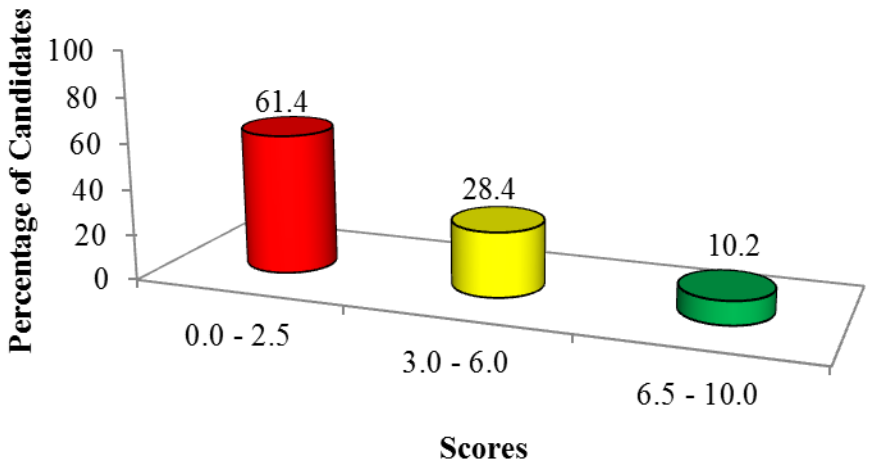
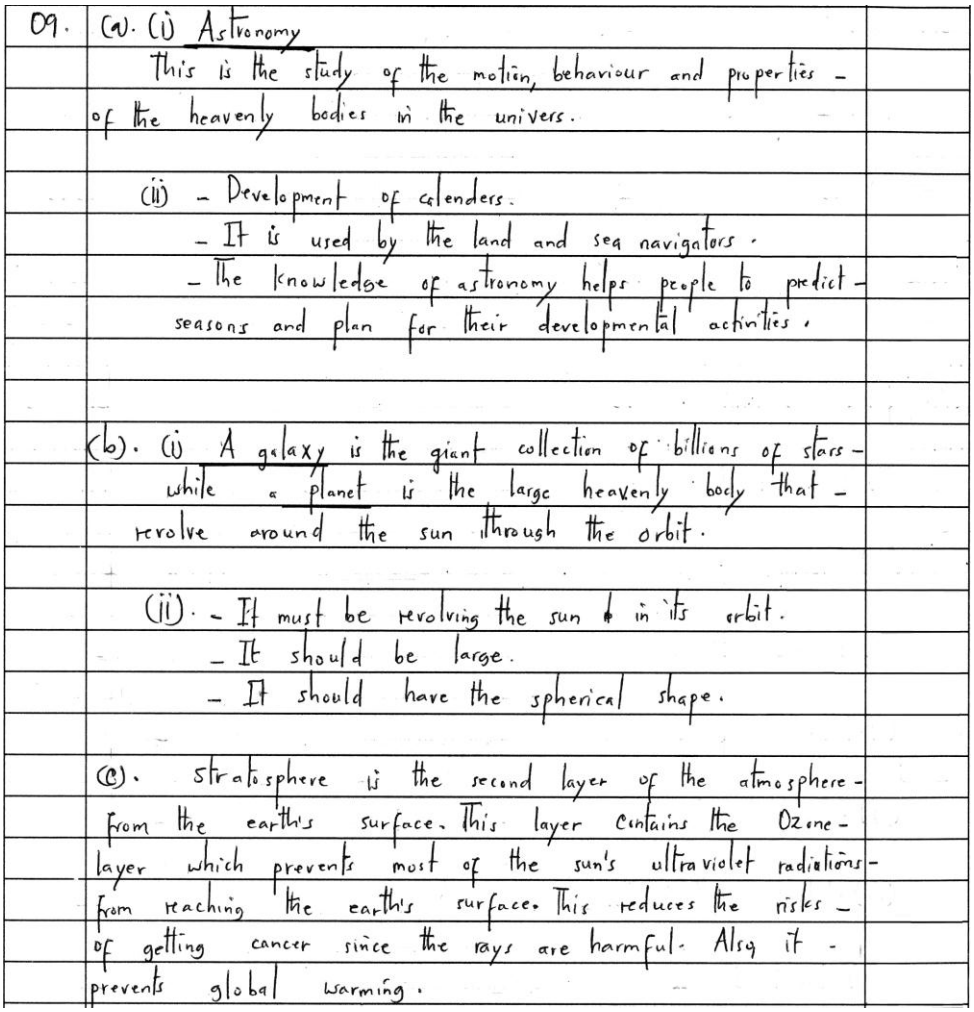


Figure 9: *Candidates' Performance in Question 9*

Most of the candidates who did well in this question showed greater understanding of the topic of *Elementary Astronomy* as they were able to define and state the importance of astronomy. Also, they were accustomed with the characteristics of a star and a planet and managed to answer correctly part (b) of the question. However, some of them lacked adequate knowledge on the structure and composition of the atmosphere. They failed to explain properly the importance of stratosphere to living things on the earth's surface, that is, it contains ozone layer which absorbs the harmful

ultraviolet radiation from reaching the earth's surface. Extract 9.1 illustrates the responses given by one of the candidates who replied correctly to each part of this question.

Extract 9.1


09. (a). (i) Astronomy
This is the study of the motion, behaviour and properties of the heavenly bodies in the univers.

(ii) - Development of calenders.
- It is used by the land and sea navigators.
- The knowledge of astronomy helps people to predict seasons and plan for their developmental activities.

(b). (i) A galaxy is the giant collection of billions of stars while a planet is the large heavenly body that revolve around the sun through the orbit.

(ii). - It must be revolving the sun in its orbit.
- It should be large.
- It should have the spherical shape.

(c). stratosphere is the second layer of the atmosphere from the earth's surface. This layer contains the Ozone layer which prevents most of the sun's ultraviolet radiations from reaching the earth's surface. This reduces the risks of getting cancer since the rays are harmful. Also it prevents global warming.

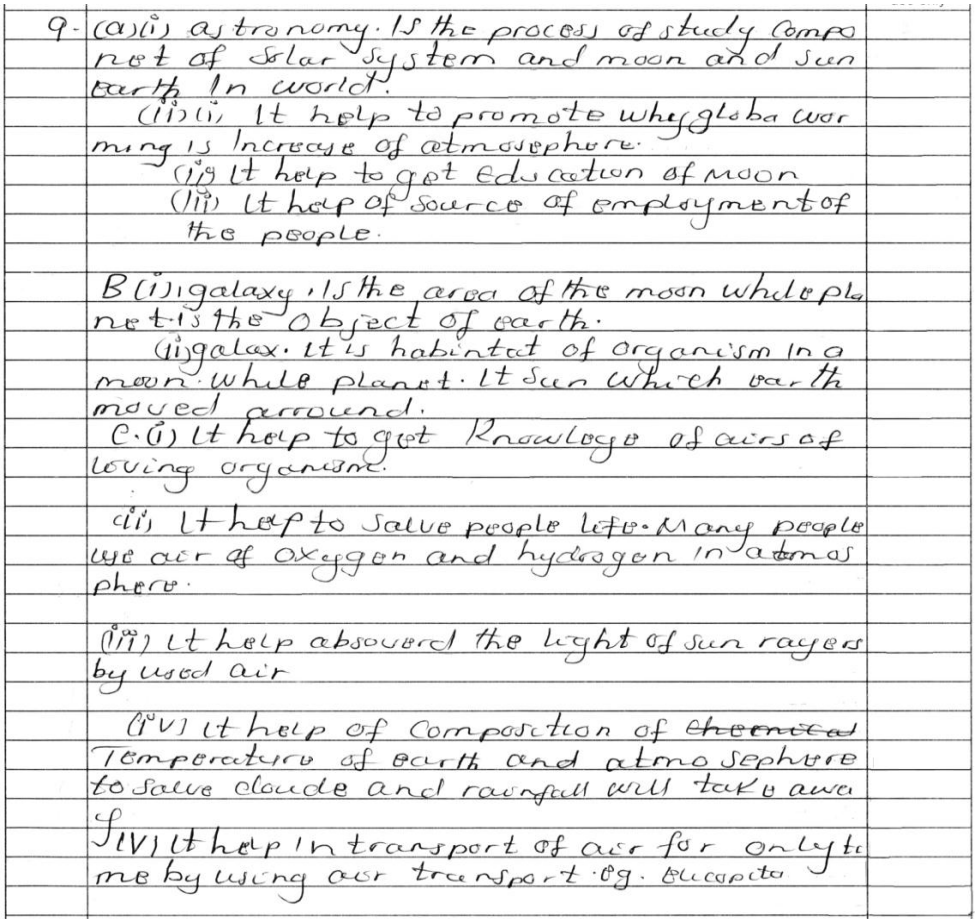
In extract 9.1 the candidate provided correct answers to each part of the question including good explanation on the importance of stratosphere to living things.

With regard to candidates who scored low marks in this question, the analysis of performance scores and responses revealed that, they lacked knowledge on astronomy and solar system. In part (a) (ii), for example, one of the candidates wrote that the importance of stratosphere is *"it help religions during religions*

wanted to make a coverage with God". Another challenge was failure to provide all the required points in a particular part of the question, for example in part (b) (ii) some of these candidates supplied incomplete number of points required. These candidates failed to give detailed differences between galaxy and planet.

Generally, most of these candidates lacked knowledge on the context of astronomy and solar system. For example, they did not know that a planet is a heavenly body which is massive and owns its gravity, orbits a star and cleared the neighbourhood around its orbit. Instead, they provided incorrect characteristics in defining a planet. Moreover, some of the candidates wrote responses which were not understandable indicating poor mastery of English language. Extract 9.2 is a sample answer from the script of one of the candidates who performed poorly in this question.

Extract 9.2


9. (a)(i) astronomy. IS the process of study Compo net of Solar system and moon and sun earth In world.
(ii)(i) It help to promote whey globa war ming is Increase of atmosephere.
(ii) It help to get Education of moon
(iii) It help of source of employment of the people.

B (i) galaxy, IS the area of the moon whileple net is the object of earth.
(ii) galax. It is habintat of organism In a moon. while planet. It sun which earth moved arround.
C. (i) It help to get Knowlege of airs of leving organism.

(ii) It help to salve people life. Many people use air of oxygen and hydrogen in atmos phere.

(iii) It help absovers the light of sun rayers by used air

(iv) It help of Composition of ~~theoretical~~ Temperature of earth and atmosephere to salve cloude and rainfall will take awa

(iv) It help in transport of air for onlyti me by using air transport. eg. Eucapita

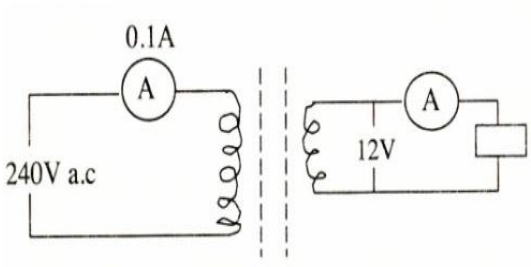
In extract 9.2, the candidate provided incorrect answers to every part of the question including wrong distinction between a galaxy and a planet.

2.3 Section C: Short Answer Questions

This section consisted of two (2) short answer questions from the topics of Electromagnetism and Thermal Expansion. Each question carried 10 marks. Candidates were required to answer one (1) question from this section.

2.3.1 Question 10: Electromagnetism

This question required the candidates to (a) state (i) Cork screw rule (ii) Dynamo rule and (b) (i) give one structural difference between, A.C and D.C generators (ii) mention one application of induction coil. In part (c) they were required to find the ammeter reading on the output part of a step down transformer shown in figure below assuming that there is no power loss in transformer.



The question was attempted by 29,555 (22.1%) candidates of whom 66.4 percent scored from 0 to 2.5 marks, 21.9 percent scored from 3 to 6 marks and 11.7 percent scored from 6.5 to 10 marks. The general performance in this question was average because the percentage of the candidates who scored marks above the pass mark was 33.6 percent. Figure 10 displays this performance pictorially.

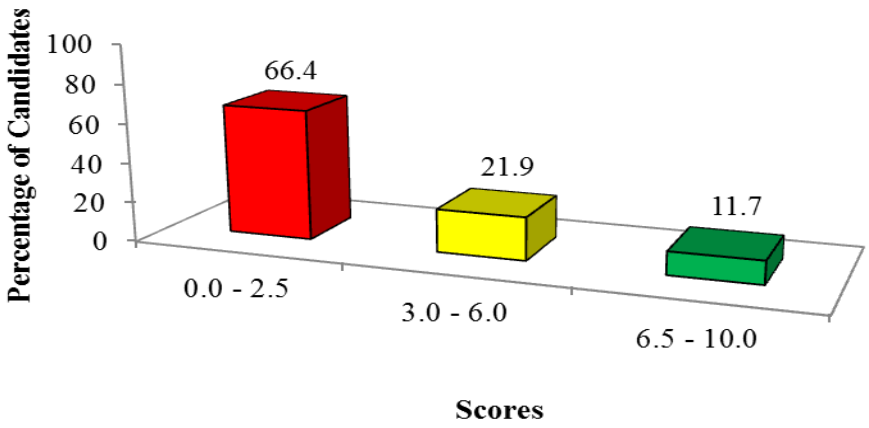
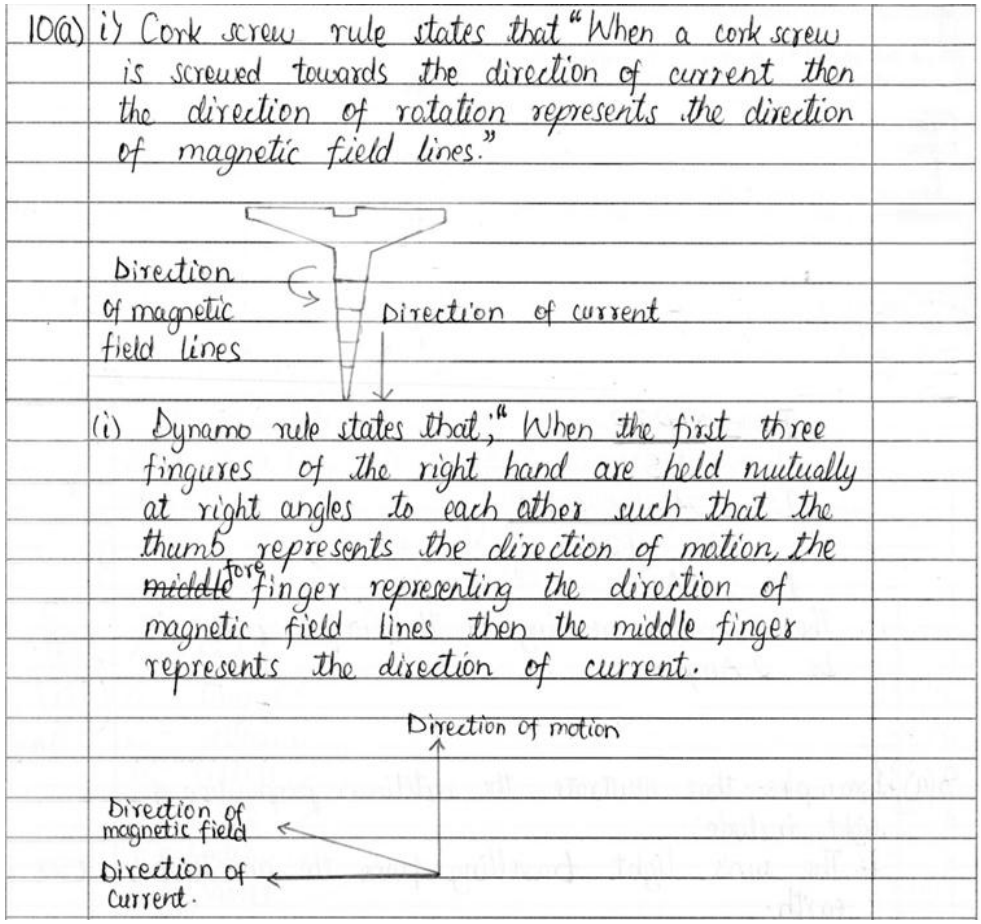


Figure 10: *Candidates' Performance in Question 10*

Most of the candidates who performed well in this question stated well the cork screw rule and dynamo rule. They also, calculated precisely the current on the output part of the transformer by applying the formula which relates current and potential difference in both primary and secondary coils of the transformer.

However, some of them failed to score all the marks in this question since they were not able to explain correctly the structural difference between A.C and D.C generator as well as the corresponding applications of induction coil. Extract 10.1 shows a sample of good responses in this question.

Extract 10.1



(b)(i) One structural difference between AC and DC generators is that AC generator uses slip rings whereas DC generators uses commutators.

ii) One application of the induction coil is that it is used in the car ignition system.

(c) Given data;
Voltage in primary coil, $V_P = 240V$
Voltage in secondary coil, $V_S = 12V$
Current in primary coil, $I_P = 0.1A$
Current in secondary coil, $I_S = ?$
Required to find ammeter reading in secondary coil, I_S.

From transformer equations

$$\frac{V_P}{V_S} = \frac{I_S}{I_P}$$

$$I_S = \frac{V_P I_P}{V_S}$$

$$I_S = \frac{240V \times 0.1A}{12V}$$

$$I_S = 2A$$

∴ The ammeter reading on the output part will be 2 Amperes.

In extract 10.1, the candidate was able to state and illustrate correctly the Cork screw and dynamo rules. Consequently, he/she explained correctly the application of induction coil and finally calculated the current in the output part of the transformer.

On the other hand, most of the candidates who failed this question lacked basic knowledge of electromagnetism. They were not able to state correctly the Cork screw rule and failed to deduce that Dynamo rule is the same as Fleming's right hand rule. Some of the candidates embarked on defining the term dynamo. In addition to this, they lacked knowledge of the concepts of AC and D.C generators. They were supposed to know that generators use electromagnetic induction to convert mechanical energy into electrical energy. For an AC (alternating current) generator, the electrical current periodically reverses its direction while for a DC (direct current) generator, the current flows only in one direction. The other thing that they ought to

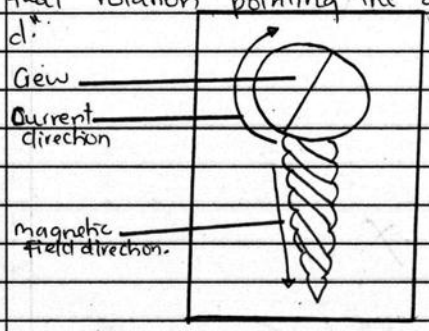
know was that, the major difference between an AC, Generator and a DC Generator is that the DC Generator requires a mechanism to provide a DC output which is done mechanically with a commutator or electronically with a rectifier. Consequently, the rotating parts in AC Generator are the low current resistivity rotor (the iron core with little copper wire winding) so it is safe even in high speed. Rotating parts in a DC generator is heavy and with high current, limiting its maximum speed. So, the candidates could identify the structural difference between the two generators as, AC generator has two slip rings while DC generator has a single split ring called the commutator.

Another difficult that the candidates encountered in this question were the application of induction coil. They were supposed to realize that an induction coil also known as spark coil, is a type of electrical transformer used to produce high voltage pulses from a low-voltage direct current (DC) supply. From this prior knowledge, they could state some general applications of induction coil to serve as ignition coil in motor vehicles, in wireless telegraph and in triggering flash tubes. Finally, the analysis revealed that, the candidates also failed because of poor computational skills resulted from inadequate knowledge on the concept of transformer turn's ratio equation given as $\frac{E_S}{E_P} = \frac{N_S}{N_P}$. Extract 10.2 shows responses given by one of the candidates who had poor performance in this question.

Extract 10.2

10. a. i.: Cork screw rule.

"When right hand cork the screw, the rotation of crew pointing the direction of current and that rotation pointing the direction of magnetic field."



ii. Dynamol rule.

"When dynamol starts to move or to rotate the rotation of dynamal pointing the direction of current where its rotation direction pointing the direction of magnetic field.

b. i) a.c generator	d.c generater
+ Is the type of generater which used to produce high ~~Current~~ voltage in it.	Is the type of generature which produce low voltage in it.

ii. Induction coil applied in Transformer

c.

In extract 10.2 the candidate failed to supply the required responses to each item of the question. For example, in part (a), he/she gave incorrect illustration of the cork screw rule.

2.3.2 Question 11: Thermal Expansion

In this question the candidates were required to (a) (i) give the meaning of the term thermal expansion (ii) mention two applications of thermal expansion of solids (b) (i) list three areas where bimetallic strips are used,

(ii) explain why a bimetallic strip made of brass and invar is curved outside with brass and; (c) describe how simple fire alarm system operates.

Majority of the candidates (79.9%) opted for this question whereby 66.4 percent of them scored from 0 to 2.5 marks, 29.9 percent scored from 3 to 6 marks and 3.7 percent scored from 6.5 to 10 marks. Figure 11 presents these scores showing that, the performance was average since a total of 33.6 percent of the candidates managed to score marks above the failure range (0 -2.5 marks).

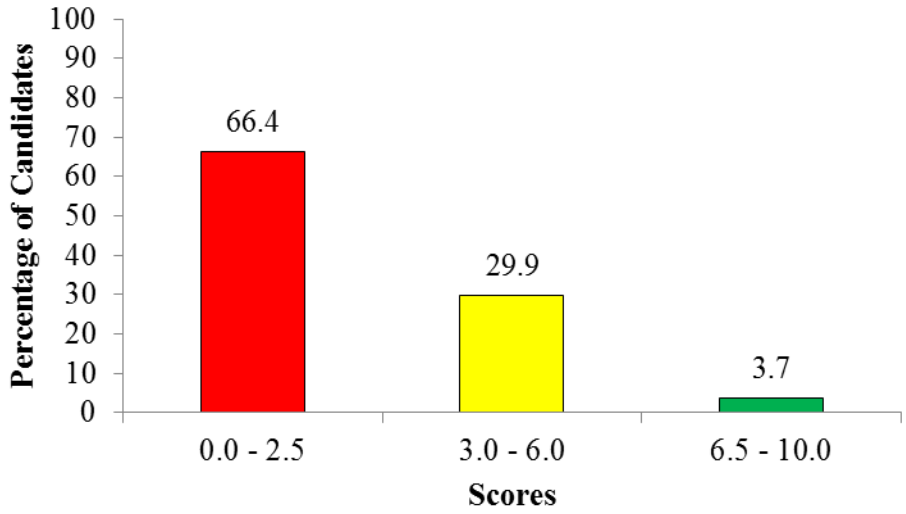
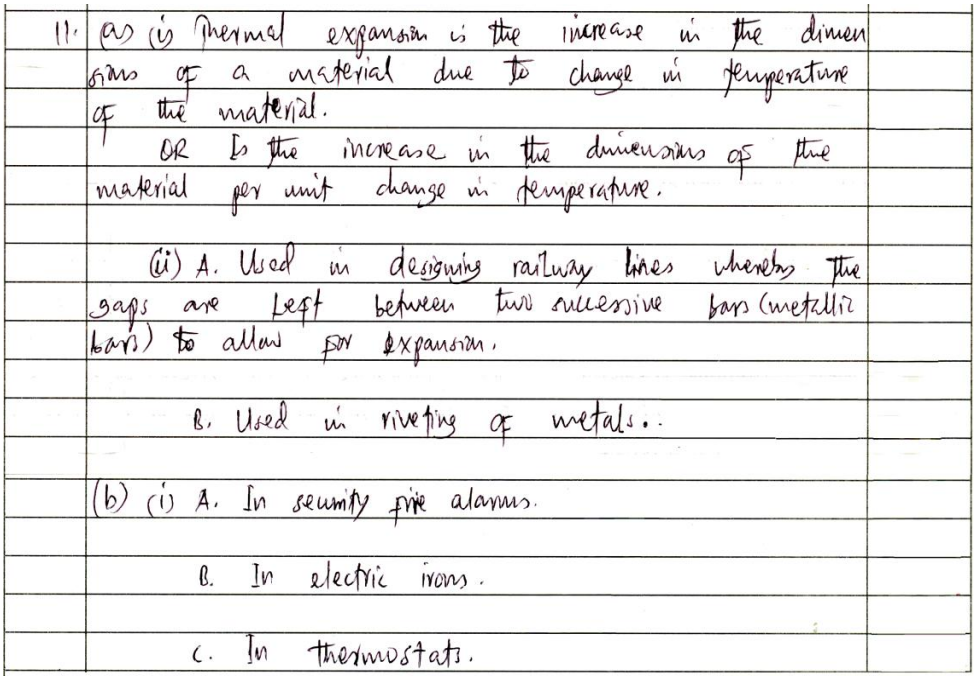


Figure 11: *Percentage of Candidates' Performance per Score*

The candidates who performed well in this question were able to give an appropriate meaning of the term thermal expansion. For example one candidate wrote *"Thermal expansion refers to the increase in size like length, volume and area of a body due to a change in temperature"*. This shows that the candidate had content knowledge regarding to the concept of thermal expansion. They also managed to mention the applications of thermal expansion in solids. For instance, one candidate stated the applications of thermal expansion of solids as *"in railway tracks where the spaces between railway lines are left to allow expansion"*. Some candidates showed an enormous understanding on explaining the areas where bimetallic strip are used by referring to thermostats, bimetallic thermostats, fire alarms, electric bells, electric kettles and refrigerators or freezers.

Similarly, a significant number of candidates provided detailed explanations on why a bimetallic strip made of brass and invar is curved outside with brass. Some of them described correctly on how simple fire alarm system operates. One candidate explained the reason for a bimetallic strip made of brass and invar is curved outside with brass as: *"because brass has a high linear expansivity than the invar, thus it expands faster and more than invar"*. This is an indicator that the candidate had adequate content knowledge on the applications of expansion of solids in everyday life. Extract 11.1 is a sample of good responses given by a candidate among those who performed well this question.

Extract 11.1


11. (a) (i) Thermal expansion is the increase in the dimensions of a material due to change in temperature of the material.
OR Is the increase in the dimensions of the material per unit change in temperature.

(ii) A. Used in designing railway lines whereby the gaps are left between two successive bars (metallic bars) to allow for expansion.

B. Used in riveting of metals..

(b) (i) A. In security fire alarms.

B. In electric irons.

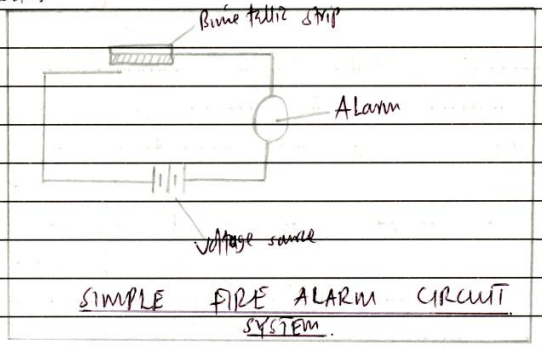
C. In thermostats.

11. (b) (ii) A bimetal strip made up of brass and invar is curved outside with brass BECAUSE Brass has a - higher ~~than~~ linear thermal expansivity value than invar that it EXPANDS faster and more than the invar making the outside of the curve of the bimetal strip.

(c) Simple fire alarm system works/operates using the principle of thermal expansivity and curving of a bimetallic strip due to temperature change.

The simple fire alarm system consists of bimetallic strip in circuit with the alarm. The bimetallic strip - acts as the switch of the circuit.

When a the temperature rises due to the - fire outbreak, the bimetallic strip EXPANDS and curves; when it curves it completes the circuit of the alarm circuit and fire alarm rings to alert an - fire outbreak.



SIMPLE FIRE ALARM CIRCUIT SYSTEM.

The responses in extract 11.1 were correct, neat and systematically presented. This indicated that the candidate understood well each of the concepts tested in this question.

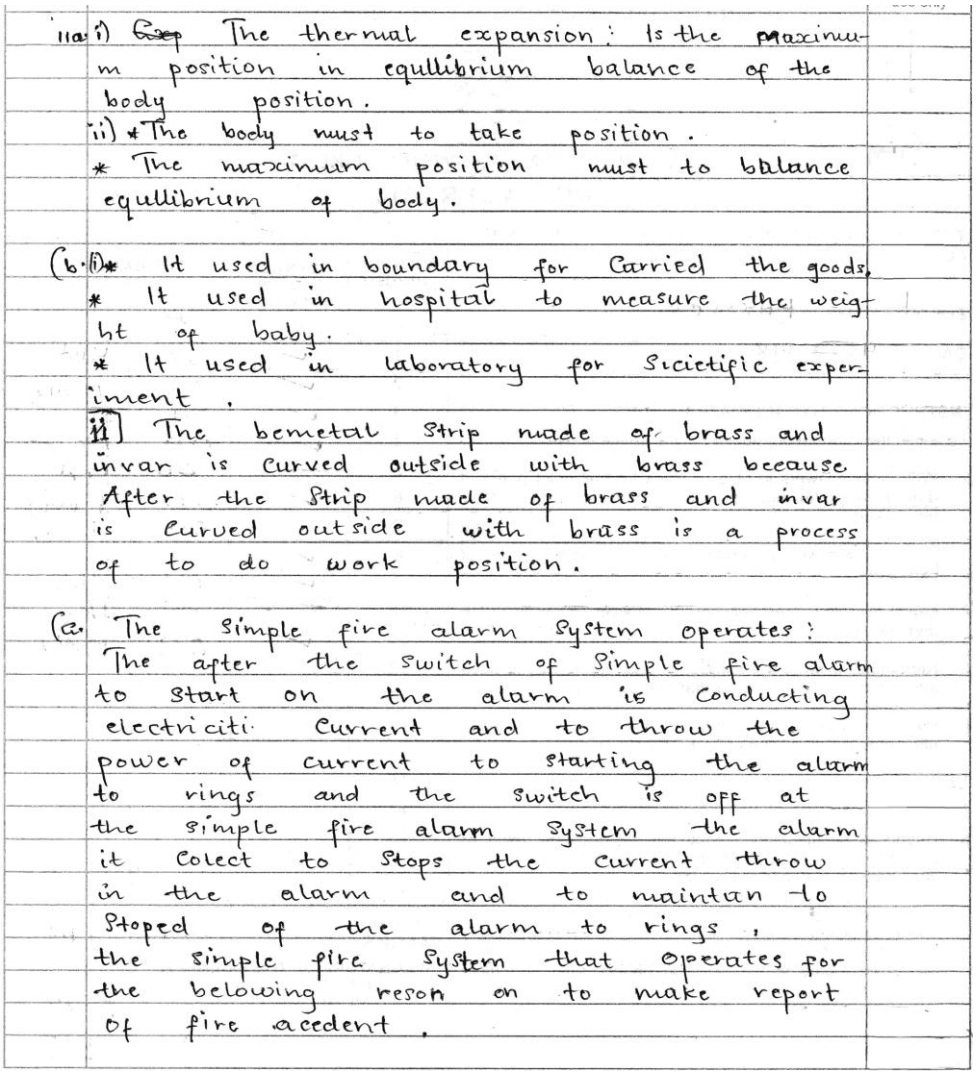
Further analysis on the responses of those who scored marks from 0 to 2.5 revealed that, 35,674 (26.7%) candidates lacked knowledge of thermal expansion. These candidates provided incorrect responses which were not related to the demand of the question. They were supposed to understand that thermal expansion refers to the tendency of matter to change its shape, area and volume in response to a change in temperature resulting into the increase of the kinetic energy of its molecules.

In giving the applications of thermal expansion of solids, candidates would refer railroad tracks and bridges, for example, have expansion joints to allow them to freely expand and contract with temperature changes. But these candidates failed to apply their daily life environment to recapitulate the applications of thermal expansion. Others scored some marks not more than 2.5 as they were able to define the term thermal expansion and provided some of its applications but did not correctly respond to all parts of the question.

Another part of the question which mostly caused these candidates to achieve low marks was part b (i) and (ii). In this part, the candidates seemed to have no knowledge on the concept of bimetallic strips. They did not understand that bimetallic strips are used for heat detection, such as that in fire alarms and thermostats. They also failed to give reasons why a bimetallic strip made up of brass and invar is curved outside with brass. The possible clue that could help them give the correct response was that, the bimetallic brass/invar strip is a brass on one side bonded to invar on the other side where invar is a steel-like alloy of nickel and iron with low coefficient of thermal expansion while brass has high coefficient of thermal expansion. So, the brass expands much more than invar because of its greater thermal expansivity.

Finally, in part (c) most of these candidates described mode of action of electric bell instead of fire alarm, indicating that they were familiar with electric bell and not fire alarm. Extract 11.2 illustrates a sample of responses given by one of the candidates who provided irrelevant answers to all parts of the question.

Extract 11.2



11a: i) The thermal expansion: Is the maximum position in equllibrium balance of the body position.
ii) * The body must to take position.
* The maximum position must to balance equllibrium of body.

(b. (i)* It used in boundary for Carried the goods.
* It used in hospital to measure the weight of baby.
* It used in laboratory for Sicietific experiment.
ii] The bemetal strip made of brass and invar is curved outside with brass because After the strip made of brass and invar is curved outside with brass is a process of to do work position.

(c. The simple fire alarm System operates: The after the switch of simple fire alarm to start on the alarm is conducting electriciti Current and to throw the power of current to starting the alarm to rings and the switch is off at the simple fire alarm System the alarm it colect to stops the current throw in the alarm and to maintan to Stoped of the alarm to rings, the simple fire System that operates for the belowing reson on to make report of fire accedent.

The responses given in extract 11.2 indicates that, the candidate lacked both knowledge and English language competencies. For example, it is difficult to understand the explanation given in part (c) due to various grammatical errors.

3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE PER TOPIC

In this section candidates' performance was discussed on the basis of tested topics to determine the performance of candidates by topics. Likewise, comparison of the candidates' performance per topic for the year 2018 against that in the year 2017 was done for the purpose of evaluating progress of the teaching and learning.

3.1 Candidates' Performance Per Topic in 2018

In Physics 1 paper, a total of eighteen (18) topics were examined. The topics included; *Structure and Properties of Matter; Light; Waves; Measurement of Thermal Energy; Electronics; Application of Vectors; Optical Instruments; Elementary Astronomy and Current Electricity.* Other topics were; *Magnetism; Simple Machines; Work, Energy and Power; Newton's Laws of Motion; Archimedes' Principle and the Law of Flotation; Vapour and Humidity; Radioactivity; Electromagnetism* and *Thermal Expansion.*

The analysis of candidates' performance revealed that, good performance was shown in question 3 which comprised of several topics. Also, 66.6 percent of the candidates attempted well followed by average performance of 64.5 percent on question 1 which was constructed from various topics too. Moreover, the topic of Magnetism which was homogeneous Matching Items tested in question 2 had an average performance of 52.4 percent followed by the topic of *Elementary Astronomy* with an average performance of 38.6 percent tested in question 9. Other topics which had an average performance were *Electromagnetism* in question 10 and *Thermal Expansion* in question 11 each of average performance of 33.6 percent. The factors which might have contributed to the average performance included candidates' adequate content knowledge of various topics, ability in elucidating problems that involved detailed descriptions, some competencies in applying mathematical computations and ability to express oneself in English Language.

Further analysis of the candidates' performance in each topic showed that five (5) topics had weak performance. These include; *Light* (23.5%) from question 8, *Vapour and Humidity* (14.2%) from question 5, *Radioactivity* (7.7%) from question 7, Waves (4.8%) from question 6 and lastly *Archimedes' Principle and Law of Flotation* (2.6%) from question 4. These performances imply that, objective questions tested in question 1 (Multiple Choice Items), question 2 (Matching Items) and question 3 (Fill in the Blank Spaces Items) were a bit well performed as compared to the subjective questions when expressed in percentage performance. This indicates that, among the factors which influenced the performance of most of candidates was lack of self-explanatory competencies in solving subjective questions.

Other factors which led to poor performance was poor mathematical skills, inability to identify the requirements of the question, incompetence in drawing and sketching graphical presentation of the data given and interpretation of the drawn graph. The detailed illustration of the performance of the candidates per topic is given in Appendix I.

3.2 Comparison of Candidates' Performance between 2017 and 2018

Reflection on the performances of the candidates on the CSEE 031-Physics 1 examinations for the years 2017 and 2018 found that, there are some variations in performance in some topics. A significant increase was 25.44 percent observed in question 3 (Fill in blank Spaces Items) where in 2017 the performance was Average (41.16%) but in 2018 the performance was Good (66.6%). Another significant rise was in the topic of Electromagnetism where in 2017 had weak performance of 13.33 percent, whereas in 2018 there was average performance of 33.6 percent giving a rise of 20.27 percent.

Moreover, slight increase in performance was in question 1 (Multiple Choice Items) by 6.28 percent. The analysis indicated that the performance was 58.22 percent in 2017 but changed to 64.5 percent in 2018. In the topic of *Light*, the performance increased by 6.16 percent although the topic had weak performance of 17.34 and 23.5 percent in 2017 and 2018 respectively. Another slight increase (1.06%) was observed in the topic of *Thermal Expansion* which in 2017 the performance was 32.52 percent whereas in 2018 increased up to 33.6 percent.

On the other hand, the drop in performance was noted in the topic of *Waves* where, in 2017 the performance was 23.10 percent and in 2018 chopped down to 4.8 percent marking a fall of 18.3 percent. (See appendix II).

These results show that; some improvements have been made in teaching/learning of the topics of *Electromagnetism*, *Light* and *Thermal Expansion* which showed remarkable changes from 2017 to 2018. However, still there is a great challenge in teaching and learning of the topic of *Waves* whose performance is consistently becoming worse year after year.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The analysis in candidates' performance revealed that the performance was good in question 3 (Fill in the Blank Spaces Items) constructed from the topics of *Simple Machines; Measurement of Thermal Energy; Work, Energy and Power; Electronics; Radioactivity; Electromagnetism; Newton's laws of Motion; Waves and Elementary Astronomy.* But the candidates' performance was average in questions constructed from four (4) topics of *Magnetism*, *Elementary Astronomy*, *Electromagnetism* and *Thermal Expansion.*

The analysis further revealed that candidates' performance was poor in questions constructed from the remaining five (5) topics of Light, *Vapour and Humidity*, *Radioactivity*, *Waves* and *Archimedes' Principle and the Law of Flotation*. From this analysis, the general performance of candidates in Physics CSEE 2018 was average as 45.5 percent of candidates scored averagely.

The analysis has also shown that the candidates who performed poorly faced challenges in attempting some of the examination's questions, hence scored low marks. The following are some of the factors that could be attributed to failure of candidates to respond correctly to some of the questions. The first factor was the failure to identify the requirements of the question. A big number of candidates were found to provide responses which were absolutely irrelevant to the need of the question.

Another factor which observed to hinder performance was lack of content knowledge and skills in some topics. For example, some candidates showed an inadequate knowledge in responding to question 4 where the majority failed to apply the Principle of Archimedes' and the Law of Flotation in giving descriptions and solutions to the question.

Further analysis revealed that lack of numerical skills was another major obstacle towards the performance of candidates. This problem caused majority of candidates fail to manipulate the given information and hence performed incorrect calculations using wrong formulae. This was observed in questions 4, 5, 6, 7, 8 and10 which required calculations.

Lack of skills in sketching and drawing, in conjunction with poor interpretation of graphs, also led to some of candidates fail to get enough marks particularly to question 7 from the topic of *Radioactivity*. In this question, some candidates failed to sketch the decay curve which could help them estimate the mass of the sample of the material given.

Poor English Language proficiency was observed to be among the impediments which faced the candidates especially to questions that required detailed facts. For instance, question 6 where most of candidates failed to give reasons on why notes of the same pitch played on a violin and flute has different quality. Other questions which observed to have the same problems included: question 4, 5, 7, 9 and 11 which required some explanations.

Inability to follow instructions; where some of candidates attempted all the questions in section C which required them to answer only one question. Also, in questions which required the candidates to provide many points (reasons) some candidates wrote less than the required ones.

4.2 Recommendations

For future improvement of the performance of the candidates the following are recommended.

4.2.1. Students are advised to:

(a) Study Physics textbooks and reference books in order to acquire broad knowledge and skills in various concepts, principles and laws and avoid basing only on class notes, Pamphlets/Hand-outs as well as Questions and Answers' books.

(b) Be familiar with Physics Syllabus and Examination Format in order to understand the content they have to learn as well as the competencies and skills they should build before they seat for the final examinations.

(c) Learn and use English language in their day to day communication in order to strengthen their ability to explain various concepts in English.

(d) Integrate the concepts of mathematics in acquiring computational skills so as to solve problems involving calculations.

4.2.2. The teachers are advised to:

(a) Cover the syllabus on time and assess students adequately to prepare them for examinations.

(b) Identify struggling learners in each topic and use appropriate ways of guiding them to grasp the concepts in order to reduce the gap between lower and higher achievers.

(c) Use various teaching methods such as Jig Saw, Think Pair Share (TPS), Gallery work, Project work, Physics clubs as well as Study tour so that to raise the interest of students to learn physics.

(d) Guide and encourage students to use English language in their day to day communications in order to build both speaking and writing skills in English.

(e) Incorporate theory and practical in their teachings so that students will have enough time of conducting as many experiments as possible in all levels to acquire desirable competencies.

4.2.3. The Ministry of Education, Science and Technology is advised to:

(a) Make sure that teaching & learning standards such as teacher – students' ratio and teaching/learning facilities are supportive in order for students to learn Physics by doing.

(b) The School Quality Assurers should have regular classroom assessment on the progress of teaching and learning of Physics in order to identify challenges which cause most of students to fail in this subject. Then advice teachers, students and school owners on how to improve the performance.

(c) Support Physics teachers to share their teaching and learning experiences in order to have common interpretation and awareness of the syllabus.

4.2.4. Tanzania institute of education is advised to:

(a) To make analysis of the syllabus especially in the topics which students perform poorly in recent years such as Light, Vapour and Humidity, Radioactivity, Waves, Archimedes' Principle and Electromagnetism. This could assist to find the best ways of improving the teaching/learning strategies, aids and resources.

(b) Investigate if there is a need of allowing students in their final year (form four) to have introduction to calculating devices especially on the use of a calculator to allow them use either mathematical tables or calculators in their final examinations.

4.2.5. Parents/Guardian are advised to:

(a) Guide their children academically including giving them enough time to study while at home and not let them waste time on non-academic issues such as business, mobile phones chatting and taking TV programs which take much time.

(b) Encourage their children to work hard in their studies and support them with learning facilities especially textbooks.

Appendices

Appendix I

CANDIDATES' PERFORMANCE IN EACH TOPIC - CSEE 2018

S/n	Topic	Number of Questions	Question Number	Percentage of candidates who scored 30 percent and above	Remarks
1	Filling in the Blanks Items: Simple Machines; Measurement of Thermal Energy; Work, Energy and Power; Electronics; Radioactivity; Electromagnetism; Newton's Laws of Motion; Waves; Elementary Astronomy.	1	3	66.6	Good
2	Multiple Choice Items: Structure and Properties of Matter; Light; Waves; Measurement of Thermal Energy; Electronics; Application of Vectors; Optical Instruments; Elementary Astronomy; Current Electricity.	1	1	64.5	Average
3	Magnetism	1	2	52.4	Average
4	Elementary Astronomy	1	9	38.6	Average

5	Electromagnetism	1	10	33.6	Average
6	Thermal Expansion	1	11	33.6	Average
7	Light	1	8	23.5	Weak
8	Vapour and Humidity	1	5	14.2	Weak
9	Radioactivity	1	7	7.7	Weak
10	Waves	1	6	4.8	Weak
11	Archimedes' Principle and the Law of Flotation	1	4	2.6	Weak

Appendix II

THE COMPARISON OF CANDIDATES' PERFORMANCE BETWEEN CSEE 2017 AND 2018 IN TERMS OF TOPICS

S/n.	Topic	EXAMINATION FOR 2017			EXAMINATION FOR 2018		
		Total Number of Questions	Percentage of Candidates who scored 30% and above	Remarks	Total Number of Questions	Percentage of Candidates who scored 30% and above	Remarks
1	Fill in the Blanks Questions	1	41.16	Average	1	66.6	Good
2	Multiple Choice Questions	1	58.22	Average	1	64.5	Average
3	Magnetism				1	52.4	Average
4	Elementary Astronomy				1	38.6	Average
5	Electromagnetism		13.33	Weak	1	33.6	Average
6	Thermal Expansion		32.54	Average	1	33.6	Average
7	Light		17.34	Weak	1	23.5	Weak
8	Vapour and				1	14.2	Weak

	Humidity						
9	Radioactivity				1	7.7	Weak
10	Waves		23.10	Weak	1	4.8	Weak
11	Archimedes' Principle and the Law of Flotation.				1	2.6.	Weak