THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR DIPLOMA IN SECONDARY EDUCATION EXAMINATION (DSEE) 2019

731 PHYSICS

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FOREWORD

The Diploma in Secondary Education Examination (DSEE) marks the end of two years pre-service training of professional secondary teachers. It gives light on effectiveness of training and skills gained in both academics and pedagogy. The candidates' answers to the examination questions are strong indicators of how the training was conducted. It shows the competence of student teachers in teaching and learning of Ordinary level Physics. The candidates' items response analysis report on Physics subject DSEE 2019 was prepared in order to give feedback to student teachers, tutors, parents, policy makers and the public in general on how the candidates responded to the examination questions.

The report highlights some of the factors which made the candidates fail to score high marks in the questions. The factors include failure to identify the task of the question, inadequate Physics skills and inadequate content knowledge in academics and pedagogy topics. The views provided will help educational administrators, college principals, school managers, tutors, student teachers and other educational stake holders to identify proper measures to be taken in order to improve the training of teachers and candidates' performance in future examinations.

The National Examinations Council of Tanzania will highly appreciate observations and suggestions from tutors, student teachers and the public in general that can be used to improve future examiners' reports.

Finally, the Council would like to thank the Examiners, Coordinators, the data processing unit and other stakeholders who participated in the preparation of this report.

Dr. Charles E. Msonde

EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report is based on the analysis of candidates who sat for the Diploma in Secondary Education Examination (DSEE) in May, 2019 in Physics paper 1. A total of 1912 candidates sat for DSEE Physics examination, whereby 1,616 candidates were using University of Dodoma (UDOM) curriculum and 296 were using the Tanzania Institute of Education (TIE) curriculum.

The report is intended to measure, assess and evaluate the skills acquired by the candidates as specified in the TIE 2009 academics and pedagogy syllabus. The general performance of candidates was good as shown in the following table.

Performance of Candidates in Physics Examination

Candidate Types	**Sat**	**Number of Candidates and Percentage**						
		Passed	**Grades**					
			A	B	C	D	F
TIE Curriculum (DSEE)	296	296 100%	45 15.2%	150 50.7%	101 34.1%	0 0%	0 0%
UDOM Curriculum (DSEE)	1616	1603 100%	10 0.6%	153 9.5%	827 51.2%	613 37.9%	12 0.7%
TOTAL	1912	1899 100%	55 2.9%	303 15.8%	928 48.5%	613 32.1%	12 0.6%

The table shows that 100 percent and 99.2 percent of candidates under TIE and UDOM curriculum passed the examination respectively. Although there were only 55 candidates who passed at A grade, most of them scored grade B to D and 12 failed by scoring in F grade. Since the assessment for the candidates who are pursuing DSEE using UDOM curriculum was in transition; in this report, the detailed candidates' items responses analysis was done for Physics paper 1 (DSEE 2019) based on TIE curriculum.

In the TIE curriculum, the Physics paper 1 comprised sixteen (16) questions which were categorized into three sections A, B and C. Section A composed of ten (10) short answer questions and candidates were supposed to answer all questions. This section carried a total of 40 marks. Section B and C had three

(3) questions each. Candidates were required to answer two (2) questions from each of sections B and C. These sections carried a total of 30 marks each.

The next section of the report analyses the candidates' performance in each question. It describes what the candidates were required to do in each question, their performance levels and possible reasons to justify the observed performance. Sample answers to the questions have been extracted from the candidates' scripts and attached to illustrate the cases presented. Furthermore, graphs or charts have been used to summarize the candidates' performance in a particular question. The performance in each question is rated as good, average or weak if the percentage of candidates' marks are in the range of 70 – 100, 40 – 69 and 39 – 0, respectively. These categories of performance are also indicated by using special colours, whereas the green, yellow and red colours denote good, average and weak performance respectively as seen in the graphs or charts. The report also contains appendices A and B which show the general performance in each topic and in terms of grades. Finally, the report provides some recommendations that may help to improve the candidates' performance in future examinations.

2.0 CANDIDATES' ITEM RESPONSE ANALYSIS IN PHYSICS 1

2.1 Question 1: Measurements

This question had two parts (a) and (b). In part (a), the candidates were required to define the term fractional error and part (b) required them to deduce the fraction error of each quantity in a given formula $T = 2\pi\sqrt{\frac{l}{g}}$ which is an expression of the period of oscillation in a simple pendulum.

All candidates (100%) attempted this question, out of which 78.4 percent scored from 0 to 1.5 marks, 15.2 percent scored from 2.0 to 2.5 marks and 6.4 percent scored from 3.0 to 4.0 marks out of 4.0 marks allotted to this question. This indicates that the general candidates' performance in this question was weak since only 21.6 percent scored 2.0 marks and above. The performance of the candidates in this question is shown in the histogram in Figure 1.

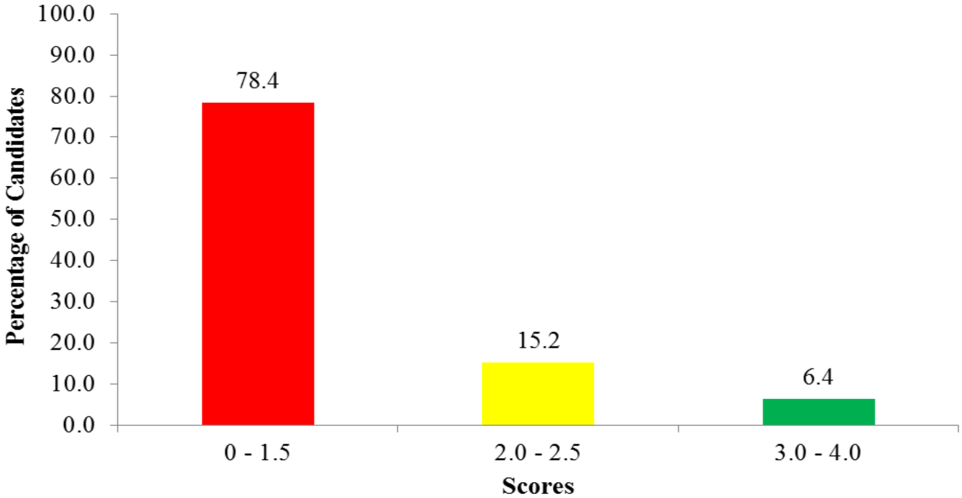
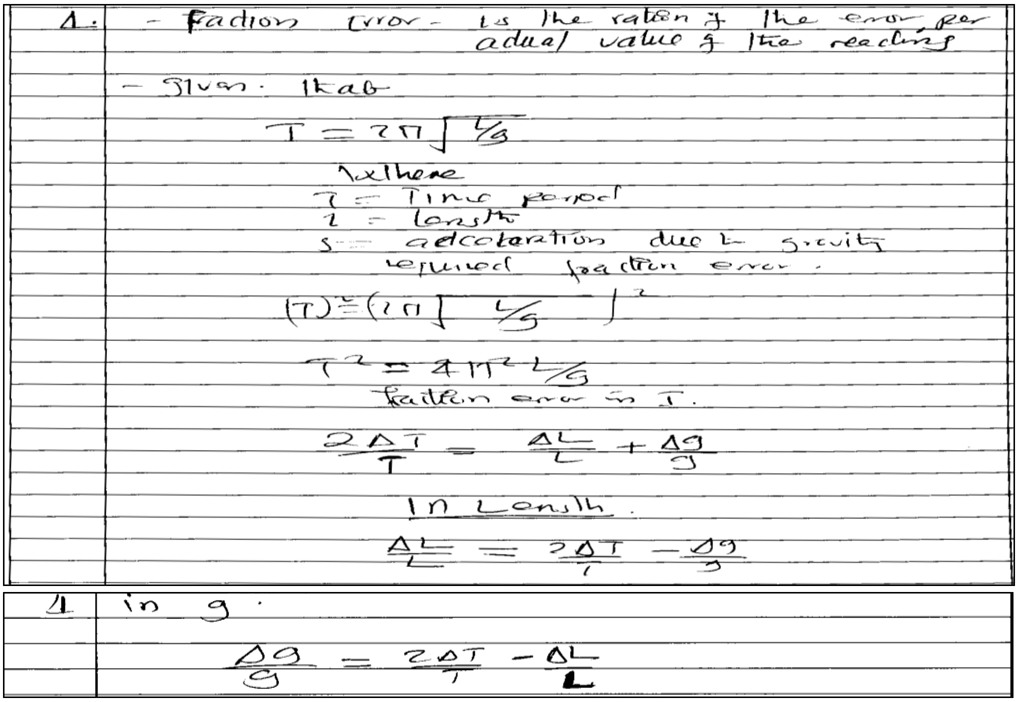


Figure 1: *Candidates' Performance in Question 1*

The candidates (78.4%) who performed poorly had inadequate knowledge on fractional error as they failed to define the term fractional error and deduced it incorrectly. Others tried to deduce the expression of fractional error but they ended with a wrong expression because they skipped the step of introducing natural logarithm. Extract 1.1 shows a sample from a candidate with poor performance.


1. - Fadion error - is the ratio of the error per actual value of the reading

- given. 1kab

$T = 2\pi\sqrt{L/g}$

where
T = Time period
l = length
g = adcolaration due to gravity
required fraction error.

$(T)^2 = (2\pi\sqrt{L/g})^2$

$T^2 = 4\pi^2 L/g$

fraction error in T.

$\frac{2\Delta T}{T} = \frac{\Delta L}{L} + \frac{\Delta g}{g}$

In Length.

$\frac{\Delta L}{L} = \frac{2\Delta T}{T} - \frac{\Delta g}{g}$

1 in g.

$\frac{\Delta g}{g} = \frac{2\Delta T}{T} - \frac{\Delta L}{L}$

Extract 1.1 is an incorrect response from a candidate who failed to explain the meaning of fractional error and to deduce the fractional error.

The analysis of the candidates' responses shows that some of the candidates (21.6%) who scored high marks had adequate knowledge on the concept of measurements because they provided the correct meaning of the term fractional error. They also managed to deduce the fractional error from the given equation. The candidates were able to use the formula of natural logarithm which made them to derive correctly the expression of fractional error. Extract 1.2 shows a sample response from a candidate who provided correct answers to this question.

01. (a) Fractional error is the ratio of absolute error to true/actual value.

Fractional error $= \frac{|\Delta x|}{x}$

Where $|\Delta x|$ is absolute error

x is actual value

(b) Given an equation.

$T = 2\pi\sqrt{\frac{L}{g}}$

square both sides

$T^2 = 4\pi^2 (L/g)$

Apply natural logarithm both sides

$2\ln T = \ln 4 + 2\ln \pi + \ln L - \ln g$.

$2\ln T = \ln 4 + 2\ln \pi + \ln L + \ln g$.

Differentiate both sides

$\frac{2\Delta T}{T} = 0 + 0 + \frac{\Delta L}{L} + \frac{\Delta g}{g}$

$2\frac{\Delta T}{T} = \frac{\Delta L}{L} + \frac{\Delta g}{g}$.

∴ Fractional error of T^2 is $\frac{2\Delta T}{T}$, L is $\frac{\Delta L}{L}$ and g is $\Delta g/g$.

Extract 1.2 shows a correct response from a candidate who provided the correct responses to this question.

2.2 Question 2: Mechanics

The question had two parts (a) and (b). In part (a), the candidates were required to explain what will happen to the moment of a man standing in a rotating turn table when he (i) suddenly stretches his hands horizontally (ii) raises hands upwards. In part (b) candidates were given a stem which states that; a disc of mass 2 kg and radius of 20 cm if free to rotate about an axis through its centre and perpendicular to the disc. If a force of 50 N is applied tangentially to the disc. The candidates were required to calculate angular acceleration.

All candidates (100%) attempted the question and their scores were as follows: 95.6 percent scored from 0 to 1.5 marks, 3.7 percent scored 2.0 to 2.5 marks and 0.7 percent scored 3.0 to 4.0 marks out of 4.0 marks allocated to this question. The data analysis shows that the question was poorly performed as 95.6 percent of the candidates scored below 1.5 marks. Figure 2 is a chart that illustrates the candidates' performance in this question.

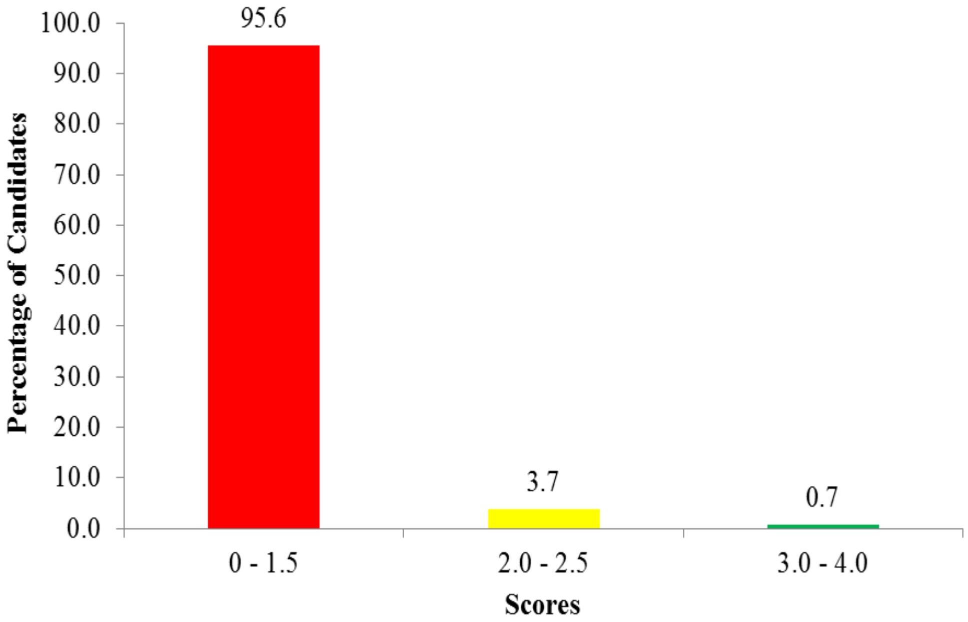


Figure 2: *Candidates' Performance in Question 2*

The analysis of the candidates' item response indicates that, the candidates who performed poorly were unable to explain the effect to moment of inertia when a man's hands are stretched horizontally and raised upwards while he is on a rotating table. They had insufficient knowledge on the factors that affect the moment of inertia. The candidates did not retrieve the fact that the moment of inertia depends on radius and hence the man's hands saved the same purpose as the radii. Some of them confused the concept of centripetal acceleration with angular acceleration of a disc. This led them to apply centripetal force formula to calculate moment of inertia of a disc. As a result, they failed to obtain the value of angular acceleration of the rotating disc. Extract 2.1 shows a sample response from a script of a candidate with weak performance.

2. (b) soln

Data given

Mass = 2 kg

r = 20 cm = 0.2 m

F = 50 N

Required

α = ?

formulae and procedures.

from

$F = \frac{Mv^2}{r}$

but $v = \omega r$.

$50 = \frac{20 v^2}{0.2}$

$v^2 = 0.5$, v = 0.7 m/s.

Then

$\omega = \frac{v}{r}$ = 3.5 m/s.

but

$\alpha = I\omega$

$= \frac{1}{2}MR^2\omega$

$\alpha = \frac{1}{2} \times 2kg \times (0.2)^2 \times (3.5)^2$

α = 0.49 m/s²

Hence angular accelerations = 0.49 m/s²

Extract 2.1 is a sample of a response from a candidate who failed to answer correctly the question

On contrary, some candidates managed to respond correctly to this question. Their responses were related to the factors that affect the moment of inertia. They were able to explain the effect of stretching hands horizontally and rising hands upwards to the moment of inertia when a man standing on a turning table. These candidates also, applied the right formula to calculate the angular acceleration of a rotating disc. Extract 2.2 is a sample response from one of the candidates with good performance.

2. (a)(i) When the man standing in a rotating turn table suddenly stretches his hands horizontally. The moment of inertia of a man is increased due to rotation of table.

(ii) When the man standing in a rotating turn table raises his hand upwards the, moments of inertia of a man will remain constant.

(b) Given

Mass of disc = 2kg

radius 20cm, = 0.2m,

is perpendicular to the disc

given f = .50N

To calculate angular acceleration

Given $I = \frac{1}{2}MR^2$.

from $F = ma$.

but $a = w$

$w = F/m$.

$w = \frac{1}{2}\frac{MR^2}{F}$

$= \frac{\frac{1}{2} \times 2 \times (0.2)^2}{50N} = 8 \times 10^{-4} m/s^2$

Extract 2.2 shows a correct response from a candidate who had knowledge on the sub topic of Rotation of a rigid body.

2.3 Question 3: Properties of Matter

The question consisted of two parts (a) and (b). Part (a), required the candidates to define the terms (i) inter atomic force (ii) perfectly elastic body and (iii) brittle materials as used in strength of materials. Part (b) required them to explain why a spring balance shows wrong readings after it has been used for a long time.

The question was attempted by all (100%) of the candidates whose scores were as follows: 54.4 percent scored 0 to 1.5 marks, 26.4 percent scored 2.0 to 2.5 marks and 19.3 percent scored 3.0 to 4.0 marks. According to this data analysis, the overall performance in this question was average because the majority (45.7%) of the candidates scored 2.0 and above. A graphical presentation of these data is shown in Figure 3.

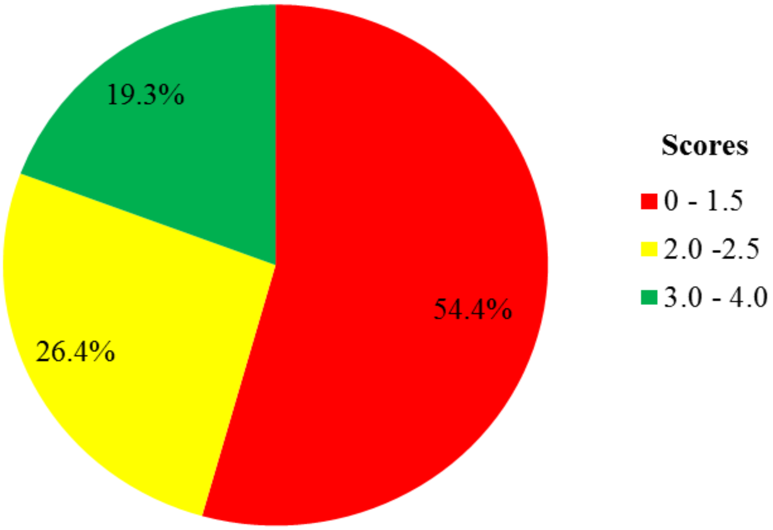


Figure 3: *The Candidates' Performance in Question 3*

The analysis of the candidates' performance in this question shows that some candidates (45.7%) performed well in this question since they managed to define correctly the term inter atomic force, perfectly elastic body and brittle materials and gave right explanations on how accuracy of spring balances is affected after it has been used for a long time. This implies that they were knowledgeable on the topic of Properties of Matter. The extract 3.1 is a sample response from a candidate who provided a correct answer to the question.

3a. iii BRITTLE MATERIAL
Is a material which show little range of plastic limit such as glass.
Brittle material also tends to break down when maleable into another shape or size.

ii. PERFECTLY ELASTIC BODY
Is a material which at all recover its original shape and size after the removal of force of deformation.

i. INTER ATOMIC FORCE
Is a force existing between atoms or molecules of bodies.
Electrostatic force is one of the example of inter atomic force.

3. b. Spring balances show wrong readings after been used for a long time due to fatigue of the material.
Therefore through this reason a spring fail to recover its original strength including shape and size which results into readings of measures (zero readings error) even without load attached to it.

Extract 3.1 is good response from a candidate who provided correct answers in all parts of the question.

The analysis of the candidates' performance in this question shows that the candidates who performed poorly had insufficient knowledge on the topic Properties of Matter. One candidate for example, defined inter atomic force as; *the deformed force of the elastic material* and another defined it as *inter atomic force is the internal force of the body which resists deformation when the deforming force is applied*. These responses indicate that the candidate confused the concepts of inter atomic forces with that of restoring force of elastic materials. In addition, they failed to associate fatigue in metals with the weakening of the spring in the spring balance. Hence they gave incorrect explanations why spring balances give wrong readings after being used for a long time. Extract 3.2 is an example of a response from a candidate who performed poorly.

3. i) Inter atomic force this is the force act between the particle of the atom.

ii) Perfectly elastic body this is body which does not loss energy or can return to its origion after streched and can be harmed into different shape example example Iron

iii) A brittle material This is the kind of material which can not form differe of Shape. after harmed example. chalk

b) Spring to balances show wrong reading after been used for a long time because spring balances loss it's strength when tensile strain is suspended at a long period of time

Extract 3.2 shows an incorrect response from a candidate who failed this question.

2.4 Question 4: Heat

This question had three parts (a), (b) and (c). In part (a), the candidates were required to explain the term internal energy of a system. In part (b) they were required to write the equation of the change in internal energy of the system ΔU in terms of heat supplied to the system ΔQ and the work done on the system ΔW. In part (c) it was given that a quantity of heat Q is supplied to a sample of an ideal gas under reversible condition. The candidates were required to explain how the first law of thermodynamics is used to describe the changes that occur if the gas is maintained at (i) constant volume and (ii) at constant pressure.

All candidates (100%) attempted this question. 94.9 percent of these candidates scored from 0 to 1.5 marks, 4.1 percent scored from 2.0 to 2.5 marks and 1.0 percent scored from 3.0 to 4.0 marks. The total marks allotted to the question were 4.0. The data analysis shows that the performance in the question was weak, because most of the candidates (94.9%) scored low marks (0 to 1.5). The histogram in Figure 4 illustrates the candidates' performance in question 4.

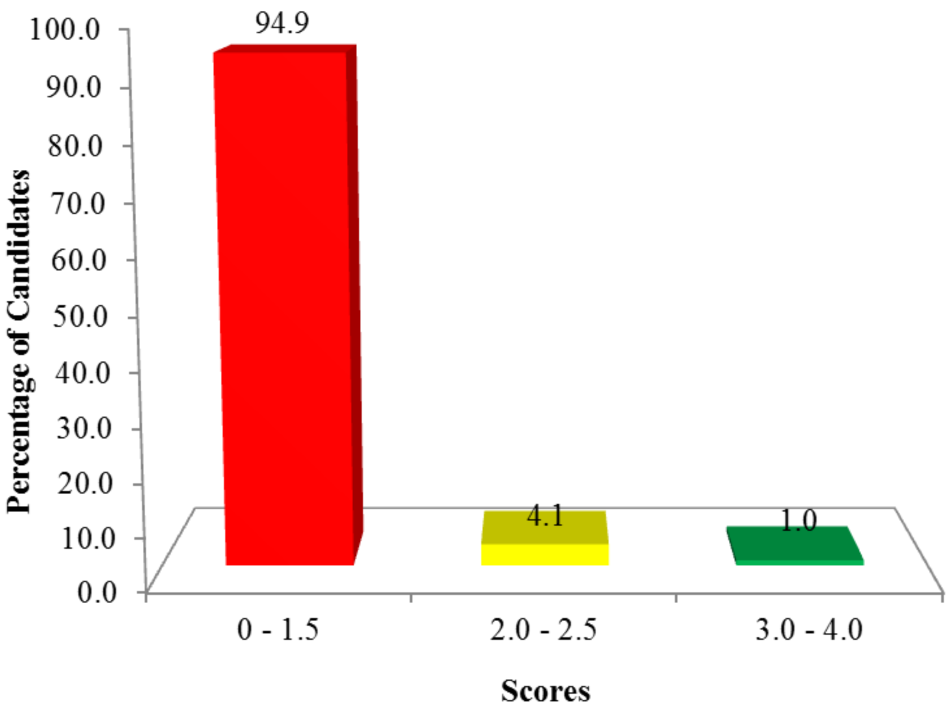


Figure 4: *Candidates' Performance in Question 4*

The analysis of the candidates' responses show further that, the candidates who scored (0 to 1.5) marks provided incorrect answers in most parts of the question. This implies that they lacked knowledge on the basic concept of thermodynamics. Some of them failed to explain correctly the meaning of internal energy of a system and wrote a wrong equation of change in internal energy of the system. On top of that, some candidates confused the first law of thermodynamics with Boyle's and Charles's laws. One candidate for example, described first law of thermodynamics at constant volume as; *When a gas is maintained at constant volume, then the pressure will be proportional directly to the temperature* and another one described that *when a gas is maintained at constant pressure, then the volume will be directly proportional to the temperature.* These candidates stated Boyle's and Charles's laws instead of the first law of thermodynamics. Extract 4.1 is a sample response of an incorrect answer taken from a script of one of the candidates.

4. (a) Internal energy of a System is a process where by a System of a Certain material Contain its energy in internal part.

(b).

(c) i) Constant Volume.
When a gas has maintained at Constant Volume there will be a Change in temperature and pressure in a System.

ii) Constant pressure.
When a gas has maintained at Constant pressure there will be a Change in temperature and Volume in a System.

Extract 4.1 shows an incorrect response from a candidate who failed to all parts of the question.

The analysis of candidates' items response shows that the candidates who scored good marks had adequate knowledge on the topic of heat specifically, on the concept of thermodynamics. They managed to answer correctly all parts of the question. These candidates had a good understanding of internal energy of a system and its equation as well as the description of the first law of thermodynamics at constant volume and pressure. Extract 4.2 shows a sample response from one of the candidates who performed well in this question.

4(a) Internal energy of a system
- This is the total average kinetic energy of the molecules of the gas when the gas is heated at constant volume.

4(b) - The equation are shown below.

$\Delta Q = \Delta U + \Delta W$,

where

ΔQ = Heat supplied to a system.
ΔU = Internal energy of a system.
ΔW = work done on the system,

4(c) i/ Constant volume.
- When the heat is supplied at constant volume there will be no change of volume hence no work done.

i.e

$\Delta Q = \Delta U + \Delta W$,
but $\Delta W = P\Delta V = P(V_2 - V_1)$
at constant volume, $V_2 = V_1 = V$,
$\Delta W = P(V - V) = 0$.
$\Delta Q = \Delta U$.

4(c) ii/ At constant pressure,
- When the gas is heated at constant pressure they will cause the change of both the internal energy and change of work done on the system.

That means;
$\Delta Q = \Delta U + \Delta W$,

Extract 4.2 shows a response from a candidate who provided a correct response to the question.

2.5 Question 5: Geophysics

This question consisted of two parts. In part (a) the candidates were required to define the terms (i) primary waves (ii) secondary waves and (iii) surface waves. In part (b) they were required to mention two types of surface waves.

The question was attempted by all candidates (100%) that sat for this paper. Out of which 82.8 percent scored from 0 to 1.5 marks, 11.1 percent scored 2.0 to 2.5 marks and 6.1 percent scored 3.0 to 4.0 marks, where a total of 4.0 marks were allotted to the question. The data analysis shows that the candidates' performance in the question was weak because 82.8 percent of them scored below 2.0 marks. Figure 5 is a chart that shows candidates' performance in the question.

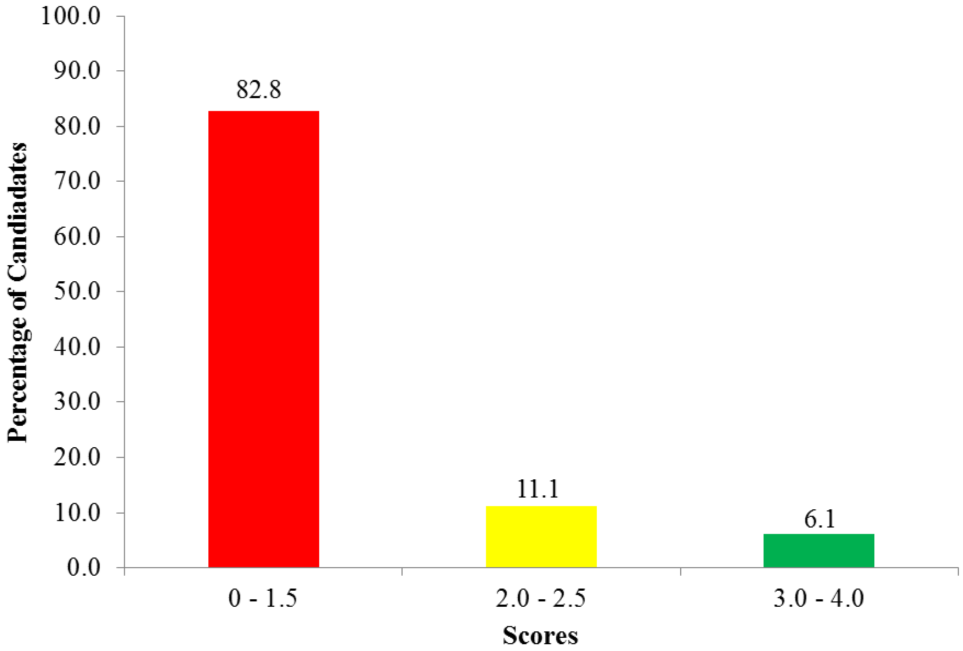


Figure 5: *Candidates' Performance in Question 5*

The data analysis reveals that the performance of the candidates in this question was weak because most of them had insufficient knowledge on the concept of earthquakes and surface waves. They were not able to define correctly the term primary waves, secondary waves and surface waves. They also failed to mention properly two types of surface waves. Some of them associated the types of surface waves with mechanical and transverse waves. As a result they gave a wrong description of surface waves. Extract 5.1 is a sample answer from one of the candidates with weak performance.

5. (a) (i) Primary waves: Are the source or the origin of underground waves that particles moves and collide to form earthquake

(b) (i) Mechanical surface waves

(ii) Transverse surface waves.

Extract 5.1 shows an incorrect response from a candidate who failed to define primary waves.

Furthermore, the analysis shows that the candidates (17.2%) who performed well in the question had sufficient knowledge on the concept of earthquakes. They were able to provide the correct definitions of primary, secondary and surface waves. These candidates mentioned two types of surface waves correctly. Extract 5.2 is a sample from one of the candidates with good performance.

5: (a) (i) primary waves Are the type of wave which originate at the point of focus called hypocentre during the Earthqualce.

(ii) Secondary waves Are the type of waves which emerge immediately after the primary wave during the Earthqualce.

(iii) surface waves Are the types of waves which originate directly above the focus at the point called epicenter during the Earthqualce.

(b) Types of surfale wave.

(1) Love ~~wave~~ surfale waves.

(11) Rayleigh surfall waves.

Extract 5.2 shows a correct response from one candidate who defined primary, secondary and surface waves.

2.6 Question 6: Waves

The question demanded the candidates to explain why sound is easily diffracted through windows but light cannot.

All candidates (100%) attempted this question whereby 94.9 percent scored from 0 to 1.5 marks, 1.7 percent scored from 2.0 to 2.5 marks and 3.4 percent scored from 3.0 to 4.0 marks. Generally, candidates' performance in this question was weak because 94.9 percent of them scored 1.5 and below. Figure 6 shows a pie chart presenting a summary of candidates' performance.

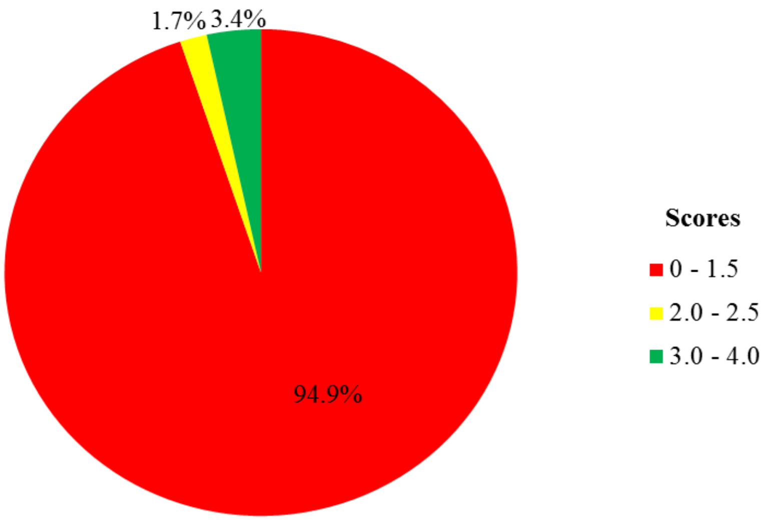


Figure 6: *Candidates' Performance in Question 6*

About ninety five (94.9%) percent of candidates with (0 to 1.5 marks) failed to give correct responses required in this question. These candidates had little knowledge on the concept of diffraction of sound waves. They were not able to link sound waves diffraction behaviours with its wavelength; the longer the wavelength the greater the diffraction. Some of these candidates confused the concept of sound diffraction with sound waves and light waves transfer. Hence they gave wrong answers to this question. Extract 6.1 shows a sample of a weak response from one of the candidate's script.

6.	Because of the following reasons'
	(i) Sound has high frequency as compared to light.
	(ii) Sound can transfer at any media'
	(iii) the sound can not be absorbed, as compared to light.

Extract 6.1 shows an incorrect response from a candidate who performed poorly in this question.

On the other hand few candidates (3.4%) performed well in this question. They had adequate knowledge on the concept of waves especially sound waves diffraction. They were able to give correct reasons why sound waves are easily diffracted through windows. These candidates were also able to recognise that light cannot be diffracted through windows because the diameter of aperture that it passes through should have the same dimensions as the wavelength of incident. However, sound waves have long wavelength, hence windows are enough to diffract them. Extract 6.2 shows a sample of good response from a candidate's script.

6	Sound has large wave lengths resulting it to be diffracted on large slits such as windows but light has very small wavelengths therefore needs a very small comparable slits to diffract it and can not be diffracted through windows

Extract 6.2 shows a good response from a candidate who provided correct answers.

2.7 Question 7: Physics Laboratory Management

This question required the candidates to explain why laboratory cupboards have locks and labels.

The question was attempted by 100 percent of the candidates whose scores were as follows: 18.2 percent scored from 0 to 1.5 marks, 31.5 percent scored from 2.0 to 2.5 marks and 50.3 percent scored from 3.0 to 4.0 marks. In general the data analysis shows that candidates' performance in this question was good because 81.8 percent of them scored 3.0 marks and above out of 4.0 marks allotted to the question. The performance of the candidates in this question is also shown in the histogram in Figure 7.

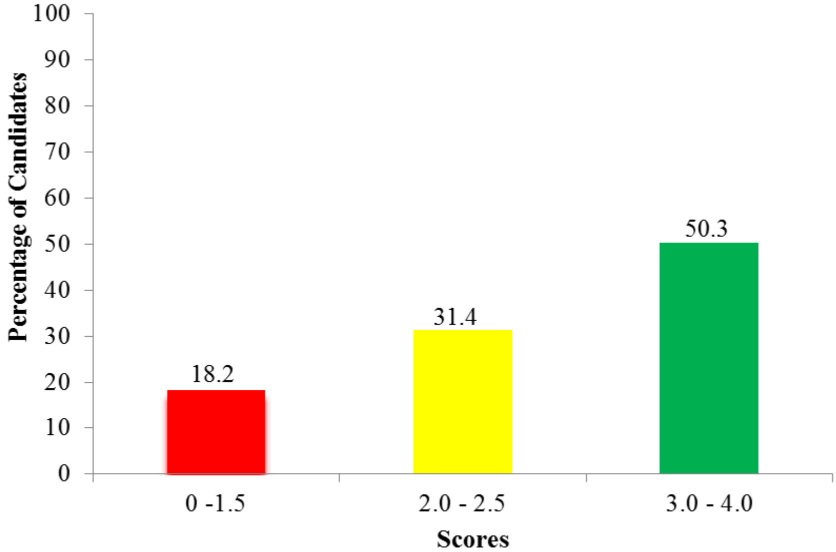
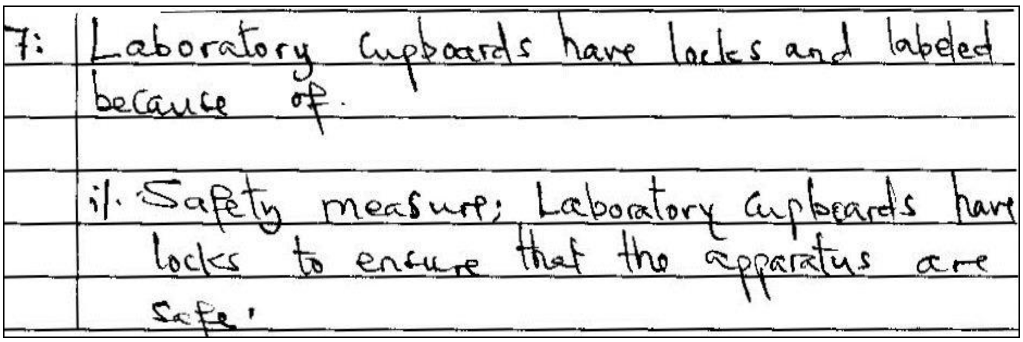


Figure 7: *Candidates' Performance in Question 7*

Analysis of the candidates' performance shows that the candidates who managed to respond correctly to the question, explained the right reasons for laboratory cupboards to have locks and labels. These candidates were aware that locks and labels on laboratory cupboards ensure security and safety of stored apparatus. Some of them added that, locks on laboratory cupboards limit unauthorized access to the apparatuses while labels ensure available the apparatus are easily recognized for easy access when setting an experiment. Extract 7.1 shows a sample of a good response from a candidate.


7: Laboratory cupboards have locks and labeled because of.

i/. Safety measure; Laboratory cupboards have locks to ensure that the apparatus are safe.

> 7 ii/. Proper arrangement of the materials:
> Laboratory cupboards are labeled in order to facilitate proper arrangement of apparatus in the laboratory. Labelling helps teachers to place like materials in the same cupboard.
>
> iii/. Accessibility of the apparatus when needed.
> Locks and labelling of the cupboards in the laboratory helps teacher to access the apparatus when needed.
>
> iv/ Identification of lacking apparatus,
> Labelling of cupboards in the laboratory can help teacher to identify the apparatus that miss in the laboratory since apparatus are arrange according to their kind and uses.

Extract 7.1 shows a response from a candidate who provided correct justification why laboratory cupboards have locks and labels.

Some candidates (18.2%) with low marks (0 to 1.5) failed to give the correct responses needed for this question. These candidates did not understand laboratory management particularly, storage and maintenance of laboratory apparatuses. Extract 7.2 shows a sample response from a script of a candidate who scored poorly in this question.

> 7. Laboratory Cupboards have lockeds and labeled because!
> (i) Every body to be known in the respective useand be carrying in the application perfectly

Extract 7.2 shows an incorrect response from a candidate who performed poorly.

2.8 Question 8: Physics Laboratory Management

The question demanded the candidates to write four possible causes of fire in a Physics laboratory.

All candidates (100%) attempted the question, whereby 13.2 percent scored 0 to 1.5 marks, 25.0 percent scored 2.0 to 2.5 marks and 61.8 percent scored 3.0 to 4.0 marks. According to this data analysis, the overall performance in this question was good because the majority (86.8%) of the candidates scored 3.0 to 4.0 marks out of 4.0 marks allotted to this question. A graphical presentation of these data is shown in Figure 8.

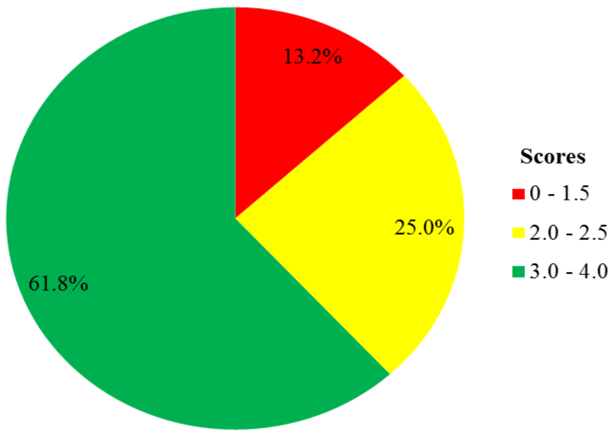


Figure 8: *Candidates' Performance in Question 8*

The analysis of the candidates' items response shows that most candidates (86.8%) performed well this question. The candidates' good performance was due to by sufficient understanding of the concept of safety rules in a Physics laboratory. Therefore, most candidates were able to provide correctly four causes of fire in a Physics laboratory. Extract 8.1 shows a sample of a good response from one candidate.

8	(i) Electric shock due poor wiring system.
	(ii) Improper storage of gas tubes.
	(iii) Explosure of the radio active material
	(iv) Explosure of chemical's example
	sulphuric acid. (concentrated sulphuric
	acid).

Extract 8.1 shows a correct response from a candidate who provided four causes of fire in the Physics laboratory.

There were however a few candidates (13.2%) who scored low marks by providing incorrect responses to the question. This implies that they had a little understanding of Physics laboratory safety rules. Some of these candidates mentioned general Physics laboratory rules instead of causes of fire in the Physics laboratory. As a result they scored low marks (0 to 1.5) in this question. Extract 8.2 shows a sample response from a script of a candidate who scored low marks in this question.

8	For possible causes of fire in a physics labo-
	ratory
	i) Runing in the laboratory
	ii) To oppose to follow instruction
	iii) Sleeping in labaratory
	iv) Thrown of the body in the laboratory

Extract 8.2 shows a response from a candidate who failed to respond correctly to the question.

2.9 Question 9: Planning for Teaching

The question required the candidates to explain four considerations when preparing a scheme of work.

The question was attempted by all candidates (100%) that sat for this paper whereby 16.2 percent of them scored from 0 to 1.5 marks, 38.2 scored from 2.0 to 2.5 marks and 45.6 percent scored from 3.0 to 4.0 marks, out of 4.0 that marks were allotted to the question. The data analysis shows that the candidates' performance in the question was good because 83.8 percent of them scored 2.0 marks and above. Figure 9 shows a chart presenting a summary of the candidates' performance.

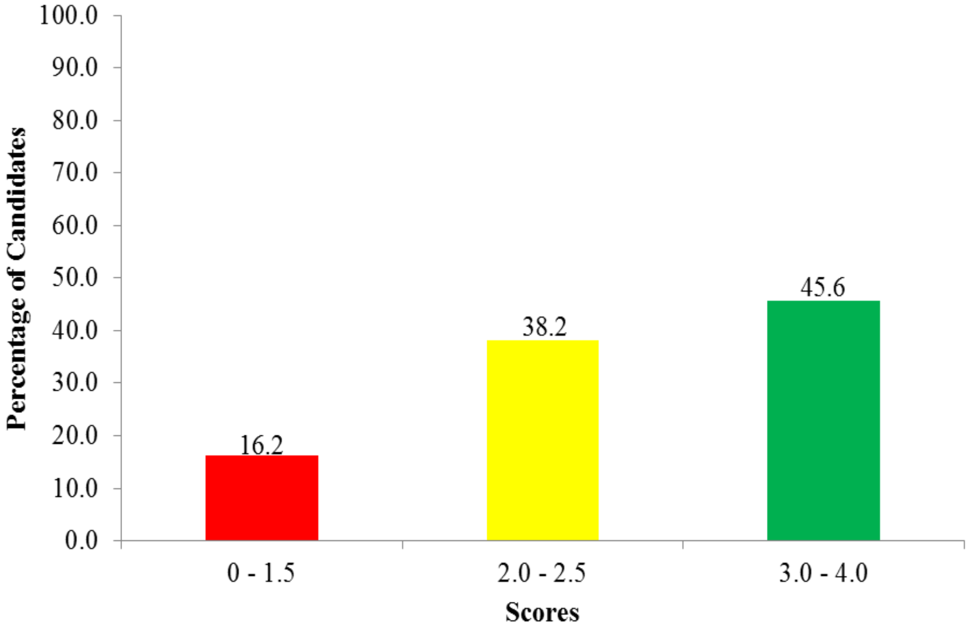


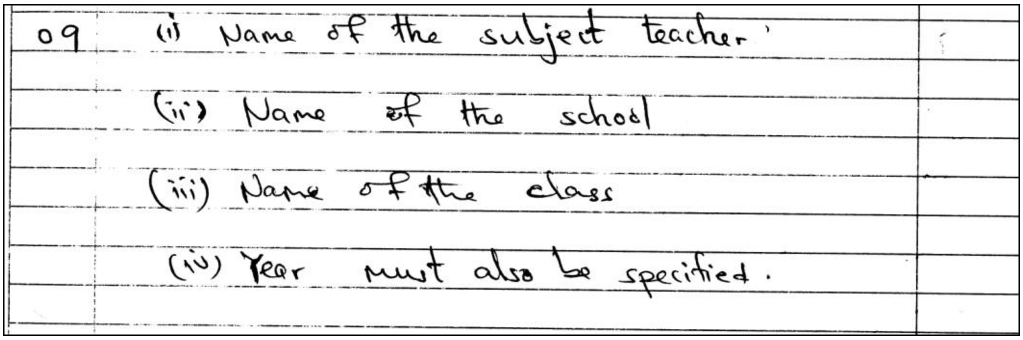
Figure 9: *Candidates' Performance in Question 9*

The analysis of candidates' performance in the question shows that most of the candidates had sufficient knowledge on preparation of a scheme of work. As a result they were able to state correctly the four considerations when preparing a scheme of work. Extract 9.1 shows a sample of a correct response from one of the candidate's script.

9. Considerations when preparing a scheme of work.
- A syllabus;
  - This enable the teacher to extract all the necessary informations in teaching and learning process. It includes topics, objectives
- A school calendar
  - It shows the events that will interfear the teaching and learning process and how to adjust them in the scheme of work.
- A school timetable (Academic)
  - It will enable a teacher how to distribute number of periods in each topic within a time
- National calendar.
  - It shows different events such as holidays and public days that may interfear the timetable hence how enable a teacher to overcome it.

Extract 9.1 shows a response from a candidate who provided a correct answer to the question.

The analysis of candidates' performance shows that a few candidates (16.2%) who performed poorly had inadequate knowledge on the concept of preparation of scheme of work. Hence they failed to explain the four considerations when preparing a scheme of work. One of these candidates mentioned four considerations when preparing a scheme of work as; *name of school, name of scheme of work designer, year in which scheme is to be implemented* and *name of class*, while another candidate mentioned, *general objectives, topics, sub topic* and *specific objectives*. The responses from these candidates were irrelevant to the question asked; these candidates provided preliminary information written in a scheme of work and a lesson plan respectively. Extract 9.2 shows a sample response from a script of a candidate who performed poorly.


09 (i) Name of the subject teacher

(ii) Name of the school

(iii) Name of the class

(iv) Year must also be specified.

Extract 9.2 shows an incorrect response from a candidate who failed to explain all four considerations when preparing a scheme of work.

2.10 Question 10: Assessment in Physics

The question required the candidates to mention four assessment tools used in the teaching and learning of Physics.

The question was attempted by all candidates (100%) who sat for this paper. Out of them 2.0 percent scored from 0 to 1.5 marks, 2.7 percent scored 2.0 to 2.5 marks and 95.3 percent scored 3.0 to 4.0 marks out of 4.0 marks that were allotted to the question. The data analysis shows that the candidates' performance in the question was good because 98.0 percent of them scored 2.0 to 4.0 marks. Figure 10 is a chart that shows candidates' performance in this question.

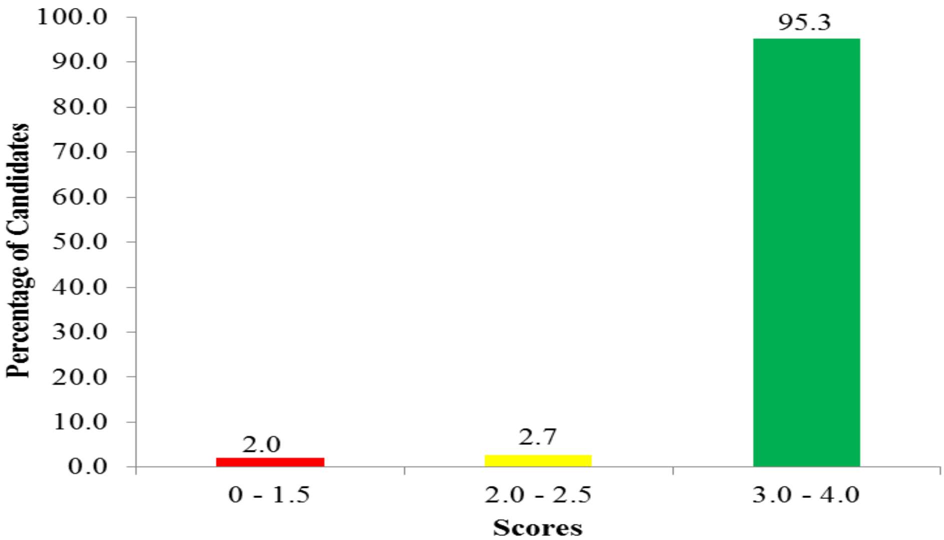


Figure 10: *Candidates' Performance in Question 10.*

The analysis of the candidates' item response shows that majority (98.0%) performed well because they had adequate knowledge on assessment tools used in teaching and learning of Physics. They were able to mention correctly four assessment tools used in Physics. Extract 10.1 presents a sample of a good response from one of the candidate's script.

10.	Assessment tools used in teaching and learning physics.
	i) Tests
	ii) Portifolio
	iii) Interview
	iv) Checklist

Extract 10.2 presents a good response from a candidate who provided correct answers of the question.

Furthermore, the analysis of the candidates' responses shows that those who scored low marks provided incorrect answers to the question. This implies that they insufficient knowledge on the basic concepts of assessment in teaching and learning Physics. Hence they failed to mention four assessment tools used in teaching and learning of Physics. For example one of these candidates mentioned assessment tools used in Physics as; *syllabus, text books, reference books, teacher's guard* and *teacher's practical manual*. The response from this candidate was irrelevant to the question requirement. The candidate mentioned Physics curriculum materials instead of Physics assessment tools. Extract 10.2 shows a sample response from a script of a candidate who performed poorly.

10	Assessment tools used in teaching and learning Physics,
	i) Syllabus of physics subject
	ii) Physics text books
	iii) Physics reference books
	iv) Physics teacher's manual and teachers guide.

Extract 10.2 shows a response from a candidate who failed to respond correctly to the question.

2.11 Question 11: Mechanics.

This question consisted of three parts. In part (a) the candidates were required to explain why a curved path is always banked. In part (b) they were required to give two necessary conditions for an oscillatory motion to be considered simple harmonic. In part (c) they were given the equation $x = r\cos(\omega t + \varphi)$ and were required to: (i) identify the meaning of each symbol in the equation (ii) write the velocity-time graph and acceleration–time graph equations and (iii) use equations in (ii) to sketch the corresponding graphs showing how velocity and acceleration vary with time.

A total of 88.9 percent of the candidates attempted this question, out of them 33.5 percent scored from 0 to 5.5 marks, 55.1 percent scored from 6.0 to 10.0 marks and 11.4 percent scored from 10.0 to 15.0 marks, where 15.0 marks were allotted to the question. These scores imply that the candidates' performance in this question was good since 66.5 percent of them scored 6.0 marks and above. Figure 11 illustrates the candidates' performance in this question.

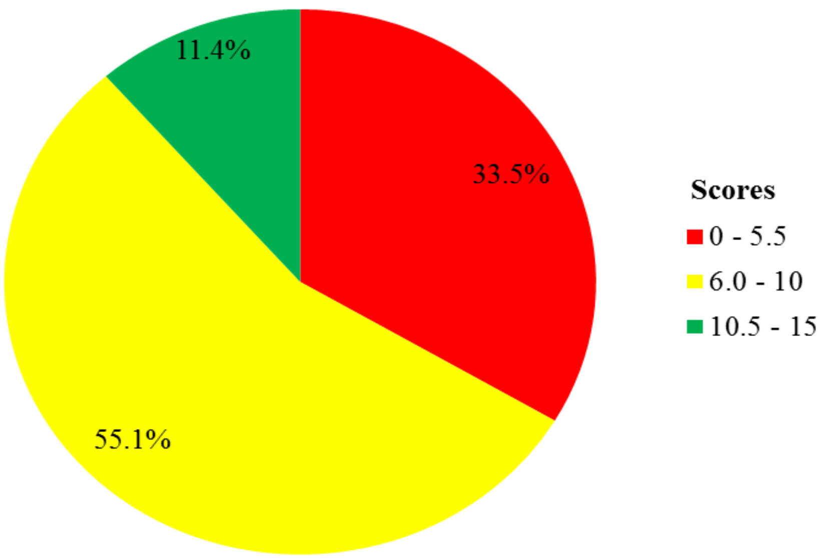


Figure 11: *Candidates' Performance in Question 11.*

The analysis of the candidates' response shows that 66.5 percent of candidates performed well because they had an adequate knowledge on the concepts of circular motion and simple harmonic motion. They explained correctly why roads are banked round a curved pathway. Furthermore, they managed to apply knowledge of mathematical skills in calculus. Therefore, they were able to differentiate the displacement equation to get velocity ($\frac{dx}{dt} = \vec{v} = -r\cos(\omega t + \phi)$) and acceleration ($\frac{dv}{dt} = \vec{a} = -r\omega^2\cos(\omega t + \phi)$) equation, this enabled them to draw the corresponding velocity-time and acceleration-time graphs.

These candidates were also able to use the given displacement- time equation $\mathbf{x} = r\cos(\omega t + \phi)$ for a particle with simple harmonic motion to state correctly the meaning of the symbol in the equation. Extract 11.1 presents a sample of a good response from one of the candidate's script.

11 a/ Soln
Roads are banked round a curved pathway:
Because:- Firstly to avoid oversliding:.
The roads are banked round a curved to avoid oversliding when passing through the corner with the high..
Secondly:: to make the car or motor-vehicles to move with maximum speed when passing around the corner or curved pathway. It help the car to pass with Maximum speed around the corner.

b/ Soln
Conditions:
i/ For a body to execute a simple harmonic Motion, the acceleration of the body must be directly toward the mean position.

ii/ For a body to execute a simple harmonic motion, the acceleration of the must be direct proportional to the displacement.

$$a \propto -y$$

where
a = acceleration
y = displacement.

11 c/ Solution

Data given

Displacement $(x) = r\cos(\omega t + \theta)$

Required to find

i/ The Meaning of each symbols.

x = Displacement in cm or m

r = Amplitude / Radius in cm or m

ω = Angular Velocity in rad

t = time in seconds

θ = Phase angle / Phase difference

ii/ Write down the velocity - time and acceleration - time equation.

Solution

Velocity - time equation.

From

$x = r\cos(\omega t + \theta)$

$\frac{dx}{dt} = -r\omega\sin(\omega t + \theta)$

But

$\frac{dx}{dt}$ = Velocity = V

$V = -r\omega\sin(\omega t + \theta)$.

$\therefore$ Velocity - time equation $(V) = -r\omega\sin(\omega t + \theta)$

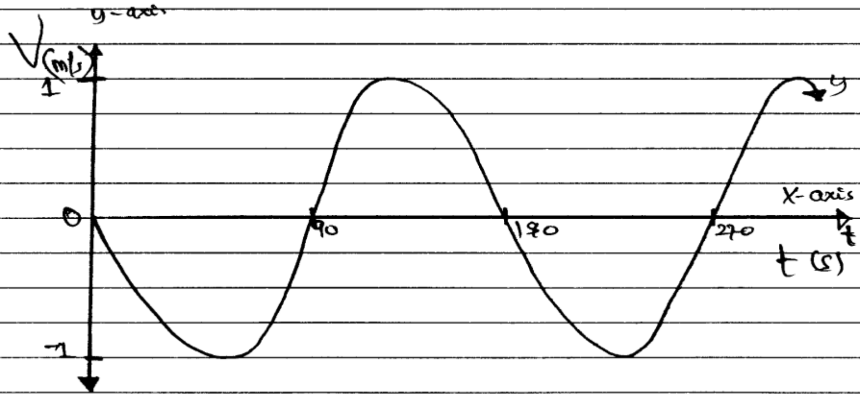
11 c/ iii/ To sketch the corresponding graphs showing how velocity and acceleration varies with time.

- Velocity - time graph.

given equation

$$V = -r\omega \sin(\omega t + \theta)$$

THE GRAPH OF VELOCITY VS TIME.



y = displacement

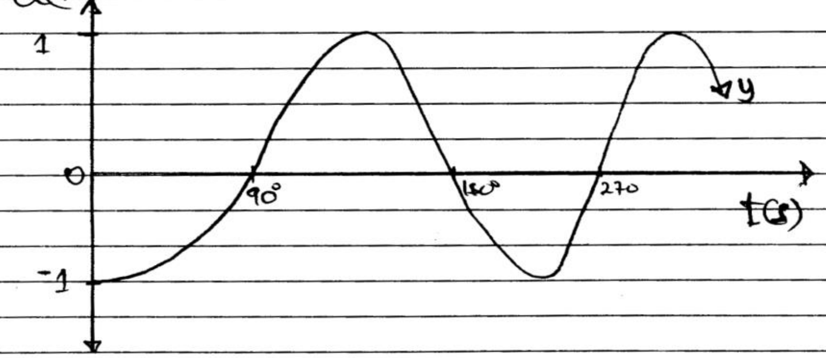
11 • Acceleration-time graph

given

$$a = -r\omega^2 \cos(\omega t + \theta)$$

~~THE VELOCITY TIM~~

THE ACCELERATION - TIME GRAPH.



y = displacemen

11 c) ii)

Acceleration-time equation.

Now

$$\frac{dx}{dt} = -r\omega \sin(\omega t + \theta)$$

But $dx/dx = V$.

$$v = -r\omega \sin(\omega t + \theta)$$

Then

$$\text{acceleration } (a) = dv/dt$$

$$dv/dt = \frac{d}{dt}\left(-r\omega \sin(\omega t + \theta)\right)$$

$$dv/dt = -r\omega \cdot \omega ~~\sin~~ \cos(\omega t + \theta)$$

$$a = -r\omega^2 \cos(\omega t + \theta)$$

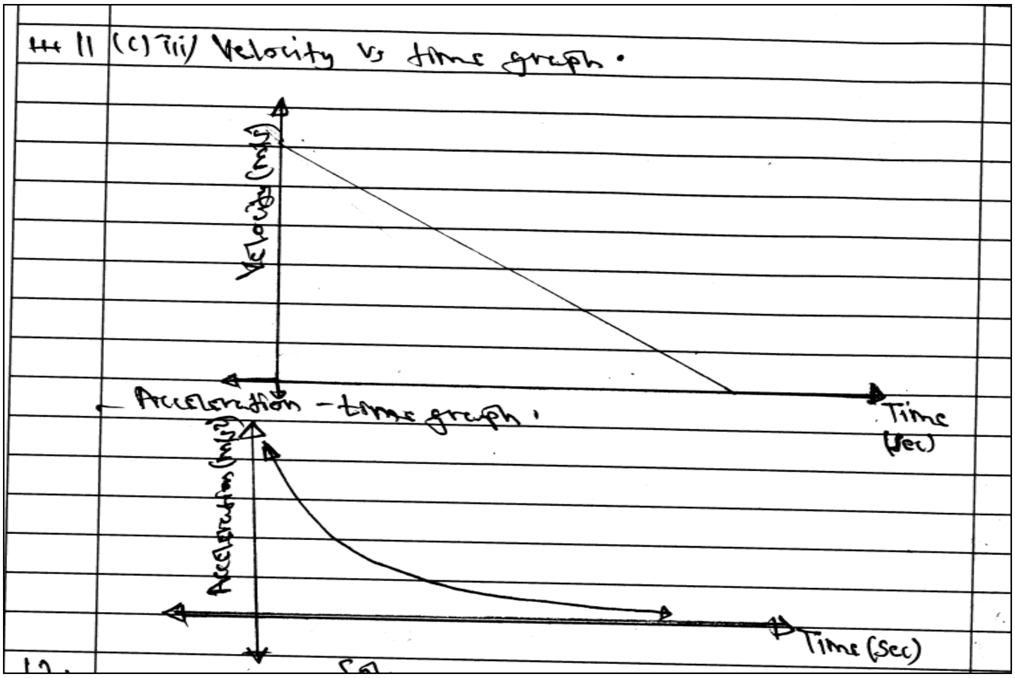
$\therefore$ Acceleration-time equation $(a) = -r\omega^2 \cos(\omega t + \theta)$

Extract 11.1 presents a good response from a candidate who provided correct answers in all parts of the question.

The analysis of the candidates' response shows that the candidates who scored low marks provided incorrect answers to most parts of the question. This indicates that they lacked knowledge on mechanics especially the concepts of circular motion and simple harmonic motion. Some of them failed to explain correctly. Some of the candidates were able to explain why roads are banked round a curved pathway but failed to associate a curved pathway on the road with a centripetal force which acts upon the vehicles.

Furthermore, these candidates failed to recognize that centripetal force is provided by the friction force between the tyres and the road. When the road is banked, the centripetal force which keeps the vehicle from moving in a circular path is provided by the horizontal component of the normal force $Fc = R\sin\theta$.

These candidates also had little knowledge of mathematical skills in calculus. Due to this they failed to differentiate the displacement equation to get velocity and acceleration equations. As a result, they were not able to draw the corresponding velocity-time and acceleration-time graphs. Extract 11.2 shows a sample of a weak response from one of the candidate's scripts.



Extract 11.2 shows an incorrect response from a candidate who performed poorly in this question.

2.12 Question 12: Current Electricity

In this question, the candidates were required to find (a) the current in 10 Ω and (b) the potential difference across the whole circuit given that two wires of 10 Ω and 5 Ω are parallel and arranged in series with 20 Ω wire and that the current in 5 Ω wire is 2 A.

A total of 271 (91.6%) candidates attempted this question, out of which 14.8 percent scored below 6.0 marks, 26.9 percent scored 6.0 to 10.0 marks and 58.3 percent scored 10.5 to 15 marks. These scores show that the candidates' performance in this question was good because 85.2 percent of them scored 6.0 to 15 marks. Figure 12 illustrates candidates' performance in the question.

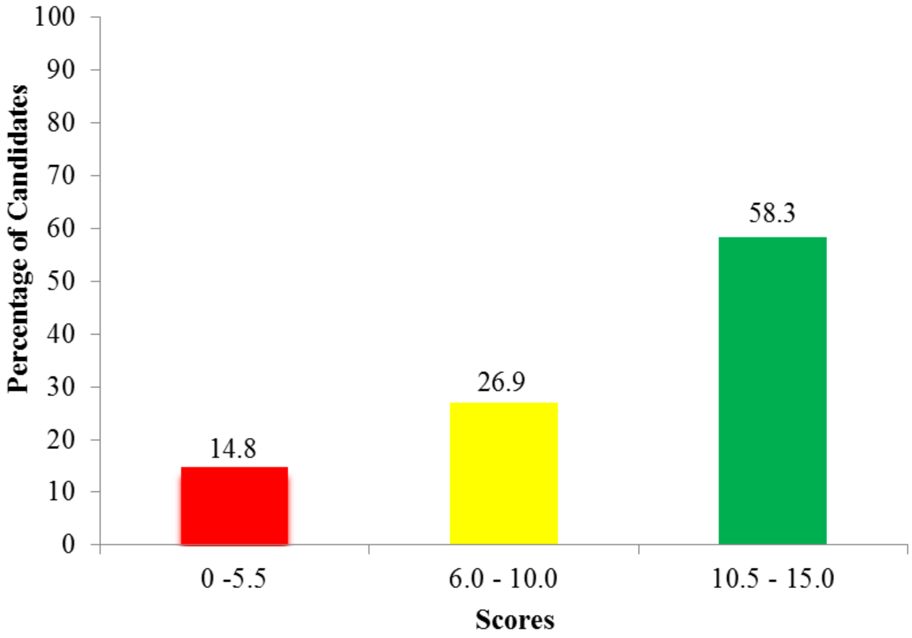
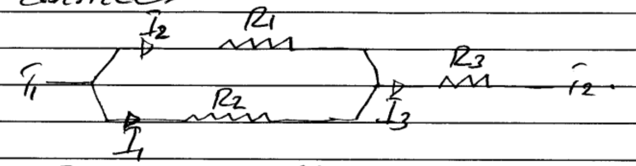


Figure 12: *Candidates' Performance in Question 12.*

The analysis of candidates' responses in this question shows that 85.2 percent of the candidates scored good marks. These candidates had a good understanding of the concepts of current electricity in particular parallel and series arrangement of resistors. Moreover, most candidates had a good understanding of the behaviour of resistors when in parallel or series connection in an electrical circuit. In addition, they were able to apply correctly Ohm's law equation to calculate the voltage drop in a particular resistor and to deduce right equations for equivalent resistance in parallel and series arrangements of resistors. Extract 12.1 shows a sample of good responses to this question.

12\. Given Resistance (R_1) = 10Ω. } in parallel
Resistance (R_2) = 5Ω. }.
and
resistance R_3 = 20Ω. in series.
Current I = 2A. in 5Ω.

consider



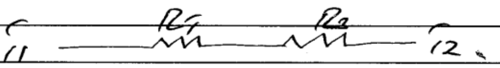
From parallel connection.

Total resistance (R_T) = $\frac{R_1 R_2}{R_1 + R_2}$.

$R_T = \frac{(10Ω * 5Ω)}{5Ω + 10Ω} = \frac{50Ω^2}{15Ω}$.

$R_T = 3.33Ω$.

Then in series.



Total resistance $R = R_T + R_3$
$= 3.33Ω + 20Ω$
$= 23.33Ω$.

then

@ From Resistance 5Ω. and current given 2A.

$V_2 = I_1 R_2$.
$= 5Ω \times 2A$
$V_2 = 10V$. Since 5Ω is parallel to 10Ω the
$V_1 = V_2$.

$10V = I_2 R_1$

$I_2 = \frac{10V}{10\Omega}$.

$I_2 = 1A$.

(a) The current in $10\Omega = 1A$.

(b) Then From the circuit

$I_3 = I_1 + I_2$.

$= 2A + 1A$.

$I_3 = 3A$.

Then

$V_T = I_3 \times R$

where R = Total resistance from the circuit $R = 23.33\Omega$.

$I_3 = 3A$.

$V_T = 3A \times 23.33\Omega$.

$V_T = 70V$

∴ The required potential different across the whole circuit is 70V

Extract 12.1 shows a good response from a candidate who provided correct responses to the question.

Those who scored 0 to 5.5 marks (14.8%) provided incorrect responses in most parts of the question and some of them answered some parts and skipped other parts. Generally, most of these candidates had inadequate knowledge on the topic of current electricity hence, they provided inappropriate responses in most parts of the question. Extract 12.2 shows a sample of a response from one of the candidates who scored poorly in this question.

$V = I_1 R_1$.

but $\frac{V}{R_T} = I_1 + I_2$,

$I_2 = 2A$ – through 5Ω,

$\frac{V}{R_T} = I_1 + 2A$.

but $V_T = V_1 = V_2$ in parallel.

$\frac{I_1 R_1}{R_T} = I_1 + 2A$.

$R_T = 70/3$, and $R_1 = 10\Omega$,

$\frac{10 I_1}{70/3} = I_1 + 2A$.

$\frac{30}{70} I_1 = I_1 + 2A$

$\frac{3}{7} I_1 - I_1 = 2A$

$I_1 \left(\frac{3}{7} - \frac{1}{1} \right) = 2A$.

$I_1 \left(\frac{3-7}{7} \right) = 2A$

$-\frac{4}{7} I_1 = 2A$.

$I_1 = -\left(\frac{2 \times 7}{4} \right) A$

$I_1 = -\frac{14}{4} A = \frac{-7}{2} A = -3.5A$.

– The –ve sign indicate the current in opposite direction.

∴ The current through 10Ω is $3.5A$

$I_{T_1} = I_{4\Omega} + I_{5\Omega}$

$I_T = 3.5\,A + 2\,A$

$I_{T_1} = 5.5\,A.$

Total current $(I_T) = 5.5A.$

– In series the current is constant.

$I_T = I_{T_1} = I_3 = I = 5.5A.$

∴ Total current in circuit = 5.5A.

Total resistance in the circuit $= \frac{70}{3}\,\Omega.$

From.

$V = IR.$

$V = \left(5.5 \times \frac{70}{3}\right) V.$

$V = 128.33\,V$

∴ The potential difference across the whole circuit is 128.33V

Extract 12.2 shows a response from a candidate who performed poorly in this question.

2.13 Question 13: Waves

The question is under the topic of waves. It consisted of three parts namely (a), (b) and (c) in which, part (a) required the candidates to state the necessary conditions for interference of light to occur. Part (b) required them to calculate the radius of curvature of a Plano-convex lens and the diameter of the twentieth bright fringe of a Plano-convex lens is used to produce Newton's rings. If the diameter of the tens dark rings viewed by normal light of wavelength 5.00×10^{-7} m is 4.48 mm. In part (c) the candidates were required to explain why explosions from other planets are not heard on earth.

The 19.3 percent of candidates who sat for this paper attempted this question. The data analysis shows that the scores were as follows: 82.5 percent scored from 0 to 5.5 marks and 17.5 percent scored 6.0 to 10.0 marks. No candidate scored above 10.0 marks. These scores show that the overall performance in this question was poor as only 82.5 percent performed poorly in the question. Figure 13 is a bar chart that shows the candidates' performance in this question.

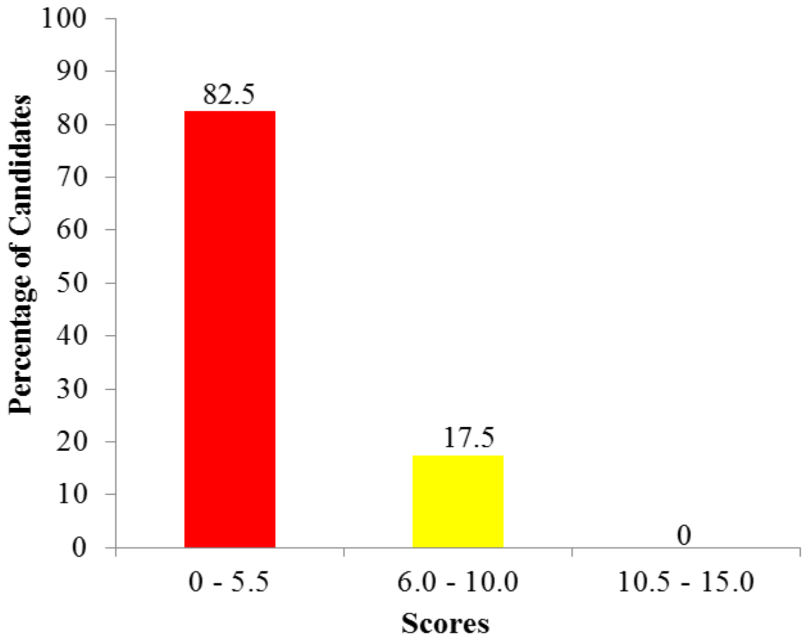


Figure 13: *Candidates' Performance in Question 13.*

The analysis of the candidates' item response indicates that most of the candidates (82.5%) who scored low marks in this question provided responses characterised by incorrect concepts, formulae and errors in computation. One candidate for example used wrong formula to calculate radius of curvature of a Plano–convex lens as follows; $R = \frac{4.48 \times 10^{-3}}{2}$ while another one applied $n\lambda D = ay$ which is used to determine the position of bright fringes in Young's double slit experiment. Generally, it was noted that failure in this question was contributed by various reasons including: low ability to recall important concepts of the topic waves and insufficient knowledge in solving equations involving the radius of curvature of a Plano-convex lens and the diameters of bright rings in Newton's rings experiment.

A number of candidates failed to explain why explosions in other planet are not heard on earth. The response from one candidate read: *Because they have low frequency and wavelength therefore the do not heard on the earth.* Another candidate wrote: *The explosions on the other planet not head on the earth this is due to high collision with air since they move at high speed and get ionized before to reach to the earth's surface.* These irrelevant responses show that candidates had poor understanding on the concept of sound waves propagation. However candidates were supposed to say that since there is vast empty space (no medium) between the planets and earth, the sound waves of explosions cannot propagate up to earth. Extract 13.1 represents an example of responses from one of the candidates who performed poorly in this question.

13 b) i) Data given.
Wave length $\lambda_{10th} = 5.00 \times 10^{-7}$ m
Diameter D_{10th} = 4.48 mm → 4.48×10^{-3} m
Required
i) The radius of curvature of a plano-convex lens = ?
from
radius = Diameter / 2.
Radius of curvature of a plano-convex lens = $\frac{4.48 \times 10^{-3}}{2}$
radius = $\frac{4.48 \times 10^{-3}}{2}$
= 2.24×10^{-3} m.
∴ The radius of curvature of a plano-convex lens = 2.24×10^{-3} m.

ii) Require diameter of the twentieth bright ring = ?
from
Diameter of 10th = 4.48 mm
Diameter of 20th = ?
from
~~Diameter of the dark is line~~
The diameter of bright ring is twice to the diameter of dark ring.
Diameter of 20th = 4.48 mm × 2
= ~~8.89~~ 8.96 mm
∴ The diameter of bright ring = 8.96 mm

Extract 13.1 shows an incorrect response from a candidate who performed poorly.

As for the candidates who had average performance (17.5%) they were able to provide correct answers to some parts of the question. They managed to state correctly all six necessary conditions for interference of light. In addition, they applied the right formula to calculate the radius of curvature of a Plano–convex and the diameter of the twentieth bright ring. Hence, they managed to get average marks (6.0 to 10.0). Extract 13.2 shows response from one of the candidates who got average marks in this question.

13. (a) Six necessary condition for interference of light to occurs.

(i) The two or more source of a light wave should be monochromatic. So in order a light wave to undergoes interference, two or more source of a light wave should be monochromatic.

(ii) The two or more source of a light should be coherent source. This is happened that the two or more wave should be show a coherent source.

(iii) The two or more source of a light should be polized or unpolized. hence a light wave of can separate from one point to another hence in order a interference to occurs a source of a light wave should be polized or unpolized

(iv) The two or more source of a light should be close each other. For interference of light to occurs, the two or more source of a light should be close each other

(v) The two or more source of a light should be a screen. Screen should be necessary for interference of a light wave.

13 (a) (i) The two or more light wave sho uld be a fringer separation such as Dark and bright fringer hence the Interference of a light wave will occurs.

(b) Data provided

Wavelength $= 5.00 \times 10^{-7}$ M
number of a fringer $= 10$th
radius of a flat glass (r) $= 4.48$ mm $= 4.48 \times 10^{-3}$ m

asked to find

(a) The radius of curvature of a plano - convex lense

soln.
From, the formula.

$$r = \sqrt{(n + 1/2) \lambda R}$$

where by
r = small radius of a flat glass
n = number of a fringers a flat glass
R = radius of a curvature of flat glass
λ = wave length of a flat glass
hence, make subject the value of R,

square both side

$$r^2 = (n + 1/2) \lambda R$$

13.

(b) Divide $(n + \frac{1}{2})\lambda$ both side

$$\frac{r^2}{(n+\frac{1}{2})\lambda} = \frac{(n+\frac{1}{2})\lambda}{n+\frac{1}{2}\lambda} R$$

$$R = \frac{r^2}{(n+\frac{1}{2})\lambda}$$

$$R = \frac{(4.48 \times 10^{-3})^2 m^2}{(10+\frac{1}{2}) \times 5.00 \times 10^{-7} m}$$

$$R = \frac{(4.48 \times 10^{-3})^2 m^2}{(10 + 0.5) \times 5.00 \times 10^{-7} m}$$

$$R = \frac{(4.48 \times 10^{-3})^2 m^2}{5.25 \times 10^{-6} m}$$

R = ~~852.2 M.~~ 3.82 M.

∴ The Radius of curvature of a plano convex lens is 3.82 M.

Extract 13.2 presents a good response from a candidate who provided correct answers to this question.

2.14 Question 14: Assessment in Physics

This question had two parts; (a) and (b). In part (a) the candidates were required to explain six characteristics of a good Physics test. In part (b), candidates were required to explain three domains of educational objectives.

The question was attempted by 98.0 percent of the candidates that sat for this paper. The data analysis shows that 4.5 percent of the candidates scored from 0 to 5.5 marks, 56.2 percent scored 6.0 to 10.0 marks and 39.3 percent scored 10.5 to 15.0 marks. The general performance in the question was good since 95.5 percent scored 6.0 marks and above. Figure 14 illustrates candidates' performance in this question.

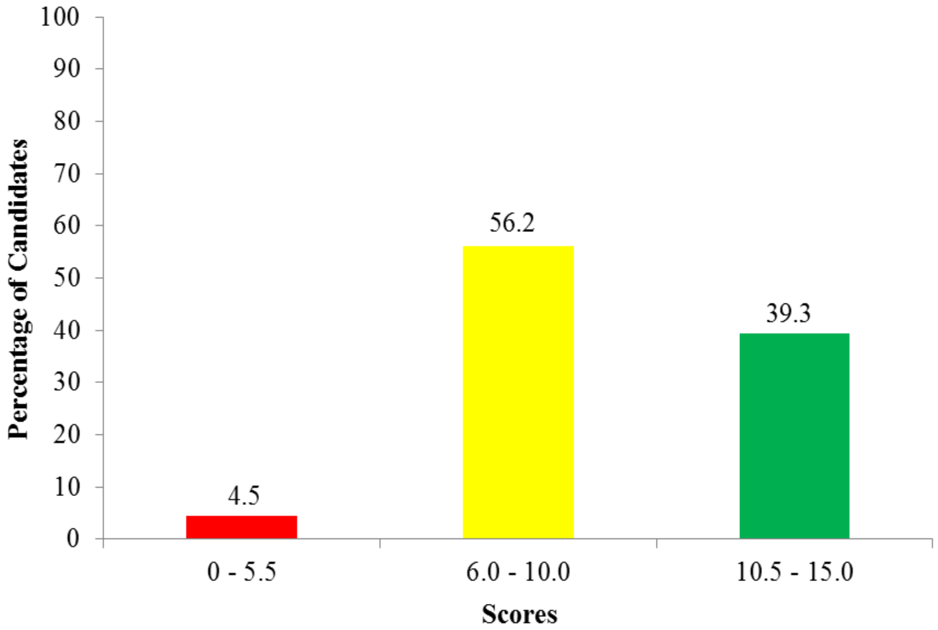


Figure 14: *Candidates' Performance in Question 14*

The analysis of the candidates' responses in this question shows that majority (95.5%) of them performed well and scored 6.0 marks and above. Good performance was due to ability of the candidates of explaining correctly six characteristics of a good test and three domains of educational objectives. This indicates that the candidates had sufficient knowledge on the topic of assessment in Physics. Hence, they were able to give the required details of objectives from each educational domain. Extract 14.1 shows a sample response from a candidate with good performance.

14. (a)

test: Is the series of Question which Is Used to measure the ability of the learners when they are Performing a Certain task/activities. In order to construct a test your should be an objective test item and subjective test item so as easy to construct a good test.

The following are the characteristics of a good Physics test as follows.

Validity of a test. refers as the ability of test what Is supposed to test. So in order a test to be validity you should balance the number of a test item that Is Used and arrangement of space from one test item to another hence they result a good Physics test

Appropriate to the level of learner. the good Physics test should be appropriate to the level of learners According to the level such as age so it result to make a good Physics test.

clarity to the learners. The good Physics test should be clear and simple language for easy a learners to solving their answers hence may result of a good Physics test.

14. (a) Relies on objective :- a good Physics test should be relies on objectives of what teacher is taught of a certain topics/ subtopics so through this situations may result a good physics test

Practibility : a good Physics test should be practibility for easy the learners to answering the question and may result a test to be good.

Reliability : also reliability is the among characteristics of a good Physics test as the inconsistence of a test which have already done having the same time time. so the reliability it can show the test is good.

Generally a good Physics test it can make the learner to be more interesting, creative and active hence may result to increase the performance of the learners.

(b) Educational objective ; refers as the objective which can show the instruction in performing a certain task or activities in order to achieve the educational goals.

The following are the domains of educational objectives as follows

14. (b) Psychomotor skills / domains: this is the types of domains which is based on sensory motor skills like imitation, Circularity so through this skills a students / learners can transfer the ideas from one person to another.

Cognitive domains: Is the domain which deals with the mental ability. This domain may based on mental activities on how they are performing a certain task and what they are performing a certain task thus why they judge through by cognitive ability.

Affermative domain: Is the domain which deals with the interest of a person he/she when they are performing a certain task or activities and they are more motiv[illegible] alo[illegible] thus why were performing that task.

In finally education objective of enable the students he/she to perform well activities when they are given by the teacher / director.

Extract 14.1 shows a good response from a candidate who provided correct responses to the question

However, some of the candidates (4.5%) performed poorly in this question. They were not able to explain correctly characteristics of a good test and the domains of educational objectives. One of the candidates for example wrote *the following are domains of educational objectives for Physics subject: are: curriculum, syllabus,* and *scheme of work.* This response indicates that the candidate confused the concept of domains of educational objectives with planning for teaching of Physics. As a result, such a candidate scored low marks especially in part (b) of this question. Extract 14.2 shows a sample response from a candidate that performed poorly in this question.

14	b/ Educational objectives. These refers to
	the statement describes the achievement
	of learners in educational system.
	The following are the domains of
	educational objectives for a physics subject
	To develop Concept on a certain content
	or topic after taught that influence to
	solve his or her problem in educational system
	To build critical thinking in a certain
	content or topic about the real environment
	from educational program
	To encourage development skills from
	educational system to real life such as in
	constructing build.

Extract 14.2 shows an incorrect response from a candidate who wrote answers which were irrelevant to the question.

2.15 Question 15: Laboratory Management

The question demanded the candidates to explain how experiments/practical sessions make students participate in learning.

This question was attempted by 92.9 percent of candidates, out of which 78.9 percent had scores in the range of 0 to 5.5 marks, 17.8 percent had scores in the range of 6.0 to 10.0 marks and only 3.3 percent had scores in the range of 10.5 to 15.0 marks. The data analysis shows that the general performance of the candidates in the question was poor because majority of them (78.9%) scored below 6.0 marks. Figure 15 is a bar chart that illustrates the candidate' performance in this question.

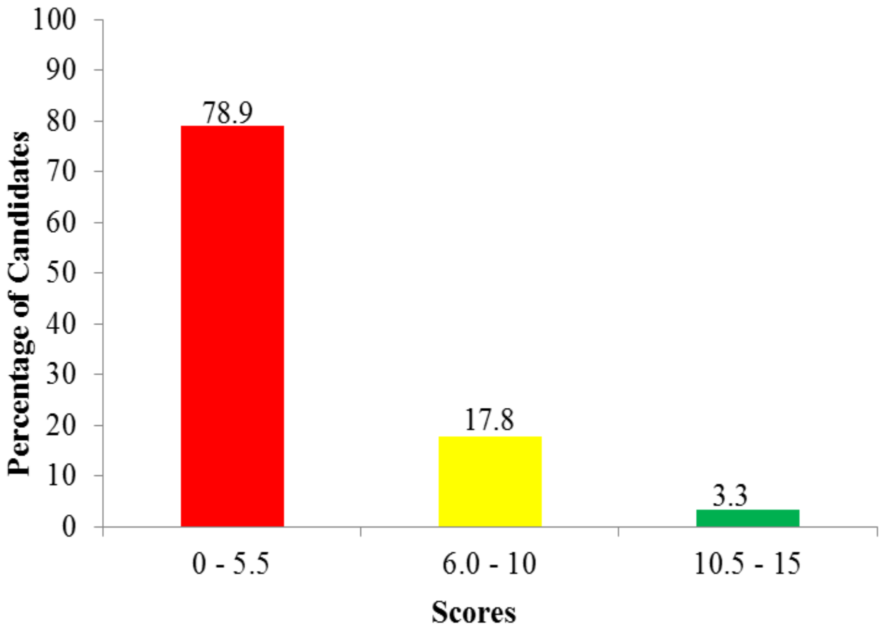


Figure 15: *Candidates' Performance in Question 15.*

The analysis of the candidates' item response shows that majority (78.9%) of the candidates who performed poorly in this question failed to explain correctly how to engage students in different learning activities when experiments/practicals are being carried out. They did not explain how to enable students learn by doing during the practical sessions. Some of these candidates scored low marks because of explaining the importance of experiments instead of how experiments make students participate in learning. Extract 15.1 shows a response from one of the candidates who performed poorly in this question.

15 Practicals or experiments; Are the activities
done by both teachers and students practically
in educational setting. It involve implementation of theo
retically learning into practical learning to students.
It is the process where students practising or doing ex
periment of what they have learnt theories theoritically an
d it can be outside or inside of the classroom or sch
ool setting. Practicals or experiments make the students
participate in learning through different ways. These
ways are as follows;

Practical or experiments motivate students during teac
hing and learning process; this cause students to be
motivated and interested to learn and participate
with his/her teacher as well as among studen
ts since their being interested with the lesson.

Practical and experiment emphasize critical
thinking among students. Means that when
students doing practical of what they have
learnt it causes to think critical about what
they are taught by teacher. So it cause critic
al thinking to students during teaching and lea
rning physics.

Practical and experiment encourage more under
standing among students which cause participation duri
ng teaching and learning process; because will do by
their own hence increasing understanding about wha
t they are doing or learnt in the class. So it encou
rage understanding.

Practical and experiment promotes creativity
among students during teaching and learning process
This creativity cause active participation during teach
ing and learning process in the class. So practic

Extract 15.1 shows an incorrect response from a candidate who performed poorly.

A few candidates (21.1%) that performed well in this question were able to explain correctly the way activities in experiments/practicals make students participate in learning. They also highlighted some of the activities that involve students when doing of experiment. This indicates that these candidates were conversant with the concept of preparation and conducting of Physics practicals. Extract 15.2 presents a response from one of the candidates who answered this question correctly.

15. Laboratory → Is the Special room from which Scientific experiments/practical are ~~Conduct~~ Carried out. experiments involve students in ~~these~~ investigating various physical phenomena.

The following are the reasons ~~why~~ on how experiments/practicals make the students participate in learning

Preparation of apparatus → Since students participate in collecting all apparatus used in performing a particular ~~activities~~ experiments regarding the type of problems given. It can be mechanics, current electricity or light.

Setting up the apparatus. students participate in Setting up the apparatus ready for Carrying out the experiment. It involves arrangement and connection of apparatus depend on the nature of the experiment they want to carry out.

To find data also during this stage students individually or in ~~group~~ small group participate in ~~to~~ collecting data through carrying out the experiment of the particular problems.

Data analysis → also students are always involved in analysing the data obtained after performing experiment, through sharing ideas or make discussion ~~with their colleague~~ themselves some time with the help of teacher concern or laboratory technician.

Also during Report writing, a student is required to participate in writing a report concerning the carried experiment

Generally: During physics experiments/practical students are actively involved in learning, where it enable them to acquire a meaningful learning.

Extract 15.1 shows a correct response from a candidate who managed to answer the question.

2.16 Question 16: Teaching

The questions required the candidates to explain how to measure the resistance of a coil of wire by using voltmeter-ammeter method in Ohm's law.

This question was attempted by 9.1 percent of the candidates, out of which 66.7 percent scored from 0 to 5.5 marks, 11.1 percent scored 6.0 to10.0 marks and 22.2 percent scored 10.5 to 15.0 marks. The data analysis of this question reveals that the general performance of the candidates was poor because only 33.3 percent of them scored above average. Figure 16 is a histogram that gives a summary of the candidates' performance in this question.

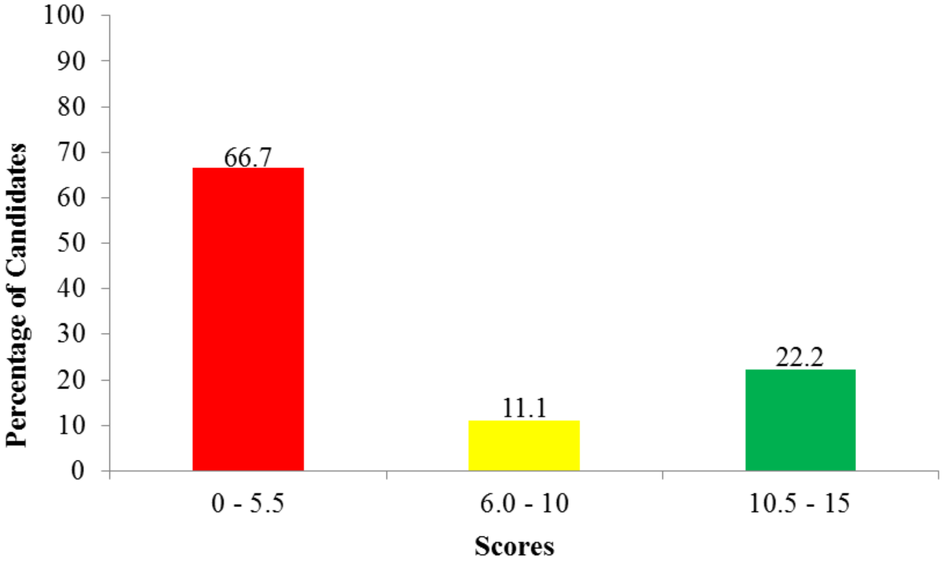
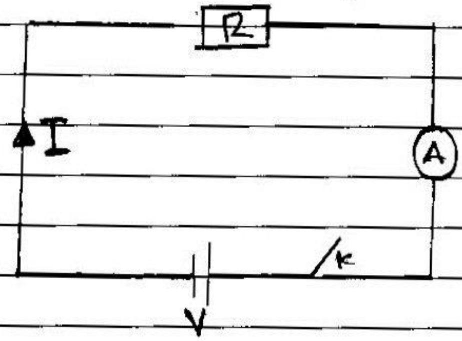


Figure 16: *Candidates' Performance in Question 16*

The analysis of candidates' responses shows that 66.7 percent of the candidates performed poorly in this question because they failed to explain correctly how to measure the resistance of a coil of wire by using voltmeter-ammeter method. Instead of drawing a complete electric circuit with a voltmeter V connected across a resistor R, some drew an electric circuit either without a voltmeter or connected in series to a resistor R. This shows that the candidates lacked a clear understanding on the concept of measuring the resistance of a coil wire using voltmeter-ammeter method. Furthermore, some of them failed to apply Ohm's law to draw a graph of potential difference V (V) against current I (A). Hence, they were not able to determine the slope from the graph which is the resistance of the coil wire. Extract 16.1 is a sample of an incorrect answer from one of the candidate's scripts.

16. Ohm's law, state that the current passing through the conductor is directly proportional to the potential difference across the conductor of the wire.

Consider the diagram of Circuit below



Where

I = current

R = Resistance of a coil wire

A = Ammeter

V = voltmeter.

From Ohm's law

$V \propto I$

$V = kI$

Where

$k = R$

$V = RI$

$V = IR$

$R = \frac{V}{I}$.

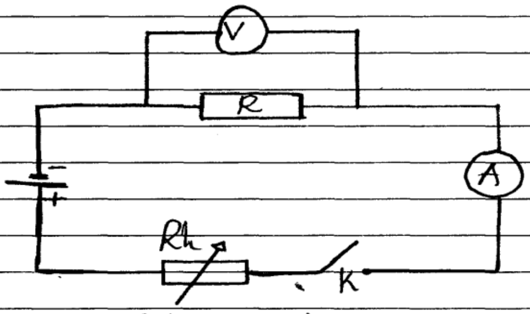
Resistance of a coil of wire by voltmeter Ammeter Method can be Measured through series connection of Voltmeter – Ammeter.

Extract 16.1 2 shows an incorrect response from a candidate who performed poorly in this question.

The candidates who performed well in this question understood the concept of measuring resistance of a coil wire by voltmeter-ammeter method. These candidates were able to describe correctly the procedures of using voltmeter-ammeter in measuring resistance of a coil wire. They drew a correct electric circuit and managed to apply Ohm's law to sketch a graph of potential difference, V (V) against current I (A). The slope of the graph helped the candidates to determine the resistance of a coil wire. Extract 16.2 shows a sample response from a candidate who performed well this question.

16. Ohm's law is a physicist who describes the relationship between potential difference and the current. He was done an experiment by using the following resources/apparatus: a coil wire, ammeter, voltmeter, resistance box, a key and dry cell and the connectives wire.

He measure the resistance of a coil of wire by voltmeter-ammeter method. Hence I will use the following circuit diagram in order to measure the resistance of a coil wire.



where: Rh is Rheostat
K is switch
—(A)— is ammeter
—|I+— is a dry cell
—(V)— is a voltmeter
and R is the resistance of a coil of wire, hence;
For different values of resistance at the change of rheostat, it means Rh will change and the value of current

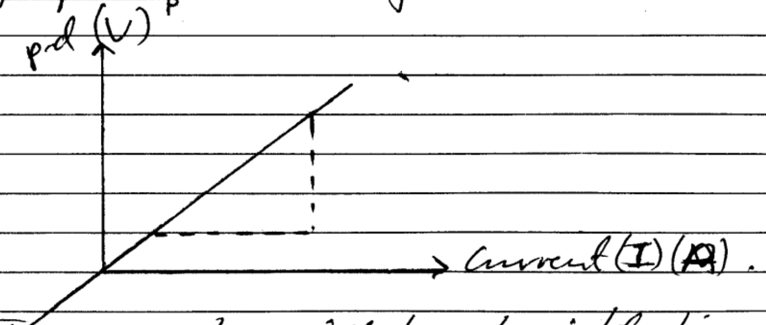
16 at ammeter and its corresponding value of voltage at voltmeter is recorded. The value of voltage and current for different value of rheostat (resistance) is tabulated as shown below

The table of results.

V (V)	I (A)

Then, the graph of Voltage (V) in vertical axis against current (I) in horizontal axis is drawn as show below

<u>The graph of V(V) against I (A)</u>



The graph will be straight line graph and pass through the origin. Then, the gradient of the graph will be

$$\text{Slope} = \frac{\text{Change of } V}{\text{Change of } I} = \frac{\Delta V}{\Delta I}$$

16. Therefore the slope of the graph will represents the value of the resistance of a coil of wire in Ohm(Ω).

Extract 16.2 shows a response from a candidate who provided a correct response to the question.

3.0 ANALYSIS OF CANDIDATES' PERFORMANCE PER TOPIC

In Physics 1 examination paper, a total of sixteen (16) questions were tested. There were a total of 7 academic and 4 pedagogical topics. These topics are: *Teaching*, *Current Electricity*, *Physics Laboratory Management*, *Assessment in Physics*, *Planning for Teaching*, *Geophysics*, *Properties of Matter*, *Heat*, *Mechanics*, *Waves* and *Measurements*.

The analysis of the candidates' performance shows that three topics; *Assessment in Physics*, *Planning for Teaching* and *Current Electricity* had good performance because the percentage of the candidates' scores ranged from 96.8 to 85.8 percent. The good performance was attributed to sufficient knowledge and skills on items that required explanations and mathematical manipulations. Average performance of candidates was noted in the topics; *Physics Laboratory Management* (63.2%) and *Properties of Matter* (45.6%). Some of the main reasons for average performance included failure of the candidates to comprehend the concepts in some parts of the question items and lack of mathematical skills to perform required calculations. Furthermore, the analysis shows that there were six topics with poor performance. These topics were; *Mechanics* (34.6%), *Teaching* (33.3%), *Measurements* (21.6%), *Heat* (17.2%), *Geophysics* (5.5%) and *Waves* (5.1%). Poor performance was contributed to insufficient mastery of the content knowledge, lack of formulae derivation skills, inadequate knowledge in explaining Physics facts/ phenomena in relation to daily life context.

The summary of the candidates' performance in all topics is shown in Appendix A.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The analysis of the candidates' item response revealed that majority of the candidates performed well but some of them faced challenges in responding to the questions. The major challenges which were identified through this analysis is an inadequate knowledge which caused some of the candidates to provide incorrect responses in some parts of the questions. This may have been due to ineffective revision, poor coverage of some topics by tutors and lack of practice which could enhance candidates' understanding.

Despite explained challenge in attempting questions in DSEE 2019 for Physics 1, it is observed that, the candidates' performance was good. This is due to the fact that, all candidates who sat for this paper passed with grades A to C as shown in Appendix B.

It is expected that the feedback given in this report will enable stakeholders, tutors and student teachers to take the necessary measures to improve teachers' training and candidates' performance in DSEE Physics examination in the future.

4.2 Recommendations

In order to improve performance in future, it is recommended that:

(a) Tutors should continue applying participatory learning method by teaching through demonstrations and experiments. They should also assess all the topics as stipulated in both the academic and pedagogy syllabus to enhance the learners' level of understanding on the subject matter.

(b) Tutors should guide the candidates to work hard to master Physics concepts involving manipulation skills since it is noted that they failed to associate description of physical quantity with formula in a particular topic.

(c) Candidates have to prepare well for the examinations. They have to read and understand theories, principles and laws of Physics to enable them to relate the acquired knowledge and skills in their day to day activities.

(d) Candidates have to concentrate on conceptual understanding of theories and the subject matter in each topic covered under both academic and pedagogy syllabus. They should not to rush to solve questions without adequate theoretical knowledge.

(e) Candidates should work hard in attaining mathematical skills so that they can be able to solve problems which include mathematical manipulations.

(f) Tutors should conduct more practical work during normal teaching hours. This will enhance understanding of content knowledge and improve student teachers' level of competence on the subject matter.

Appendix A

THE CANDIDATES' PERFORMANCE PER TOPIC IN PHYSICS

No	Topic	Question Number	Performance in Percentage		Remarks
			Candidates' score 40% or above	Average	
1	Assessment in Physics	10	98.0	96.8	Good
		14	95.5		
2	Planning for Teaching	9	83.8	92.2	Good
3	Current Electricity	12	85.2	85.2	Good
4	Physics Laboratory Management	7	81.8	63.2	Average
		8	86.8		
		15	21.1		
5	Properties of Matter	3	45.6	45.6	Average
6	Mechanics	2	2.7	34.6	Poor
		11	66.5		
7	Teaching	16	33.3	33.3	Poor
8	Measurements	1	21.6	21.6	Poor
9	Heat	4	17.2	17.2	Poor
10	Geophysics	5	5.5	5.5	Poor
11	Waves	6	5.1	5.1	Poor

Appendix B

CANDIDATES' PERFORMANCE PER GRADE IN PHYSICS