THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

CANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR DIPLOMA IN SECONDARY EDUCATION EXAMINATION (DSEE) 2018

731 PHYSICS

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FOREWORD

The Diploma in Secondary Education Examination (DSEE) is intending to give qualification requirements to candidates seeking for an opportunity to be teachers. The students for Diploma in Education candidates who have sat for the Advanced Certificate of Secondary Education Examination (ACSEE) and qualify to join Teachers' Colleges. The examination is administered upon completion of two years training in educational studies and in two teaching subjects. This is according to the Tanzania education policy which stresses that, the minimum requirement for teaching the Ordinary Level Secondary Schools should be a Diploma in Education holder.

In order to improve the performance in Diploma in Secondary Education Examination, the National Examination Council of Tanzania (NECTA) has prepared this report on the Candidates' Items Response Analysis. The report focuses on the analysis of every item indicating whether the performance was good, average and poor and it explains the reasons for this performance.

Some of the reasons for poor performance highlighted in the report are failure to understand the demand of the question, failure to follow the instructions, using wrong approaches to the question, lack of mathematical skills and approaches, inadequate knowledge of the subject content. This item response analysis report will help educational administrators, teachers and students to identify the proper measures apply and to improve candidates' performance in future DSEE examinations that are administered by the Council.

The National Examinations Council of Tanzania will highly appreciate to receive more suggestions from teachers, students and the public in general to improve future examiner's reports.

Finally, the Council would like to thank the examiners and other education stakeholders for their contribution in the preparation of this report.

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report on the performance of candidates aims at providing feedback about performance of the candidates who sat for the Diploma in Secondary Education Examination in May, 2018 in Physics subject. A total of 405 candidates sat for the examination, out of which 346 candidates were using University of Dodoma (UDOM) curriculum and 59 were using the Tanzania Institute of Education (TIE) curriculum. The examination tested the candidates' competences in the acquired knowledge and skills to qualify as Ordinary Level Secondary School teachers. The general performance of the candidates was good as the following Table shows.

Table: Performance of Candidates in Physics Examination

Candidates Type	**No. of Cand. Sat**	**Number of Candidates and Percentage**					
		Passed	**Grades**				
			A	B	C	D	F
All (DSEE)	405	405 100	1 0.25	36 8.89	213 52.59	155 38.27	0 0.0
UDOM Curriculum (DSEE)	346	346 100	0 0.0	5 1.45	187 54.05	154 44.51	0 0.0
TIE Curriculum (DSEE)	59	59 100	1 1.69	31 52.54	26 44.07	1 1.69	0 0.0

The table shows that all (100/%) candidates under TIE and UDOM curriculum passed the examination. Although, there was only one candidate who passed at A grade, a good number of them (36) and (213) scored grade B and C respectively. In addition, 155 candidates passed at grade D while no candidate who scored F grade.

Since the assessment for the candidates who are pursuing DSEE using UDOM curriculum is in transition; in this report, the detailed analysis was done on the candidates' responses to the DSEE 2018 questions in physics based on TIE curriculum only.

In the TIE curriculum, the Physics paper 1 comprised of sixteen (16) questions which were categorised into three sections; A, B and C. Section A had a total of ten (10) short answer questions and candidates were supposed to answer all the questions. This section carried a total of 40 marks. Sections B and C had three (3) questions each and the candidates were required to answer two

questions from each section. These sections, B and C carried a total of 30 marks each. The following are the topics used for setting the questions: *Analysis of Physics Curriculum Materials, Fundamentals of Teaching and Learning Physics, Preparation for Teaching, Assessment in Physics, Laboratory Management, Geophysics, Measurements, Mechanics, Atomic Physics, Electronics* and *Heat*.

The analysis of the candidates' responses in every question is indicated as good, average and poor performance. Extracts of sample responses from candidates are shown to illustrate good or poor responses. Reasons are given to justify why the performance was good or poor. Extracts for poor responses are not shown when all candidates scored average and above the allotted marks in a that question. Furthermore, graphs and charts on the analysis are inserted to provide a summary of candidates' performance in each particular question.

The analysis categorizes the performance as good if the percentage of performance lies in an interval of 70 - 100 percent, average if it lies in an interval of 40 - 69 percent and poor if it is in an interval of 0 - 39 percent. The question is regarded as well performed if the candidates' overall scores are above 40% of marks allotted to a respective question. Green, yellow and red colours are used to represent good, average and weak performance respectively. The report also contains an appendix which shows the general performance in each topic. Finally, the report provides some recommendations that may help to improve the candidates' performance in future examinations.

2.0 CANDIDATES' ITEMS RESPONSE ANALYSIS IN PHYSICS 1

2.1 Question 1: Measurements

This question had two parts; (a) and (b). Part (a) required the candidates to define the terms accurate and error while part (b) required them to determine the maximum possible fractional error and the percentage error in the measurement of force acting on an object of mass m travelling at a velocity v in a circle of radius r given $F = \frac{mv^2}{r}$. The measurement recorded was m = 3.5 kg $\pm$ 0.1 kg, v = 20 ms^{-1} $\pm$ 1 ms^{-1} and r = 12.5 m $\pm$ 0.5 m.

This question was attempted by 100 percent of the candidates and their scores were as follows: 5.1 percent scored from 0 to 1.5 marks, 20.3 percent scored from 2.0 to 2.5 marks and 74.6 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 the question was good. The candidates' performance is summarized in Figure 1.

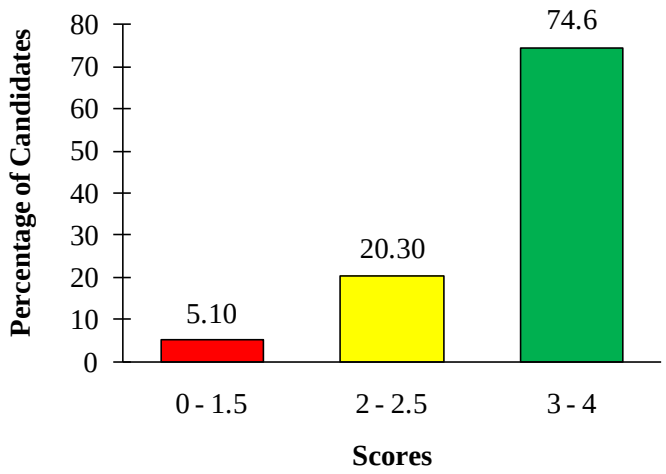
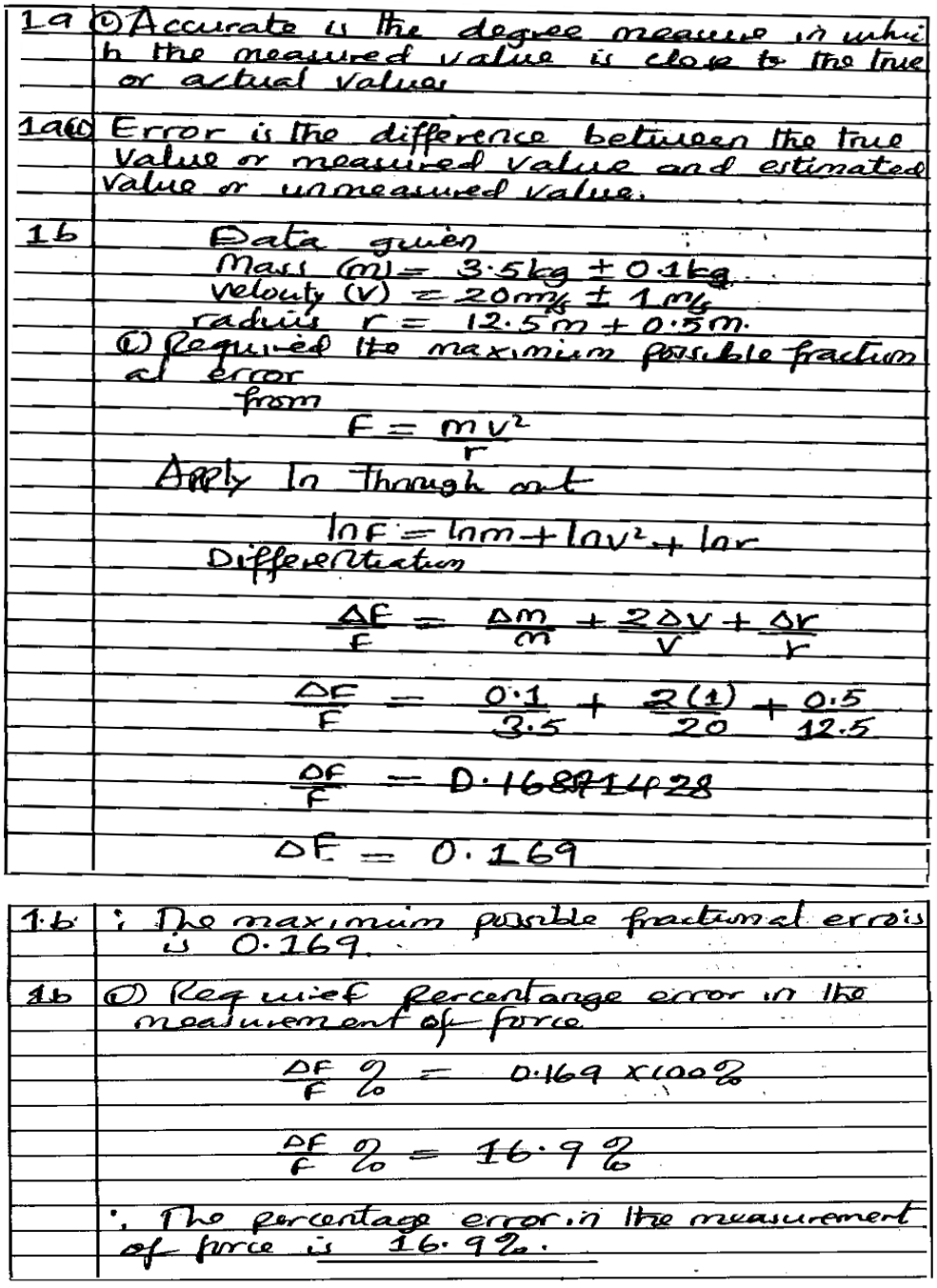


Figure1: Candidates' Performance in Question 1

This question demanded retrieval of simple knowledge about the definitions of terms that related to measurements and mathematical treatment of errors and analysis thereof. The analysis shows that the question was well performed as 74.6 percent of the candidates scored 3.0 marks and above.

The candidates were able to provide the correct definitions of the terms accurate and error in part (a). In part (b) they managed to use the correct procedures to find the maximum possible fractional error and the percentage error in the measurement of force acting on an object of mass m travelling at a velocity v in a circle of radius r. Extract 1.1 is a sample of a good response from one of the candidates.

Extract 1.1



1a (i) Accurate is the degree measure in which the measured value is close to the true or actual value.

1a(ii) Error is the difference between the true value or measured value and estimated value or unmeasured value.

1b Data given

Mass (m) = $3.5kg \pm 0.1kg$

Velocity (V) = $20m/s \pm 1m/s$

radius $r = 12.5m + 0.5m$.

(i) Required the maximum possible fractional error

from $F = \frac{mv^2}{r}$

Apply In Through out

$\ln F = \ln m + \ln v^2 + \ln r$

Differentiation

$$\frac{\Delta F}{F} = \frac{\Delta m}{m} + \frac{2\Delta V}{V} + \frac{\Delta r}{r}$$

$$\frac{\Delta F}{F} = \frac{0.1}{3.5} + \frac{2(1)}{20} + \frac{0.5}{12.5}$$

$$\frac{\Delta F}{F} = 0.16871428$$

$$\Delta F = 0.169$$

1b ; The maximum possible fractional error is 0.169.

1b (i) Required percentage error in the measurement of force

$$\frac{\Delta F}{F}\% = 0.169 \times 100\%$$

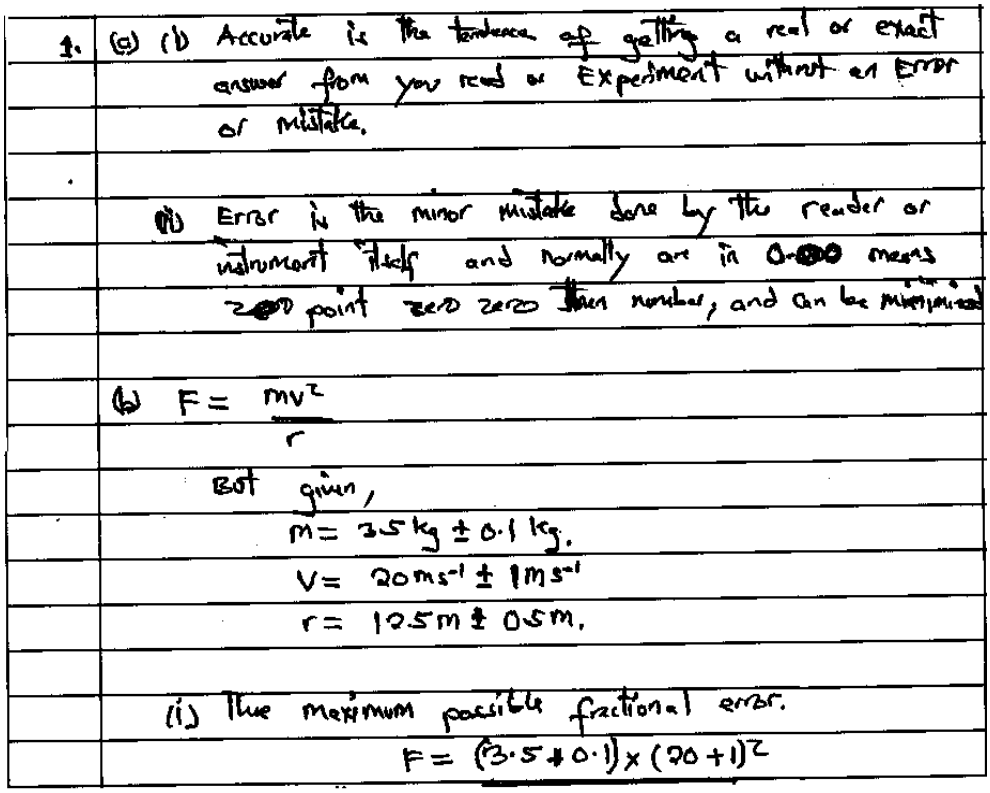
$$\frac{\Delta F}{F}\% = 16.9\%$$

∴ The percentage error in the measurement of force is 16.9%.

Extract 1.1 shows a response from a candidate who attempted the question and provided the correct responses to both parts (a) and (b) of the question.

The candidates (5.1%) who performed poorly had inadequate knowledge of the concept of error and measurements as they failed to define the terms accurate and error correctly. Other candidates failed to understand that errors are always maximized. Hence, they failed to derive the required equation for finding maximum possible fractional error and the percentage error. Others were able to derive but they ended with wrong derivation that missed number 2. Instead of $\frac{\Delta F}{F} = \frac{\Delta m}{m} + \frac{2\Delta v}{v} + \frac{\Delta r}{r}$, they obtained $\frac{\Delta F}{F} = \frac{\Delta m}{m} + \frac{\Delta v}{v} + \frac{\Delta r}{r}$, hence they failed to get the required error. Extract 1.2 illustrates the work of one of the candidates who performed poorly in this question.

Extract 1.2


1. (a) (i) Accurate is the tendency of getting a real or exact answer from you read or Experiment without an Error or Mistake.

(ii) Error is the minor mistake done by the reader or instrument itself and normally are in 0.000 means 2.000 point zero zero then number, and can be minimized

(b) $F = \frac{mv^2}{r}$

But given,

$m = 3.5\,kg \pm 0.1\,kg$.

$V = 20\,ms^{-1} \pm 1\,ms^{-1}$

$r = 12.5m \pm 0.5m$.

(i) The maximum possible fractional error.

$F = (3.5 \pm 0.1) \times (20 + 1)^2$

Extract 1.2 is a response from a candidate that failed to respond correctly to the question. The candidate failed to define accuracy and error and calculated wrongly the maximum possible fraction error and percentage error.

2.2 Question 2: Atomic Physics

The question required the candidates to mention four agents that can ionize gases. This question was attempted by 100 percent of the candidates, of which 50.8 percent scored from 0 to 1.5 marks, 25.5 percent scored from 2.0 to 2.5 marks and 23.7 percent scored from 3.0 to 4.0 marks. These data signify that the general performance in this question was average because 49.2 percent of candidates scored 2.0 to 4.0 marks. A graphical representation of the performance in this question is shown in Figure 2.

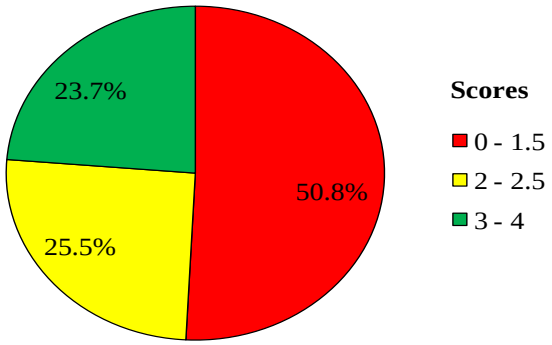
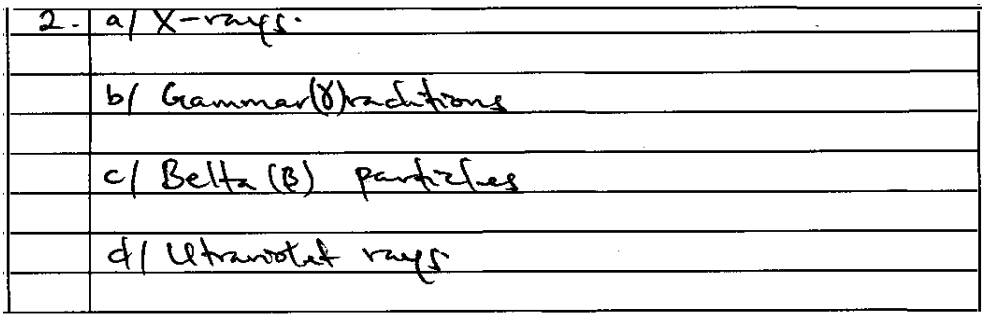


Figure 2: The Candidates' Performance in Question 2

The analysis of the candidates' responses indicates that some of the candidates who scored high marks (49.2%) had adequate knowledge of the concepts of agents that ionize gases because they were able to mention correctly the four agents that ionize gases. Extract 2.1 shows a sample response from one of the candidates who performed well in this question.

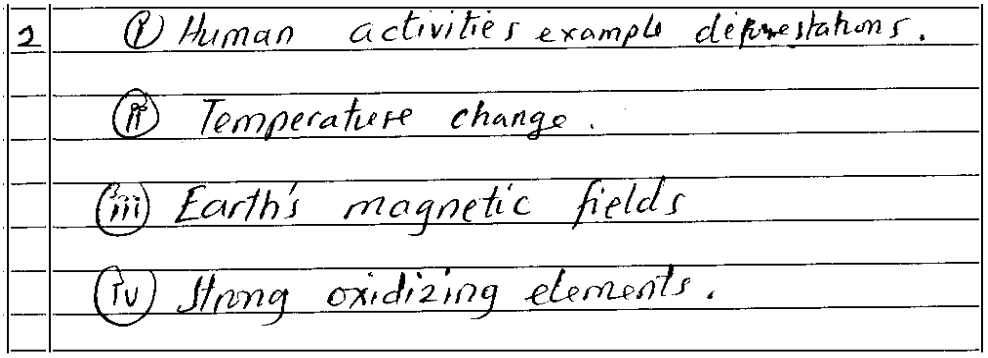
Extract 2.1



Extract 2.1 shows a response from a candidate who managed to mention correctly the agents of ionisation.

The analysis shows that the candidates who performed poorly in this question had inadequate knowledge on the concept of Atomic Physics specifically on the agents that ionise gases. Some candidates failed to recognize the flame, energetic electrons, ultra violet, X-rays and radiations from radioactive substances that ionize gases, while others were able to mention only one agent. Extract 2.1 shows a sample response of the candidate who performed poorly.

Extract 2.1



Extract 2.1 is a response from one of the candidates who failed to mention correctly agents that ionize gases and hence performed poorly.

2.3 Question 3: Electronics

In this question the candidates were required to state two advantages of solid dielectric.

The question was performed by all candidates (100%) and their scores were as follows: 69.5 percent scored from 0 to 1.5 marks, 25.4 percent scored from 2.0 to 2.5 marks and 5.1 percent scored 3.0 to 4.0 marks out of 4.0 marks allotted to this question. The data analysis shows that the question was poorly performed as 69.5 percent of the candidates scored below 1.5 marks. The performance of the candidates in this question is depicted by the histogram in Figure 3.

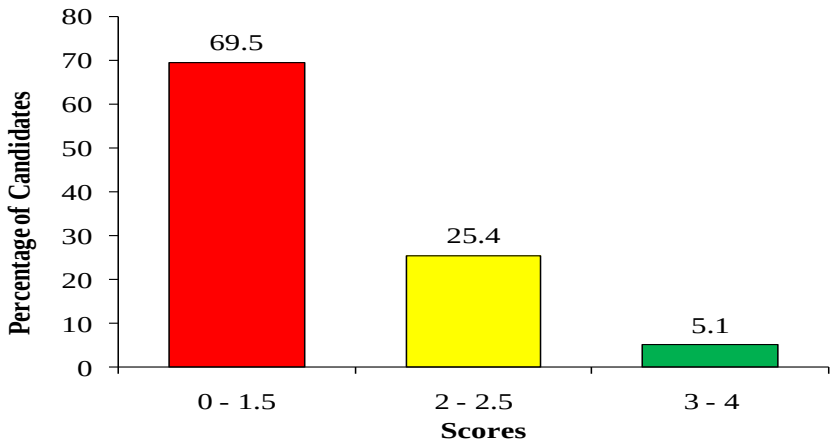
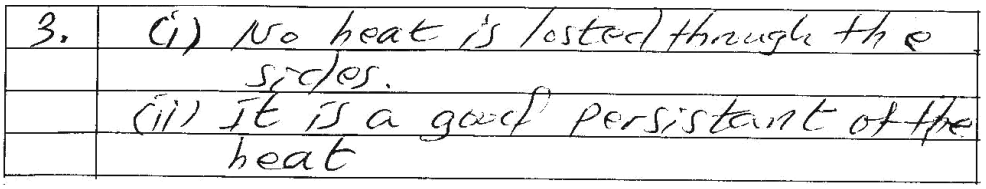


Figure 3: The Candidates' Performance in Question 3

The analysis of the candidates' item response shows that the candidates who performed poorly were unable to state two advantages of solid dielectric because they had insufficient knowledge on the concept of solid dielectric. One candidate for example wrote the advantages of solid dielectric as; *it is travelled linearly to the conductor* and *it is covered in order to reduce shock.* These responses indicate that the candidate confused the concept of solid dielectric with current electricity. Extract 3.1 is an example of a response from a candidate who performed poorly.

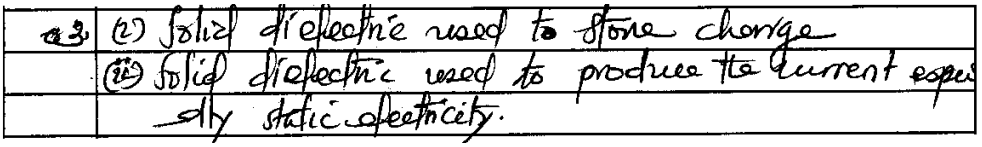
Extract 3.1


3. (i) No heat is losted through the sides.
(ii) It is a good persistant of the heat

Extract 3.1 shows a candidate who failed to respond correctly to the question by providing an answer related to the concepts of good and bad conductors of heat instead of solid dielectric.

On the contrary, some candidates managed to respond correctly to this question. Their responses were related to the concept of solid dielectric. Extract 3.2 is a sample of a candidate's response from a script with good performance.

Extract 3.2



Extract 3.1 shows a candidate's who was able to state two advantages of solid dielectric. The candidate had good understanding of the concept of solid dielectric.

2.4 Question 4: Mechanics

The question demanded the candidates to explain briefly how the use of safety belts reduces shock of a car accident.

The question was attempted by 100 percent of the candidates whose scores were as follows: 62.7 percent scored 0 to 1.5 marks, 32.2 percent scored 2.0 to 2.5 marks and 5.1 percent scored 3.0 to 4.0 marks out of 4.0 marks allotted to this question. Generally, the candidates' performance in this question was poor since only 5.1 percent of them scored 3.0 marks and above. Figure 4 is the pie chart that illustrates the candidates' performance in this question.

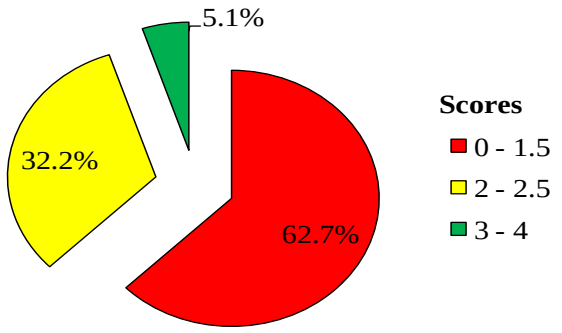
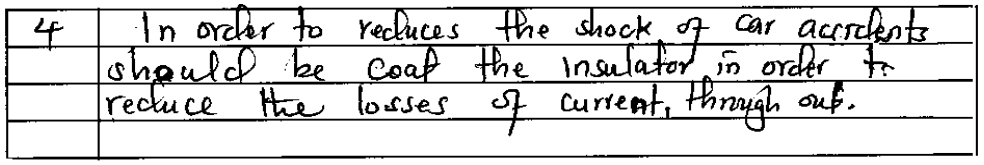


Figure 4: Candidates' Performance in Question 4

The analysis of the candidates' performance in this question shows that the candidates (62.7%) who performed poorly had inadequate knowledge on the topic of Mechanics, especially application of Newton's First Law of Motion (law of inertia). One of candidates explained that; *the use of safety belts is to enable the water in the belt* and another one explained that *safety belts helps to make engine operate well*. Extract 4.1 is a sample response of an incorrect answer taken from a script of one of the candidates.

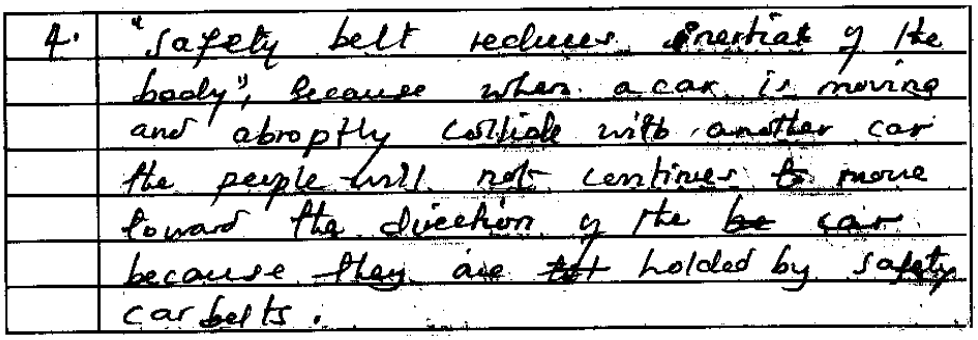
Extract 4.1



In extract 4.1 shows the candidate's an irrelevant response to the question.

Some candidates (5.1%) performed well this question since they managed to explain correctly how the use of safety belts reduces the shock of a car accident. This implies that they were able to apply the concept of Newton's First Law of Motion (law of inertia) to explain the use of safety belts. The extract 4.2 is a sample response from a candidate who provided a good answer to the question.

Extract 4.2



Extract 4.2 shows a correct response from a candidate who had knowledge on the topic of Mechanics, specifically on the application of Newton's First Law of Motion (Law of Inertia).

2.5 Question 5: Mechanics

This question is under the topic Mechanics and the subtopic Rotation of a rigid body. The question required the candidates to calculate the angular momentum of a circular ring of diameter 40 cm and mass 1kg rotating about an axis normal to its plane which passes through the centre with a frequency of 10 rotations per second.

All candidates (100%) attempted this question. 83.1 percent of these candidates scored from 0 to 1.5 marks, 3.3 percent scored from 2.0 to 2.5 marks and 13.6 percent scored from 3.0 to 4.0 marks. The total marks

allotted to the question was 4.0. The data analysis shows that the question was poorly performed, because 83.1 percent of candidates scored 1.5 marks and below. The distribution of the candidates' scores is shown in Figure 5 below.

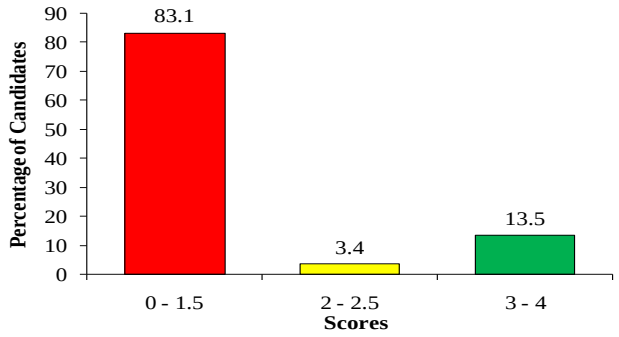
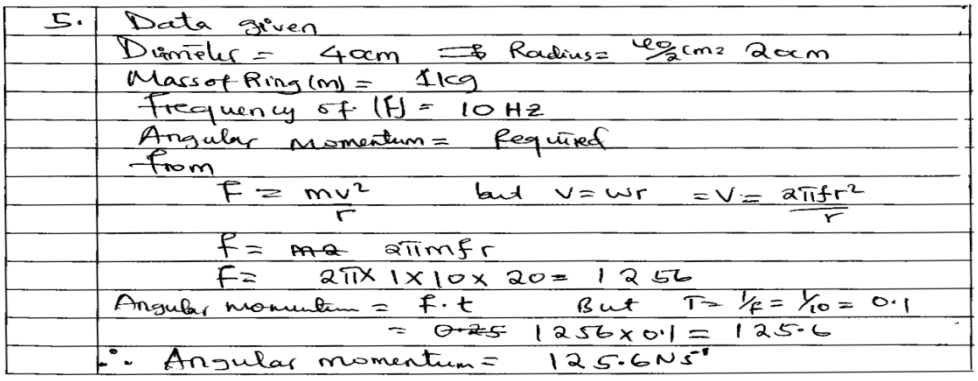


Figure 5: Candidates' Performance in Question 5

The analysis of the candidates' items response shows that, the candidates who performed poorly were not able to use the formulae to calculate the moment of inertia of a ring and angular velocity. As a result, they failed to arrive to the correct solution. Some of them confused the concept of moment of inertia of a ring with circular motion. This led them to apply the circular motion formula to calculate moment of inertia of a ring. Therefore, they failed to obtain the value of angular momentum of a circular ring about the axis of rotation. Extract 5.1 shows a sample response from a script of candidate with poor performance.

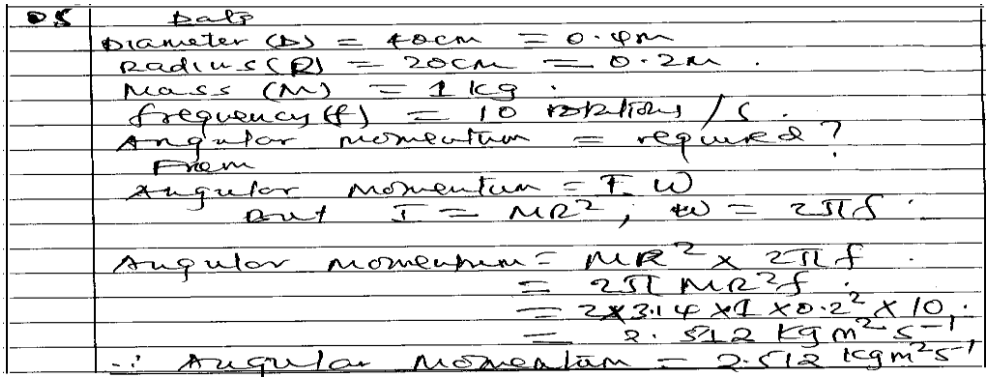
Extract 5.1


5. Data given
Diameter = 40cm ⇒ Radius = 40/2 cm = 20cm
Mass of Ring (m) = 1kg
Frequency of (f) = 10 Hz
Angular momentum = Required
from
$F = \frac{mv^2}{r}$ but $V = \omega r$ $= V = \frac{2\pi f r^2}{r}$
$F = 2\pi mfr$
$F = 2\pi \times 1 \times 10 \times 20 = 1256$
Angular momentum = $F \cdot t$ But $T = 1/f = 1/10 = 0.1$
$= 0.25$ $1256 \times 0.1 = 125.6$
∴ Angular momentum = $125.6 Ns^{-1}$

Extract 5.1 is a sample from candidate who failed to respond correctly to the question by applying the formula of calculating the centripetal force of a body to calculate the moment of inertia of a ring.

Furthermore, the analysis shows that the candidates who performed well the question (13.6%) had sufficient knowledge on the concepts of rotational of rigid bodies. They were able to calculate correctly the angular momentum of a circular ring about the axis of rotation. These candidates applied the right formula to calculate the moment of inertia of a ring ($I_{ring} = MR^2$). They used the relation $\omega = 2\pi f$ to find angular velocity and the formula of angular momentum, ($L = I\omega$) to calculate the value of angular momentum about axis of rotation. Extract 5.2 is a sample response from one of the candidates with good performance.

Extract 5.1



Extract 5.2 show a correct response from a candidate who had knowledge on the topic of Rotation of a Rigid body, specifically in calculating the value of angular momentum of the disk.

2.6 Question 6: Heat

This question required the candidates to explain why the specific heat capacities of air is different when constant pressure is 1040 Jkg^{-1} K^{-1} and when constant volume is 740 Jkg^{-1} K^{-1}.

The question was attempted by 100 percent of the candidates. All of candidates (100%) scored from 0 to 1.5 marks. This score analysis shows that the question was poorly performed. The candidates lacked basic manipulation skills to associate description of heat capacities of air and when formula. The histogram in Figure 6 illustrates the candidates' performance in question 6.

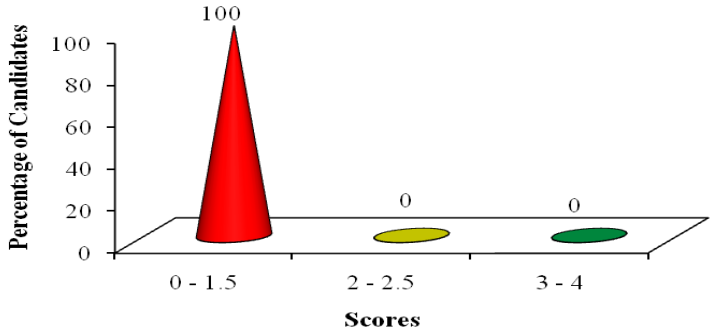
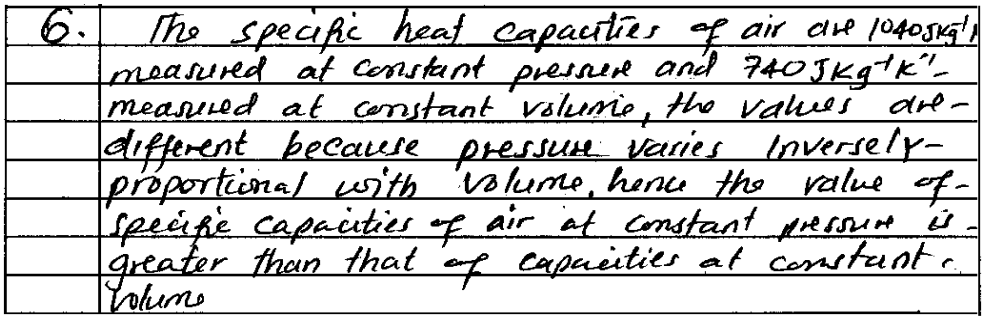


Figure 6: Candidates' Performance in Question 6

The analysis of the candidate' performance shows that the candidates who performed poorly in this question had insufficient knowledge on the concept of heat capacities of air. They were not able to give the correct reasons for the value of specific heat capacities of air at constant pressure and volume.

The candidates were supposed to give reasons using both the formulae and description as follows: At constant pressure and volume there is an increase in temperature of a given mass of air involving an increase in the internal energy by the same amount ΔU. The specific heat capacity is given by the relation $c = \frac{\Delta Q}{m\Delta\theta}$. At constant volume, $\Delta Q = \Delta U$, since $\Delta W = 0$; but at constant pressure, $\Delta Q > \Delta U$ since $\Delta W = P\Delta V$. However, the candidates' responses to this question were based on incorrect descriptions. Extract 6.1 is a sample response from a script of a candidate who performed poorly.

Extract 6.1


6. The specific heat capacities of air are 1040$JKg^{-1}K^{-1}$ measured at constant pressure and 740$JKg^{-1}K^{-1}$ measured at constant volume, the values are different because pressure varies inversely proportional with volume, hence the value of specific capacities of air at constant pressure is greater than that of capacities at constant volume

Extract 6.1. shows a response from a candidate who failed to respond correctly to the question by providing an answer related to Boyle's Law (Pressure is inversely proportional to volume of a gas), instead of specific heat capacities of air.

2.7 Question 7: Laboratory Management

The question required the candidates to mention four safety measures in the Physics laboratory.

The question is from the topic of Laboratory Management. It was attempted by 100 percent of the students whose scores were as follows: 15.3 percent scored from 0 to 1.5 marks, 6.7 percent scored from 2.0 to 2.5 marks and 78.0 percent scored from 3.0 to 4.0 marks. In general, the data analysis shows that, candidates' performance in this question was good because 78.0 percent of them scored 3.0 marks and above out of 4.0 marks allotted to the question. A graphical presentation of these data is shown in Figure 7.

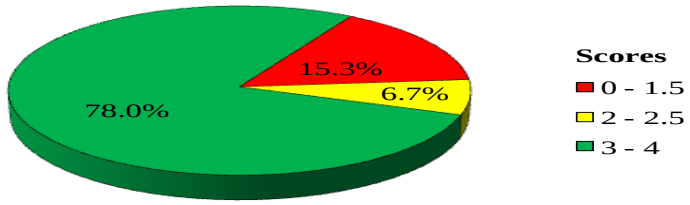
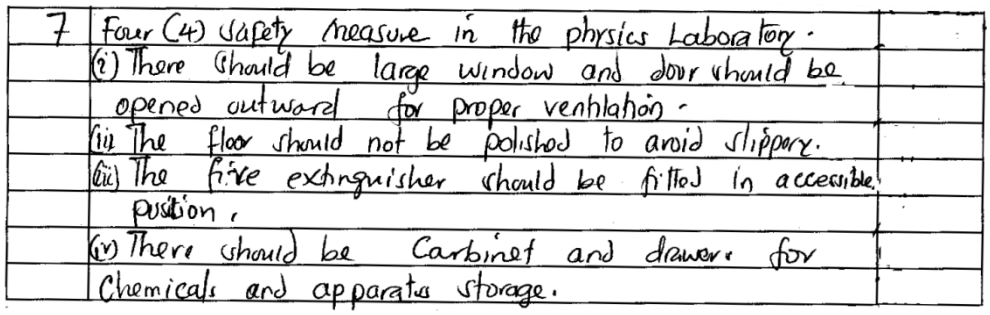


Figure 7: Candidates' Performance in Question 7

Analysis of the candidates' performance shows that the candidates who managed to correctly respond to the question, mentioned correctly four safety measures in the physics laboratory. Extract 7.1 shows a sample answer taken from a script of a candidate who performed well in the question.

Extract 7.1


7 Four (4) safety measure in the physics Laboratory.
(i) There should be large window and door should be opened outward for proper venhlation.
(ii) The floor should not be polished to avoid slippery.
(iii) The fire extinguisher should be fitted in accessible position.
(iv) There should be Carbinet and drawers for Chemicals and apparatus storage.

Extract 7.1 shows a response from one of the candidates who mentioned four safety measures in Physics laboratory correctly.

However, about (15.3%) of the candidates who performed poorly confused safety measures and types of accidents in Physics laboratory. Due to this confusion, they failed to mention safety measures in a Physics laboratory. Extract 7.2 shows a sample of an incorrect response from one of the candidate's script.

Extract 7.2

7	The four safety measures in the physics laboratory are
	(i) Emergency response safety
	(ii) Personal and general safety
	(iii) Electrical safety
	(iv) Mechanical safety

Extract 7.2 shows how the candidate failed to mention four safety measures in Physics laboratory. The candidate confused the concept of safety measures with the one on types of accidents in Physics laboratory.

2.8 Question 8: Laboratory Management

The question demanded candidates to write information required in writing a practical report after the experiment where four points were required.

The question was constructed from the topic Laboratory Management. The question was attempted by 100 percent of candidates, whereby 1.7 percent scored 2.0 to 2.5 marks and 98.3 percent scored 3.0 to 4.0 marks. No candidate scored below 2.0 marks According to this data analysis, the overall performance in this question was good because the majority (98.3%) of the candidates scored 3.0 to 4.0 marks. This indicates that the topic was well understood by most of the candidates. The performance of the candidates in this question is also depicted by the histogram in Figure 8.

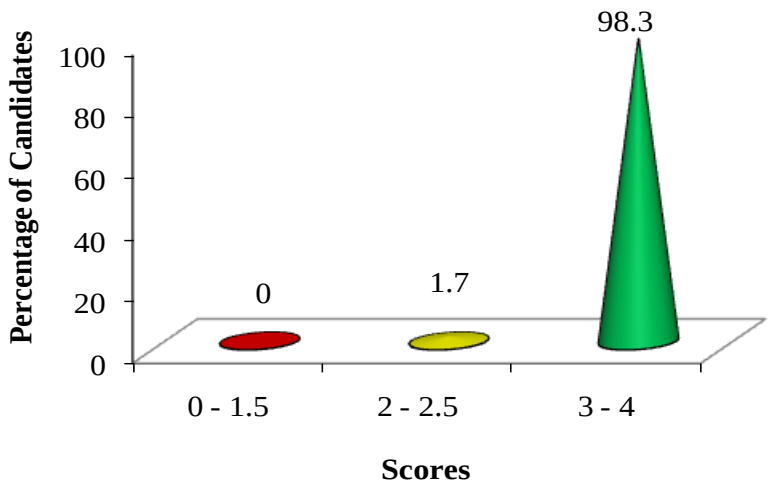
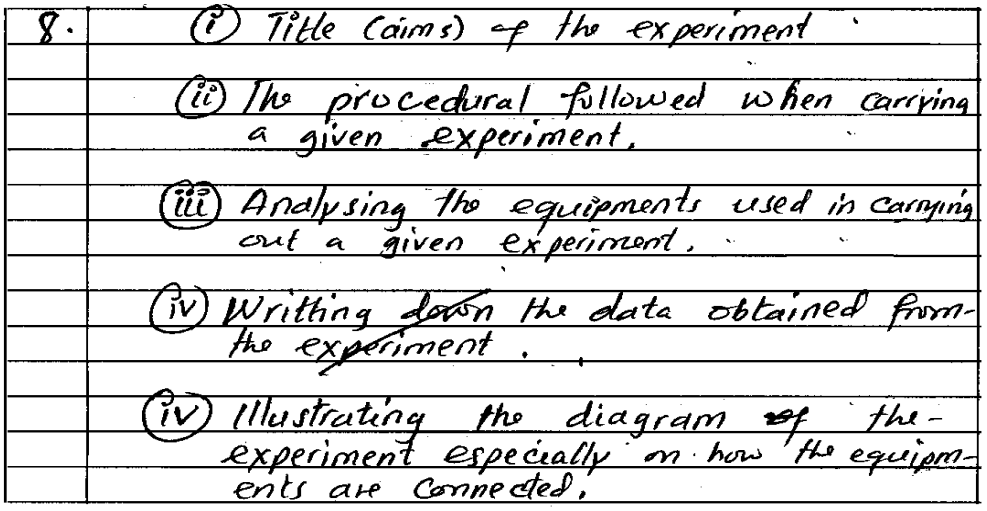


Figure 8: Candidates' Performance in the Question 8

The analysis of the candidates' performance shows that the candidates who performed well (98.3%) in this question, were able to write precisely the information required in writing a practical report after the experiment. Extract 8.1 is a sample good of a response from one of the candidate's scripts.

Extract 8.1


8. (i) Title (aims) of the experiment

(ii) The procedural followed when carrying a given experiment.

(iii) Analysing the equipments used in carrying out a given experiment.

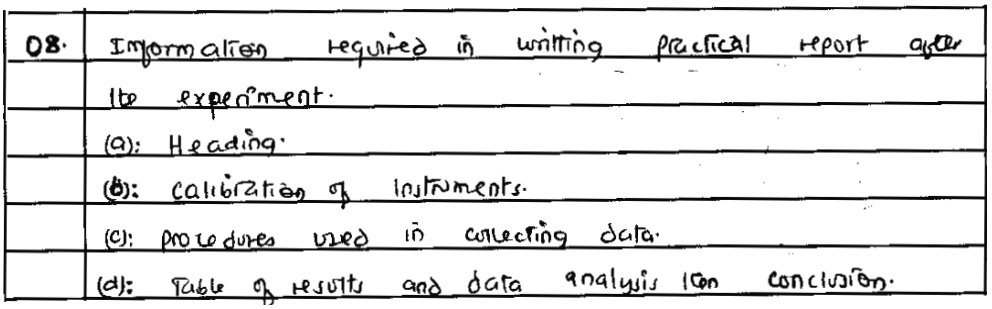
(iv) Writting down the data obtained from the experiment.

(iv) Illustrating the diagram of the experiment especially on how the equipments are connected.

Extract 8.1 shows good responses to the question. This candidate was able to write four correct information required in a practical report.

However, some candidates (1.7%) scored 2.0 to 2.5 marks in this question. They lacked basic knowledge needed in writing a practical report after an experiment. They provided information on procedures of a scientific investigation which was not the question requirement. Some of the candidates were able to write only one to two correct responses out of four responses. They scored below 3.0 marks. Extract 8.2 is a sample answer from one of the candidates script with poor performance.

Extract 8.2


08. Information required in writting practical report after the experiment.

(a): Heading.

(b): calibration of instruments.

(c): procedures used in collecting data.

(d): Table of results and data analysis then conclusion.

Extract 8.2 shows a candidate who failed to write correctly all the four information required in writing a practical report after an experiment.

2.9 Question 9: Assessment in Physics

The question required the candidates to give four important things that a Physics teacher should consider when constructing a table of specification.

All candidates (100%) attempted this question whereby 8.5 percent scored from 0 to 1.5 marks, 30.5 percent scored from 2.0 to 2.5 marks and 61.0 percent scored from 3.0 to 4.0 marks. Generally, candidates' performance in this question was good because 91.5 percent of them scored 2.5 marks and above. Figure 9 shows a chart presenting a summary of the candidates' performance.

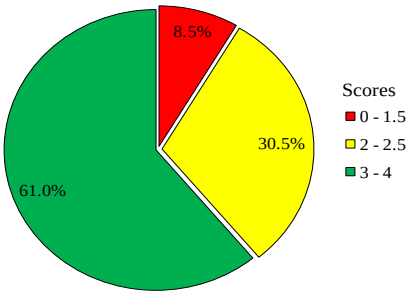
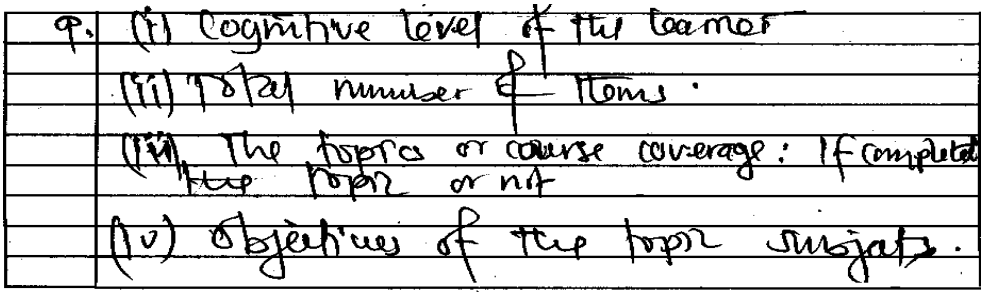


Figure 9: Candidates' Performance in Question 9

The analysis of candidates' performance in the question shows that good performance in this question was contributed by candidates' sufficient understanding of the concept of table of specification. Therefore, they were able to provide correctly four important things required when a teacher constructs a table of specification. Extract 9.1 shows a sample of a good response from a candidate.

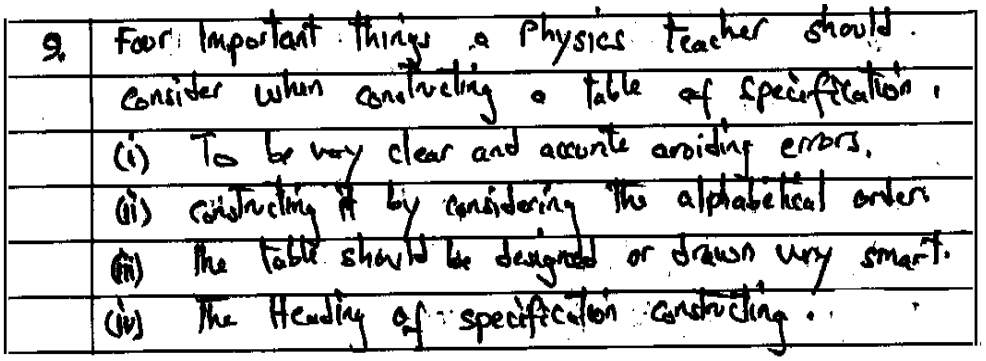
Extract 9.1



Extract 9.1 shows a candidate who provided correctly four important things to consider when constructing a table of specification.

Some candidates (8.5%) with low scores (0 to 1.5) failed to give correct responses needed for this question. These candidates had a little idea on the concept of table of specification. Extract 9.2 shows a sample response from a script of a candidate who scored poorly in this question.

Extract 9.2



Extract 9.2 shows a response from a candidate who performed poorly.

2.10 Question 10: Preparation for Teaching

This question required the candidates to state four advantages of tutorial software in teaching and learning Physics.

The question is under the topic Preparation for Teaching. It was attempted by all candidates (100%) that sat for this paper. Out of them 15.3 percent scored from 0 to 1.5 marks, 33.9 percent scored 2.0 to 2.5 marks and 50.8 percent scored from 3.0 to 4.0 marks where 4.0 marks were allotted to the question. The data analysis shows that the candidates' performance in the question was good because 84.7 percent of them scored above 2.0 marks. Figure 10 is a chart that shows Candidates' Performance in this question.

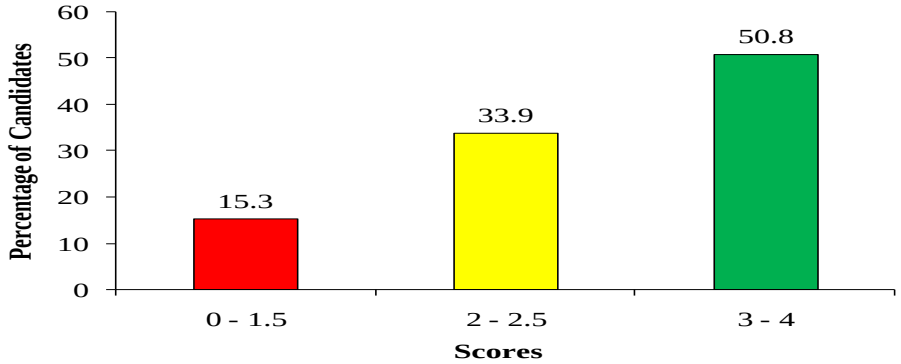
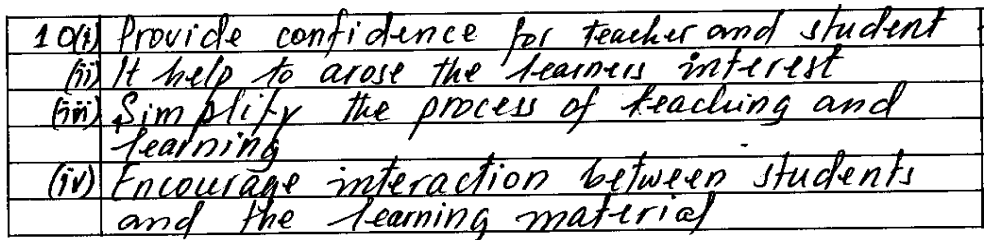


Figure 10: Candidates' Performance in question 10

The analysis on the candidates' performance shows that most of the candidates had sufficient knowledge on tutorial software. As a result, they were able to state correctly the four advantages of tutorial software in teaching and learning of Physics. Extract 10.1 shows a sample of a correct response from one of the candidate's script.

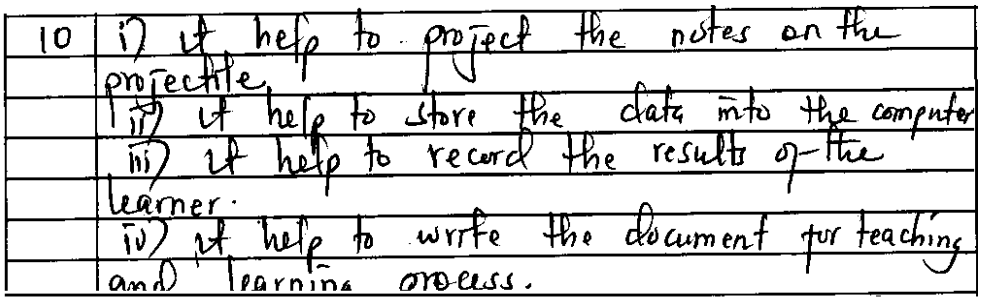
Extract 10.1



Extract 10.1 shows a response from a candidate who provided a correct response to the question.

The analysis of candidates' performance shows that, the few candidates (15.3%) who performed poorly had inadequate knowledge on the concept tutorial software. Hence, they failed to state the advantages of tutorial software. One of the candidate explained an advantage of tutorial software to be; *tutorial software helps to display information*. While another candidate stated that, *it helps in preparation of the lesson plan*. The responses from these candidates were irrelevant to the question asked. Some of the candidates confused the concept of tutorial software with that of electronic devices used in teaching and learning. Extract 10.2 shows a sample response from a script a candidate who performed poorly.

Extract 10.2



Extract 10.2 shows a response from a candidate who failed to state the four advantages of tutorial software in teaching and learning of Physics.

2.11 Question 11: Mechanics

This question consisted of three parts. In part (a) The candidates were required to explain: (i) parking orbit, (ii) velocity of escape and (iii) weightlessness. In part (b) they were required to calculate the total energy needed to place a satellite of mass 1000kg moving in a circular orbit of radius 7000km round the earth, whereby the earth is assumed to be a sphere of radius 6400km. In part (c) the candidates were required to deduce Newton's law of universal gravitation from Kepler's third law.

The question is under the topic *Mechanics* and the subtopic *Universal Gravitation*. 81.4 percent of the candidates attempted this question. Out of them 2.1 percent scored from 0 to 5.5 marks, 45.8 percent scored from 6.0 to 10.0 marks and 52.1 percent scored from 10.5 to 15.0 marks. These scores imply that the candidates' performance in the question was good since 97.9 percent of them scored over 10.5 marks. Figure 11 is the pie chart that illustrates the candidates' performance in this question.

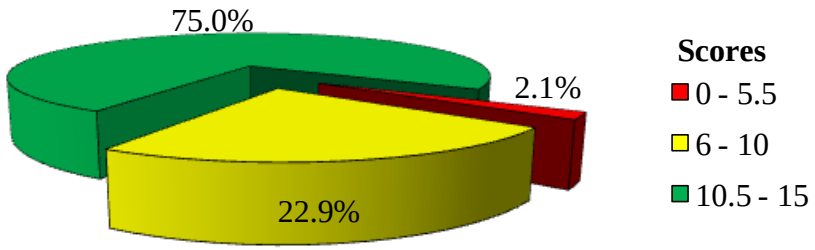


Figure 11: Candidates' Performance in Question 11

The analysis of candidates' responses shows that the majority of the candidates (97.9%) performed well because they had an adequate knowledge on the concept of universal gravitation. They were able to explain correctly the terms parking orbit, velocity of escape and weightlessness. On top of that, they managed to apply the right formula to calculate total energy needed to place a satellite in a circular orbit round the earth.

These candidates were also able to use concepts that involve a resolving planet on the circular orbit and through manipulation used the formulae to deduce the Newton's law of universal gravitation from Kepler's third law. Extract 11.1 presents a sample of a good response from one of the candidate's script.

Extract 11.1

11 (a) (i) Parking orbit – This is the orbit whose satellite have the same direction and period of time as that of the earth. In parking orbit is seems to be stationary to the observer standing on the earth.

(ii) Velocity of escape :- This is the minimum velocity experienced by the body to over the earths gravitational effects. It is the minimum velocity in which an object move with it up to the infinity by over coming gravitational effect of the earth

(iii) Weightlessness :- This refers to the objects which experiences the gravitational pull of the earth.

(b) Solution ;

Data Given

mass (m) of satellite = 100kg.

radius of orbit (r) = 7000km

Radius of sphere (R) = 6400km.

Total energy ET = ?

from

$$\text{Total energy} = \frac{-GMem}{2(R+h)}$$

$$\text{Total energy} = \frac{gR^2m}{2(R+h)}$$

11 (b)

$$ET = \frac{gR^2m}{2R}$$

$$= \frac{9.8 \times 6400\,km \times 1000\,kg}{2 \times 7000\,km}$$

Total energy $= 35 \times 10^5\,J$

11 (c) From the diagram except that Gravitational force is provided by centripetal force.

$$\frac{GmeM}{R^2} = MwR$$

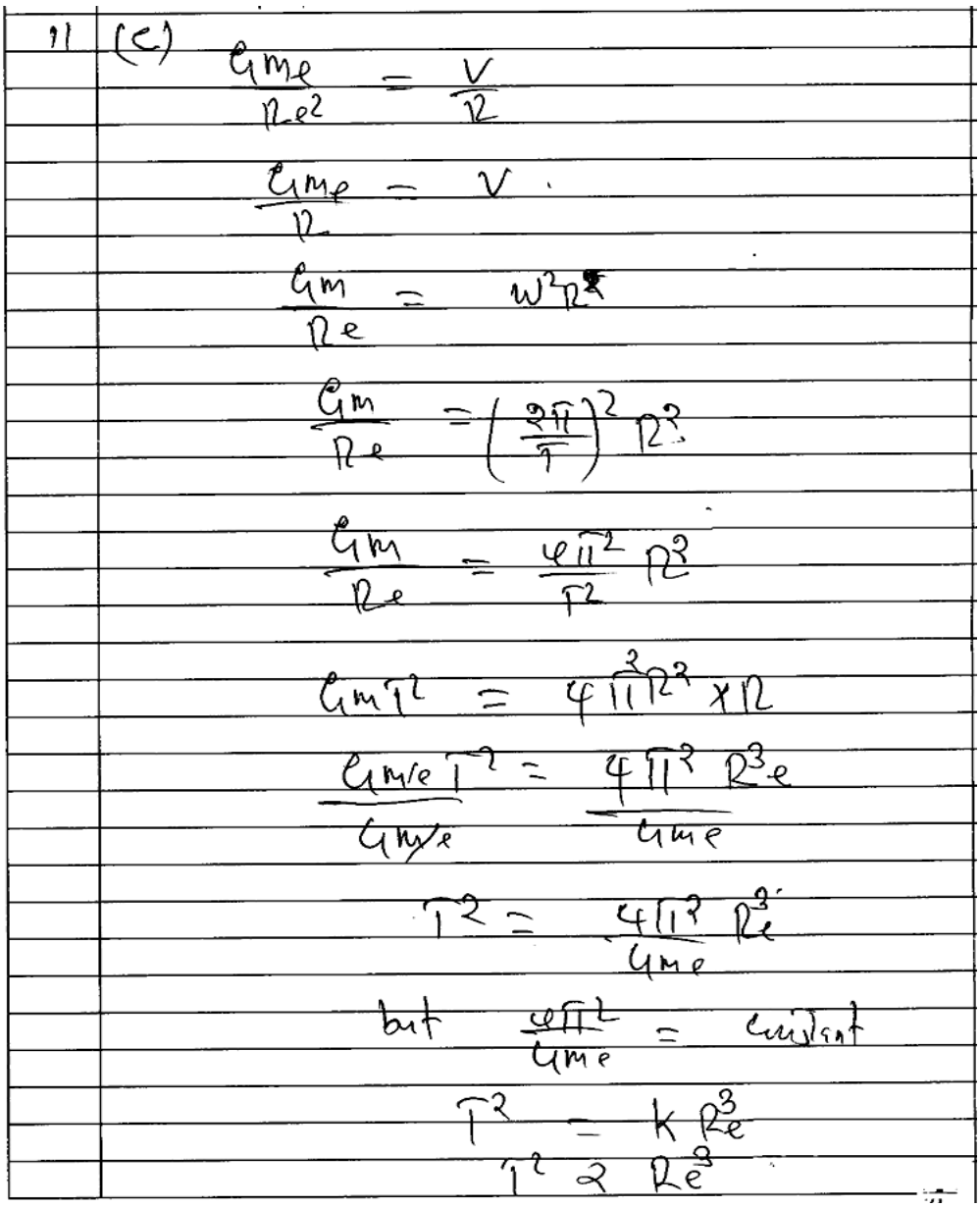
$$\frac{Gme}{R^2} = wR$$

but $w = \frac{2\pi}{T}$

Then

$$\frac{GmeM}{R^2} = \frac{MV}{R}$$

$$\frac{Gme}{R^2} = \frac{V}{R}$$

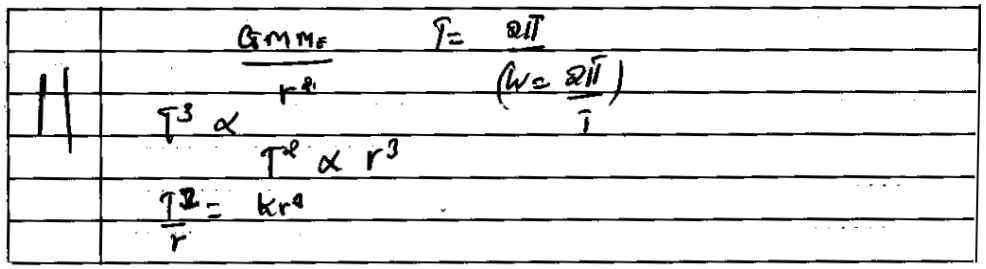


Extract 11.1 presents a good response from a candidate who provided correct answers in all parts of the question.

The analysis of the candidates' response shows further that, the candidates who scored low marks provided incorrect answers to most of parts of the question. This implies that they lacked knowledge on the basic concepts of universal gravitation. Some of them failed to explain correctly the meaning of the terms parking orbit, velocity of escape and weightlessness. Some candidates were able to give the meaning of one term but failed the rest.

Furthermore, they failed to recognize that the total energy needed to place a satellite in a circular orbit round the earth is given by relation. Total energy needed W = increase in potential energy and kinetic energy, i.e. Total energy $= \frac{GMm}{r_E} - \frac{GMm}{r_0} + \frac{1}{2}mv^2$. These candidates failed to deduce Newton's law of universal gravitation from Kepler's third law since they lacked knowledge on concepts that relate the centripetal force provided by the sun's gravitational force on the planet and the force exerted on the sun by the planet. Extract 11.2 shows a sample of a poor response from one of the candidate's script.

Extract 11.2



Extract 11.2 shows a response of a candidate who performed poorly in this question.

2.12 Question 12: Mechanics

The question had two parts; (a) and (b). In part (a), the candidates were required to write the expression for dynamic pressure and show that it is dimensionally correct. In part (b) the candidates were required to find the payload of an aeroplane of mass 200 tons whose wings act as aerofoil and it has a total area of $50m^2$ and the velocity of air below and above the wings is 120 ms^{-1} and 500 ms^{-1} respectively.

This question was attempted by 32.2 percent of the candidates, whereby, 47.4 percent got marks from 6.0 to 10.0 marks and 52.6 percent got marks from 10.5 to 15.0 marks. Hence the general performance of candidates in this question was average. The scores of candidates is summarized in Figure 12.

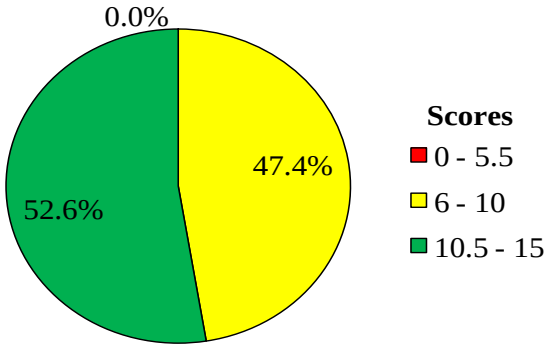
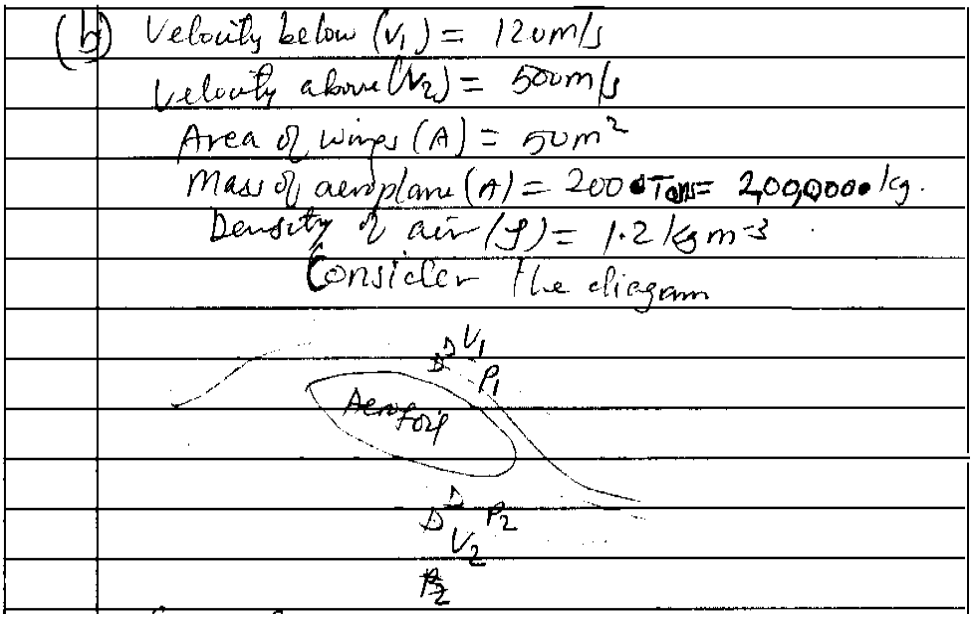


Figure 12: Candidates' Performance in Question 12

The analysis of candidates' responses in this question shows that 52.6 percent of the candidates scored average marks. They had reasonable knowledge on the concepts of pressure. These candidates were able to write the expression for dynamic pressure and the law of homogeneity to check the correctness of dimensions of the asked physical quantity. These candidates were also able to recognize that aeroplane wings as aerofoils work under the principle of Bernoulli. Hence, they were able to use Bernoulli's equation to find the payload the aeroplane can carry. Extract 12.1 shows a sample of good response from a candidate's script.

Extract 12.1



From Bernullis theory

$(P_1 - P_2) = \rho g(h_2 - h_1) + \frac{1}{2}\rho(V_2^2 - V_1^2)$

$h_1 = h_2$

$(P_1 - P_2) = \frac{1}{2}\rho(V_2^2 - V_1^2)$

But

$P_1 - P_2 = \Delta P$

$\Delta P = \frac{1}{2}\rho(V_2^2 - V_1^2)$

$\Delta P = \frac{1}{2} \times 1.2\,kg\,m^{-3} \times ((500\,ms^{-2})^2 - (170\,ms^{-2})^2)$

$\Delta P = 149360\,NM^{-2}$

From Payload = Force need to carry the aeroplane

Pressure = $\frac{Force}{Area}$

Force = Pressure × Area.

Given

Pressure (ΔP) = $149360\,NM^{-2}$

Area (A) = $50m^2$

~~Force (F)~~ = $149360\,NM^{-2} \times 50m^2$

$F = 7{,}068{,}000\,N$

∴ The payload aeroplane can carry is 7,068,000 N.

12 (a) Pressure = $\frac{Force}{Area}$.

From. [Pressure] = $ML^{-1}T^{-2}$

[Force] = MLT^{-2}

[Area] = L^2

$ML^{-1}T^{-2} = \frac{MLT^{-2}}{L^2}$

$ML^{-1}T^{-2} = ML^{-2}T^{-2}$

$ML^{-1}T^{-2} = ML^{-1}T^{-2}$.

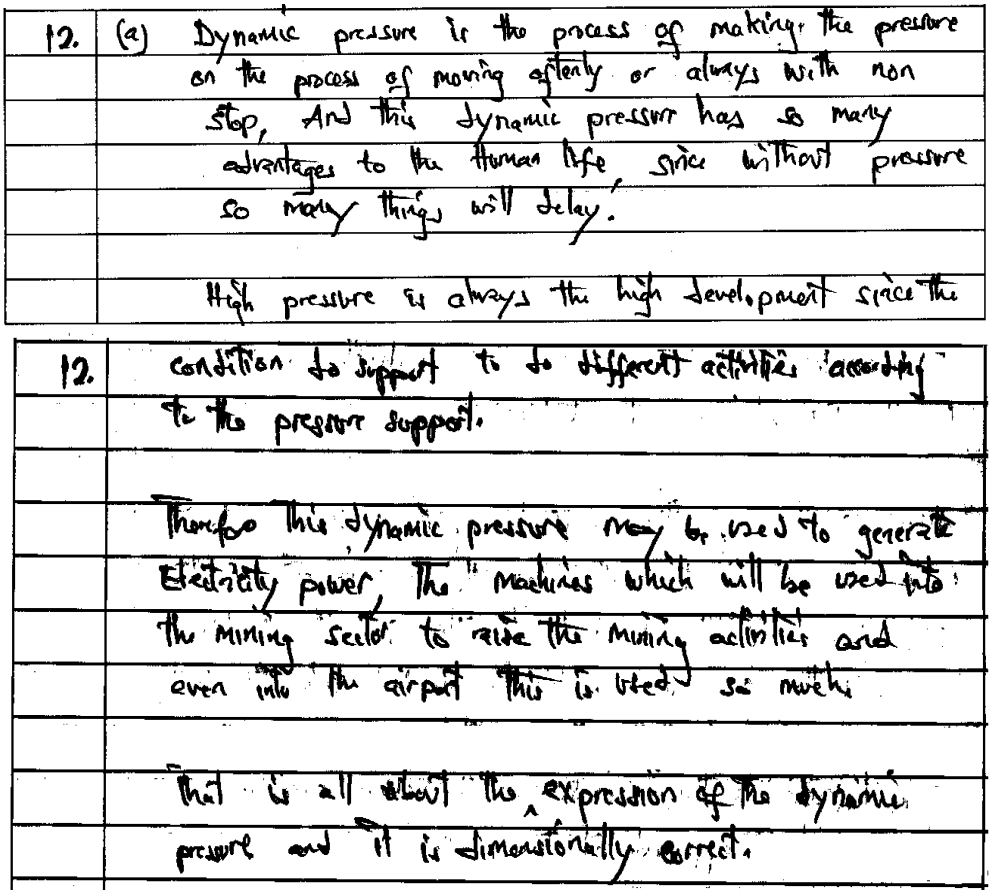
∴ $ML^{-1}T^{-2} = ML^{-1}T^{-2}$.

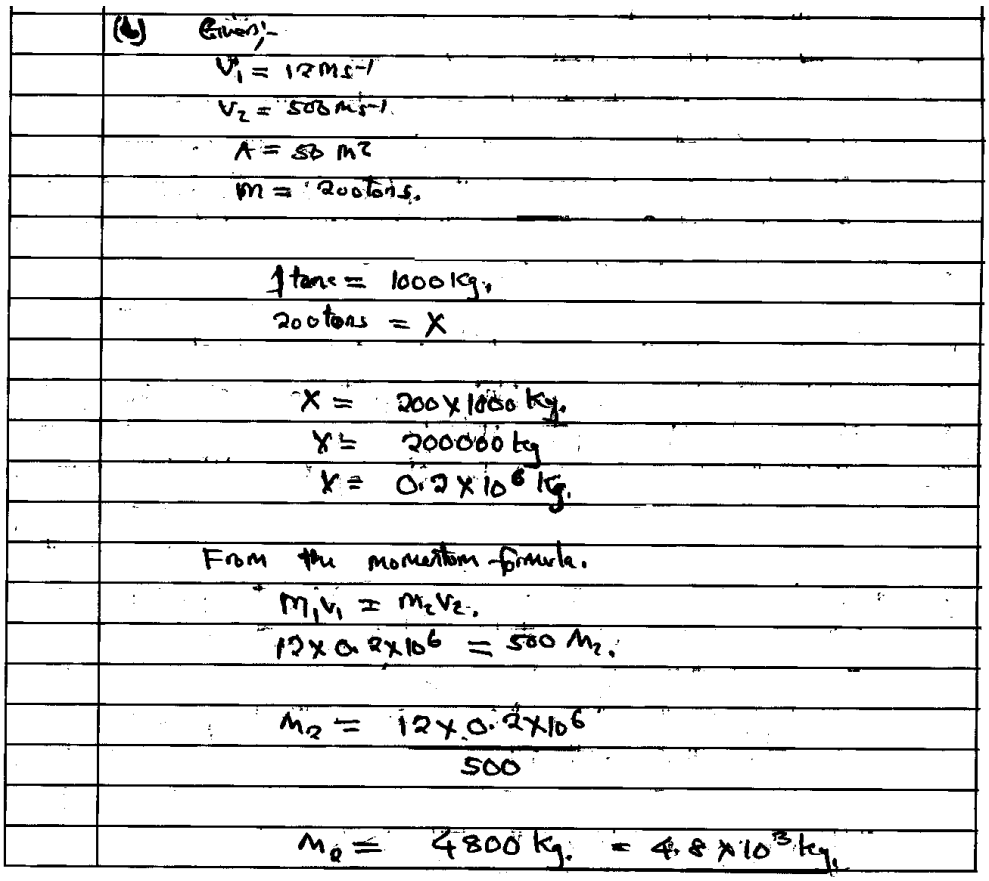
∴ The equation is correct since the dimension at left hand side is equal to the dimension at right hand side

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

The analysis of candidates' responses shows that the candidates who scored low marks failed to realise that the pressure P is related to density of moving fluid ρ and the velocity v with which a fluid is moving. Hence, they failed to write the correct expression $P = \frac{1}{2}\rho v^2$. Therefore, they were not able to show the dimensional correctness in the equation of dynamic pressure. Some of them were able to write Bernoulli's equation but failed to substitute the required data on the equation, while others failed to relate the payload with upthrust on the aeroplane wings. They therefore, failed to use Bernoulli's equation to calculate the thrust. Some candidates were able to find the thrust and the weight of an aeroplane but failed to relate it with the payload that an aeroplane can carry. This was likely due to the lack of adequate knowledge on this topic. Extract 12.2 shows a sample of a poor response from a candidate's script.

Extract 12.2





Extract 12.2 shows a response from a candidate who failed to respond correctly to the question requirement by applying an irrelevant formula to calculate the payload an aeroplane can carry.

2.13 Question 13: Geophysics

The question required the candidates to explain three negative and three positive effects of volcanoes.

The question is under the topic of Geophysics and (84.7%) of the candidates that sat for this paper attempted this question. The data analysis shows that the scores were as follows: 2.0 percent scored from 6.0 to 10.0 marks and 98.0 percent scored from 10.5 to 15.0 marks. No candidate scored below 6.0 marks. Hence, candidates' general performance in this question was good. Figure 13 is a histogram that shows the candidates' performance in this question.

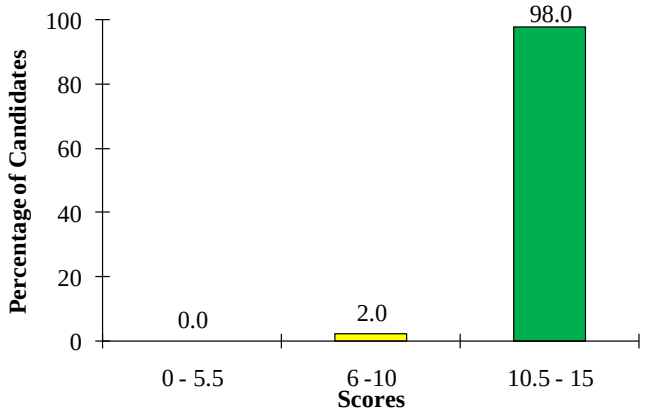
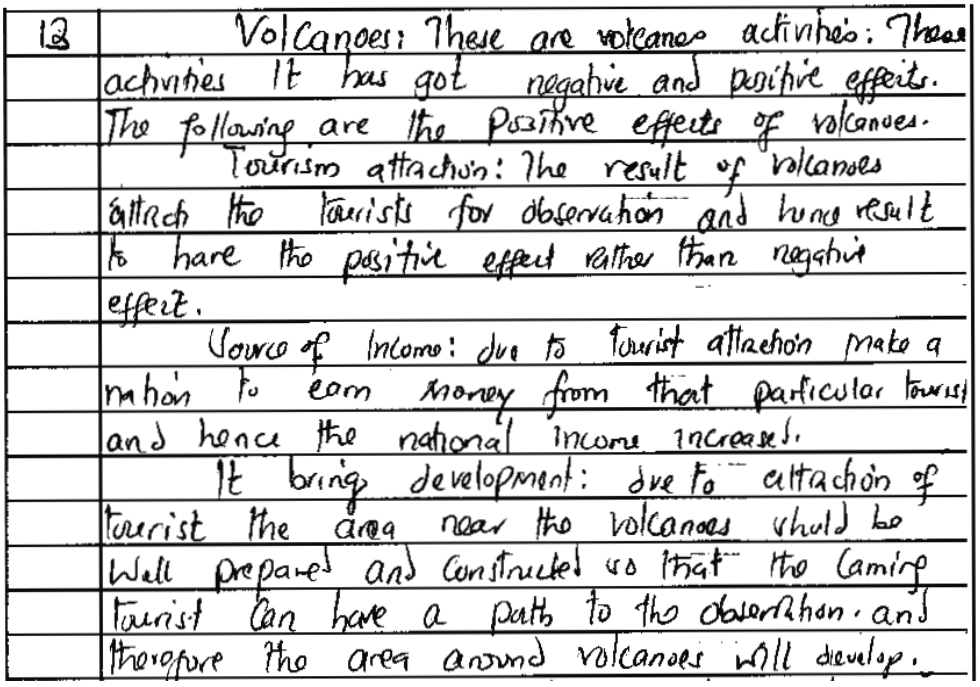


Figure 13: Candidates' Performance in Question 13

The analysis of the candidates' responses in this question shows that the candidates (98.0%) who performed well in this question, were able to explain correctly three positive and three negative effects of volcanoes using vivid examples. In addition they were able to link the effects of volcanoes with human activities such as agriculture, tourism, minerals, environment and human life in general. Extract 13.1 shows a sample answer from a script of a candidate who performed well in this question.

Extract 13.1

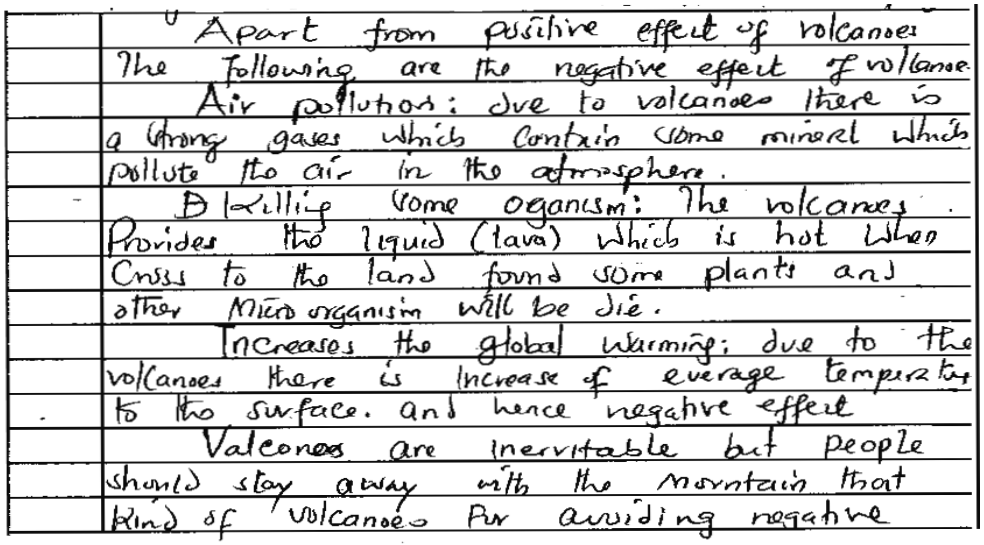

13

Volcanoes: These are volcanoe activities: These activities It has got negative and positive effects. The following are the positive effects of volcanoes.

Tourism attraction: The result of volcanoes attract the tourists for observation and hence result to have the positive effect rather than negative effect.

Source of Income: due to tourist attraction make a nation to earn money from that particular tourist and hence the national income increased.

It bring development: due to attraction of tourist the area near the volcanoes should be well prepared and constructed so that the coming tourist can have a path to the observation. and therefore the area around volcanoes will develop.


Apart from positive effect of volcanoes
The following are the negative effect of volcanoes
Air pollution: due to volcanoes there is
a strong gases which contain some mineral which
pollute the air in the atmosphere.
B Killing some organism: The volcanoes
Provides the liquid (lava) which is hot when
Cross to the land found some plants and
other Micro organism will be die.
Increases the global warming: due to the
volcanoes there is increase of everage temperature
to the surface. and hence negative effect
Valconoes are inevitable but people
should stay away with the mountain that
kind of volcanoes For avoiding negative

Extract 13.1 shows the response of a candidate who provided the correct response explaining three effects of volcanoes.

2.14 Question 14: Preparation for Teaching

In this question candidates were required to explain five activities to be carried out before teaching a new topic.

The question is under the topic of Preparation for teaching and 74.6 percent of the candidates that sat for the paper attempted the question. The data analysis shows that, 27.3 percent of candidates scored from 6.0 to 10.0 marks and 72.7 percent of them scored from 10.5 to 15.0 marks. None of candidates scored below 6.0 marks. Generally, the performance in the question was good since all 44 candidates (100%) scored in the range of either average or good performance. Figure 14 below illustrates candidates performance in this question.

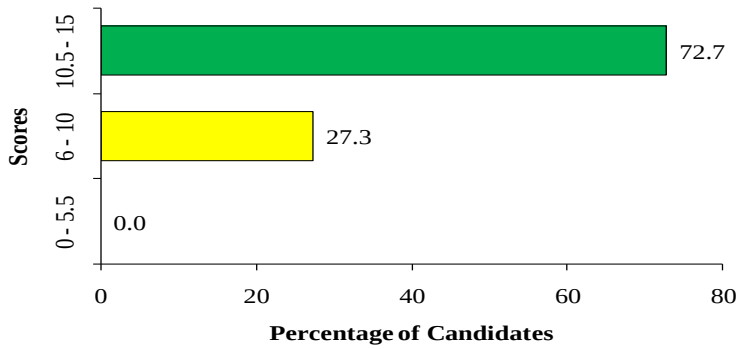


Figure 14: Candidates' Performance in question 14

The analysis of the candidates' responses to this question shows that, majority of candidates (72.7%) who attempted the question performed well. Good performance was attributed by the ability of the candidates to and comprehend key lesson concepts in preparation for teaching Physics. This indicates that the candidates had sufficient knowledge on the preparation of teaching Physics. Hence, they were able to describe the activities to be done before teaching a new topic. Extract 14.1 shows a sample response from a candidate with good performance.

Extract 14.1

1T. Teaching a new topic in the class, can be facilitated by different activities before entering in the class for effective teaching. The followings are the activities to be carried out before teaching a new topic

Preparation of ~~schools~~ scheme of work, before teaching a new topic, the teacher have to prepare the scheme of work first, which will indicate different activities to be carried out so as that the intended topic will be ~~wee~~ well understood by the students.

Preparation of lesson plan, Also before a teacher to start the new topic, ~~he~~ he/she has to prepare a lesson plan which will enable her/him to carry out activities of teaching a new topic in the classroom in a good way. Therefore the lesson plan must be prepared before starting a new topic.

Preparation of lesson notes, also lesson notes have to be prepared before the teacher to start a new topic, the notes concerned with the new topic must be prepared before the new topic has been started. Therefore lesson notes helps the teacher to make systematic presentation of the subject matter.

Preparation of teaching and learning resources, teaching and learning resources to be used during the presentation of the lesson must be prepared first before to start a new topic. Different teaching aids have to be prepared before to start a new topic and must correlate to the subject matter.

Preparation of teaching and learning strategies, before teaching a new topic, the teacher have to be aware with teaching methodologies which he/she will use to teach in the classroom and these methodologies must relate to nature of the class.

14.	Generally, before starting a new topic, the tea cher have to get prepared in many area in which he or she can do. Through this the teaching and learning process of a new topic can be effective and understood to all learners or students.

Extract 14.1 shows a response from a candidate who provided correctly the activities done before teaching a new topic.

2.15 Question 15: Analysis of Physics Curriculum Materials

This question consisted of two parts; part; (a), where candidates were required to state ten main components of a Physics logbook and part (b) where the candidates were required to explain five important headings that are used in writing a Physics practical report.

This question was attempted by 76.3 percent of the candidates that sat for this paper. Item analysis showed that 11.1 percent of them had scores in the range of 6.0 to 10.0 marks while 88.9 percent had scores in the range of 10.5 to 15.0 marks. No candidate scored below 6.0 marks. Hence, the data analysis show that the general performance of the candidates was good. Figure 15 is a pie chart that illustrates the candidates' performance in this question.

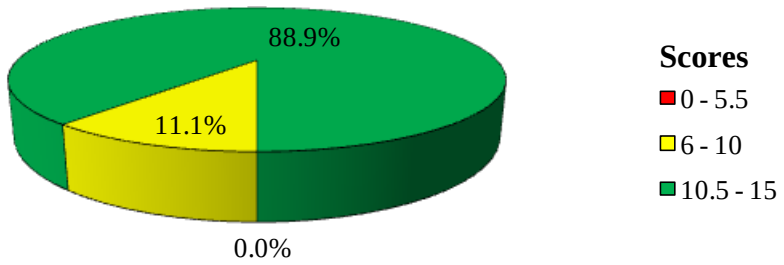


Figure 15: Candidates' Performance in Question 15

The analysis of the candidate' performance shows that majority of candidates (88.9%) who attempted this question performed well. The performance is because of sufficient knowledge on the components of a Physics logbook that the candidates had. Candidates had ability to state and explain correctly all ten components of a logbook. Furthermore, the candidates managed to explain correctly five important headings which are used when writing a Physics practical report. Extract 15.1 shows a sample response from a script of one candidate who performed well in the question.

Extract 15.1

(c) Subject teacher's signature. After giving a comment a subject teacher signs in that logbook.

Head of department signature. Also this part a head of department signs after checking the information filled by the subject teacher

Head of school's signature. This part is filled by the head of school after checking the information filled by the subject teacher and head of department.

These logbook is very important because it helps teacher to evaluate his or her teaching speed and may be used by head of school to determine the teaching and learning difficulties.

15(b) (i) Aim of experiment

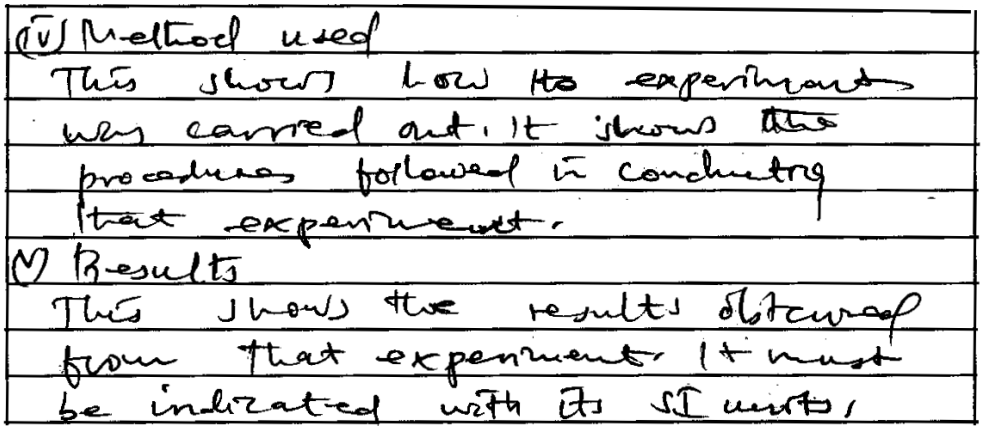
This shows or tells what the experiment is aimed to determine what.

(ii) Apparatus used

This shows the neseccary equipments and apparatuses that were used in conducting that experiment.

(iii) Diagram for setup

This is a sketch of the apparatus show was arranged.



Extract 15.1 represents good responses from candidates who provided correct answers in all parts of the question.

2.16 Question 16: Fundamentals of Teaching and Learning Physics

The question required the candidates to explain how teaching and learning of Physics helps in the following areas of daily life giving examples for each:

(a) To acquire knowledge of Physics concept and laws.
(b) To apply scientific procedures in investigating physical phenomenon.
(c) To use relevant skills in investigating physical phenomenon.
(d) To apply fundamental concepts, principles, laws and theories in solving problems.
(e) To use knowledge and manipulative skills to construct various appliances.

This question was attempted by 49.2 percent of the candidates. Out of them 34.5 percent scored from 6.0 to 10.0 marks and 65.5 percent scored 10.5 to 15.0 marks. No candidate scored below 6.0 marks. Hence, the general candidates' performance in the question was good. Figure 16 is a histogram that gives a summary of the candidates' performance in this question.

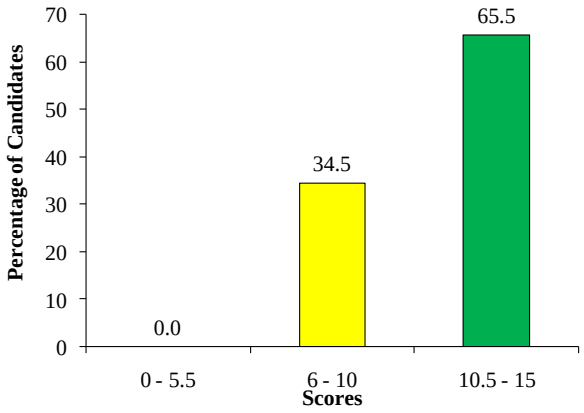


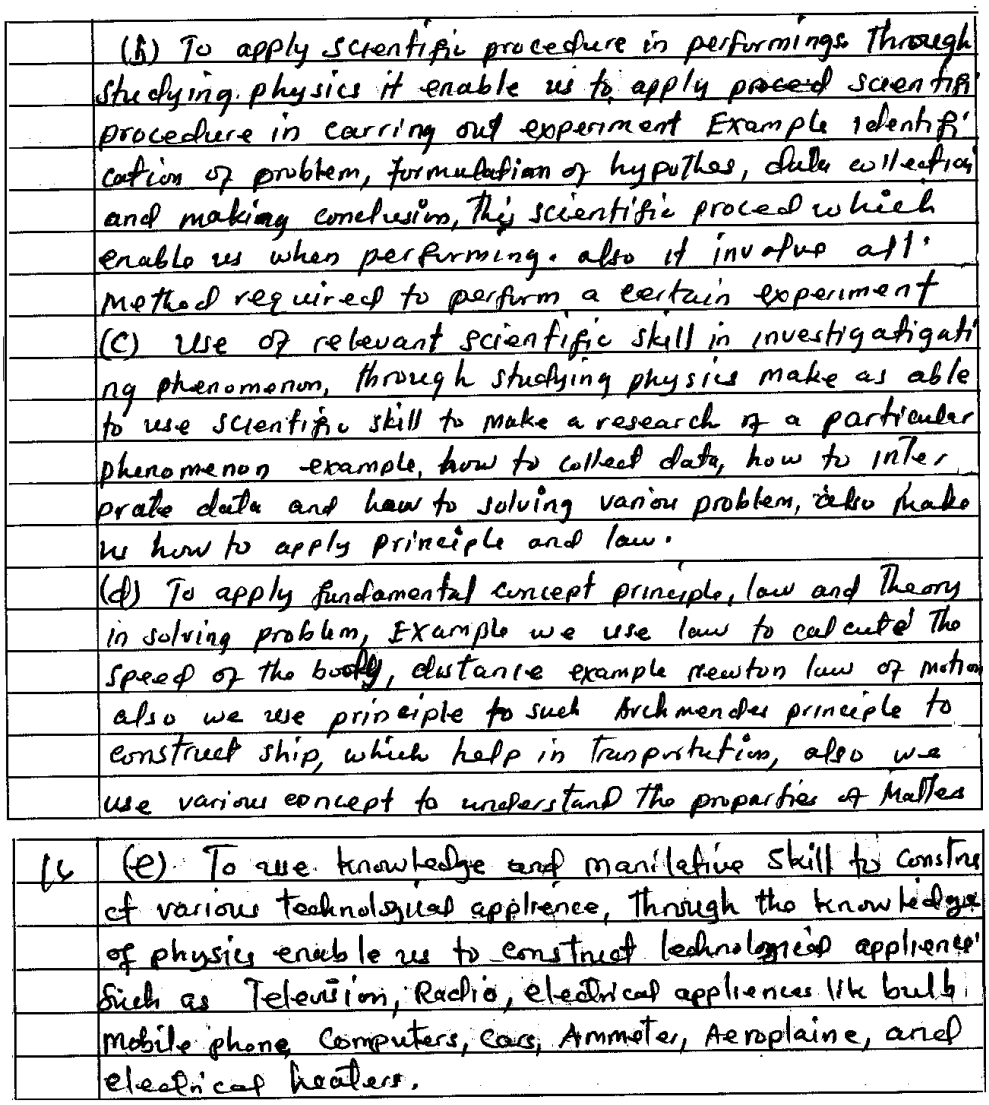
Figure 16: Candidates' Performance in Question 16

The analysis of the candidates' responses shows that the candidates (65.5%) performed well in this question. The candidates were able to explain precisely the way teaching and learning Physics is helpful in various aspect of life. Furthermore, the candidates were able to explain using vivid examples, the way the Physics concepts, phenomenon, laws, principles and theories are applied to solve human problems in daily life. Extract 16.1 shows a sample response from a candidate's with good performance.

Extract 16.1.

16 Physics is the branch of science which deal with matter in relation to energy. physics involve with study of various matter, physic is very important to the human life because it applied in different area in dail life.

(a) To aquire knowledge of physics concept and law. Through studying physics it enable us to understand various concept example the kinetic theory of gases, it explain how gas is moving, concept of measurement, physics also enable us as to know various law which used in physics and how to state it example, Pascal's Law, Archimendes principle universal newton law universal gravitation, Newton laws of motion such as first newton law of Motion, second newton law of Motion



Extract 16.1. shows a response from a candidate who explained correctly the usefulness of Physics in daily life.

3.0 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH TOPIC

The DSEE 2018 Physics 1 had sixteen (16) questions set from academics and pedagogical topics in which they constituted 6 and 5 topics respectively. The analysis of the candidates' performance shows that seven (7) topics had good performance since the percentage of the candidates' scores were in the range of 91.5 to 100 percent. These topics with good candidate performance are: *Analysis Physics Curriculum Materials* **(100%)**, *Fundamental of Teaching and Learning Physics* **(100%)**, *Geophysics* **(100%)**, *Measurements* **(94.9%)**,

Preparation for Teaching **(92.4%)**, *Laboratory Management* **(92.4%)**, and *Assessment in Physics* **(91.5%)**. The reasons for good performance was sufficient knowledge and skills on items that involved detailed explanations and numerical manipulations.

The candidates with average performance did not well in the two topics; *Mechanics* (**50.7%**) and *Atomic Physics* (**49.2%**). Furthermore, the analysis shows that there were two topics with weak candidate performance; *Electronics* (**30.5%**) and *Heat* (**0.0**%). It is noted that the reasons for candidates to get average and weak performance in these topics was because; they lacked formulae derivation skills, they were unable to relate physical quantities and they had inadequate knowledge in explaining Physics facts and phenomena in relation to daily life situations. Appendix 1 summarizes the candidates' performance in each topic. Red, yellow and green colour show weak, average and good performance respectively.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

It is evident from the analysis of candidates' item response show that the performance in most numerical questions is still a challenge to some candidates. This is observed from the failure of many candidates in all questions involving numerical calculations. For example, in question 5 and 6 most candidates performed poorly in the parts involving numerical calculation.

Candidates also had weakness in manipulation skills of associating description of physical quantity with formula in a particular topic. This was noted in irrelevant answers given by the candidates in some of the questions. In question 6 for example some candidates did not realise that the question had something to do with specific heat capacities of air and its effect at constant volume. As a result, they gave giving irrelevant responses to the question.

It is noted that there is a tendency of candidates leaning towards seemingly simple topics. For example questions 7, 8, 9 and 10 had a large number of correct responses than most of the other questions in section A. Likewise questions 13, 14, 15 and 16 had many correct responses from candidates than the other questions in section B and C. This indicates that most of candidates are study pedagogical topics than academic topics.

The topics that were performed well includes; *Analysis of Physics Curriculum Materials, Fundamental of Teaching and Learning Physics, Preparation for Teaching, Geophysics, Measurements, Laboratory Management and Assessment in Physics.* Topics that involved calculation and pure physics were skipped and were performed poorly when they were mandatory. Such topics were: *Mechanics, Electronics and Heat.*

4.2 Recommendations

In order to improve future performance the following recommendations should be put into consideration:

Firstly, the tutors and college principles should introduce Basic Applied Mathematics (BAM) to student teachers for the purpose of improving their performance in numerical questions. This will bridge the gap in mathematical knowledge that most Physics students teachers face during teaching and learning of the subject.

Secondly, he candidates are emphasized to study all topics according to the prescribed syllabus. This will enable them to perform well in all topics.

Thirdly, learning the Physics subject involves experimental observations. This means that the candidates are advised to learn various methodologies and techniques from their tutors. This will solve the problem of pedagogical content knowledge.

Fourthly, Physics as a discipline involves theories, laws and principles. Physics has an indirect link with everyday life encounters. Thus, candidates are advised to understand how Physics is associated with other disciplines.

Lastly, NECTA recommends to all educational stakeholders to make sure that these recommendations are put into implementation for better results.

Appendix

THE CANDIDATES' PERFORMANCE PER TOPIC IN PHYSICS

Na.	Topic	Question Number	Performance in Percentages		Remarks
			40 percent or more	Average	
1	Analysis of Physics Curriculum materials	15	100	100	Good
2	Fundamentals of Teaching and Learning Physics	16	100	100	Good
3	Geophysics	13	100	100	Good
4	Measurements	1	94.9	94.9	Good
5	Preparation for Teaching	14	100	92.4	Good
		10	84.7		
6	Laboratory Management	8	100	92.4	Good
		7	84.7		
7	Assessment in Physics	9		91.5	Good
8	Mechanics	11	97.9	50.7	Average
		12	52.6		
		4	37.3		
		5	16.9		
9	Atomic Physics	2	49.2	49.2	Average
10	Electonics	3	30.5	30.5	Weak
11	Heat	6	0	0	Weak