THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

STUDENTS' ITEMS RESPONSE ANALYSIS REPORT FOR THE FORM TWO NATIONAL ASSESSMENT (FTNA) 2018

031 PHYSICS

THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

STUDENTS' ITEMS RESPONSE ANALYSIS REPORT FOR THE FORM TWO NATIONAL ASSESSMENT (FTNA) 2018

031 PHYSICS

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

TABLE OF CONTENTS

FOREWORD

The Form Two National Assessment (FTNA) is a formative evaluation which intends to diagnose students' progress towards mastering of various concepts as stipulated in the Secondary School syllabus for Forms I and II. It provides teachers and students with feedback that will direct subsequent teaching and learning process in future.

This report highlights some of the reasons for students' failure to score high marks in the Physics assessment questions. The reasons include failure to follow instructions, inability to identify the requirements, poor English Language proficiency, inadequate knowledge of the topics and lack of both drawing and mathematical skills. The feedback provided will enable the education administrators, school managers and teachers to identify proper measures to be taken in order to improve students' performance in future assessments.

The National Examinations Council of Tanzania welcomes comments and suggestions from teachers, students and the public in general, in order to improve future analysis reports.

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

Students' items response analysis report for the Form Two National Assessment (FTNA) 2018 for Physics is based on the performance of the students who sat for FTNA Assessment for the year 2018. The paper intended to assess competences acquired by form two students basing on the 2018 reviewed Physics syllabus for secondary education.

The paper was comprised of three sections, namely A, B and C with a total of 10 questions. Section A had three (3) questions. Question 1 had 20 multiple choice items constructed from sixteen (16) topics. Question 2 had five (5) homogeneous matching items from the topic of *Simple Machines* while question 3 had also five filling in the blanks items covering concepts from different topics (Appendix I). Section A had a total of 30 marks. Section B had five (5) questions set from the topics of *Forces in Equilibrium, Work, Energy and Power*, *Pressure*, *Motion in a Straight Line* and *Simple Machines* with a total of 50 marks. Section C had two (2) questions constructed from the topics of *Pressure* and *Current Electricity* with a total of 20 marks. Students were required to answer all questions from all sections.

Students who sat for this paper were 503,875 and among them, 241,015 (48.01%) passed the assessment and 260,991 (51.99%) failed. In the year 2017, students who sat for this subject were 128,329 of which 44.77% passed and 55.23% failed. This indicates that the students' performance in Physics for the year 2018 has improved by 3.24 percent.

The following section analyses the performance of the students in each question. It begins by indicating the question demand and then provides the analysis of students' performance. It also highlights some misconceptions observed and summarises the reasons behind the students' performance in a particular question.

The criteria used in the analysis are as follows; The performance is considered to be good, average or weak if the percentage of the students who scored from 30 percent or above of the marks allocated to the question laid in the interval of 65-100 (green), 30-64 (yellow) and 0-29 (red) respectively. The samples of students' responses are inserted as extracts to represent good and bad cases. Some graphs and charts are used to summarize the students' performance in a particular question. The report contains appendix I which indicates the general performance in each topic and appendix II and III which show the comparison of students' performance between FTNA 2017 and 2018 in terms of topics and grades.

Finally, at the end of this analysis, recommendations and percentage of performance of students per each topic have been given as feedback to education stakeholders and to the whole process of improving students' performance in future assessments.

2.0 ANALYSIS OF STUDENTS' PERFORMANCE PER QUESTION

2.1 Section A: Objective Questions

This section consisted of three objective questions. Question 1 weighed 20 marks. Question 2 weighed 5 marks and Question 3 weighed 5 marks with each item of the questions carrying 1 mark.

2.1.1 Question 1: Multiple Choice Items

This question consisted of twenty items numbered (i) to (xx). In each item students were required to choose the correct answer among the four given alternatives lettered A to D and write the letter against the item number in the box that was provided. The items were constructed from the topics of *Introduction to Laboratory Practice*; *Measurement*; *Force*; *Archimedes' Principle and the Law of Flotation*; *Structure and Properties of Matter*; *Pressure*; *Work, Energy and Power*; *Light*; *Static Electricity*; *Current Electricity*; *Magnetism*; *Forces in Equilibrium*; *Motion in a Straight Line; Simple Machines*; *Newton's Laws of Motion;* and *Sustainable Energy Sources*.

This question was attempted by 100 percent of the students. The results indicate that 19.7 percent scored from 13.0 to 20 marks, 69.4 percent scored from 6.0 to 12.0 marks, and 10.9 percent scored from 0 to 5.0 marks. The general performance of this question was good as 89.1 percent of the students performed well. Figure 1 is a graphical representation of this analysis.

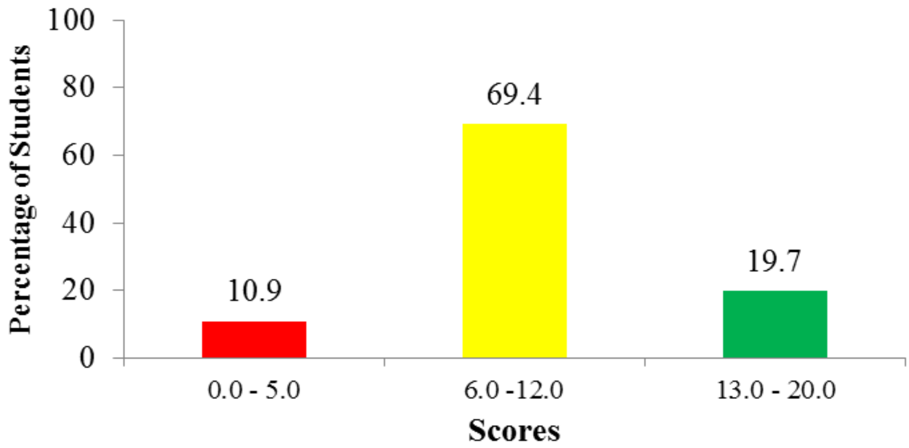


Figure 1: *Percentage of students' performance per score in question 1.*

Students who performed well in this question were knowledgeable enough to identify the correct answers. Those who performed poorly failed to give correct responses as per the requirements of the question. The analysis of the items' responses is as described hereunder:

In item (i), students were required to identify the term referring to a substance that has mass and occupies space. The answer was B, *matter*. The Majority of students chose the correct response as they managed to remember that matter is anything that has got mass and occupies space. However, few students who responded wrongly had no clear knowledge about matter. Hence, it is evident that they lacked content knowledge about the terms Energy, Universe and Nature.

In item (ii), students were required to specifically identify a clear statement that means a set of techniques used by scientists to investigate a problem. The best response was B, *scientific method*, and the distracters were data interpretation, performing experiment and data presentation. This answer shows the distinction between a set of techniques and basic principles of scientific investigation. Few students who did not respond to the item correctly failed to distinguish between techniques and principles of scientific investigation. Yet, the majority of students got the item right as they understood the requirement of the question item.

In item (iii), students were required to identify the use of Vernier caliper in measurement. The correct response was B, *diameter of a wire*. Although distance, mass and length are also measurable quantities, option B stands as the correct answer since vernier caliper can neither be used to measure mass of the car nor length of the table. However, the instrument cannot be used to measure distance of the car due to the fact that it measures length of objects to the accuracy of 0.01cm. The majority of students responded correctly. However, other students chose D, *length of the table*. This shows that they simply recalled that vernier caliper measures length without explicitly referring to the accuracy of the object.

Item (iv) required the students to name the kind of force that prevents a body to slide. The correct response was C, *Frictional force*. Despite the fact that, the three remaining distracters were also forces, most of the students responded correctly. The students knew that frictional force is the only force that prevents objects from sliding, among the four given alternatives. However, few students chose one among the three incorrect responses because they did not know the role of different types of forces.

Item (v) required the students to provide the term which defined the ability of the body to float in a fluid. The correct response was D, *floating.* The majority of the students got the item right. This shows that these students understood the demand of the question. A few students who got it wrong wasted much of their time memorizing the law of flotation instead of concentrating on the concepts involving the Archimedes' Principle and the Law of Flotation. This implies that they had low level of comprehension and thus took much time recalling the law of flotation.

In item (vi), students were required to identify the condition for a body to float in water. The correct response was B, *Density of the body must be less than density of the fluid*. Most of the students managed to select the correct response. They managed to recall the condition of the body to float in water. However, a few students failed to choose the correct response instead, they chose one of the incorrect responses. Such students failed to understand the question and did not have enough knowledge of the topic of Archimedes' principle and law of flotation.

In item (vii), students were required to give reasons as to why the arrangement of particles in a solid state has greater force of attraction between molecules. The correct response was A, *closely packed together*. In this item most of the students did the right selection. This signifies that students understood the requirements of the question item.

In item (viii), students were required to name the phenomenon observed when maize flour is poured on top of water. Most of the students made the right selection which was C, *surface tension.* This shows that the students had enough knowledge of the topic of structure and properties of matter. They also had high ability to comprehend the question and to know the requirement of the given item. A few students who made wrong selection had little knowledge of the content matter.

In item (ix), students were assessed on the topic of pressure, and factors causing pressure in liquids to be explicit. The students were required to choose the state of matter whose pressure is affected by density and height. The correct response was *C, liquid.* Most of the students selected the correct response. Moreover, few students chose incorrect answers due to the fact that they failed to recall that density and height are factors which affect pressure in liquids and not solid and gas.

In item (x), students were required to identify the physical quantity that the body has when performing work. The correct response was B, *energy*. Few students chose A because moment could significantly be associated with moment of force, which is the product of force and distance just like work. These students failed to distinguish moment from moment of force.

In item (xi), students were required to identify the unit that could be used for kinetic energy. The correct response was *D, NM*. Most of the students failed to provide the correct response. The reason behind is that students lacked mathematical treatment skills since the item could not provide a straight answer without one performing mathematical operations to get the correct unit. Below is what most of the students failed to come up with:
$K.E = {}^{1}/_{2}\, mv^2$, its unit could be, K.E = kgm^2/s^2 = kg $m/s^2 \times M$ = NM. Hence, the unit of Kinetic energy is NM.

Item (xii) required the students to mention the materials that allow only part of light to pass through them. The correct response was B, *Translucent*. In this item, most of the students selected the correct response since they were able to comprehend the question according to the requirement. However, few students selected alternative A, *transparent* which was not correct. These students did not understand that transparent materials are those materials which have the property of admitting light diffusely. They failed to differentiate between transparent and translucent materials.

In item (xiii), students were required to give the term that stands for stationary accumulation of charges on objects. The correct response was B, *Static electricity*. Most of the students responded correctly to the given item. However few students were attracted by the term charging. Possibly, these students were influenced by the words accumulation of charges on object in the stem, and hence associated them with alternative C, *charging*.

In item (xiv), students were required to give the name for the rate of flow of electrons. The correct response was *C, electric current*. Most students selected the correct response but few students were attracted by alternative A, *charging* which is wrong. These students conceived the process of charging as the movement of electric charges from the source to the device and compared the rate of flow of electrons in a material as charging.

In item (xv), students were required to identify materials which can magnetically be made strong. The correct response was *C, Cobalt and iron*. Most of the students were able to respond correctly. Those who got the item wrong were not able to differentiate permanent from temporary magnets by citing examples. They lacked clear examples that could match permanent magnets.

In item (xvi), students were required to give the term that stands for the point where the force of gravity can be considered to act. The correct response was A, *centre of gravity.* Most of the students responded correctly to the given item. However, few students failed to trace the difference between centre of gravity and centre of mass and ended up choosing alternative B, *centre of mass*. Some of them used the terms interchangeably to mean the same thing.

In item (xvii), students were required to give the term used for the rate of change of velocity of a body. The correct response was B, *acceleration.* Most of the students selected the correct response. A few students who responded incorrectly were attracted by alternative A, *uniform speed*. They did not understand that uniform speed occurs when the distance moved by the body per unit time is constant. Also, these students failed to recall that speed is a scalar quantity whereas velocity is a vector quantity.

In item (xviii), students were required to explain why the mechanical advantage is less than three in a single rope three pulley system. The correct response was D, *due to friction on pulleys*. In this item, most of the students selected the incorrect responses. They selected alternative C, *because the upper pulley does not move*. These students assumed that if the upper pulley does not move, only two moving pulleys will be related to mechanical advantage, which is then less than three.

In item (xix), the students were required to mention the law which expresses the product between mass of a body and its acceleration. The correct response was A, *Newton's second law of motion.* Most of the students selected the correct response. Few students who responded wrongly were attracted by alternative C, *Newton's third law of motion*. These students failed to recall that Newton's third law of motion states that to every action there is an equal and opposite reaction. That is to say, when one force is exerted on one body the other body will exert the same magnitude of force but in opposite direction. Although this law involves a product of mass and acceleration, the two forces act in opposite directions. Moreover, this law explains the magnitude and direction of force but not the product of mass and acceleration as Newton's second law of motion applies. Others selected alternative D, *momentum change*. These students failed to distinguish between the product of mass and acceleration (Force) and the product of mass and velocity (Momentum change).

In item (xx), students were required to name the form of energy that can be persistently used without running out. The correct response was B, *renewable*. Most of students selected the correct response. Those who failed selected alternative C, *non-renewable*. These students failed to differentiate renewable from non-renewable sources. They did not understand that non-renewable sources are sources of energy which once used cannot be replaced.

2.1.2 Question 2: Matching Items

Students were required to match each item on list A with a correct response on list B by writing its letter below the number of the corresponding item in the table provided. The question was based on Simple Machines.

This question was attempted by 99.8 percent of the students and their scores were as follows: 45.9 percent scored from 0 to 1.0 mark, 40.5 percent scored from 2.0 to 3.0 marks and 13.6 percent scored from 4.0 to 5.0 out of 5 marks allocated to the question. Figure 2 presents students' performance in question 2.

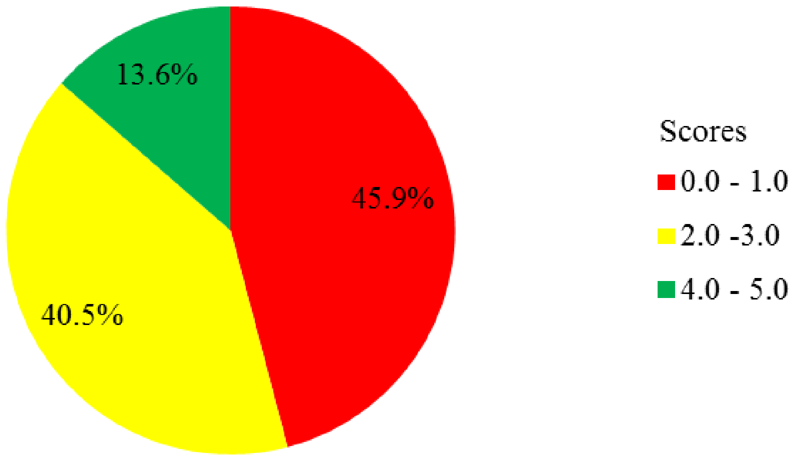


Figure 2: *Percentage of students' performance in question 2.*

The analysis of the students' response to the items of this question is as follows:-

In item (i), students were required to find a response which matches correctly the statement, *the force used to operate a machine*. The correct response was F, e*ffort*. This item was correctly selected by most of the students. However, a few students selected D, *Friction* and others selected the remaining responses like C, G, E, B and A randomly. These students lacked the knowledge of simple machines and its uses.

Item (ii) required the students to find the term which matches the sentence *example of a third class lever*. The correct response was A, *knife* and most students got it right. However, a few students lacked the knowledge of classes of levers and their uses and hence, chose incorrect options.

Item (iii) required students to find the term which matches the sentence, *ratio of number of teeth in a driven wheel to the number of teeth in the driving wheel*. The correct response was G, *Velocity ratio*. Many students matched it correctly, showing that they had adequate knowledge of simple machines and their uses. However, few students matched it wrongly as they failed to understand that velocity ratio is the ratio between distance moved by effort and distance moved by load.

Item (iv) required students to find a response which correctly matches a statement, *the force that causes the efficiency of a machine to be less than 100%*. The correct answer was D, *Friction*. Most of the students matched it correctly with alternative D, *Friction*, showing that they had adequate knowledge on the concept of efficiency and factors affecting their performance. On the other hand, few students matched it incorrectly as they failed to understand that machines cannot have an efficiency of 100% in its performance regardless of their nature, makeup and version. They were supposed to know that for a working machine, it is always affected by friction that transforms some energy into heat.

Item (v) required students to find a response which correctly matches a statement; *it is used to lift heavy weights with least effort*. The correct answer was B, *Lever*. Most of students matched it wrongly with alternative C, *Inclined plane*, showing that they did not understand the word *least* used in the statement; few students understood the word least and hence chose the correct response, lever.

2.1.3 Question 3: Filling in the Blank Spaces

Students were required to fill in blanks by writing the correct answer in the space provided.

This question was attempted by 94.5 percent of students, and 94.4 percent performed poorly as they scored from 0 to 1.0, including 74.1 percent who scored a 0 mark. The data show that 5.5 percent scored 2.0 to 3.0 marks and 0.1 percent scored from 4.0 to 5.0 out of 5 marks allocated to this question. The overall performance of this question was weak as only 5.6 percent of the students scored from 2.0 to 5.0 marks. The graphical presentation of the data is shown in figure 3.

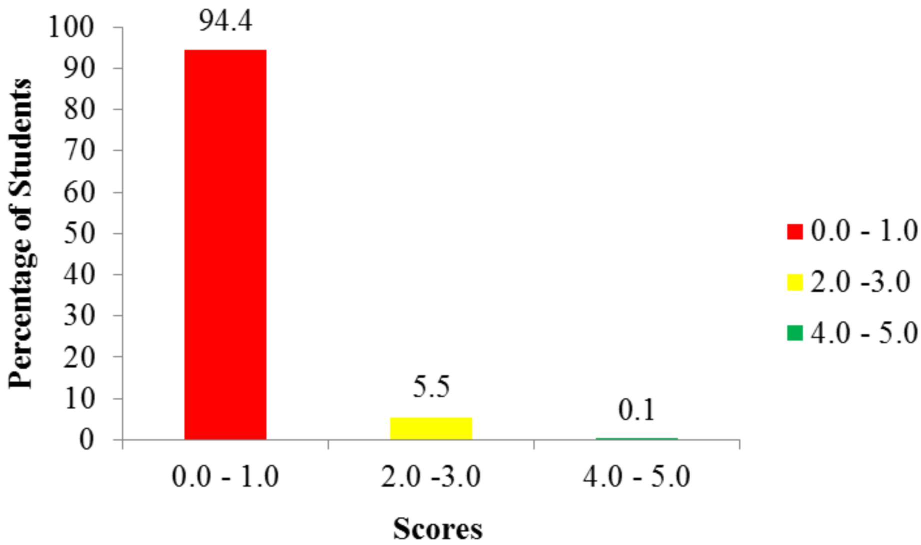


Figure 3: *Percentage of students' performance in question 3.*

The analysis of student's performance in each item is as follows:

In item (i), students were required to define mass of a body. The correct answer was *the quantity of matter inside the body*. Most of them responded correctly. Only a few of them provided wrong definitions. One of the examples of wrong definitions include: *Mass is the product of volume and density*. They failed to understand that the question demanded qualitative explanation and not the quantitative one.

Item (ii) required students to give a collective name of the resultant of a force which overcomes resistance. The correct answer was *work input/work/effort*. Majority of students wrote incorrect answers. The resultant force involves distance or movement from one position to another position, which can be termed as work input or effort. Yet, few of them managed to respond correctly, thus demonstrating their ability to comprehend and memorize.

In item (iii), students were required to give the name of a force which produces an acceleration of $1 m/s^2$ in a mass of 1 kg. The correct answer was *Newton/1N* but majority of students got it wrong. Some students gave misspelt answers like *neton*, and *newtone*. These students did not have enough knowledge about the definition of force and its SI unit. Failure to spell the answer is also an indication that the students were not competent in English. Few students answered well this part of the question, indicating that they had adequate knowledge of the concept of Newton's Laws of Motion.

In item (iv), students were required to give the name of the proper term for light which passes through different media. The correct answer was *refraction*. Most of the students got it wrong indicating that they had insufficient knowledge of the concept of refraction of light. They were supposed to know that refraction of light occurs when the direction of light changes as it passes from one medium into another.

In part (v), students were required to name a point just after elastic limit. Most of the students wrote the incorrect answer, *Plastic point* instead of the correct answer, *Yield point*. The students who gave incorrect answers failed to differentiate yield point from plastic point. Consequently, they lacked understanding of the concept of Hooke's law, particularly the analysis of the relationship between force and extension. However, few of them answered the question correctly.

2.2 Section B: Short Answer Questions

2.2.1 Question 4: Forces in Equilibrium

Part (a) of this question required the students to give two conditions for a body to be in equilibrium while part (b) required them to distinguish between centre of mass and centre of gravity. Part (c) required them to find mass of the ruler such that a meter ruler is balanced horizontally on a knife edge placed 5 cm from B with a mass of 60 g at B.

The question was attempted by 93.4 percent of the students whose scores were as follows: 86.0 percent scored from 0 to 2.5; 11.4 percent scored from 3.0 to 6.0 marks and 2.6 percent scored from 6.5 to 10 marks. Generally, students' performance in this question was weak because only 14 percent of them scored above 2.5 marks. Figure 4 provides the graphical presentation of these data.

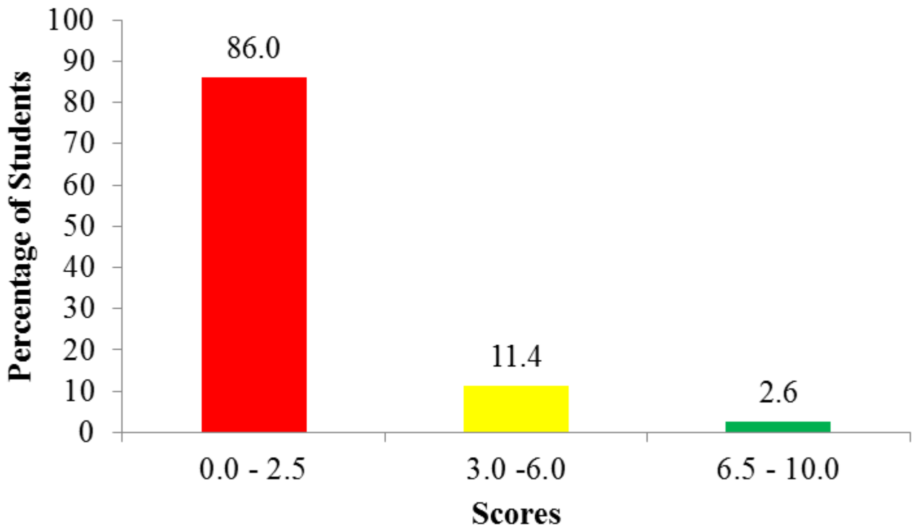


Figure 4: *Percentage of students, performance per score in question 4*

Students who scored poorly (86.0%) had inadequate knowledge of the concept of a body to be in equilibrium as they failed to provide the correct condition for a body to be in equilibrium. Some students failed to write down the difference between centre of mass and centre of gravity.

Consequently, they were not able to calculate mass of the ruler due to poor mathematical skills. They failed to locate the correct position of a pivot and mass of 60 g.

As extract 4.1 indicates, some of the students failed to draw even a sketch to support their calculations.

Extract 4.1

4. (a) State two conditions for a body to be in equilibrium.

(i) Solid Equilibrium

(ii) Liquad equilibrium

(b) Distinguish between centre of mass and centre of gravity.

Is the mass of the energy that is the mechanical advatange is less that Process of mass of a body and its acceleration is momentum change.

(c) A uniform metre rule is balanced horizontally on a knife edge placed 5cm from B with a mass of 60g at B. Find the mass of the ruler.

Soln

Data given

60g − 5cm = 45cm

mass of the ruler will be 45cm

Extract 4.1 indicates that a student failed to understand the question's demand. Consequently, the student provided irrelevant answers to all parts of the question.

On the other hand, students who performed well (14%) in this question were able to provide the correct conditions for a body to be in equilibrium.

This question had multiple options, but only two were demanded. They provided the correct difference between centre of mass and centre of gravity. They analyzed correctly the position of a pivot, mass given (60 g) and their corresponding distances from the centre of gravity which is always at the centre of the ruler. Finally they used the correct formula: clockwise moment = Anticlockwise moment to calculate mass of a ruler. Extract 4.2 is a sample of good response from one of the students who did well in this particular question.

Extract 4.2

4. (a) State two conditions for a body to be in equilibrium.

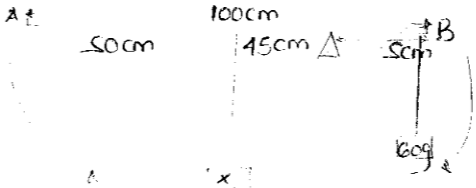
(i) upward forces should be equal to downward forces.

(ii) Sum of clockwise moments should be equal to sum of anti clockwise moments.

(b) Distinguish between centre of mass and centre of gravity.

centre of gravity is the ~~place~~ Point where the weight of a body is concetrated while centre of mass is the point where the mass of a body is concetiated

(c) A uniform metre rule is balanced horizontally on a knife edge placed 5cm from B with a mass of 60g at B. Find the mass of the ruler.



$\sum$ clockWise = $\sum$ anti clockWise.

$60 \times 5 = x \times 45$

$\frac{300}{45} = \frac{45x}{45}$ $x = 6.6667$

$\therefore$ Mass of the ruler is $6.67g$

Extract 4.2 is a sample of the best response from one of the students. It indicates that the student understood well the topic of Forces in equilibrium, particularly the concept of moments.

2.2.2 Question 5: Work, Energy and Power

Part (a) of this question required the students to give the meaning of energy. In part (b), the students were required to mention any four types of energy. In part (c), they were required to determine the velocity in km/h, when a min- bus of mass of one and a half tonnes is moving with kinetic energy of 30,000 J.

The question was attempted by 98.9 percent of the students whose scores were as follows: 28.6 percent scored from 0 to 2.5 marks; 64.4 percent scored from 3.0 to 6.0 marks and 7.0 percent scored from 6.5 to 10 marks. Generally, the students' performance in this question was good as 71.4 percent of them scored from 3.0 to 10.0 marks. Figure 5 provides the graphical presentation of these data.

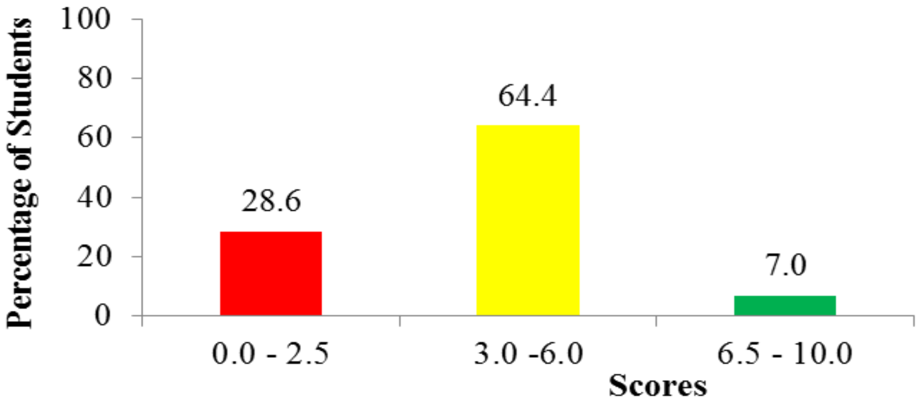


Figure 5: *Percentage of Students' Performance in Question 5.*

The students who performed well in this question were able to provide the correct meaning of the term energy, and to list any four types of energy. Nevertheless, these students managed to convert the given mass in tonnes to kilograms as the SI unit of mass and finally to use the correct formula; kinetic energy = $\frac{1}{2}$ x mass x (velocity) ^{2} to compute the velocity of the mini-bus. Finally, the students performed conversion of the final value of velocity obtained in m/s into km/h, indicating that they had enough knowledge in the concept of Kinetic energy and they had mastered mathematical computational skills. Extract 5.1 is an example of a good response from one of the students who attempted this question.

Extract 5.1

5. (a) What is energy? ...is ability of doing work.......................................

(b) Mention any four types of energy.

(i) ...Mechanical energy...

(ii) ...Heat energy...

(iii) ......Light energy...

(iv) ......Chemical energy...

(c) A min-bus of mass of one and a half tonnes is moving with kinetic energy of 30000J. What is its velocity in Km/h?

soln:-

$K.E = \frac{1}{2}MV^2$

Kinetic energy = 30000J

$30000J = \frac{1}{2} \times 1500kg \times v^2$

$\frac{30000}{750} = \frac{750}{750} kg \times v^2$

$v^2 = \sqrt{40}$

$= 2\sqrt{10} m/s$

72 km/hr → 20 m/s

? X = $2\sqrt{10}$ m/s

$= 72 \times 2\sqrt{10}$ m/s km/hr / 2010

$= 7.2\sqrt{10}$ km/hr

$= \frac{72\sqrt{10}}{10}$ km/hr

∴ velocity is $7.2\sqrt{10}$ km/hr

Extract 5.1 shows that the student understood the concept of energy and its respective types. Also, the student had enough mathematical skills which enabled him/her to calculate velocity in km/h.

On the other hand, the students who performed poorly, 28.6 percent, had inadequate knowledge of the concept of energy and inability to identify different types of energy exhibited in various forms. These students lacked content knowledge on the energy transformations when different objects are subjected to mechanical, electrical, chemical or nuclear converters and other transformation devices. Likewise, the students who performed poorly failed to integrate mathematical skills in finding the value of the velocity of the mini-bus expressed in km/h. Others failed to apply the correct formulae and instead used the irrelevant ones and consequently got incorrect answers. For instance, one student applied the formulae for velocity as follows: *velocity* = *work done* × *acceleration* which is incorrect. Another student related the impulse with momentum whose relationship does not assimilate the quantity for the kinetic energy as a result they failed to utilize the value of the kinetic energy provided in calculations. Extract 5.2 is a sample of a poor answer from one of the students.

Extract 5.2

5. (a) What is energy? is the weight has occupies space

(b) Mention any four types of energy.

(i) solid

(ii) liquid

(iii) matter

(iv) natural

(c) A min-bus of mass of one and a half tonnes is moving with kinetic energy of 30000J. What is its velocity in Km/h?

soln

~~t=30000~~

1km = 1000

t V = 30000J

$\frac{1km \times \cancel{1000}}{\cancel{1000}} = \frac{t \times 30\cancel{000}}{\cancel{1000}}$

V = 30 km/h

∴ Velocity in km/h is 30 km/h

Extract 5.2 presents the work of a student who failed to supply the correct responses to all parts of the question. The student mentioned the states of matter in part (b) instead of forms or types of energy.

2.2.3 Question 6: Pressure

The question had three parts: (a), (b) and (c). In part (a), the students were required to list down four uses of hydraulic press. Part (b), required the students to explain a hole at the bottom of a ship is more dangerous than the one that is near the surface. In part (c), they were required to calculate the pressure at the bottom of the sea water of 52 m deep, if the density of water is 1025 Kg/m^3 when the acceleration due to gravity (g) is 10 N/kg.

This question was attempted by 90.8 percent of the students. The analysis of the data as shown in Figure 6 indicates that 86.5 percent scored from 0 to 2.5 marks; 10.7 percent scored from 3.0 to 6.0 marks and 2.8 percent scored from 6.5 to 10 marks. These data indicate that the general performance in this question was weak since only 13.5 percent scored from 3.0 to 10 marks. Figure 6 shows a graphical representation of the data analyzed.

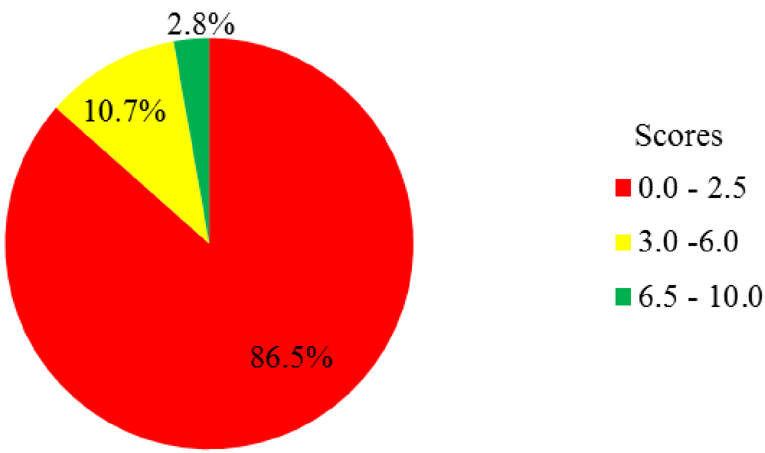


Figure 6: *Percentage of Students' performance in Question 6.*

The students who performed poorly in this question (86.5%) had inadequate knowledge of the concept of pressure. Some students failed to list down the uses of hydraulic press. These students did not know that hydraulic press can be used in industries to compress large objects such as a bale of cotton into a smaller size for more economical transport and in motor vehicles (in hydraulic brakes). Also they did not understand that hydraulic press is used to lift heavy loads and forming of metals in industries. Most of the students failed to recall that pressure increases with depth or height. The danger is due to high pressure and not the low pressure. Some students failed to recall the simple formula; Pressure = height x density x acceleration due to gravity to calculate the pressure at the bottom of the sea water. Extract 6.1 is a sample of a student's poor response.

Extract 6.1

6. (a) List down four uses of hydraulic press.

(i) Charging by contact

(ii) Charging by induction

(iii) charging by volume

(iv) Charging by digastion

(b) Why a hole at the bottom of a ship is more dangerous than the one that is near the surface? surface is the arth of more advantage volume space of neatra egribrium space.

(c) Calculate the pressure at the bottom of the sea water of 52m deep, if the density of water is 1025 Kg/m³. Take the acceleration due to gravity (g) as 10N/Kg.

water 52m x density 1025

density of water = $\frac{5330\cancel{0}}{1\cancel{0}\,N\,kg}$ = 533

∴ the acceleration due to gravity as 533

Extract 6.1 displays the incorrect responses given by a student who performed poorly in this question.

The students who scored high marks (2.8%) had sufficient knowledge of the concepts of pressure. These students were able to list down the uses of hydraulic press and to explain that a hole at the bottom of a ship is more dangerous than the one near the surface because pressure is direct proportional to the depth. Furthermore, they used the correct formula to calculate the needed pressure at the bottom of the sea as shown in extract 6.2.

Extract 6.2

6. (a) List down four uses of hydraulic press.

(i) Is used in car brake system.

(ii) Is used to raise heavy loads in harbours.

(iii) Used to compress items in industries e.g cotton bales

(iv) Used in ship building to lift heavy loads.

(b) Why a hole at the bottom of a ship is more dangerous than the one that is near the surface? The hole at bottom of the ship is more dangerous because the pressure exerted at the bottom by the water is very high compared to that near the surface. So the hole at the bottom may lead to sinking of the ship.

(c) Calculate the pressure at the bottom of the sea water of 52m deep, if the density of water is 1025 Kg/m³. Take the acceleration due to gravity (g) as 10N/Kg.

Soln

$h = 52\ m$

ρ water $= 1025\ kg/m^3$

$a = 10\ N/kg$

from

$P = \rho hg$

$P = \rho hg$

$P = 52m \times 1025\ kg/m^3 \times 10\ N/kg$

$P = 533000\ N/m^2$

$\therefore P = 533000\ N/m^2$

Extract 6.2 shows how a student managed to provide accurate responses and apply the correct formula in calculations to obtain the required answer.

2.2.4 Question 7: Motion in a Straight Line

This question required the students to: (a) give the meaning of acceleration. (b) state the condition under which the acceleration is uniform and (c) calculate the acceleration of a car with a velocity of 90 km/h which is uniformly retarded and brought to rest after 10 seconds.

The majority (90.8%) of students attempted the question, out of them 79.1 percent scored from 0 to 2.5 marks, including 41.1 percent who scored zero; 18.7 percent scored from 3.0 to 6.0 marks and 2.2 percent scored from 6.5 to 10 marks. These scores indicate that the question was performed poorly since only 20.9 percent scored from 3.0 to 10 marks. Figure 7 is the graph which indicates the scores in this question.

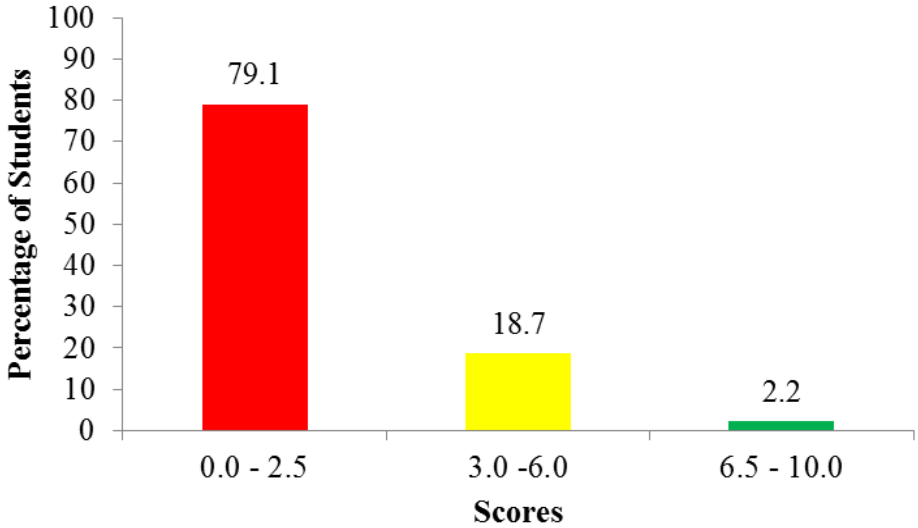


Figure 7: *Percentage of Students' performance in Question 7.*

The students who performed poorly had insufficient knowledge about the concept of Motion in a Straight Line; consequently they were not able to give the correct answers to most parts of the question. They could not recall that acceleration is the rate of change of velocity. These students had an idea of the basic concepts of Linear Motion in general but failed to elaborate the concepts therein.

Moreover, some students failed to state the condition under which the acceleration is said to be uniform. One student wrote, *Acceleration is said to be uniform during driving a car, where a car can start at rest and accelerate up to the 20 km/h*. This student did not know that for a body to be moving with a uniform acceleration the necessary condition is that its velocity must be constant but not necessarily 20 km/h. In part (b), some students failed even to identify the part of the syllabus where the content matter comes from. For example, one student responded to the condition under which the acceleration is said to be uniform by writing *is the ability of an object to do work*. This answer is actually a work, energy and Power related concept. The answer is an indicator that the student is not aware of where the term acceleration is found in the Physics syllabus.

Furthermore, in part (c) of the question, the students failed to recognize that when a body is uniformly retarded and brought to rest its final velocity becomes zero. They were therefore, supposed to employ the first equation of motion to calculate the acceleration of the car. Most of the students failed to convert one unit into another. In this aspect, students failed to convert the velocity of 90 km/h into m/s, and consequently failed to obtain the correct final answer. Extract 7.1 is a sample of a students' poor response.

Extract 7.1

7. (a) What is meant by acceleration? acceleration is the product of velocity with time.

(b) In which case the acceleration is said to be uniform? If the rate of change of velocity with time.

(c) A car with a velocity of 90km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

Solution

Velocity = 90 km/h

Time taken = 10 seconds

acceleration = ?

acceleration = Velocity x Time taken

acceleration = 90 km/h x 10 s

acceleration = 900 km/h s

In extract 7.1, a student failed to provide the correct responses to all parts of the question.

On the other hand, students who performed well in this question had adequate knowledge of the concept of Motion in Straight Line especially the aspect of uniformly accelerated and decelerated bodies. Students who scored the highest marks in this question were able to give the meaning of the term acceleration and explained correctly the necessary condition for the acceleration to be uniform.

These students applied the proper methods of converting units expressed in km/h into m/s. They also recognized that when the car is uniformly retarded and brought to rest its final velocity becomes zero. Finally, they applied correctly the first equation of motion $v = u + a\,t$ to obtain the value of the acceleration of the car. Extract 7.2 is a sample answer from one of the students who performed the question well.

Extract 7.2

7. (a) What is meant by acceleration? Acceleration is defined as the rate of change of velocity of a body.

(b) In which case the acceleration is said to be uniform? The acceleration of a body is said to be uniform when there is a constant rate of change of velocity of the body.

(c) A car with a velocity of 90km/h is uniformly retarded and brought to rest after 10 seconds. Calculate its acceleration.

Data given

Initial velocity = 90 km/h = ?

$$\frac{90\,km \times 1000\,m}{1\,hr \times 3600\,sec} = 25\,m/s.$$

Initial velocity (u) = 25 m/s.

Final velocity (v) = 0 m/s.

Time (t) = 10 sec.

$$a = \frac{v-u}{t}$$

$$a = \frac{0-25}{10}$$

$$a = \frac{-25}{10}$$

$$a = -2.5\ m/s^2.$$

$\therefore$ Its acceleration is $-2.5\,m/s^2$

Extract 7.2 is an example of a good response from one of the students who scored high marks in the question.

2.2.5 Question 8: Simple Machines

This question had three parts, namely (a), (b) and (c). Part (a) required students to define the terms machine and load. In part (b), they were required to explain why efficiency of a machine is less than 100%. Part (c) required them to calculate mechanical advantage and velocity ratio.

The question was attempted by 95.7 percent of the students whose scores were as follows: 59.7 percent scored 0 to 2.5 marks including 33.5 percent who scored zero; 26.3 percent scored from 3.0 to 6.0 marks and 14.0 percent scored from 6.5 to 10 marks. The general performance in this question was average because only 40.3 percent of them scored above 2.5 marks. Figure 8 is a graphical representation of these data.

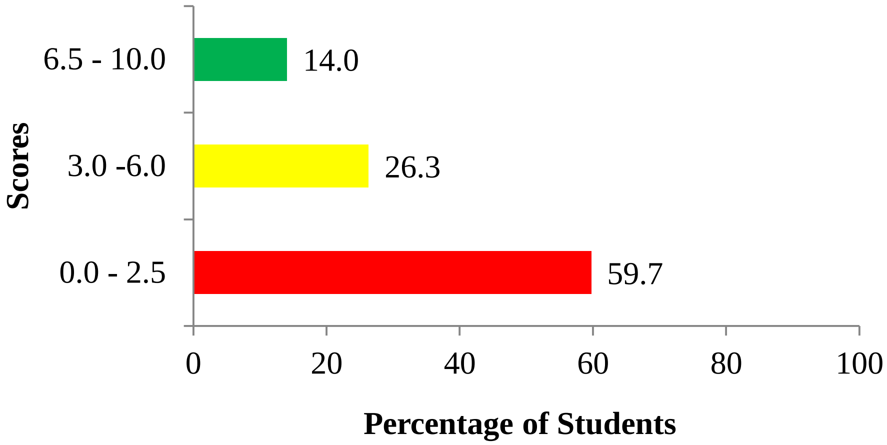


Figure 8: *Percentage of Students' performance in Question 8.*

Low achievers (59.7 percent) provided incorrect answers to most parts of the question. This indicates that they had insufficient knowledge of the basic concepts of simple machines as they failed to define the terms machine and load. This performance further implies that students were not informed that the efficiency of a machine is not 100%. They failed to calculate the mechanical advantage and velocity ratio as they did not have knowledge of mechanical advantage and velocity ratio and how they are related by the mathematical formula; Mechanical advantage = Load/Effort and velocity ratio = (Distance moved by the effort)/ (Distance moved by the load). Extract 8.1 is a sample answer from one of the students who performed poorly in this question.

Extract 8.1

8 (a) Define the following terms as applied in Physics.

(i) Machine. Is the used to keep the something in a simple things forexample to keep the Car from that Station they have until.

(ii) Load. Is used of the pulley when you want to demostrate the pulley it must be to put this Load foam of add weight of you Pulley system.

(b) Why efficiency of machine is less than 100%? Briefly explain.

because of the when the machine is higher than the 100% is be lett afect of machine so we should put In the machine efficiency less than 100% and its not higher than 100%.

(c) Simple machine was used to raise a load of weight 4000 N through a height 0.8 m using an effort of 800 N. If the distance moved by effort was 4.8 m, calculate the:

(i) Mechanical advantage.

Soln

mechanical advantage = $\frac{\text{Load}}{\text{effort}}$ =

weight = 4000N
height = 0·8m
effort = 800N
effort = 4·8m
mechanical advantage?

4000
08
800
4808

$\frac{4808}{48}$

∴ mechanical advantage = 0·1

(ii) Velocity ratio.

Vr = 400N + 0·8 = 408N

408
800

∴ the Velocity ration = 326400N

Extract 8.1 illustrates the answer of a student who lacked knowledge of the concepts of Mechanical advantage, Velocity ratio and Efficiency in Simple Machines.

High achievers (40.3%) demonstrated mastery of the concept of simple machines as they were able to correctly define the terms machine and load. These students also managed to explain that the efficiency of a machine is not 100% because of friction. They used the proper formulae to calculate mechanical advantage and velocity ratio. Generally they were good in mathematical skills. Extract 8.2 is a sample of good responses.

Extract 8.2

8. (a) Define the following terms as applied in Physics.

(i) Machine is anything that simplifies work.

(ii) Load is the force that is overcomed by a machine.

(b) Why efficiency of machine is less than 100%? Briefly explain.

Efficiency of a machine is less than 100% because ~~the~~ ~~e~~ some of the effort applied is used to overcom friction in some moving parts of a machine.

(c) Simple machine was used to raise a load of weight 4000 N through a height 0.8 m using an effort of 800 N. If the distance moved by effort was 4.8 m, calculate the:

(i) Mechanical advantage.

Given - load 4000 N
- Effort 800 N
- MA ?

$$M.A = \text{Load}/\text{Effort}$$

$$= \frac{4000}{800}$$

$$= 5$$

∴ Machenical Advantage is 5

(ii) Velocity ratio.

Given - DL = 0.8 m
- DE = 4.8 m
- VR = ?

$$VR = \frac{D.E}{D.L} = \frac{(\text{Distance moved by Effort})}{(\text{Distance moved by load})}$$

$$= \frac{4.8 \times 10}{0.8 \times 10}$$

$$= \frac{48}{8}$$

$$= 6$$

∴ Velocity ratio is 6

Extract 8.2 shows a good response from one of the students who scored the highest marks in this question.

2.3 Section C: Short Answer Questions

2.3.1 Question 9: Pressure

In this question students were required to: (a) explain how water will spurt through the bottom and the top hole of the water-can if water is filled in the can, supposing the water-can has three holes punched at the bottom, middle and almost at the top. In part (b) (i), explain why it is easier to cut a piece of meat with a sharp knife than when using blunt knife. In part (ii), calculate the pressure exerted at the tip of the needle if the tip of a needle of hypodermic syringe has a cross section area of $1x10^{-6}m^2$, if a doctor applies a force of 20 N to a syringe that is connected to the needle. In Part (c), calculate the force required to be applied to the bigger piston to stop it moving if the force of 120 N is applied to the small piston, such that, small piston of hydraulic press has an area of $3.0x10^{-4}m^2$, the bigger piston has an area of $2.0\ x10^{-2}m^2$ and that the two pistons are in the same level.

The analysis shows that 82.2 percent of students attempted this question and out of them 84.8 percent scored from 0 to 2.5 marks; 10.3 percent scored from 3.0 to 6.0 and only 4.9 percentage scored from 6.5 to 10 marks. The students' performance in this question was generally weak because only 15.2 percent of them scored above 2.5 marks. These data are summarized in figure 9.

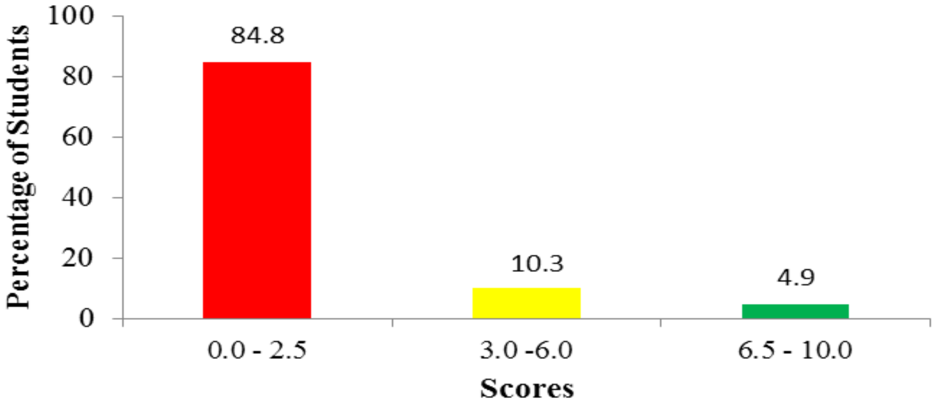


Figure 9: *shows only 15.2 percent of students who were able to score from 3.0 to 10 marks in question 9.*

Students who performed poorly in this question had inadequate knowledge of the concept of pressure and the factors affecting it. They failed to identify that pressure has several factors like height and density, and that pressure increases with depth. The larger the depth the larger the pressure and thus the larger the depth the larger the distance water covers. This accounts for the hole at the bottom of the container. In the case of the hole near the top (small depth), low pressure is experienced when compared to that at the bottom.

The students also failed to recognize the fact that, pressure is inversely proportion to area. Thus a knife of small area exerts larger pressure (sharp one) unlike the blunt knife (larger area) which exerts small pressure, thus making it difficult to cut meat with a blunt knife. The logical concept in this section was that it is easier to cut meat with a large pressure knife which is associated with small area and the opposite is true.

Some students were unable to recognize the logical relationship of the equation $\frac{F}{A} = P$. Others recognized the right formula but failed to simplify the large exponent like $1x10^{-6}m^2$ due to poor mathematical skills. Furthermore students had inadequate knowledge about hydraulic press (its principle) which provides the mathematical formula. They failed to understand that the word same level means same pressure to either side of hydraulic press arms. Some students wrote unmatched responses indicating that they did not understand the demand of the question. This seems to suggest that incompetence in the English language has contributed to students' poor performance. Extract 9.1 shows a sample of poor response from one of the students who scored low marks in this question.

Extract 9.1

9. (a) A water can has three holes punched the first at the bottom, the second at the middle and the third hole almost at the top. If water is filled in the can, how will the water spurt through the bottom and the top hole? ……………………………..

i) First punched at the botton

ii) second Middle at the ~~bottom~~ middle.

iii) third hole at the top

(b) (i) Why is it easier to cut a piece of meat with sharp knife than when using blunt knife? ……………………………………………………………..

The easier is to reall the eyeces if It see the section was ligh of piece meat with sharp knife that when using blunt knife.

(ii) The tip of a needle of hypodermic syringe has a cross-sectional area of $1 \times 10^{-6} m^2$. If a doctor applies a force of 20 N to a syringe that is connected to the needle, what is the pressure exerted at the tip of needle?

soln

$1 \times 10^{-6} m^2 = 20N$

$\frac{-6\cancel{0} m^2}{2\cancel{0}} = \frac{2\cancel{0}N}{2\cancel{0}}$

$N = -3m^2$

$= 3N/M^2$

∴ preassure exted at the tip of needle is $-3N/M^2$.

(c) The small piston of hydraulic press has an area of $3.0 \times 10^{-4} m^2$ and the bigger piston has an area of $2.0 \times 10^{-2} m^2$. The two pistons are in the same level. If the force of 120 N is applied to the small piston, calculate the force required to be applied to the bigger piston to stop it moving.

soln

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

$120N = \frac{3.0 \times 10^{-4} m^2}{2.0 \times 10^{-2} m^2}$

$120N = \frac{3\cancel{0}^{-8} \cancel{m}}{2\cancel{0}^{-4} \cancel{m}}$

$\frac{120N}{2} = \frac{3}{2}$

$60N = \frac{3}{2}^{+4}$ answer

Page 11 of 13

CC-18/FTNA

Extract 9.1 shows a poor response from one of the students who scored low marks in this question. The student failed to understand the question and thus provided irrelevant answers.

On the other hand, students who did well (15.2%) had adequate knowledge of the basic concepts of the application of pressure and factors affecting pressure. They were able to justify that pressure increases with depth. The students had enough knowledge about the application of pressure on their daily life, as they were able to explain the concept of area in relation to pressure. They explained the key concepts about pressure. Furthermore, they provided the theory of hydraulic press in accordance with the requirement of the question. Extract 9.2 portrays a sample of good response from one of the students who scored high marks in this question.

Extract 9.2

9. (a) A water can has three holes punched the first at the bottom, the second at the middle and the third hole almost at the top. If water is filled in the can, how will the water spurt through the bottom and the top hole? the water at the buttom will spurt far distance because it comes with high pressure and the top hole water will spurt nearer distance to the water can because it has low pressure.

(b) (i) Why is it easier to cut a piece of meat with sharp knife than when using blunt knife? sharp knife has a small area which ~~exert~~ gives high pressure when cutting the meat unlike to blunt knive which have ~~high~~ large area and gives low pressure when cutting

(ii) The tip of a needle of hypodermic syringe has a cross-sectional area of $1 \times 10^{-6} m^2$. If a doctor applies a force of 20 N to a syringe that is connected to the needle, what is the pressure exerted at the tip of needle?

Soln.

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

$$P = \frac{20N}{1 \times 10^{-6} m^2}$$

$$P = \frac{\cancel{20N}\ 2 \times 10^{1} N}{1 \times 10^{-6} m^2}$$

$$P = \frac{2 \times 10^{1} \div 10^{-6} N}{1 m^2}$$

$$P = \frac{2 \times 10^{(1 - -6)} N}{1 m^2}$$

$$P = \frac{2 \times 10^{7} N}{1 m^2}$$

$$P = 20000000 N/m^2$$

∴ Pressure exerted at the tip of needle is 20000000 pascal.

(c) The small piston of hydraulic press has an area of $3.0 \times 10^{-4} m^2$ and the bigger piston has an area of $2.0 \times 10^{-2} m^2$. The two pistons are in the same level. If the force of 120 N is applied to the small piston, calculate the force required to be applied to the bigger piston to stop it moving.

Soln.

Data:

Force$_1$ = 120N

Force$_2$ = x.

$A_1 = 3 \times 10^{-4} m^2$

$A_2 = 2 \times 10^{-2} m^2$

From $P_1 = P_2$

$$\frac{F_1}{A_1} = \frac{F_2}{A_2}$$

$$\frac{120N}{3 \times 10^{-4} m^2} = \frac{F_2 (x)}{2 \times 10^{-2}}$$

$$\frac{12 \times 10^{1} N}{3 \times 10^{-4} m^2} = \frac{F_2}{2 \times 10^{-2} m^2}$$

$$\frac{12 \times 10^{1} \div 10^{-4} N}{3 m^2} = \frac{F_2}{0.02 m^2}$$

$$\frac{12 \times 10^{(1 - -4)} N}{3 m^2} = \frac{F_2}{\cancel{0.00}\ 0.02 m^2}$$

$$\frac{4 \times 10^{5} N/m^2}{1} \times 0.02 m^2 = F_2$$

$$400000 N/m^2 \times 0.02 m^2 = F_2$$

$$8000 N = F_2$$

~~F₂ = 8~~

∴ the force required is 8000N

Page 11 of 13

CC-18/FTNA

Extract 9.2 shows a sample answer from a student who answered this question well. He/she provided accurate responses to all parts of the question and demonstrated good mastery of mathematical skills.

2.3.2 Question 10: Current Electricity

The question had three parts (a), (b) and (c). Part (a) required students to define the word coulomb while part (b) required students to state ohm's law. In part (c) (i) students were supposed to draw a schematic diagram of two resistors of 3 Ω and 6 Ω connected in parallel to a 3V battery, while in (c) (ii) students were required to calculate the effective resistance of the circuit. Furthermore, in part (c) (iii), students were required to calculate the current passing through a 6 Ω resistor.

The question was attempted by majority (90.3%) of the students and out of them, 81.9 percent scored from 0 to 2.5 marks, 14.6 percent scored from 3.0 to 6.0 marks and 3.5 percent scored from 6.5 to 10 marks. These scores indicate that the question was poorly performed since only 18.1 percent scored above 2.5 marks. Figure 10 portrays the performance of students in this question.

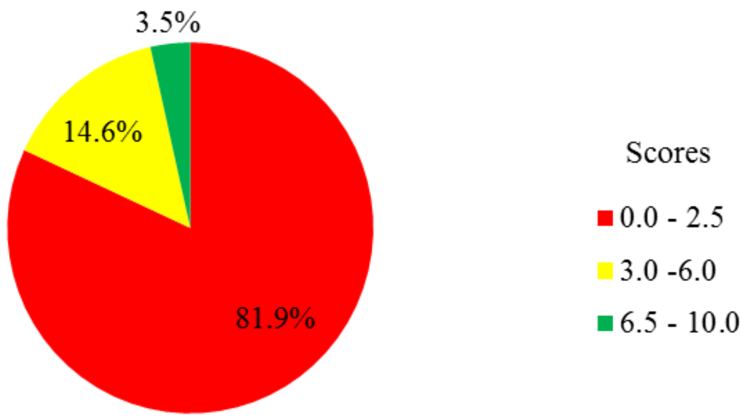


Figure 10: *Percentage of Students' performance in Question 10.*

Students who scored low marks (81.9%) provided incorrect responses due to lack of knowledge on the basic concepts of current electricity. They were unable to define the term coulomb. Some students failed to distinguish coulomb from current as they wrote the definition of current instead of coulomb. Also, some of them failed to state ohm's law. They failed to recall that voltage is direct proportional to current for any conductor, provided that temperature and other physical conditions remain constant.

Others wrote *Voltage is proportional to resistance* which is a wrong answer.

Generally, these students lacked mathematical skills of variations. Some students seemed to have a problem of identifying which is a series or parallel circuit. They also failed to draw a circuit diagram especially parallel just in case the circuit diagram was not given. Also, they were unable to combine or calculate the effective resistance of a parallel circuit. They failed to recognize that voltage in a parallel circuit for every involved resistor is the same. Moreover, they had insufficient knowledge about practical demonstration of parallel circuit. Consequently, students confused the ideas of effective capacitance with resistance in a circuit. They wrote an equation expressing effective capacitance when three capacitors are connected in series to mean effective resistance for three resistors in parallel. This implies that, they failed to understand the question as they could not make a distinction between resistors and capacitors. They had little knowledge of both static and current electricity. Extract 10.1 presents the sample of an incorrect answer.

Extract 10.1

10. (a) Define the word coulomb……………………………………

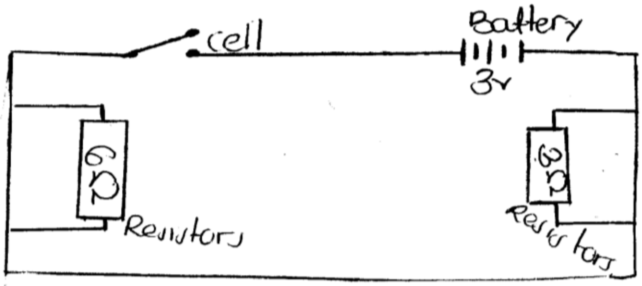
Word coulomb is the process of attract the magnetic poles substance.

(b) States Ohm's law……………………………………

~~Uto~~ It state that "Unlike charge magnetic pole is like attract other charge".

(c) Two resistors of 3Ω and 6Ω are connected in parallel to a 3V battery.

(i) Draw the schematic diagram.



(ii) Find the effective resistance of the circuit.

$6\Omega \times 3\Omega$

$= 18\Omega$

The effective ~~resist~~ resistance of the circuit $= 18\Omega$

(iii) Calculate the current passing through a 6Ω resistor.

soln

$\cancel{6\Omega} = \frac{6\Omega \times 3\Omega}{3\Omega}$

$\cancel{6\Omega} = \frac{18\Omega}{3\Omega}$

$= \frac{6\Omega}{6\Omega}$

$= 1\Omega$ answer

Extract 10.1 displays the incorrect responses given by a student who performed poorly in this question.

Students who performed well were able to define correctly the term coulomb and state ohm’s law. Furthermore, they drew the circuit diagram appropriately indicating that they were knowledgeable about combining parallel resistors. They managed to recall that potential drop for any two resistors connected in parallel is the same. Extract 10.2 is the answer from the script of one of the students who performed the question well.

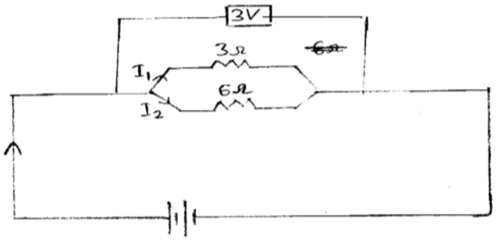
Extract 10.2

10 (a) Define the word coulomb. Coulomb is defined as the ~~quantity of~~ ~~or~~ amount of electric current of 1 Ampere flowing at a given point in 1 second.

(b) States Ohm's law. The Ohm's law states that "the current flowing through a conductor is directly proportional to the voltage across it, provided that temperature and other physical factors remains constant"

(c) Two resistors of 3Ω and 6Ω are connected in parallel to a 3V battery.

(i) Draw the schematic diagram.



(ii) Find the effective resistance of the circuit.

$R_1 = 3\Omega$

$R_2 = 6\Omega$

Effective resistance $= \cancel{\frac{R_1R_2}{R_1+1}}$ $\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_T}$ OR $\frac{R_1R_2}{R_1+R_2}$

Parallel connection,

$\frac{1}{R_1} + \frac{1}{R_2} = \frac{1}{R_T}$

$\frac{1}{3} + \frac{1}{6} = \frac{1}{R_1}$

$\frac{2+1}{6} = \frac{1}{R_1}$

$\frac{3}{6} \times \frac{1}{R_1}$

$\frac{6}{3} = \frac{3R_1}{3}$

Effective resistance of the circuit is 2Ω

(iii) Calculate the current passing through a 6Ω resistor.

Current passing through 6Ω = ?

Parallel connection have same pd distribution.

To calculate I_2.

$V = 3V$

$R = 6\Omega$

$I_2 = ?$

From Ohm's law,

$V = IR$

$\frac{3V}{6} = \frac{I \times 6}{6}$

$I_2 = \frac{1}{2} = 0.5A$

∴ The current flowing through a 6Ω resistor is 0.5A.

Extract 10.2 shows a sample answer from a student who attempted this question correctly.

3.0 ANALYSIS OF STUDENTS' PERFORMANCE

3.1 Students' performance in each topic

The Physics paper had ten (10) questions extracted from various topics of form I and II basing on the Form Two National Assessment Format issued in 2017. The analysis of performance shows that two questions (1 and 5) had good performance since the percentages of the students who passed were 89.1 and 71.4 respectively. Question 1 was a multiple choice question that was set from different topics. The topics included: *Introduction to Laboratory practice; Measurement; Force*; *Archimedes Principle and Law of Flotation*; *Structure and Properties of Matter*; *Pressure*; *Work, Energy and Power*; *Light*; *Static Electricity*; *Magnetism*; *Forces in Equilibrium*; *Motion in a Straight Line*; *Simple Machines*; *Newton's Laws of Motion*; *Sustainable Energy Sources* and *Current Electricity*. Question 5 was set from the topic of *Work, Energy and Power*. Questions 2 and 8 tested the topic of *Simple Machines* and were averagely performed (47.2%).

Besides, the analysis shows that, the remaining six (6) questions had poor performance as most of the students scored below 30 percent in each question. These questions were constructed from the topics of *Structure and properties of matter*; *Force*; *Light*; *Forces in Equilibrium*; *Pressure*; *Motion in a Straight Line* and *Current Electricity*.

Appendix I summarizes the students' performance in each topic. Red, yellow and green colours show weak, average and good performance respectively.

3.2 Comparison of students' performance between 2017 and 2018 in terms of topics and grades

The comparison of students' performance in terms of topics tested in FTNA 2017 with the 2018 performance indicates that there is a drop or rise in performance in some of the topics. The reflection of performance of the students shows a rapid increase in performance from 75.0 percent in 2017 to 89.1 percent in 2018 for the multiple choice items in question 1 derived from different topics.

Another significant rise in performance was observed in the topic of *Work, Energy and Power* in which the performance of the students in 2017 was average (44.5%) compared with performance in 2018 which has improved up to 71.4 percent. This significant improvement is an indicator that teachers and students had put much effort to improve performance.

Furthermore, the analysis reveals that in 2017 the performance was weak (19.4%) in the topic of *Motion in a Straight Line*, but in 2018, the performance in the same topic has slightly increased to 20.9 percent. This improvement is insignificant because the performance is still weak.

Despite this achievement in the topic of *Work, Energy and Power*, some topics still need to be seriously dealt with to improve the students' performance. The topics include *Current Electricity* whose performance was 13.5 percent in 2017 and 18.1 percent in 2018; *Pressure* whose performance dropped from15.1 percent in 2017 to 14.4 percent in 2018 and *Forces in Equilibrium* whose performance improved from 10.2 in 2017 to 14.0 in 2018 (*See appendix II*).

When comparing the results in terms of grades, the data show that 503,875 students sat for the physics FTNA 2018 and 128,329 students sat for the same level in 2017. The performance in terms of grades shows that, there was a slight increase of performance in 2018 where by 48.01 percent of students scored from A to D. Also, an F score decreased from 63.26 percent in 2017 to 51.99 percent in 2018.

Further analysis shows that, 13,662 (2.72%) students scored an A in 2018 as compared to 10,177 (2.11%) students who scored an A in 2017. However, 15,298 (3.05%) students scored a B grade in 2018 compared to 2017 results where 13,216 (2.74%) scored a B grade being a rise of 0.31 percent.

Also, 61,233(12.20%) students in 2018 scored a C grade unlike 2017 whereby 51,545(10.68%) students scored a C .This is 1.52 percent less than the 2018 performance. In the year 2018, 150,822(30.04%) students scored a D whilst 102,473(21.22%) students scored the same grade in 2017. This marks a significant increase of 8.8 percent (*See appendix III*).

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The analysis of performance in terms of questions in Physics, 2018 clearly highlighted the challenges faced by students in understanding the content and requirements of the particular questions. The analysis also provides the suggestions that can help to overcome the observed problems. It has been shown that failure to understand certain concepts necessary for answering most of the questions, coupled with the poor conceptualization of the subject matter by the students, has led to the poor performance. Besides, difficulty in applying mathematical knowledge to solve questions which required the use of mathematical skills caused some students to fail to work with the data given so as to attain the required answers. This was observed in questions 4, 5, 6, 7, 8, 9 and 10 which were set from the topics of *Forces in Equilibrium*; *Work, Energy and Power*; *Pressure*; *Motion in a Straight Line*; *Simple Machines*; and *Current Electricity*.

Furthermore, lack of sketching and drawing skills led the students to achieve low marks as they drew poor diagrams. This was observed in questions 4 and 10 which were set from the topics of *Forces in Equilibrium* and *Current Electricity* respectively. In both cases, the students failed to interpret the explanations provided in the question and transform them into simple diagrams for easy formulation of formulae and calculations.

Incompetence in English also caused some of the students to fail to present their responses correctly especially those items which required explanations.

Generally, the students' performance in this paper was average, although most of the questions were poorly done. The only items which were well performed were the multiple choice items and question 5 which was extracted from the topic of *Work, Energy and Power*. These questions were well performed because most of students had sufficient content knowledge on particular topics. The averagely performed questions were questions 2 and 8 which were constructed from the topic of *Simple Machines*. This is an indicator that the topic of simple machines was well understood during the process of teaching and learning. The rest of the questions had poor performance (*See appendix I)*.

Although this performance is not encouraging, the general performance in this year has improved by 3.24 percent as compared to last year when 44.77 percent of the students passed. The general performance for the year 2018 was average (48.01%). The comparison in performance between the year 2017 and 2018 is shown in Appendix II.

It is expected that the feedback given in this report will enable students, teachers, parents, school managers and directors and all education stakeholders to take necessary measures to improve students' performance in future FTNA Physics assessments.

4.2 Recommendations

In order to improve the students' performance in the future, the following recommendations should be taken into account:

(a) During preparation and assessment periods, students need to be repeatedly advised on the importance of identifying the requirements of the question before attempting the question.

(b) Students need to assimilate the knowledge acquired in mathematics to solve different questions involving calculations.

(c) Students should be encouraged to use English in their day to day communication in order to strengthen their ability to explain various concepts in English.

(d) Teachers should use various teaching methods such as jig saw, think pair share (TPS), gallery work, project work, formation of Physics clubs as well as study tour so as to raise the interest of students to learn Physics.

(e) Teachers should emphasize on demonstrations and drawing activities in order to enable the students develop drawing skills in various topics.

(f) Teachers should cover the syllabus in time to give the students enough time to make revisions.

(g) During the process of teaching and learning, teachers and students should concentrate much on the topics of *Motion in Straight Line*; *Current Electricity*; *Pressure*; *Forces in Equilibrium*; *Structure and Properties of Matter*; *Force*; and *Light* which were observed to have poor performance.

APPENDICES

Appendix I

THE STUDENTS' PERFORMANCE IN PHYSICS IN EACH QUESTION IN 2018

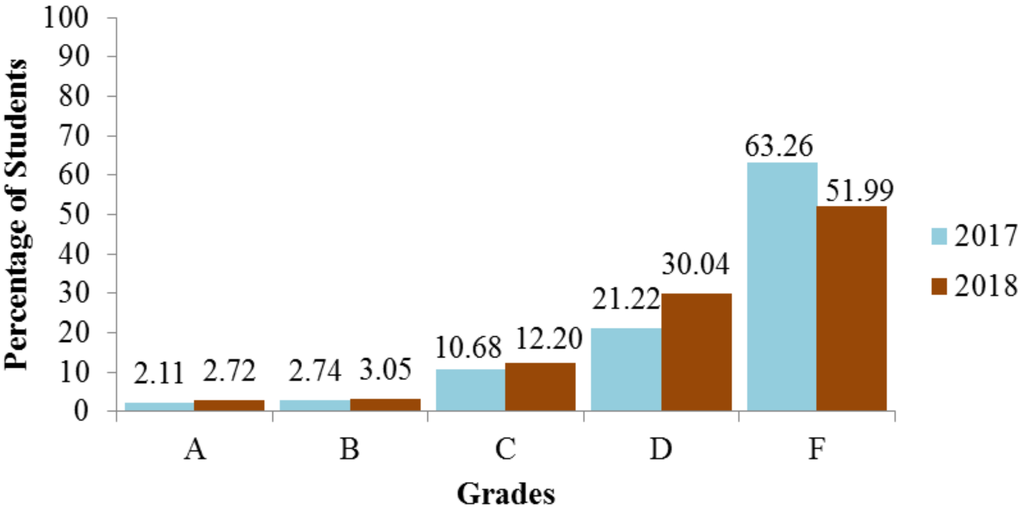
S/n	Topic	Question Number	The percentage of students who scored the average of 30% and above	Remarks
1	Introduction to Laboratory practice; Measurement; Force; Archimedes Principle and Law of Flotation; Structure and properties of matter; Pressure ; Work, Energy and Power; Light; Static Electricity; Magnetism; Forces in Equilibrium; Motion in Straight Line; Simple Machines; Newton's Laws of Motion; Sustainable Energy Sources; and Current Electricity.	1	89.1	Good
2	Wok, Ennery and Power	5	71.4	Good
3	Simple Machines	2 & 8	47.2	Average
4	Motion in Straight Line	7	20.9	Weak
5	Current Electricity	10	18.1	Weak
6	Pressure	6 & 9	14.4	Weak
7	Forces in Equilibrium	4	14.0	Weak
8	Structure and properties of matter, Force, Simple Machines and Light	3	5.6	Weak

Appendix II

COMPARISON OF STUDENTS' PERFORMANCE BETWEEN 2017 AND 2018 IN TERMS OF TOPICS

S/n	Topic	2017			2018		
		Number of Questions	**The percentage of students who scored the average of 30% and above**	**Remarks**	**Number of Questions**	**The percent age of students who scored an average of 30% and above**	**Remarks**
1.	Introduction to Laboratory practice; Measurement; Force; Archimedes Principle and Law of Flotation; Structure and properties of matter; Pressure ; work ,energy and power; Light; Static Electricity; Magnetism; Forces in Equilibrium; Motion in Straight line; Simple Machines;	1	75.0	Good	1	89.1	Good

	Newton's laws of Motion; Sustainable Energy Sources; and Current Electricity.						
2.	Work, Energy and Power	1	44.5	Average	1	71.4	Good
3	Simple Machines				2	47.2	Average
4.	Motion in Straight Line	1	19.4	Weak	1	20.9	Weak
5.	Current Electricity	1	13.5	Weak	1	18.1	Weak
6.	Pressure	2	15.1	Weak	2	14.4	Weak
7.	Forces in Equilibrium	1	10.2	Weak	1	14.0	Weak
8.	Structure and properties of matter, Force, Simple Machines and Light				1	5.6	Weak



The performance of students in the year 2017 and 2018 in different grades