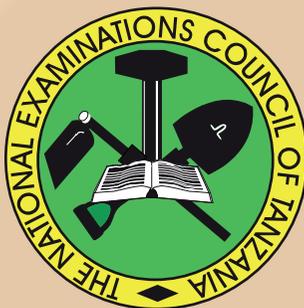


THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA



**STUDENTS' ITEMS RESPONSE ANALYSIS
REPORT FOR THE FORM TWO NATIONAL
ASSESSMENT (FTNA) 2017**

032 CHEMISTRY

THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA



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032 CHEMISTRY

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FOREWORD

This Students' Items Response Analysis Report has been prepared to provide feedback to students, teachers, parents, policy makers and the public in general, on the performance of the students who sat for the Chemistry Form Two National Assessment (FTNA), in 2017.

The Form Two National Assessment is a two years formative evaluation which, among other things, shows the effectiveness of the educational system in general and the educational delivery system in particular. Essentially, the students' responses to the assessment questions is a strong indicator of what the educational system was able or unable to offer to the students in their two years of secondary education.

The analysis presented in this report is intended to contribute towards the understanding of some of the reasons behind the performance of the students in Chemistry subject. The report highlights some of the factors that made the students score high marks and also the factors that made some score low marks in each question. The factors which made some of the students fail to score high marks include, inadequate knowledge in the respective topics, inability to identify the demands of the questions, poor mathematical skills, lack of English Language proficiency and lack of exposure to laboratory activities. The feedback provided will enable the educational administrators, school managers, teachers and students to identify proper measures to be taken in order to improve the students' performance in future Assessments administered by the Council.

The Council would like to thank Chemistry Subject Coordinators, Examiners and all others who participated in the preparation of this report. The Council would also like to express sincere appreciation to all the staff who participated in the analysis of data used in the report.

The National Examinations Council of Tanzania will highly appreciate constructive comments and suggestions from teachers and other education stakeholders in general for improving future reports.



Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report analyses the performance of the students who sat for the Form Two National Assessment (FTNA), 2017 in Chemistry subject. The 2017 Chemistry Assessment was set according to the FTNA format which was developed from the 2010 Chemistry syllabus for secondary education for Form I and II levels.

The paper comprised two sections namely, A and B. Section A consisted of ten multiple choice items, five matching items and five filling in the blanks items. Section B comprised of eight short answer questions. The students had to answer all the questions. Section A had a total of 20 marks, whereas section B had 80 marks.

In 2017 a total of 485,133 students sat for Chemistry assessment, of which 251,709 students (51.98%) passed while in 2016, a total of 409,327 students sat for the assessment and 45.76 percent passed. This data shows that, there is an increase of 18.52 percent of the students who sat for the subject in 2017 which is an increase of 6.22 percent of students who passed when compared to 2016.

This report is divided into four sections. The first section is an introduction and the second is the analysis of the students' performance. The third section is an analysis of performance in each topic and the fourth is on conclusion and recommendations.

2.0 ANALYSIS OF THE STUDENTS PERFORMANCE IN EACH QUESTION

In this analysis, the students' performance has been categorized as poor, average or good on the basis of score intervals of 0 – 29, 30 – 64 and 65 – 100 respectively as shown in appendix 1.

2.1 SECTION A

This section consisted of two (2) questions. Each question carried a total of ten (10) marks. The pass score for this section was 3.0 marks.

2.1.1 Question 1: Multiple Choice Items.

The question consisted of items (i) to (x) which were composed from the following topics: *Introduction to Chemistry; Matter; Heat Sources and Flames; Fuels and Energy; Air, Combustion, Rusting and Fire Fighting; Atomic Structure and Periodic Classification*. The students were required to choose the correct answer from the given alternatives A to D.

The question was attempted by all of the students (100%) of which 67.75 percent scored 3 to 6 marks, 27.98 percent scored 0 to 2.5 marks and 4.27 percent scored 7 to 10 marks. Out of those who attempted the question, 1.91 percent scored a zero mark. The following figure gives the pictorial representation of these statistics.

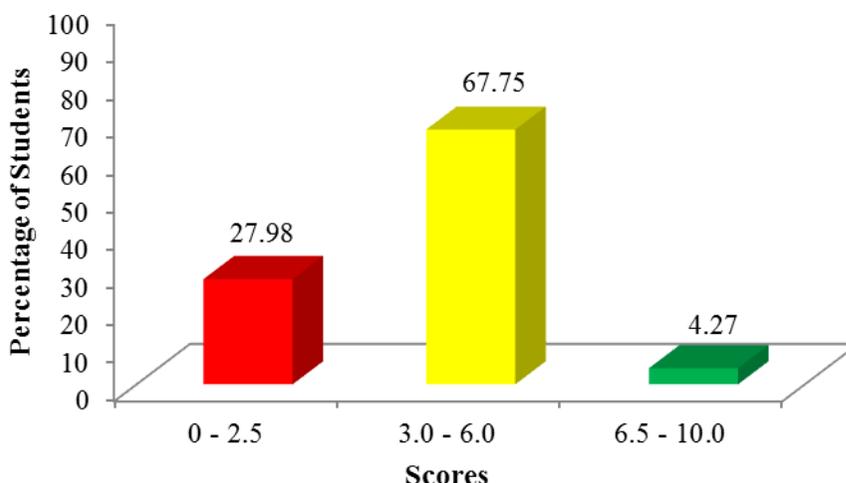


Figure 1: Performance of the students in question 1.

Figure 1 shows that 72.02 percent of the students scored 3 to 10 marks, which indicates a good performance in this question. However, 27.98 percent scored low (1 – 2.5) marks as most of them faced difficulties

especially in answering items (i), (v) and (vii) as the majority chose incorrect answers.

In item (i), the students were required to choose the correct option that represented the meaning of Chemistry. The correct response was 'B', (The study of nature and properties of matter), but most of the students chose 'A' (The study of matter in relation to energy). Those students failed to differentiate the terms 'nature' and 'matter' hence, chose an incorrect option. They also failed to recognize 'properties of matter' as the key concept in defining Chemistry. Failure to choose the correct response indicates lack of adequate knowledge about the term.

In item (v) the students were required to write the number of atoms in a water molecule. The correct response was 'B' (Three), but most of the students chose 'A' (Two). This incorrect response suggests that the students failed to understand that water molecule is made up of three atoms from two different elements. In order to arrive at the correct choice, the students were supposed to have adequate knowledge on elements, atoms and molecules.

In item (vii), the students were required to choose the correct option that represented an appropriate extinguisher used to put off fire caused by cooking oil. The correct answer was 'C' (wet chemical extinguisher), but majority of the students chose 'A' (water extinguisher). Those students failed to realize that oil normally float on water hence fire will perpetuate. They also failed to understand that water extinguisher fire caused by solid material such as paper, wood and cloth. The students' failure in this item was caused by lack of knowledge about fire-fighting techniques.

2.1.2 Question 2: Matching Items and Filling in the Blanks

The question comprised parts (a) and (b). In part (a), the question consisted of List A and List B. List A comprised of five (5) items which were to be matched with the corresponding five correct responses in List B. In part (b), the students were required to fill in the blanks by writing the correct answer on the spaces provided.

The question was attempted by all of the students (100%) of which 39.55 percent scored 3 to 6 marks. Those who scored 0 to 2.5 marks were 43.43 percent. The percentage of those who scored 6.5 to 10 marks were 17.02 of

which 1.64 percent scored 10 marks. Statistics shows that the general performance was average as 56.57 percent of the students scored from 3 to 10 marks.

Analysis of the responses indicates that item (i) and (v) of part (a) were poorly done by the majority of the students. In item (i), the students failed to identify the suitable method to be used to separate the mixture of sodium chloride and ammonium chloride. The correct response was 'H' (Sublimation), but most of the students chose either 'A' (Evaporation), 'C' (Boiling) or 'E' (Distillation). Those students failed to understand that the choice of methods to separate mixtures depends on the nature and properties of constituent substances in the mixture.

In item (v), the students were required to identify a method used to get the solvent from the solution mixture. The majority of the students chose 'C' (boiling) instead of the correct answer 'E' (distillation). Those students failed to realize that boiling retrieves only the solutes and not the solvent. This is an indication that they had inadequate knowledge on the methods of separating mixtures.

In part (b), item (ii) was difficult to most of the students. The item required the students to write the term which represents the arrangement of electrons in different shells in the atom. The correct response was 'electronic configuration', but most of the students gave assorted incorrect answers, a phenomenon that indicates lack of knowledge on the structure of the atom.

2.2 SECTION B

This section consisted of eight (8) short answer questions. Each question carried a total of ten (10) marks. The pass score for each question was 3.0 marks or more.

2.2.1 Question 3: Laboratory Techniques and Safety

The question had parts (a), (b) and (c). In part (a), the students were provided with a table of apparatus, from which they were required to draw and state the functions of burette, filter funnel and beaker. In part (b), the students were required to define First Aid, Laboratory and list two components of the first aid kit.

The question was attempted by all the students(100%), of which more than half (51.84%) scored 3 to 6 marks and 27.78 percent scored 6.5 to 10 marks with 2.7 percent scoring all the 10 marks. The students who scored 0 to 2.5 marks were 20.38 percent of which 6.25 scored a zero mark. Figure 2 gives a summary of these statistics.

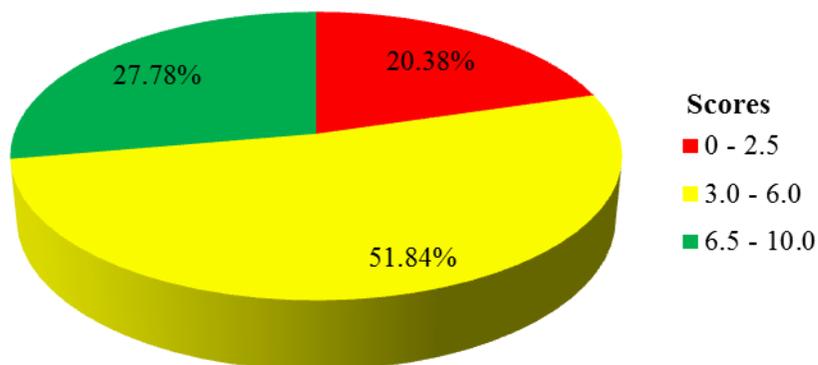


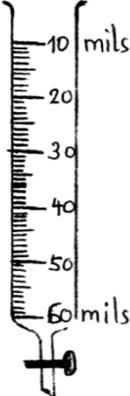
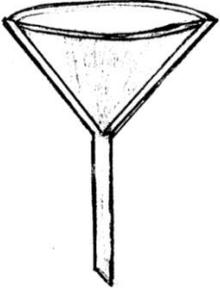
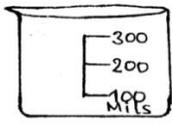
Figure 2: Performance of the students in question 2.

As shown in figure 2, the majority of the students (79.62%) scored 3 to 10 marks indicating that the performance was good.

The students who scored high marks (6.5 – 10) managed to draw neat diagrams of the apparatus and stated their functions. They also defined the terms precisely indicating that they had enough knowledge on the topic of *Laboratory Techniques and Safety*. Extract 3.1 is an example of good responses.

Extract 3.1

3. (a) Draw and state one function of each of the following apparatuses:

Apparatus	Drawing	Function
(i) Burette		<p>It is used for measuring accurate volume of liquids. It is oftenly used in titration experiments.</p>
(ii) Filter funnel		<p>It is used for separating mixture of sand and water.</p>
(iii) Beaker		<p>It is used for holding and heating liquids during experiments</p>

(b) Define the following terms:

(i) First aid

..... is an immediate care of or help given to a victim before taking him/her to the hospital

(ii) Laboratory

..... is a special room or building designed for carrying out scientific experiments.

(c) List two components of a first aid kit.

(i) Adhesive bandage (plaster)

(ii) Soap

Extract 3.1, the student drew correct diagrams of the apparatus, wrote the appropriate functions and gave the proper definitions of the terms. He/she also mentioned the two components of the first aid kit correctly.

Further analysis showed that, the students who scored low marks (0 – 2.5) failed to draw appropriate diagrams and stated incorrect functions of the apparatus as some of them sketched a measuring cylinder instead of a filter funnel. Also, some students drew round bottomed flask instead of a filter funnel while others drew a separating funnel instead of the burette. This observation signifies that those students lacked exposure to the laboratory apparatus. In another case; some students failed to define First Aid and Laboratory in part (b). For example, in one script a student wrote ‘a spesho roo or blouing of the laboratory’ an indication of poor mastery of the English Language. In part (c), the students failed to understand the requirement of the question as some wrote the functions of the First Aid kit instead of listing its components.

Extract 3.2 illustrate the case in which the student failed in all parts of the question.

Extract 3.2

3. (a) Draw and state one function of each of the following apparatuses:

Apparatus	Drawing	Function
(i). Burette		It produce some Burette in a apparatus

(ii) Filter funnel		It produce funnel in the filter.
(iii) Beaker		It produce beaker in the laboratory.

(b) Define the following terms:

(i) First aid
is the small box which contain further in the area.

(ii) Laboratory
is the specially room that, built in a specific area.

(c) List two components of a first aid kit

(i) It produce pain.

(ii) It produce light life.

Extract 3.2 shows a script of a student who sketched a bottle, a rod, mortar and pestle instead of burette, filter funnel and beaker respectively. The student gave incorrect answers in parts (b) and (c) as well.

2.2.2 Question 4: Matter

The question consisted of three parts; (a), (b) and (c). Part (a) required the students to define matter. In part (b), the students were required to state whether each of the processes: rotting mango, clouds changing into rain and decaying of teeth is either a chemical or a physical change. In part (c), the students were required to state four differences between a chemical change and a physical change.

The question was attempted by almost all the students (100%) out of which 42.48 percent scored 3 to 6 marks, 30.64 percent scored 0 to 2.5 with 11.74 percent scoring a zero mark. The students who scored 6.5 to 10 marks were 26.88 percent of which 6.04 scored all the 10 marks. These data show that the general performance was good because the majority, (69.36%) of the students scored from 3 to 10 marks.

The students who scored high marks were able to define matter appropriately, categorized each of the given phenomena as physical or chemical change and correctly stated four differences between physical and chemical change. Extract 4.1 shows one of the good responses.

Extract 4.1

4. (a) Define matter. Is anything which has mass and occupies a certain space.

(b) Tell whether the following is a chemical change or physical change:

(i) Rotting of mango..... chemical change.

(ii) Clouds changing into rain..... Physical change

(iii) Decaying of teeth..... chemical change.

(c) State four differences between a chemical change and physical change.

S/n	Chemical change	Physical change
(i)	It is irreversible, which means it can not change back to its original state.	It is reversible, meaning that it can recover its original state.
(ii)	There is energy liberated or absorbed during the change.	There is no energy liberated or absorbed during the change.
(iii)	It affects the chemical composition of substance since new substance is formed.	It doesn't affect the chemical composition of a substance.
(iv)	There is a new substance formed.	No new substance that is formed.

Extract 4.1 shows a response of a student who defined matter correctly, categorized each of the given phenomena into physical or chemical change. She/he stated four differences between physical and chemical change correctly.

On the other hand, the students who scored low marks failed to define the term matter. They also failed to identify the physical and the chemical changes on the given phenomena. Other students failed to differentiate physical from chemical change. For example in answering part (a), one student wrote, 'matter are the smallest particle that can form an atom'. In other cases, some of the students mixed the two terms and gave the difference between chemical change and physical change interchangeably. This is an indication that the students lacked knowledge on the concept of changes in state of matter. Extract 4.2 shows a sample of responses, which did not meet the requirement of the question.

Extract 4.2

(b) Tell whether the following is a chemical change or physical change:

(i) Rotting of mango..... Physical change.....

(ii) Clouds changing into rain..... Chemical change.....

(iii) Decaying of teeth..... Physical change.....

(c) State four differences between a chemical change and physical change.

S/n	Chemical change	Physical change
(i)	clouds changing into rain.	Rotting of mango orange
(ii)	Decaying of teeth.	Decaying of teeth
(iii)	Rotting of mango.	Rotting of orange.
(iv)	Rotting of orange.	clouds changing into rain

Extract 4.2 is part of an answer in which a student produced incorrect responses in all parts. In part (c), the student picked the phenomena of (b) (i) – (iii) and made them answers.

2.2.3 Question 5: Oxygen

The question comprised of parts (a), (b) and (c). In part (a) of the question, the students were required to write names and formulae of the two chemicals that can be used in the preparation of oxygen gas. In part (b), they were required to state an appropriate method of collecting oxygen gas based on solubility and density of the gas in water. Finally, they were required to state how the gas can be tested. In part (c), they were required to list four uses of oxygen gas.

The question was attempted by all the students (100%) and the performance was poor. Figure 3 illustrates the performance of the students.

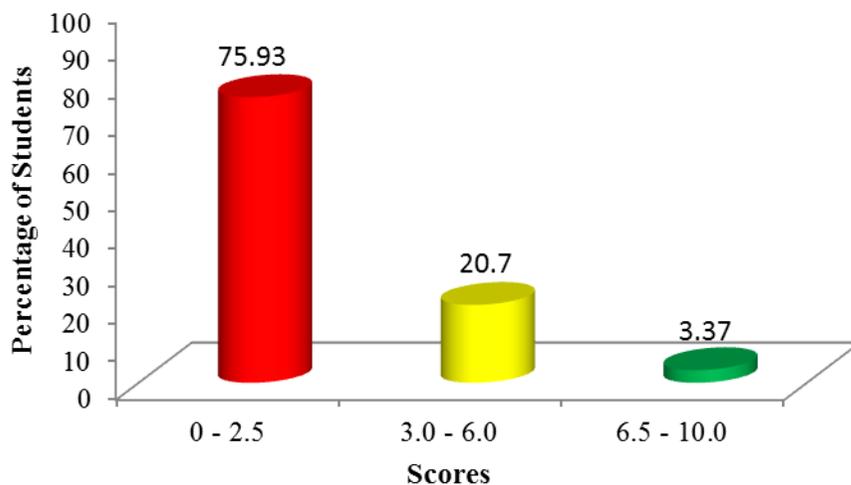


Figure 3: Performance of the students in question 5.

As it is seen from Figure 3, the students who scored 0 to 2.5 marks were 75.93 percent, while those who scored 6.5 to 10 were 3.37 percent. The Figure also shows that 20.70 percent scored 3 to 6 marks.

The students who scored low marks failed to write the names and formulae of the two chemicals that are used in the preparation of oxygen gas. Most of them gave incorrect chemical formulae such as H_2O , Mg_2O_2 , $\text{Ca}(\text{NO}_3)_2$ and H_2SO_4 . In other cases, some of the students wrote any chemicals having oxygen atoms regardless of whether it is used in the preparation of oxygen gas or not.

In part (b) (i), some of the students responded by either giving the apparatus used to collect the gas (gas jar) or commented on the solubility of oxygen in water. Not only that, other students failed to give the test of oxygen. In part (c), some of the students wrote the occurrence of oxygen in air instead of listing its uses. These incorrect responses suggest that the students failed to understand the requirement of the question. Extract 5.1 is a sample of poor responses.

Extract 5.1

5. (a) Write the names and formulae of the two chemicals that can be used in the preparation of oxygen gas.

(i) liquid gas

(ii) element gas

(b) (i) State an appropriate method of collecting oxygen gas based on solubility and density of the gas in water.

Oxygen hydrogen gas in daily life

(ii) How can oxygen gas be tested?

because is prepared in the laboratory by reacting dilute hydrochloric acid and zinc granules.

(c) List four uses of oxygen gas.

(i) liquid.

(ii) physical change.

Extract 5.1 shows a script of a student who resorted to writing anything regardless of whether it is meaningful or not. For instance he/she wrote “liquid gas” and “element gas” as the names and formula of the two chemicals.

The few students who scored high marks presented the correct names and formulae for the two chemicals that can be used in the preparation of oxygen. They stated correctly that downward displacement of water is the method of collecting oxygen gas based on solubility and density of the gas in water. They were also able to state the chemical test for oxygen gas; and finally listed four uses of oxygen gas correctly. Extract 5.2 illustrates the case.

Extract 5.2

5. (a) Write the names and formulae of the two chemicals that can be used in the preparation of oxygen gas.

(i) Hydrogen peroxide H_2O_2

(ii) Potassium chlorate $KClO_3$

(b) (i) State an appropriate method of collecting oxygen gas based on solubility and density of the gas in water.

It is collected by downward displacement of water.

(ii) How can oxygen gas be tested?

Burning it with glowing splint of wood.

(c) List four uses of oxygen gas.

(i) Used by divers in large water bodies

(ii) Used to burn fuel in rocket

(iii) Used for welding process

(iv) Used for respiration purpose.

Extract 5.2 shows a script of a student who wrote correct names and formulae (hydrogen peroxide and potassium chlorate) of the two chemicals that can be used to prepare oxygen gas. She/he stated the appropriate method of collecting the gas and listed four uses of the gas.

2.2.4 Question 6: Formula, Bonding and Nomenclature

This question comprised of parts (a), (b) and (c). In part (a), the students were required to name the following radicals: SO_3^{2-} , ClO_3^- and PO_4^{3-} . Part (b) of it required the students to calculate oxidation state of the underlined elements in the compounds: NH_4Cl , Al_2O_3 , Na_2SO_4 and H_2O_2 . In part (c), the students were required to calculate the percentage composition by mass of the underlined elements in compound H_2SO_4 and $Ca(NO_3)_2$.

Statistics show that, the question was attempted by all the students (100%) where by the percentage of students who scored 0 to 2.5 marks was 84.31 with 65.79 percent scoring a zero mark. The students who scored 3 to 6 marks were 11.33 percent and those who scored 6.5 to 10 marks were 4.36

percent with 0.46 percent scoring full marks. Figure 3 summarizes the performance of the question.

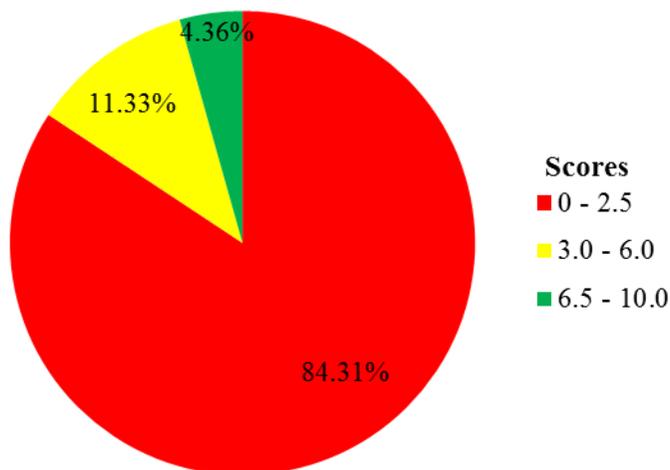


Figure 4: Performance of the students in question 6.

Figure 4 indicates that 84.31 percent of the students scored marks below 3.0, an indication of a poor performance in this question. Analysis of the students' responses indicates that most of the students who scored low marks failed to write the correct names of the radicals as some of them wrote names of the first element in each radical instead of the radicals' names. Others used the number of oxygen atoms as the basis of naming and hence came up with improper names. Furthermore, some of them failed to calculate the oxidation state and the percentage composition by mass of the elements. This was caused by the use of an inappropriate mathematical approach. In other cases, some of them used atomic numbers in calculation instead of atomic masses. Extract 6.1 portrays a response among the poor responses.

Extract 6.1

6. (a) Write the names of the following radicals:
- (i) SO_3^{2-} Sulphur (IV) Oxide
 - (ii) ClO_3^- Chloride (III) Oxide
 - (iii) PO_4^{3-} Phosphorus Oxide.

- (b) Calculate the oxidation state of the underlined element in the following compounds:



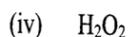
$$\begin{aligned} & \text{NH}_4\text{Cl} \\ & (1 \times 1) + 4 + \text{Cl} \\ & 1 + 4 = \text{Cl} \\ & \text{Cl} = +1 \end{aligned}$$



$$\begin{aligned} & \text{Al}_2\text{O}_3 \\ & (13 \times 2) + 0 + 3 \\ & 16 + 0 = 3 \\ & 0 = 16 - 3 \\ & 0 = 16 \end{aligned}$$



$$\begin{aligned} & \text{Na}_2\text{SO}_4 \\ & 14 \times 2 + \text{S} + 16 \times 4 \\ & 28 + \text{S} + 64 \\ & \text{S} = 64 - 28 \\ & \text{S} = +32 \end{aligned}$$



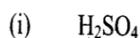
$$1 \times 2 + 0 \times 2$$

$$2 + 0 \times 2$$

$$0 = 2 \times 2$$

$$0 = 4$$

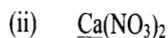
(c) Calculate the percentage composition by mass of the underlined element in the following compounds:



$$1 \times 2 + 16 + 32 \times 4$$

$$\frac{18 \times 32 + 4}{100}$$

$$= 98\%$$



$$40 \times (4 \times 16) \times 3 + 2$$

$$40 \times 224 \times 3 + 2$$

$$448$$

$$2$$

$$22.2\%$$

Extract 6.1 shows a script of a student who named the constituent elements of the radicals instead of naming the radicals. She/he also used improper approach to calculate the oxidation state and the percentage composition by mass of the underlined elements.

On the other hand, the students who scored high marks managed to write the correct names of the radicals and applied appropriate formula to calculate the oxidation state and the percentage composition by mass as demanded by the question. Extract 6.1 shows the responses of a student who performed well in this question.

Extract 6.2

6. (a) Write the names of the following radicals:

- SO_3^{2-} sulphite
- ClO_3^- chlorate (v) oxide
- PO_4^{3-} Phosphate

(b) Calculate the oxidation state of the underlined element in the following compounds:

- NH_4Cl
 $\text{NH}_4\text{Cl} = 0$
 $(-3) + (+1 \times 4) + \text{Cl} = 0$
 $-3 + 4 + \text{Cl} = 0$
 $\text{Cl} = 3 - 4$
 $\text{Cl} = -1$
 $\therefore \text{Cl} = -1$
- Al_2O_3
 $\text{Al}_2\text{O}_3 = 0$
 $(+3 \times 2) + 3 \times 0 = 0$
 $3 \times 0 + 6 = 0$
 $3 \times 0 = -6$
 $0 = \frac{-6}{3}$
 $\therefore 0 = -2$
- Na_2SO_4
 $\text{Na}_2\text{SO}_4 = 0$
 $(+1 \times 2) + \text{S} + (-2 \times 4) = 0$
 $2 + \text{S} + (-8) = 0$
 $\text{S} - 6 = 0$
 $\text{S} = +6 \Rightarrow \text{S} = -8 + 6 = -2$
 $\therefore \text{S} = +6$
- H_2O_2
 $\text{H}_2\text{O}_2 = 0$
 $(+1 \times 2) + 2 \times 0 = 0$
 $2 + 2 \times 0 = 0$
 $2 \times 0 = -2$
 $0 = \frac{-2}{2}$
 $\therefore 0 = -1$

(c) Calculate the percentage composition by mass of the underlined element in the following compounds:

- H_2SO_4
Molecular mass of the compound = $2 + 32 + (16 \times 4)$
 $= 98$
Sulphur = $32 \Rightarrow \frac{32}{98} \times 100\% = 32.65\%$
 \therefore The percentage composition of sulphur is 32.65%
- $\text{Ca}(\text{NO}_3)_2$
Molecular mass of the compound = $40 + (14 + 48) \times 2$
 $= 164$
Calcium = $40 \Rightarrow \frac{40}{164} \times 100\% = 24.39\%$
 \therefore The percentage composition of calcium is 24.39%

Extract 6.2 shows a script of a student who gave correct names of radicals and made plausible calculations to obtain the true values of oxidation state and percentage composition by mass as per the task of the question.

2.2.5 Question 7: Heat Sources and Flames; Air, Combustion, Rusting and Fire Fighting

This question consisted of three parts; (a), (b) and (c). Part (a) (i) required the students to give two reasons why a flame produced by a “spirit lamp” may not be good for heating in the laboratory. Besides, in part (a) (ii) they were required to name the type of flame produced by a spirit lamp. In part (b), the students were given the following question: *By using locally available materials in your school, state how the fire can be extinguished in the following situations:*

- (i) *Kerosene spilled on the floor catches fire.*
- (ii) *Friend’s clothes catch fire which gets out of her control.*

In part (c), the students were instructed to suggest suitable methods of preventing rust in moving parts of machines and motor vehicle bodies.

The question was attempted by all the students (100%) and the performance is as shown in Figure 5.

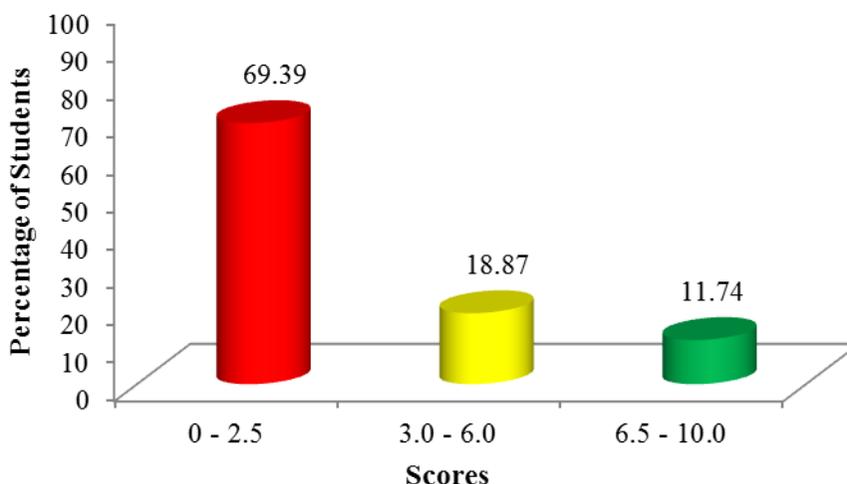


Figure 5: Performance of the students in question 7.

As shown in Figure 5 the majority of the students, equivalent to 69.39 percent scored 0 to 2.5 marks with 43.51 percent scoring a zero mark. The students who scored 3 to 6 marks were 18.87 percent and 11.74 percent

scored 6.5 to 10 marks. According to the statistics, only 1.49 percent scored all the 10 marks allocated to the question. Such a trend shows that the general performance was average.

Analysis indicates that, some of the students who scored low marks failed to explain that a spirit lamp produces luminous flame which is not hot and produce soot. Other students gave the answer in other way round by explaining why a non-luminous flame is preferred. In part (b), some students failed to explain how fire produced by spilled kerosene and that of burning cloth could be extinguished using locally available materials. For instance, some of the students mentioned water as the suitable material to extinguish kerosene fire without understanding that water extinguishes fire caused by solid materials such as paper, wood and cloth. They also failed to realize that kerosene normally floats on water hence fire will perpetuate. This implies that the students lacked adequate knowledge about fire-fighting.

In part (c), some students failed to suggest the suitable methods used to prevent rust. For example, one student wrote the method of preventing rust being the use of fuels instead of oil. Other students left the item unanswered, an indication of lack of knowledge on the concept of rusting. Extract 7.1 illustrates the case.

Extract 7.1

7.	(a)	(i)	Why a flame produced by a "spirit lamp" may not be good for heating in the laboratory? Give two reasons.
		i)	Because good fuel must burn in air
		ii)	Because good fuel does not produce soot

(ii) Name the type of flame produced by a spirit lamp.
 *Non-luminous flame*

(b) By using locally available materials in your school, state how the fire can be extinguished in the following situations:

(i) Kerosene spilled on the floor catches fire.
 *Carbon extinguisher*

(ii) Friend's clothes catch fire which gets out of her control.
 *wet die Dry air extinguisher*

(c) Suggest the suitable method of preventing rust in the following:

(i) Moving parts of machines e.g. motorcycle chain
 *oil Oiling paint*

(ii) Motor vehicle (car) bodies.
 *Oiling*

Extract 7.1 shows a script of a student who wrote qualities of a good fuel which were incorrect instead of giving reasons why a flame produced by a “spirit lamp” may not be good for heating in the laboratory. The student wrote industrially made fire-extinguishers instead of locally available materials used to extinguish fire. The suggested methods of preventing rust are also incorrect.

On the other hand, the students who scored high marks gave a correct explanation on why a flame produced by a spirit lamp may not be preferred for heating in the laboratory. They named the type of flame produced by a spirit lamp correctly. They also explained correctly the way of extinguishing fire using locally available materials in the school surroundings by stating that they could use sand and raw branches of plants. Most of them were also able to suggest suitable methods of preventing rust in moving parts of machines and car bodies. Extract 7.2 represents a sample of good responses.

Extract 7.2

7.	(a)	(i)	Why a flame produced by a "spirit lamp" may not be good for heating in the laboratory? Give two reasons. (i) Because it produces less amount of heat which is not enough to be used to heat different substance during the experiment. (ii) Also, because it produces soot.
		(ii)	Name the type of flame produced by a spirit lamp. luminous flame
	(b)		By using locally available materials in your school, state how the fire can be extinguished in the following situations: (i) Kerosene spilled on the floor catches fire. Here, I can use sand and raw branches of trees (ii) Friend's clothes catch fire which gets out of her control. Also, here I can use the fire blanket and water, since the materials which are burning are organic, that's all.
	(c)		Suggest the suitable method of preventing rust in the following: (i) Moving parts of machines e.g. motorcycle chain. These parts of machine can be prevented from rusting by using the lubricant and other substance such as oil. Hence the word is oiling. (ii) Motor vehicle (car) bodies. The motor vehicle bodies are prevented from rusting through the method of painting them.

Extract 7.2 shows a script of a student who gave correct reasons and named the flame produced by a spirit lamp. He/she stated the appropriate locally available materials that could be used to extinguish fire and suggested suitable methods of preventing rust.

2.2.6 Question 8: Periodic Classification

In this question, the students were provided with the following portion of the periodic table in which elements were represented by letters A, B, C, D, E, F, G and H.

I							VIII
A	II	III	IV	V	VI	VII	B
C							D
E					F	G	
	H						

In part (a) (i), the students were required to name the elements represented by letters A, B, C, D, E, F, G, and H. They were also required to write their electronic configurations in part (a) (ii). In part (b), the students were required to identify the letters which represent the element(s) with zero valency, lightest atom and the alkaline earth metal.

The question was attempted by all the students (100%) and the general performance was average as 63.14 percent scored 3.0 marks or above. The students who scored 6.5 to 10 marks were 38.89 percent with 6.57 percent scoring all the 10 marks and those who scored 3.0 to 6.0 marks were 24.25 percent. On the other hand the students who scored 0 to 2.5 marks were 36.86 percent with 14.91 percent scoring a zero mark.

The students who scored high marks (6.5 – 10) managed to mention the names of the elements and wrote the appropriate electronic configurations. Furthermore, they identified the elements with zero valency, the lightest element and the alkaline earth metal accordingly. This implies that they had adequate knowledge about the position of elements in the periodic table, their electronic configurations and their properties. Extract 8.1 shows an example of good response.

Extract 8.1

8. The following is a part of periodic table with some elements represented by letters. Study it and answer the questions that follow.

I							VIII
A	II	III	IV	V	VI	VII	B
C							D
E					F	G	
	H						

- (a) (i) Mention the names of the elements represented by letters:

A Hydrogen.....
 B Helium.....
 C Lithium.....
 D Neon.....
 E Sodium.....
 F Sulphur.....

G Chlorine.....
 H Calcium.....

- (ii) Write the electronic configuration of the elements represented by letter G and H.

G = 2:8:7.....
 H = 2:8:8:2.....

- (b) Identify the letter which represents the elements with the following properties:

(i) Zero valency... B and D.....

(ii) Lightest atom... A.....

(iii) Alkaline earth metal... H.....

Extract 8.1 shows the script of a student who correctly mentioned the names of the elements, presented the required electronic configurations and correctly identified the letters representing the elements with the stated properties.

However, most of the students who scored low marks were unable to mention the correct names of the elements. Some of the students wrote chemical symbols instead of the names of the elements such as He for helium, H for hydrogen and Li for lithium. Those students had misconception, since they used to see elements in the periodic table represented by their symbols and not names. Others failed to write the electronic configurations of the elements and they wrote conventional symbols instead of electronic configurations. There were also some who failed to identify the element with zero valency, the lightest element and the alkaline earth metal according to the demand of the question. In general, those students lacked knowledge about the concept of the periodic table. Extract 8.2 is a sample of the poor responses.

Extract 8.2

8. The following is a part of periodic table with some elements represented by letters. Study it and answer the questions that follow.

I							VIII
A	II	III	IV	V	VI	VII	B
C							D
E					F	G	
	H						

(a) (i) Mention the names of the elements represented by letters:

A H.....
 B He.....
 C Li.....
 D Be Ne.....
 E Ca Cl Na.....
 F K P S.....

G	Ca	KCl
H	P K	Ca

(ii) Write the electronic configuration of the elements represented by letter G and H.

2: 8: 8

(b) Identify the letter which represents the elements with the following properties:

(i) Zero valency... it the properties of zinc

(ii) Lightest atom... it the properties of hydrogen

(iii) Alkaline earth metal... it produce of group II and element

Extract 8.2 shows a script of a student who wrote chemical symbols instead of names of the elements, gave incorrect electronic configurations. Instead of writing the letter representing the elements, the student wrote explanations which were incorrect.

2.2.7 Question 9: Hydrogen

Part (a) of this question required the students to write an alternative acid used in the preparation of hydrogen gas other than dilute hydrochloric acid. In part (b), the students were required to list two physical and chemical properties of hydrogen gas. In part (c), they were required to write what is observed if a burning wooden splint is lowered in a test tube containing hydrogen gas. In part (d), the students were required to give two uses of hydrogen gas in daily life.

The question was attempted by all the students (100%) and the overall performance was average. The statistics show that the students who scored 3.0 to 6.0 marks were 21.44 percent and the ones who scored 6.5 to 10 marks were 11.60 percent. The students who scored 0 to 2.5 marks were 66.96 percent out of which 47.35 percent scored a zero mark.

The students who performed well in this question managed to indicate that dilute sulphuric acid can be used as an alternative acid in the preparation of hydrogen gas. They also wrote the correct physical and chemical properties of hydrogen gas. Furthermore, they were able to identify that pop sound

will be given out once a burning wooden splint is lowered in a test tube containing hydrogen gas. In addition they gave the two uses of hydrogen gas in daily life as illustrated in Extract 9.1.

Extract 9.1

9. Hydrogen gas is prepared in the laboratory by reacting dilute hydrochloric acid and zinc granules.

(a) Write an alternative acid that can be used to prepare hydrogen instead of dilute hydrochloric acid.
 Dilute Sulphuric Acid (H_2SO_4)

(b) Give two physical and two chemical properties of hydrogen.

S/n	Physical properties	Chemical properties
(i)	It is colourless, tasteless and odourless	It reacts slowly with oxygen to form water
(ii)	It is less denser, than air	It burns but not support combustion

(c) What will happen if a burning wooden splint is lowered in a test tube containing hydrogen gas?
 It will burn with a pop sound when lowered in a test tube containing hydrogen gas.

Extract 9.1 is part of an answer which a student pointed out that dilute sulphuric acid is the correct alternative acid used to prepare hydrogen gas. She/he wrote correct physical and chemical properties of hydrogen gas and the outcome of lowering the burning wooden splint in a test tube containing oxygen.

However, the students who scored low marks failed to identify the alternative acid that can be used to prepare hydrogen gas. Some of them wrote nitric as the alternative acid but they failed to understand that nitric acid oxidizes the hydrogen to form water. In attempting part (b), some of the students provided the differences between physical and chemical changes instead of giving the physical and chemical properties of hydrogen. In other cases, some of the students interchanged the physical and chemical properties of hydrogen. In part (d), some students responded by writing the uses of oxygen gas instead of hydrogen gas. These incorrect responses

suggest that the students were confusing between hydrogen and oxygen. Extract 9.2 is an example of poor responses.

Extract 9.2

9. Hydrogen gas is prepared in the laboratory by reacting dilute hydrochloric acid and zinc granules.

(a) Write an alternative acid that can be used to prepare hydrogen instead of dilute hydrochloric acid.
 Manganese oxide

(b) Give two physical and two chemical properties of hydrogen.

S/n	Physical properties	Chemical properties
(i)	When it change there is no new substance is formed	When it change there is a new substance which is formed
(ii)	se Can be see separat ely	Can not be seen separately

(c) What will happen if a burning wooden splint is lowered in a test tube containing hydrogen gas?
 It will not continue to burning. It will be off

(d) Give two uses of hydrogen gas in daily life.

(i) To form water when it combine with oxygen

(ii) Used in laboratory for differences experiments

Extract 9.2 shows a script of a the student who wrote manganese oxide instead of dilute sulphuric acid as the alternative acid used for preparation of hydrogen gas. She/he attempted to give the differences between physical and chemical changes instead of the physical and chemical properties of hydrogen gas. The test for hydrogen and its uses were incorrectly written as well.

2.2.8 Question 10: Matter, Formula, Bonding and Nomenclature

The question consisted of parts (a) and (b). In part (a), the students were provided with a figure showing the apparatus that can be used to separate three immiscible liquids: cooking oil, kerosene and water with densities

0.92 g/cm³, 0.65 g/cm³ and 1.00 g/cm³ respectively. The liquids were contained in the apparatus forming three layers which were labeled A, B and C from top to the bottom. The students were then required to name the apparatus and identify with reasons the liquids which formed layer A and C. In part (b), the students were required to complete the following table.

Ions		Name	Formula
Ca ²⁺	Cl ⁻	Calcium chloride	
Al ³⁺	SO ₄ ²⁻		Al ₂ (SO ₄) ₃
H ⁺		Hydrogen sulphate	

The question was attempted by all the students (100%) and the performance is shown in Figure 6.

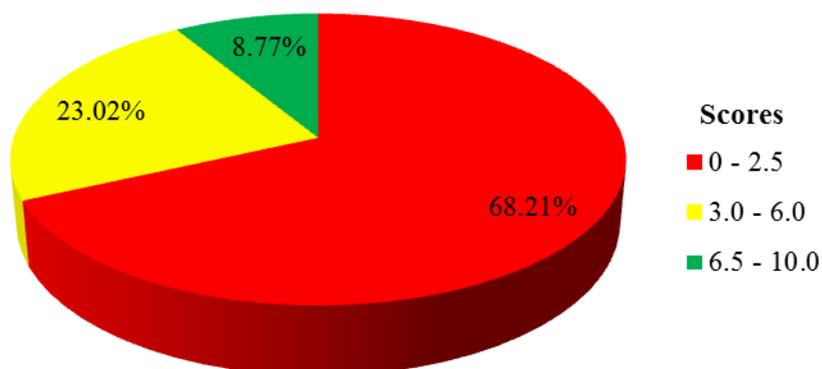


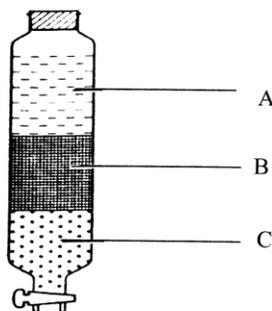
Figure 6: Performance of the students in question 10.

Figure 6 shows that the general performance in this question was average, as 31.79 percent scored 3.0 to 10 marks. The students who scored 3.0 to 6.0 marks were 8.77 percent, 6.5 to 10 marks were 23.02 percent and 68.21 percent scored 0 to 2.5 marks.

The students who scored high marks named the apparatus correctly and identified liquids A and C with reasons. They also completed the table by filling in the gaps as demanded by the question. Extract 10.1 shows one of the good responses.

Extract 10.1

10. (a) The following Figure shows the apparatus that can be used to separate three liquids: cooking oil, kerosene and water with density 0.92 g/cm^3 , 0.65 g/cm^3 and 1.00 g/cm^3 respectively.



- (i) Name the apparatus shown by the given figure.

..... Separating funnel

- (ii) By giving a reason, identify liquids A and C.

Liquid A Kerosene

Liquid C Water

Reason Liquid A is kerosene because it has low^{er} density than that of cooking oil and water. Kerosene has the density of 0.65 g/cm^3 while cooking oil has 0.92 g/cm^3 and water 1 g/cm^3 greater than that of kerosene.

.....
Liquid C is water because it has greater density than that of cooking oil and kerosene. Water has 1 g/cm^3 while kerosene 0.65 g/cm^3 and cooking oil has 0.92 g/cm^3 less denser than that of water

- (b) The following table shows the name and the chemical formula of the product formed when ions combine together. Complete filling the table.

Table showing combination of ions

Ions		Name	Formula
Ca^{2+}	Cl^-	Calcium chloride	CaCl_2
Al^{3+}	SO_4^{2-}	Aluminium Sulphate	$\text{Al}_2(\text{SO}_4)_3$
H^+	SO_4^{2-}	Hydrogen sulphate	H_2SO_4

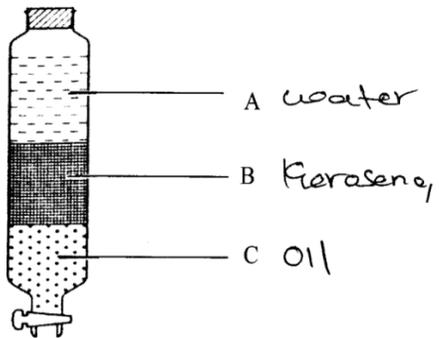
Extract 10.1 shows a script of a student who named the apparatus correctly and identified the liquids A and C. Also, the student completed filling the table with correct ion, compound and chemical formulae.

However, the students who performed poorly in this question failed to name the apparatus and to identify the liquids that formed layers A and C.

For example, one student named the apparatus as water filter instead of separating funnel. Some of them failed to identify the liquids which formed layers A and C, an indication of lack of knowledge about the concept of density of different liquids. In part (c), some of them failed to write the ion and compounds as demanded by the question. Extract 10.2 illustrates a sample of the poor responses.

Extract 10.2

10. (a) The following Figure shows the apparatus that can be used to separate three liquids: cooking oil, kerosene and water with density 0.92 g/cm^3 , 0.65 g/cm^3 and 1.00 g/cm^3 respectively.



(i) Name the apparatus shown by the given figure.
water, Oil, Kerosene

(ii) By giving a reason, identify liquids A and C.
 Liquid A *water*
 Liquid C *Oil*
 Reason *The following figure shows the apparatus that can be used to separate three liquids: cooking oil, kerosene and water with density 0.92 g/cm^3 , 0.65 g/cm^3 and 1.00 g/cm^3 respectively.*

Extract 10.2 is part of an answer from the student's script who listed the liquids instead of naming the apparatus given. The student incorrectly wrote water and oil representing liquids A and C. In part (a) (ii) she/he copied the question instead of giving the reason.

3.0 ANALYSIS OF THE STUDENTS' PERFORMANCE IN EACH TOPIC

A total of 11 topics were assessed in the FTNA, 2017 Chemistry. The analysis shows that the students had good performance in questions 1, 3 and 4 where performance was 72.02, 79.62 and 69.36 percent respectively. The questions were developed from the following topics: *Laboratory Techniques and Safety; Introduction to Chemistry; Matter; Heat Sources and Flames; Fuels and Energy; Air, Combustion, Rusting and Fire Fighting; Atomic Structure and Periodic Classification.*

Furthermore, the students had an average performance in questions 2, 7, 8, 9 and 10. These questions were composed from the topics of *Periodic Classification; Atomic Structure; Matter; Heat Sources and Flames; Fuels and Energy; Air, Combustion, Rusting and Fire Fighting; Hydrogen; Laboratory Techniques and Safety; Formula, Bonding and Nomenclature.* Average performance in the stated topics was caused by limited knowledge of the students on the areas assessed.

On the other hand, the students performed poorly in questions 5 and 6. Question 6 which was composed from the topic of *Formula, Bonding and Nomenclature* was the most poorly performed, whereby only 15.71 percent of the students passed. Question 5 from the topic of *Oxygen* was poorly performed (24.07%).

The poor performance in the stated topics was due to inadequate knowledge on the rules of writing chemical formulae, which involves the exchange of valency and chemical symbols. Another factor was lack of mathematical skills and lack of experience in laboratory experiments.

Other reasons which led to some of the students scoring very low marks included incompetence in using English Language which hindered them from understanding the demands of the questions and in producing comprehensive responses. Inadequate knowledge in the respective topics had an effect as well.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The analysis of the performance in each question shows that the performance was good in three questions, average in five questions and

poor in two questions. Thus the overall general performance of the students was average, (see appendix1). The analysis identified several factors that contributed to the failure of some of the students to respond correctly to some of the questions. Those factors include:

- (a) Lack of knowledge in some topics as illustrated by the responses which did not meet the demand of the respective questions.
- (b) Lack of adequate exposure to laboratory equipment as some of the students drew diagrams of irrelevant apparatus.
- (c) Lack of English Language proficiency. This factor was demonstrated by the failure to understand the demand of the questions and inability to write sentences with correct grammar.
- (d) Poor mathematical skills as indicated by the responses in question 6 which required calculations based on Chemistry principles and formulae.

4.2 Recommendations:

In order to improve the students' performance in future assessments, it is recommended that:

- (a) Teachers to conduct tests regularly and ensure that the syllabus is adequately covered before the National Assessment (FTNA).
- (b) Programs for laboratory activities should be administered effectively in schools to enable the students to acquire practical skills to reinforce their understanding of concepts, theories and laws in science.
- (c) Schools to monitor the English Language speaking initiatives and science teachers should use English Language in teaching and learning process to improve the students' language proficiency.
- (d) Students should be guided to take time to read thoroughly the instructions and questions before attempting any question. They should also be insisted to proofread their work before submitting.

Appendix 1

ANALYSIS OF THE STUDENTS' PERFORMANCE PER TOPIC IN 2017

S/n	Topic	Question Number	Percentage of Students who Scored an average of 30 Marks or Above	Remarks
1	Laboratory Techniques and Safety	3	79.62	Good
2	Introduction to Chemistry; Matter; Heat Sources and Flames; Fuels and Energy; Air, Combustion, Rusting and Fire Fighting; Atomic Structure and Periodic Classification	1	72.02	Good
3	Matter	4	69.36	Good
4	Periodic Classification; Atomic Structure	8	63.14	Average
5	Matter; Heat Sources and Flames; Atomic Structure; Fuels and Energy; Air, Combustion, Rusting and Fire Fighting	2	56.57	Average
6	Hydrogen	9	33.01	Average
7	Matter; Laboratory Techniques and Safety; Formula, Bonding and Nomenclature	10	31.79	Average
8	Heat Sources and Flames; Air, Combustion, Rusting and Fire Fighting	7	30.61	Average
9	Oxygen	5	24.07	Poor
10	Formula, Bonding and Nomenclature	6	15.69	Poor

