THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2015

032 CHEMISTRY
(For School Candidates)

THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

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FOREWORD

The Certificate of Secondary Education Examination marks the end of four years of secondary education. It is a summative evaluation which, among other things, shows the effectiveness of the educational system in general and education delivery system in particular. Essentially, the candidates' response to the examination questions is a strong indicator of what the educational system was able or unable to offer to the students in their four years of secondary education.

The Candidates' Item Response Analysis Report in Chemistry subject in the Certificate of Secondary Education Examination (CSEE) 2015 was prepared in order to provide feedback to students, teachers, parents, policy makers and the public in general, on the performance of candidates in this subject.

The analysis presented in this report is intended to contribute towards understanding some of the reasons behind the performance of the candidates in Chemistry subject. The report highlights some of the factors that made some of the candidates unable to score good marks in this paper. Such factors include: inadequate knowledge on various topics, poor English Language proficiency and failure to apply appropriate chemical equation and formula in the questions which required calculations.

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 candidates' performance in the future examinations administered by the Council.

The National Examinations Council of Tanzania will highly appreciate comments and suggestions from teachers, students and the public in general, that can be used for improving future Analysis Reports.

The Council would like to thank Examination officers, Examiners and all others who participated in the preparation of this report.

Dr. Charles E. Msonde
EXECUTIVE SECRETARY

1.0 INTRODUCTION

This report analyses the performance of school candidates who sat for the Certificate of Secondary Education Examination (CSEE) 2015 in Chemistry subject. The examination paper was set according to the 2008 examination format, which was developed from the Chemistry syllabus for Secondary School Education.

The paper consisted of sections A, B, and C. Section A consisted of two (2) objective questions. Section B had nine (9) short answer questions, while Section C comprised two (2) essay type questions. The candidates were required to answer all the questions.

In 2015, a total of 171,950 candidates sat for the Chemistry examination, of which 103,296 candidates equivalent to 60.11 percent, passed. In 2014, a total of 137,511 candidates sat for the examination in which 56.73 percent passed. Thus, there is an increase of 34,439 (25.04%) candidates who sat for the examination, and 3.38 percent who passed the examination in 2015 when compared to 2014.

This report is divided into four sections. It starts with the introduction, followed by the analysis of the candidates' performance in each question, then analysis of performance in each topic. Finally, the conclusion and recommendations for action are given.

The following section presents the analysis of the candidates' performance in each question.

2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH QUESTION

For each question analyzed, an overview of what the candidates were required to do, general performance and the possible reasons for the observed performance have been provided. Samples of extracts of candidates' responses have also been inserted in the appropriate sections to illustrate the cases presented.

The analysis categorizes the performance as either poor/weak, average or good, if the percentage of the candidates who scored 30 percent or more of

the marks allocated to a particular question lies in the interval: 0 – 29; 30 – 44 and 45 – 100 respectively. Furthermore, green, yellow and red colours have been used in different figures, to denote good, average and poor performance respectively.

2.1 Section A: Objective Questions

This section consisted of two (2) objective questions, 1 and 2 with 10 items each. Each item carried 1 mark, making a total of 10 marks in each question. Therefore, the pass score was 3 marks or more.

2.1.1 Question 1: Multiple Choice Items

The items in this question were composed from the following topics: *Atomic Structure; The Mole Concept and Related Calculations; Chemical Kinetics, Equilibrium and Energetics; Ionic Theory and Electrolysis; Organic Chemistry; Acids, Bases and Salts; Non-metals and their Compounds and Matter*. The candidates were required to choose the correct answer from the given five alternatives (A to E) and write its letter beside the item number in the answer booklet.

Statistics show that almost all the candidates (99.9%) responded to this question. The analysis of the candidates' performance indicates that many candidates (48.6%) scored from 0 to 2 marks, 35.0 percent scored 3 to 4 marks and 16.4 percent scored 5 to 10 marks. These statistics are presented in Figure 1.

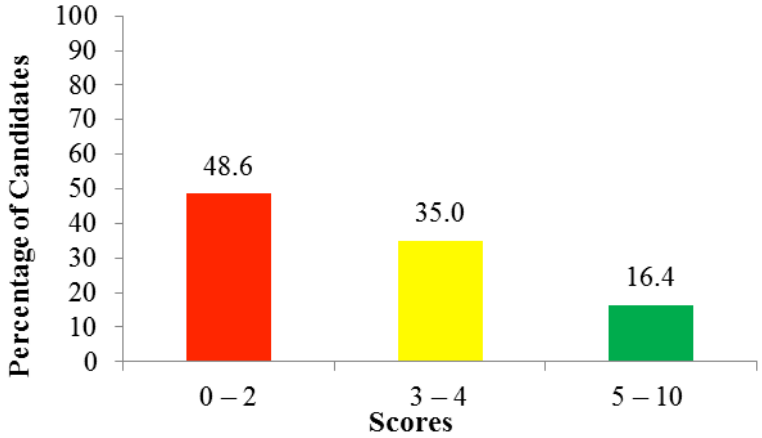


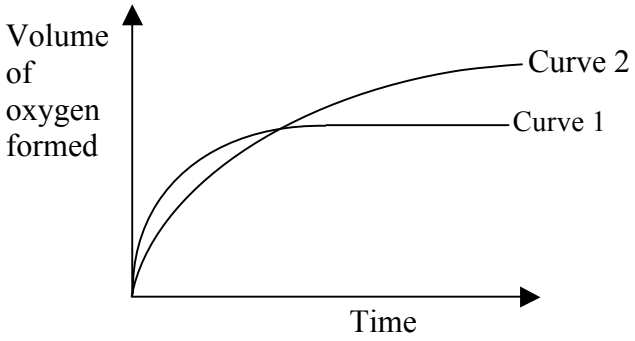
Figure 1: Performance of the candidates in question 1.

Figure 1 shows that 51.4 percent of the candidates scored 3 to 10 marks, which indicates good performance in this question. However, 48.6 percent

scored low marks as most of them faced difficulties in answering items (ii), (iii) and (ix). In item (ii) the candidates were required to select from among the given alternatives, the one which represent the number of moles of oxygen needed for complete combustion of 2.2 grams of C_3H_8 to form carbon dioxide and water. The correct option was 'C' (0.25 moles), but the majority of the candidates opted randomly to any of the alternatives. In order to identify a correct option, the candidates were supposed to write a balanced combustion reaction equation of C_3H_8 and then apply mole concept to calculate the required number of moles of oxygen. Lack of enough knowledge about the mentioned concepts might have contributed to the failure of the candidates in this particular item.

Item (iii) consisted of the graph shown below, where curve 1 was obtained from the decomposition of 100 cm^3 of 1.0M hydrogen peroxide solution catalysed by manganese (IV) oxide, according to the equation,

$2H_2O_2 \rightarrow 2H_2O + O_2$.



The candidates were required to identify alteration/change to the original experimental conditions which would produce curve 2 from among the following options:

A Lowering the temperature
B Using less manganese IV oxide
C Increasing the temperature
D Adding some 0.1 M H_2O_2
E Using a different catalyst.

The majority of the candidates were not able to associate the given equation with the graph. They failed to reason out that since curve 2 shows more volume of oxygen formed, then the only correct change which was to be effected was to add some reactant which was option D (adding some 0.1 M

H_2O_2). The majority of these candidates wrongly opted for 'E' (Using a different catalyst). They were attracted to this option because a catalyst was required in the reaction. However, they failed to recognize that catalyst has no effect on the volume of the oxygen produced, rather it speeds up the reaction.

Item (ix) inquired the candidates to select from among the five (5) alternatives, a pair of substances which are allotropes. The majority of the candidates chose wrong alternative 'B' (^{12}C and ^{14}C) instead of the correct one, 'C' (P^4 and P^8). These candidates might have confused between isotopes (elements in B) and allotropes an indication that they had inadequate knowledge of these concepts.

2.1.2 Question 2: Matching Items

This question was based on five (5) closely related concepts from topics of *Compounds of Metals; Qualitative analysis; Extraction of Metals; Periodic Classification; Non-metals and their Compounds.* The question consisted of two lists: A and B. List A comprised ten (10) items which were to be matched with the correct response in list B.

The question was attempted by 171,738 (99.9%) candidates and the general performance was good as 52.8 percent of the candidates managed to score 3 marks or above, out of 10 marks. The candidates who scored 3 to 4 marks were 24 percent and 28.8 percent scored 5 to 10 marks, of which 0.9 percent scored all the 10 marks.

Items number (ii), (iii), (iv) and (viii) seemed difficult to most of the candidates. Item (ii) required the candidates to choose a correct response from list B, which matched with the phrase " It is obtained from its ore in the blast furnace". The correct match was 'C' (Iron), but most of the candidates matched it wrongly with 'N' (silicon). The candidates were attracted to this response because silicon in form of silicon dioxide is among the impurities which are removed from the blast furnace.

Item (iii) measured the candidates knowledge on qualitative analysis, specifically on flame test. The item required the candidates to choose the correct response which matched with " It gives a lilac colour when placed in a non luminous flame". The correct option was 'D' (potassium), but the

candidates matched the item wrongly with option J or O “sodium” or “calcium” respectively. Those candidates failed to recognize that sodium gives a bright yellow flame and calcium gives a brick red or dark red flame. Thus, incorrect answers is an indication of lack of knowledge and skills in qualitative analysis, specifically in flame test of cation.

Item (iv) tested the candidates’ knowledge on the concept of solubility of salts. The item required the candidates to choose the correct response which match with “ It forms an insoluble sulphate”. The correct answer was A “barium” but many candidates chose incorrect response ‘D’ (potassium). Those candidates failed to identify insoluble and soluble salts, since potassium forms soluble sulphates. This is an indication of lack of knowledge on how solubility of metals and their compounds is affected down or across the periodic table.

In item (v) the candidates were asked to match a correct option from list B with the phrase, “It is in the same group in the periodic table with nitrogen”. The correct option was ‘I’ (phosphorus’, but the majority of the candidates chose various answers from list B. Those candidates were supposed to understand that nitrogen and phosphorus have the same number of valency electrons in the outer most shell of their atoms, hence they are placed in the same group.

Item (viii) (It is the strongest oxidizing agent among the halogens) was also difficult to most of the candidates as the majority matched it wrongly with ‘H’ (argon). Those candidates failed to understand that argon belongs to a group called rare or noble gases and not halogen. This wrong choice indicates that, the candidates lacked knowledge of the topic on *Non metals and their compounds*, particularly on the trends of oxidizing power across and down the periodic table.

2.2 Section B: Short Answer Questions

This section consisted of nine (9) short answer questions. Each question carried a total of six (6) marks. The pass score for this section was 2.0 marks or more.

2.2.1 Question 3: Air, Combustion, Fire Fighting and Rusting; Extraction of Metals

The question comprised parts (a) and (b). In part (a), the candidates were asked to state two conditions which are required for iron to rust and to list two methods which are used to prevent rusting of iron. Part (b), required the candidates to state three properties that make aluminium useful in overhead cables.

The question was attempted by 93.5 percent of the candidates and the performance was as follows: about three – quarters (32.7%) scored 0 to 1.5 marks, out of which 14.0 percent scored a 0 mark; 15.9 percent scored from 2.0 to 2.5 marks and 51.4 percent scored 3 to 6 marks, out of which 1.2 percent scored all the 6 marks. Graphical representation of these data is given in Figure 2.

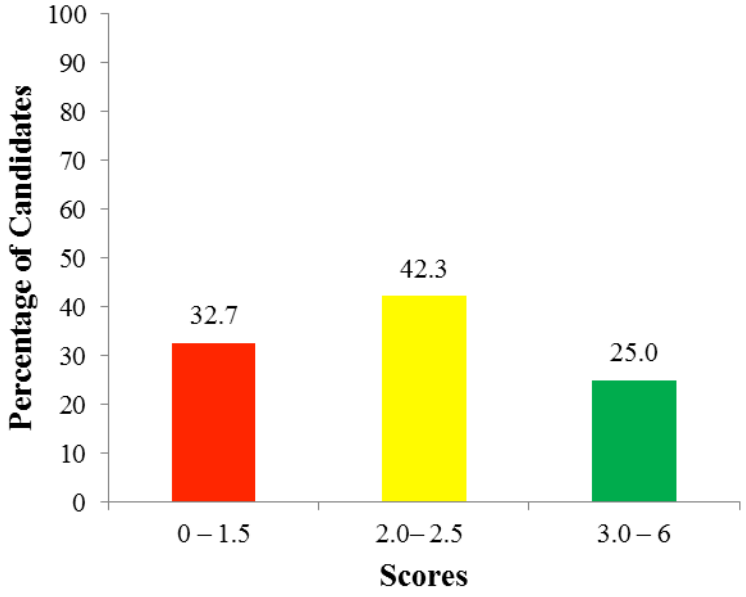
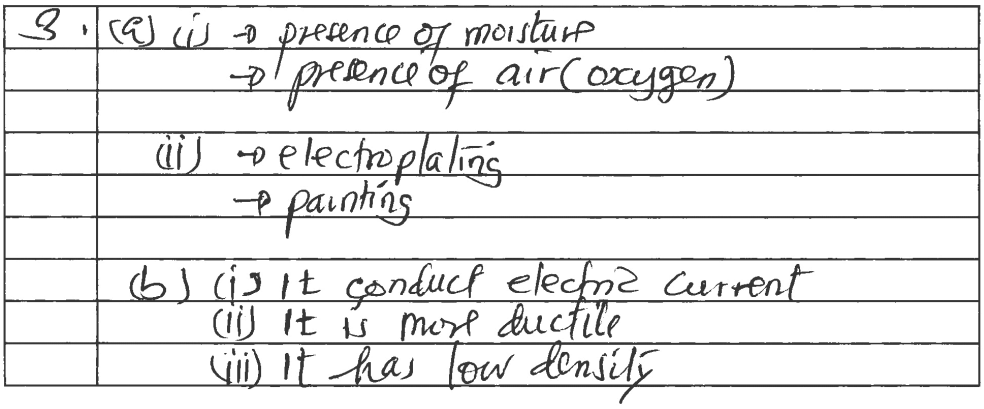


Figure 2: Performance of the candidates in question 3.

As Figure 2 shows, a total of 67.3 percent of the candidates scored relatively high marks (2 to 6), an indication of good performance in the question. Most of the candidates who did well, correctly stated the required conditions for rusting and the methods which are used to prevent rusting. The analysis reveals that part (b) was difficult to most of the candidates. Some managed to state one or two properties, while others left it unanswered. However, a

few candidates (1.2%) managed to respond correctly to all parts of the question as Extract 3.1 shows:

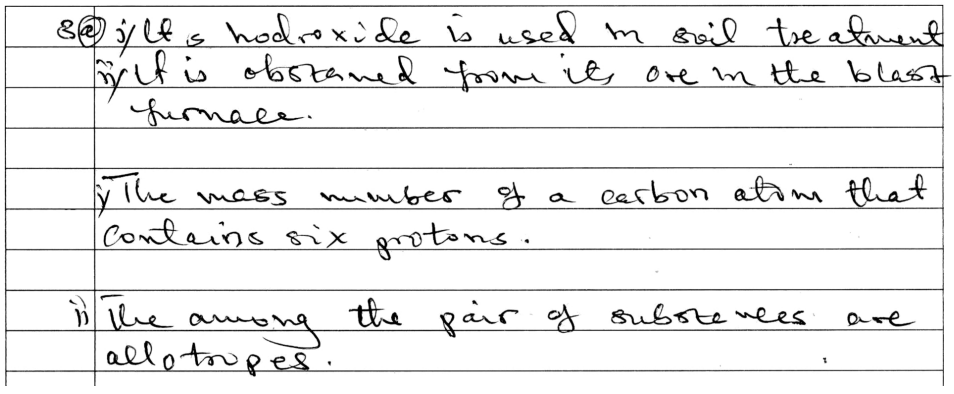
Extract 3.1

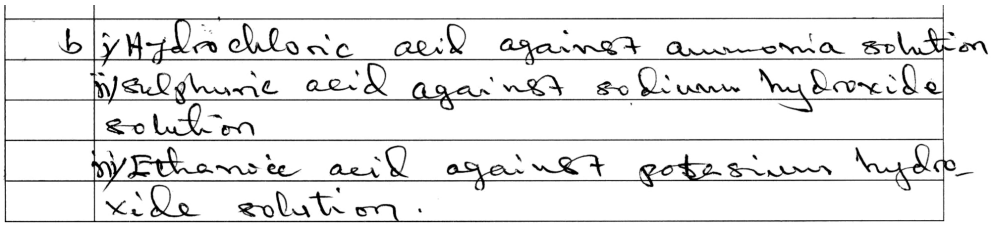


Extract 3.1 shows the response of a candidate who got right all the parts of the question.

The candidates with low scores, specifically those who scored a zero mark (14.0%), lacked knowledge of the concepts of rusting and properties which make aluminium a useful metal. The analysis reveals that, most candidates' responses resulted from guessing the general properties of either metals and or non metals. Some of such responses are: *aluminium has high boiling and melting point, it store charge for long , does not have charge, store heat for long time*. Other candidates wrote responses that were quite different from what the question demanded. Extract 3.2 represents such irrelevant responses.

Extract 3.2





Extract 3.2 shows the candidate who wrote statements which are not related to the need of the question in part (a). In part (b), she/he just copied the question.

2.2.2 Question 4: Energy and Fuels; Chemical Kinetics, Equilibrium and Energetics

Part (a) which was from the topic of Energy and Fuels required the candidates to give three examples of solid and gaseous fuels. Part (b) was based on the topic of Chemical Kinetics, Equilibrium and Energetics and it stated:

The reaction which produces methanol from carbon monoxide and hydrogen is represented by the equation

$$CO_{(g)} + 2H_{2(g)} \rightleftharpoons CH_3OH_{(g)} \quad \Delta H = -94 kJmol^{-1}.$$

The reaction is carried out at high pressure to give a good yield of methanol.

(i) Explain why increase in pressure gives a better yield of methanol.

(ii) The value of ΔH is negative. What does this tell about the reaction?

(iii) With a reason, state whether a high temperature or low temperature will give a better yield of methanol.

About half (50.5%) of the candidates who attempted this question scored below the pass mark 2.0 marks of which 14.3 percent scored 0 mark. The data indicate that, 49.5 percent of the candidates scored from from 2 to 6 marks of which 27.8 percent scored 2 to 3 marks and 21.7 percent scored 3.5 to 6 marks. These data are presented in Figure 3.

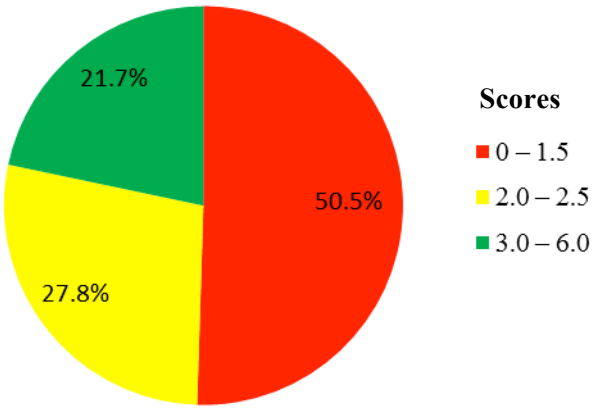


Figure 3: Performance of the candidates in question 4.

Figure 3 indicates that, half of the candidates failed in this question, while 21.7 and 27.8 percent scored good and average marks respectively. The majority of the candidates who scored high marks (3 – 6), managed to give correct responses to most items, though in part (a) (ii) some failed to give examples of gaseous fuel. They were also able to apply Le Chatelier's principle in answering the items in part (b). Extract 4.1 shows an example of good responses.

Extract 4.1

4a)	Coal
	Wood
	Charcoal
4aii)	Producer gas Watergas, Natural gas
4b)	Increase in pressure gives a better yield of methanol because
	pressure affects the side where there is high number of molecules
	In case of the reaction given, the reactants have more molecules
	than the product (methanol), hence due to high pressure, the
	reaction will be more forward and therefore more methanol
	will be produced and yielded.

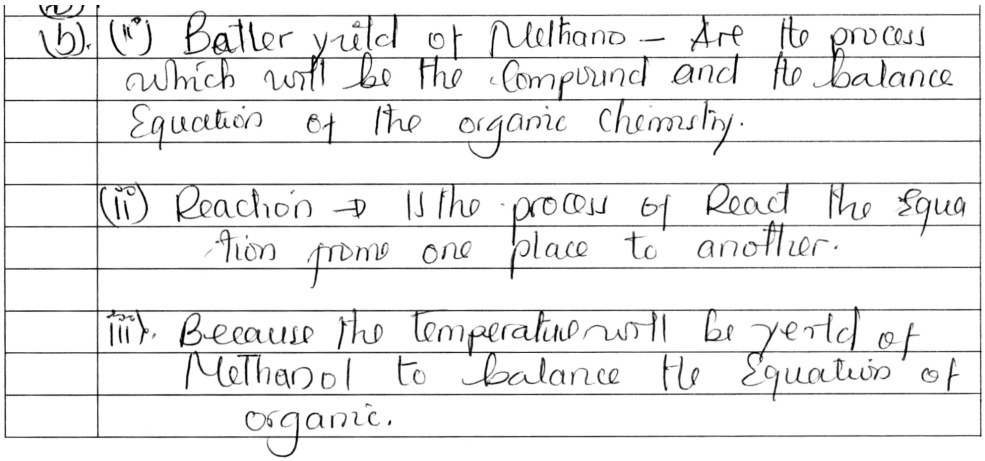
4bii)	The reaction is exothermic, this means low temperature favours more forward reaction in the equation given since exothermic reaction is the reaction which proceeds by releasing temperature to the environment hence needs low temperatures for the reactants to yield the product.
4biii)	A high temperature will not give a better yield of methanol since the equation involves exothermic reaction. While low temperature will favour or give better yield of methanol due to the nature of the reaction (exothermic)

In Extract 4.1, the candidate gave correct examples of solid and gaseous fuels, and explained the reasons for the better yield of methanol due to increased pressure. The candidate also explained correctly the meaning of a negative value of ΔH about the reaction and stated with reasons the effect of high or low temperature for a better yield of methanol.

Some of the candidates who scored low marks (50.5%), failed to respond correctly to almost all items of the question, while others left some items unanswered. They failed to identify the number of moles and evolution of heat given in the equation, hence failed to apply them in answering the items in (b). In part a (ii), some of the candidates mentioned different gases such as oxygen, hydrogen and nitrogen, thinking that they are fuels. However, some of the candidates who scored at least a few marks, managed to give one or two examples of solid fuel. Extract 4.2 indicates one of the poor responses.

Extract 4.2

(A).	(i) Solid Fuel:
	-Wood
	(ii) Stone
	(iii). Fire
	(ii) Gaseous Fuel
	(i) Ammonial Fuel
	(ii) Oxygen fuel
	(iii) Carbon fuel.



In Extract 4.2, the candidate incorrectly wrote iron, stone and fire as solid fuels and ammonia, oxygen and carbon as gaseous fuels. In part (b) he/she wrote meaningless sentences.

2.2.3 Question 5: Atomic Structure; Periodic Classification

There were two parts in this question; (a) and (b). Part (a), examined the candidates' knowledge to explain in terms of electronic configuration, the reasons for similarity in chemical properties between sodium and potassium. The candidates were also tested on the knowledge of the trend in reactivity of group I elements in the periodic table and to give reasons for such trend. In part (b), the candidates were tested on the knowledge of periodic table and electronic configuration by completing Table 1.

Table 1

S/n	Name of element	Atomic number	Electronic configuration
(i)	Lithium		
(ii)		13	
(iii)			2.8.7

The statistics show that 97.7 percent of the candidates attempted the question and performed as follows: a few (19.2%) scored 0 to 1.5 marks, 21.3 percent scored 2.0 to 2.5 marks and the majority (59.5%) scored from 3.0 to 6 marks. These data are presented in Figure 4.

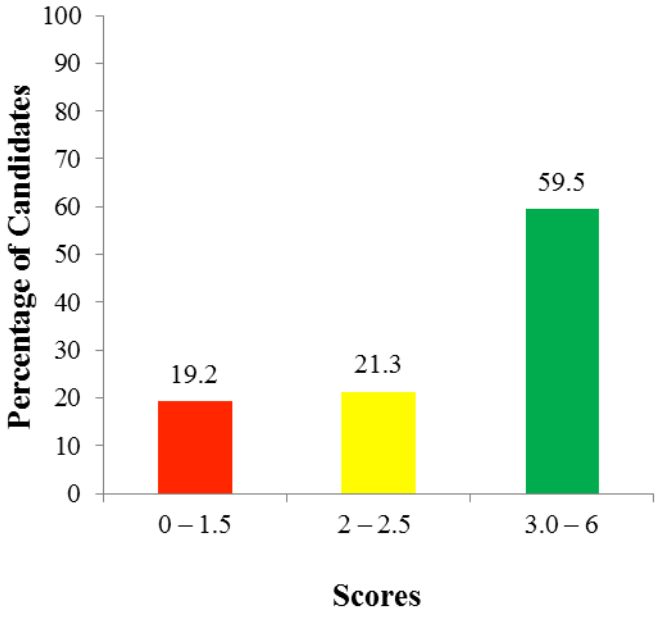


Figure 4: Performance of the candidates in question 5.

Figure 4 indicates that the majority of the candidates scored high marks (3 to 6), an indication of good performance in this question. The candidates who scored high marks recognized that sodium and potassium have one electron in their outermost shells, therefore, they have similar chemical properties. Similarly, they were able to correctly explain the trend in the reactivity of group I elements and correctly filled the provided table. This shows that the concepts tested from the aforementioned topics were well understood by most of the candidates. Extract 5.1 is one of the good responses from one of the candidates.

Extract 5.1

5 (a)(i) Sodium and potassium elements have similar chemical properties because they belong to the same group: since the outer most shell of sodium has one electron, and potassium has one electron in the outermost shell so they belong to the same group and the elements with same group have the similar chemical properties.
Sodium (Na): 2:8:1
Potassium (K): 2:8:8:1.

(ii) The reactivity trend of group I element decrease increase when going down the group due to the the decreasing of ionization energy when going down the group

(b) s/n	Name of element	Atomic number	Electronic configuration
(i)	lithium	3	2:1
(ii)	Aluminium	13	2:8:3
(iii)	chlorine	17	2:8:7

In Extract 5.1 the candidate correctly explained the similarity in chemical properties between sodium and potassium and with reasons, clearly stating the trend in reactivity of group I elements. The candidate was also able to fill the given table.

On the other hand, the candidates who scored low marks failed to explain the reason for the similarities of sodium and potassium and also were unable to state the trend in the reactivity of group I elements. Furthermore, they incorrectly filled the given table. This shows that they had no sufficient knowledge of the examined concepts of the periodic table. The analysis further shows that some of the candidates who scored low marks, managed to fill some of the information in the table but failed to give the explanation demanded in part (a). Extract 5.2 illustrates one of the poor responses.

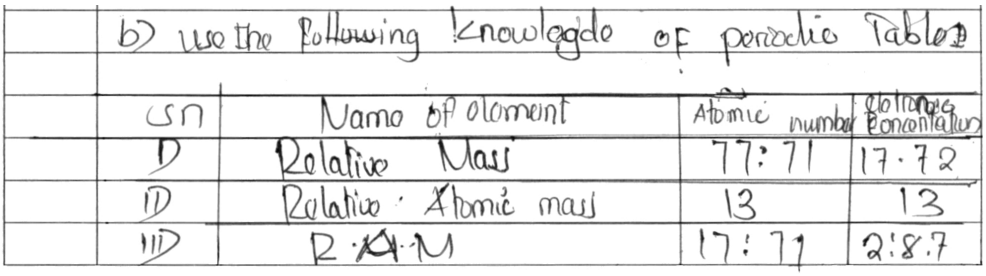
Extract 5.2

5 i) Salt pottasium
Salt Pottasium & hydrogen

ii) halogen

iii)

i) Menta'
The reactivity of group 1 Menta in the periodic Table because in you element of the menta in the one group of the Menta is not of the Non menata Menta in the variance of one



	b) use the following knowledge of periodic Table		
	SN	Name of element	Atomic number / Electronic Configuration
	I	Relative Mass	17:71 / 17.72
	II	Relative Atomic mass	13 / 13
	III	R.A.M	17:71 / 2:8.7

The candidate's response in Extract 5.2 did not meet the requirement of the question. For example in part (b), the candidate wrote; *relative atomic mass*, *relative mass* and *R.A.M* as names of elements instead of lithium, aluminium and chlorine.

2.2.4 Question 6: Matter; Acids, Bases and Salts

In part (a), the candidates were given the Table 2 shown below, which indicates suitable soil pH values for some crops to grow:

Table 2

Crops	Soil pH
Tomato	7.0
Bean	6.0
Cabbage	5.4
Cauliflower	5.6
Celery	6.3
Lettuce	6.1
Onions	5.7
Swede	5.3
Parsley	5.1

The candidates were then required to identify a crop which grows best in the: most acidic soil, least acidic soil and neutral soil. In part (b), the candidates were required to suggest one best method for separating each of the mixtures of common salt and water, iodine and sand and pieces of iron and sand.

The question was attempted by many candidates (94.3%), of which 35.9 percent scored from 2.0 to 2.5 marks, 16.8 percent scored from 3.0 to 6 marks. The candidates who scored from 0 to 1.5 marks were 47.3 percent, of

which 25.4 percent scored a zero mark. The pie chart (Figure 5) shows the distribution of the candidates' scores.

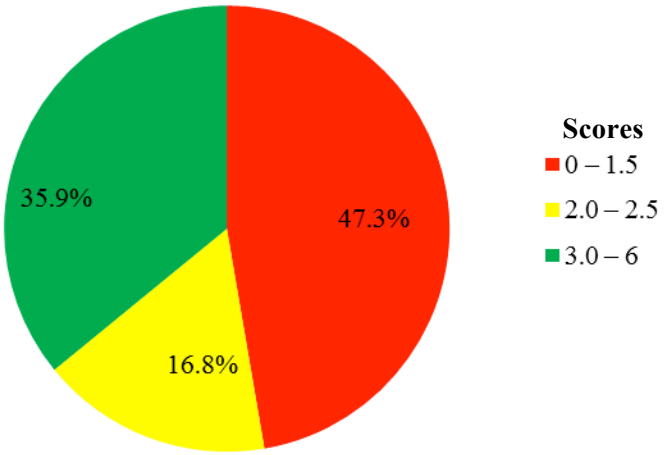


Figure 5: Performance of the candidates in question 6.

Figure 5 shows that 52.7 percent of the candidates scored 2 to 6 marks implying good performance in this queston. The candidates who got higher scores were able to identify and classify each crop to its corresponding soil pH. In part (b) they were also able to suggest the methods for separating the given mixtures. Extract 6.1 displays a sample answer from one of the candidates.

Extract 6.1

6	a) i) The crop is Parsley
	ii) In least acidic, the crop is celery
	iii) In neutral soil, the crop is tomato
	b) i) Common salt and water can be separated by
	simple distillation
	ii) Iodine and sand are separated by sublimation
	iii) Pieces of iron and sand are separated by the
	Magnetization method

In Extract 6.1, the candidate properly selected crops which grow well in most acidic, least acidic and neutral soils. The candidate was also able to suggest the best method for separating the given mixtures.

On the contrary, some of the candidates who scored low marks (0 – 1), had wrong conception that the most acidic soil is the one with high pH and vice versa; and as a result, they wrongly identify the crops. The analysis also showed that, other candidates listed several crops and wrongly categorized them as those which grow well in either least acidic, most acidic or neutral soils; an indication that they didn't understand the requirement of the question. In the same way, they failed to give proper methods for separating the given mixtures in part (b). This indicates that they lacked practical experience in laboratory procedures. Extract 6.2 shows a sample of responses which do not meet the requirement of the question.

Extract 6.2

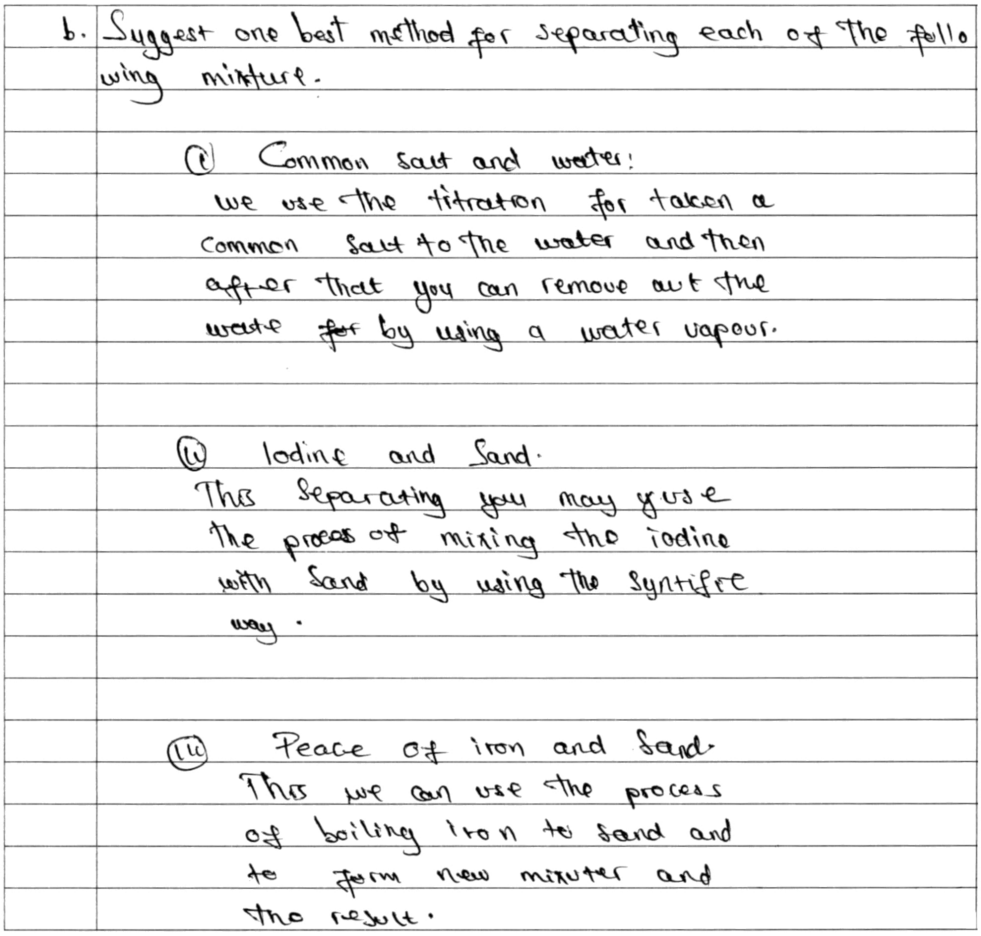
6.

Crops	Soil pH
Tomato	7.0
Bean	6.0
Cabbage	5.4
Cauliflower	5.6
Celery	6.3
Lettuce	6.1
Onion	5.7
Swede	5.3
Parsley	5.1

(i) Most acidic soil
- Tomato 7.0

(ii) Least acid soil
- Tomato
- Bean
- Cabbage
- Onion

(iii) Neutral soil
- Celery
- lettuce.
- Swede.
- Parsley.


b. Suggest one best method for separating each of the follo wing mixture.

(i) Common salt and water:
we use the titration for taken a common salt to the water and then after that you can remove out the waste for by using a water vapour.

(ii) Iodine and Sand.
This separating you may yuse the proces of mixing the iodine with Sand by using the Syntifre way.

(iii) Peace of iron and Sand.
This we can use the process of boiling iron to Sand and to form new mixuter and the result.

In Extract 6.2, the candidate listed a series of crops instead identifying one crop in respect to its soil pH. In addition, he/she suggested irrelevant methods for separating the given mixtures.

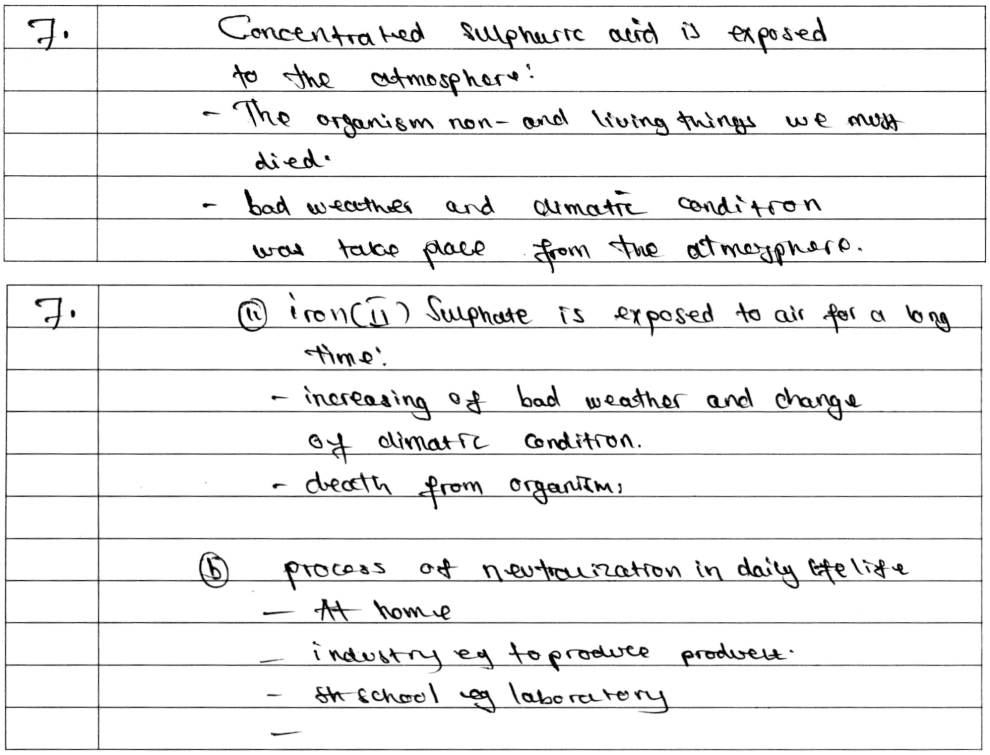
2.2.5 Question 7: Metals and their Compounds; Acids, Bases and Salts

There were two parts in this question; (a) and (b). Part (a) demanded the candidates to explain what will happen when concentrated sulphuric acid is exposed to the atmosphere, iron (II) sulphate is exposed to the air for a long time and a bottle containing $AgNO_3$ is left open. In part (b), the candidates were asked to give three applications of the neutralization process in daily life.

Although the question was compulsory, it was ranswered by only about three quarters (76.7%) of the candidates. The data show that the majority

(79.1%) of the candidates scored low marks (0 – 1), of which 63.8 percent scored a 0 mark. Thus, the general performance in this question was poor.
The candidates who scored low marks had inadequate knowledge about the concepts of hygroscopic substances, oxidation and decomposition reactions of different salts. They did not know the application of neutralization reaction in daily life experience. They were unaware that neutralization is applicable in "relieving indigestion, treating insect stings and bites, in soil treatment as liming, treating factory wastes or chemical wastes, neutralizing accidental spills and in reducing acid rain occurrence". Extract 7.1 illustrates one of the poor responses.

Extract 7.1

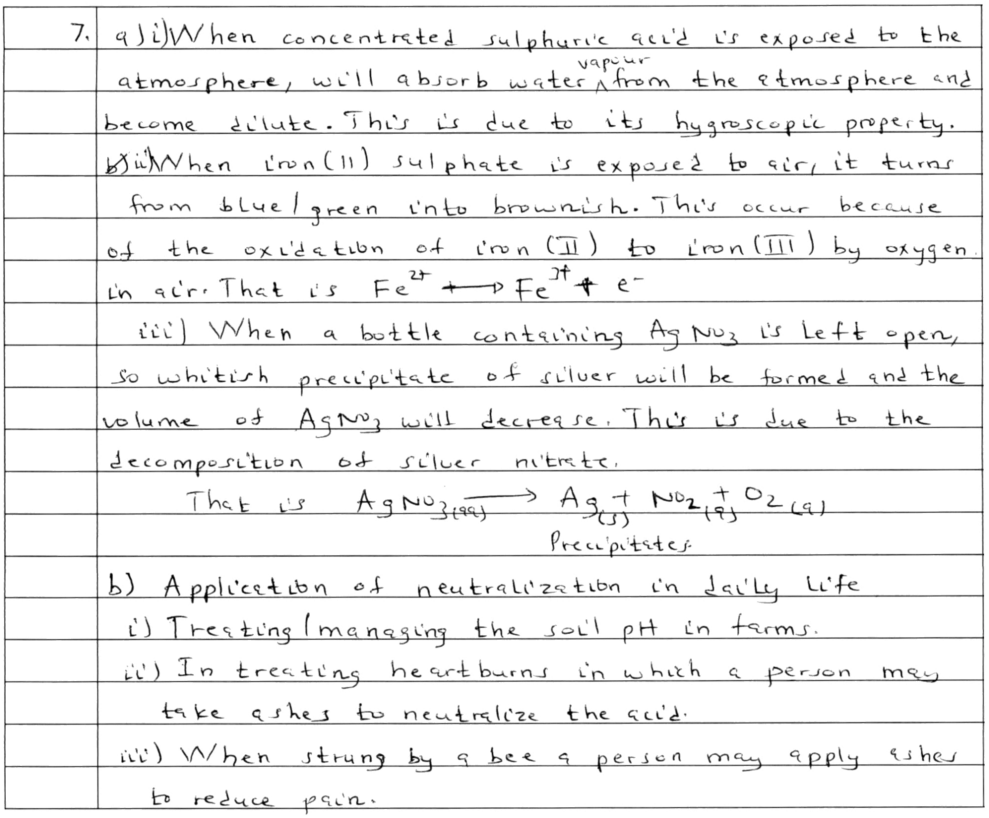


Extract 7.1 shows the candidate's wrong responses. For example when sulphuric acid is exposed to the atmosphere the candidate wrote; *the organism non and living things we must die*, indicating that he/she lacked the knowledge on properties of sulphuric acid.

On the other hand, the candidates who scored high marks, described properly the outcomes of the exposure of sulphuric acid, ferrous sulphate and silver nitrate to the air. There were some clever candidates who went further to support their description with the reaction equations (Extract 7.2).

They also gave a correct application of neutralization reaction in various fields, as the question needed. Extract 7.2 shows one of the good responses.

Extract 7.2


7. a) i) When concentrated sulphuric acid is exposed to the atmosphere, will absorb water vapour from the atmosphere and become dilute. This is due to its hygroscopic property.
ii) When iron(II) sulphate is exposed to air, it turns from blue/green into brownish. This occur because of the oxidation of iron(II) to iron(III) by oxygen in air. That is $Fe^{2+} \longrightarrow Fe^{3+} + e^-$
iii) When a bottle containing $AgNO_3$ is left open, so whitish precipitate of silver will be formed and the volume of $AgNO_3$ will decrease. This is due to the decomposition of silver nitrate.
That is $AgNO_{3(aq)} \longrightarrow Ag_{(s)} + NO_{2(g)} + O_{2(g)}$
Precipitates
b) Application of neutralization in daily life
i) Treating/managing the soil pH in farms.
ii) In treating heartburns in which a person may take ashes to neutralize the acid.
iii) When strung by a bee a person may apply ashes to reduce pain.

In Extract 7.2, the candidate gave balanced chemical equations to explain the behavior of the given compounds when exposed to the air. He/she correctly mentioned the application of neutralization reaction.

2.2.6 Question 8: Oxygen; Hydrogen; Non-metals and their Compounds; Volumetric Analysis

Part (a) of this question required the candidates to give the names or formula of the two chemicals that could be used in the laboratory to prepare oxygen, hydrogen and carbon dioxide gases and state a simple test that could be used to identify each gas. In part (b), the candidates were required to suggest a suitable indicator for the titration of hydrochloric acid against ammonia

solution, sulphuric acid against sodium hydroxide solution and ethanoic acid against potassium hydroxide solution.

The number of candidates who attempted this question was 148,826 representing 86.6 percent of the candidates, and out of which 66.1 percent scored below 2 out of 6 marks, with 27.6 percent scoring a zero mark. The candidates who scored 2 to 2.5 marks were 13.6 percent, while those who scored 3 to 6 marks were 20.3 percent. Figure 6 represents these data.

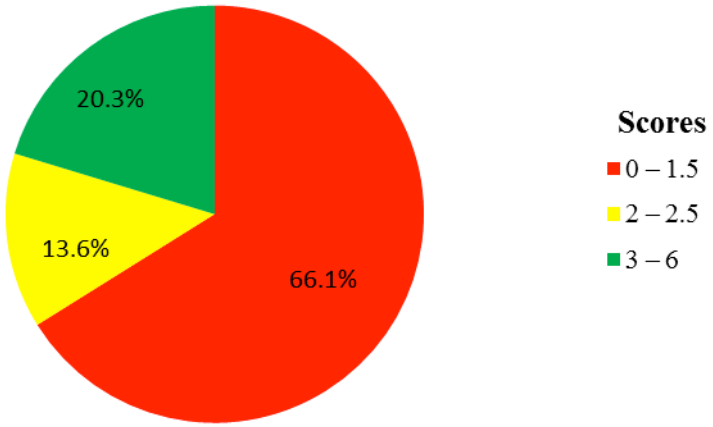
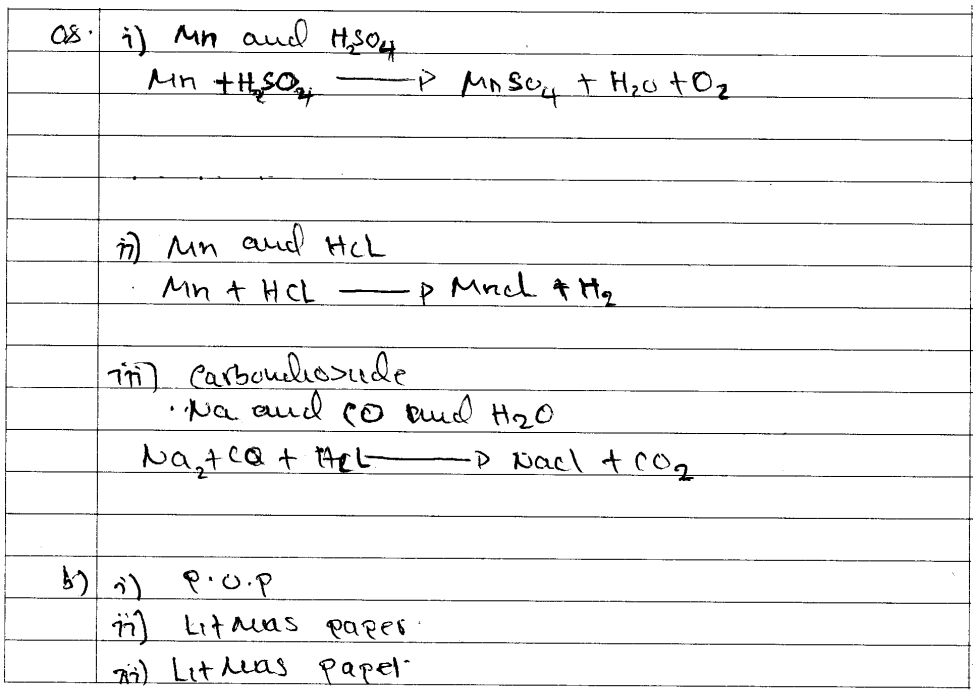


Figure 6: Performance of the candidates in question 8.

Figure 6 shows that the general performance of the candidates in this question was average, as a total of 33.9% of the candidates passed. Some of the candidates who scored low marks (0 to 1.5), failed to mention the names or the chemical formulae of the chemicals used in the preparation of gases, whereas others failed to suggest a suitable indicator for the given pair reagents. They could not recognize that the strength (pH) of an acid and a base is the basis for the choice of indicator. Extract 8.1 is a sample answer from a script of a candidate whose performance was poor.

Extract 8.1



In Extract 8.1 the candidate presented irrelevant chemical equations and wrongly suggested a litmus paper as one of the suitable indicators for titration.

The candidates who scored high marks gave correct formulae or names of the chemicals needed in the preparation of oxygen, hydrogen and carbon dioxide gases. The candidates also suggested the suitable indicators used in the titration of the given pairs of acids and bases. A sample response from one of the candidates who performed well is presented in Extract 8.2.

Extract 8.2

8. a) i) The chemical that would be used is hydrogen peroxide using Manganese dioxide catalyst. And also Copper nitrate by thermal decomposition.

TEST OF OXYGEN GAS

-When a glowing wooden splint is brought near oxygen it is relighted this tests the presence of oxygen gas.

ii) a) HCl reacted with metal (Na)

b) H_2SO_4 reacted with metal (Mg)

⇒ The TEST OF THE GAS.

When a glowing wooden splint is brought at the top of test tube containing hydrogen gas it burns with pop sound.

iii) a) When $NaHCO_3$ is reacted with HNO_3.

ii) When $MgCO_3$ is reacted with ~~HCl~~. HCl.

THE TEST OF THE GAS

When lime water on a glass rod gets exposed to carbon dioxide turns milky this is due to precipitation of calcium carbonate.

b) i) Methyl orange will be suitable since it is a strong acid and a weak base.

ii) Any indicator such as methyl orange and phenolphthalein will be suitable since it involves a strong acid and a strong base.

iii) Phenolphthalein indicator will be suitable since it involves weak acid and strong base.

In Extract 8.2 the candidate presented correct methods of preparation of the gases and the methods of testing them. The candidate also described well the application of indicators according to the strength of the acids and bases.

2.2.7 Question 9: Formula, Bonding and Nomenclature; Organic Chemistry

Part (a) of the question required the candidates to mention the type of chemical bond which is found between fluorine atoms in the fluorine molecule. The candidates were also required to name other chemical bond(s) formed when fluorine combines with other elements, with an example. In part (b), the candidates were provided with percentage composition by mass of elements in compound X as 24.24% carbon, 4.04% hydrogen and 71.72% chlorine and the vapour density of the compound 49.5. The candidates were then asked to calculate the molecular formula of the compound, draw and name the displayed/open structural formula of the possible isomer(s) from the molecular formula determined.

A total of 148,643 (86.5%) candidates attempted this question. The percentage of candidates who scored 0 to 1.5 marks was 56.7. The candidates who scored 2 to 2.5 marks were 19 percent and those who scored 3 to 6 marks were 24.3 percent. Few candidates (0.7%) scored all the 6 marks. The following pie chart gives the summary of these statistics.

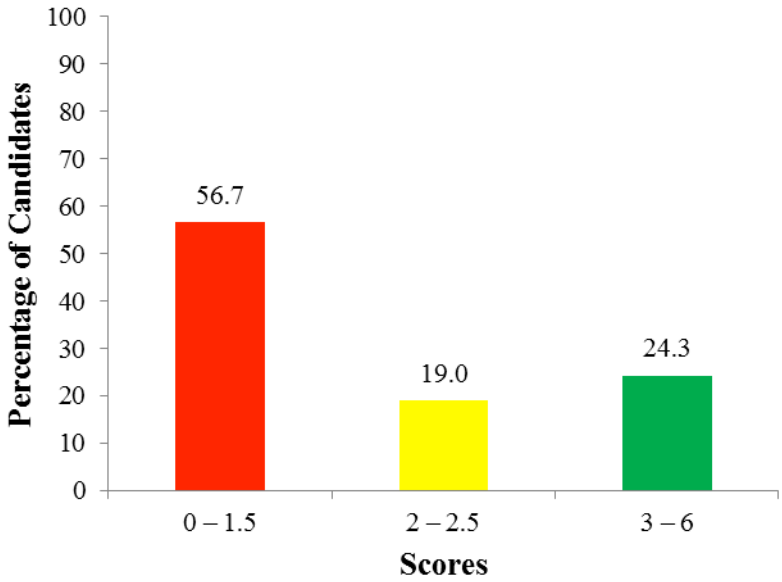


Figure 7: Performance of the candidates in question 9.

Figure 7 shows that the general performance of the candidates in this question was average as 43.3 percent of the candidates who scored from 2 to 6 marks. The candidates who scored higher marks were able to mention the type of chemical bond in fluorine molecule and gave chemical bonds formed when fluorine was combined with other elements. The candidates were able

to give examples of compounds formed when fluorine atom forms chemical bonds with other elements. In addition, they calculated correctly the molecular formula of compound X and were able to name and draw the open structures of the isomers of the determined compound. Extract 9.1 illustrates this case.

Extract 9.1

9: a) i) The type of chemical bond found in fluorine molecule is covalent bond.

9: a(ii) The other type of chemical bond is electrovalent bond.

Example; Potassium fluoride, formula is K_2F

b). i)

	C	H	CL
Mass	24.24	4.04	71.72
R.A.M	12	1	35.5
Mass / R.A.M	24.24 / 12	4.04 / 1	71.72 / 35.5
Divide small number by all	2.02 / 2.02	4.04 / 2.02	2.02 / 2.02
	1	2	1

∴ Empirical formula = $C_1H_2CL_1 = CH_2CL$

Molecular formula = n(Empirical formula),

But Molecular formula = Vapour density X2

= 49.5 X 2

= 99

Then from; Molecular formula = n(Empirical formula).

$99 = n(CH_2CL)$

Empirical formula = Relative Molecular Mass

$\Rightarrow CH_2CL = C + H_2 + CL$

$= 12 + 2(1) + 35.5$

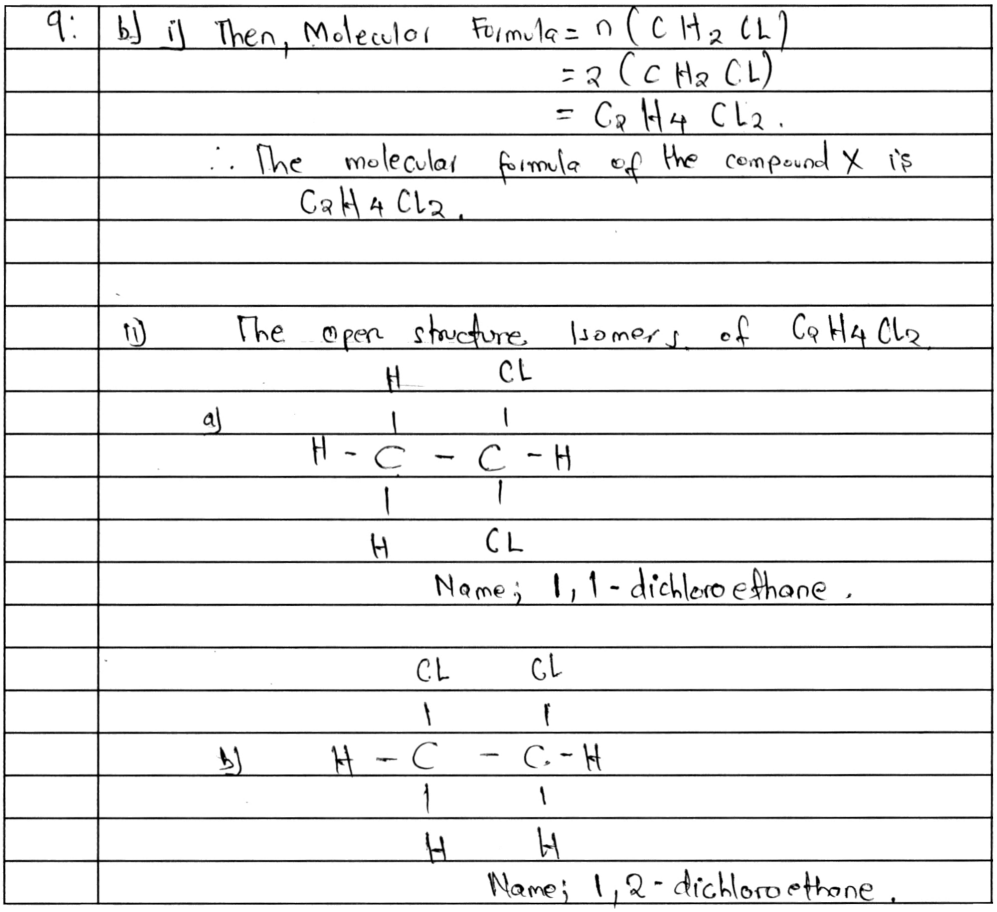
$= 49.5$

To get n:

$99 = n(49.5)$

$n = 99/49.5$

$= 2.$



In Extract 9.1 the candidate correctly named the bond formed between fluorine atoms and other elements. The candidate also correctly calculated the molecular formula of the compound and presented the isomers according to the requirement of the question.

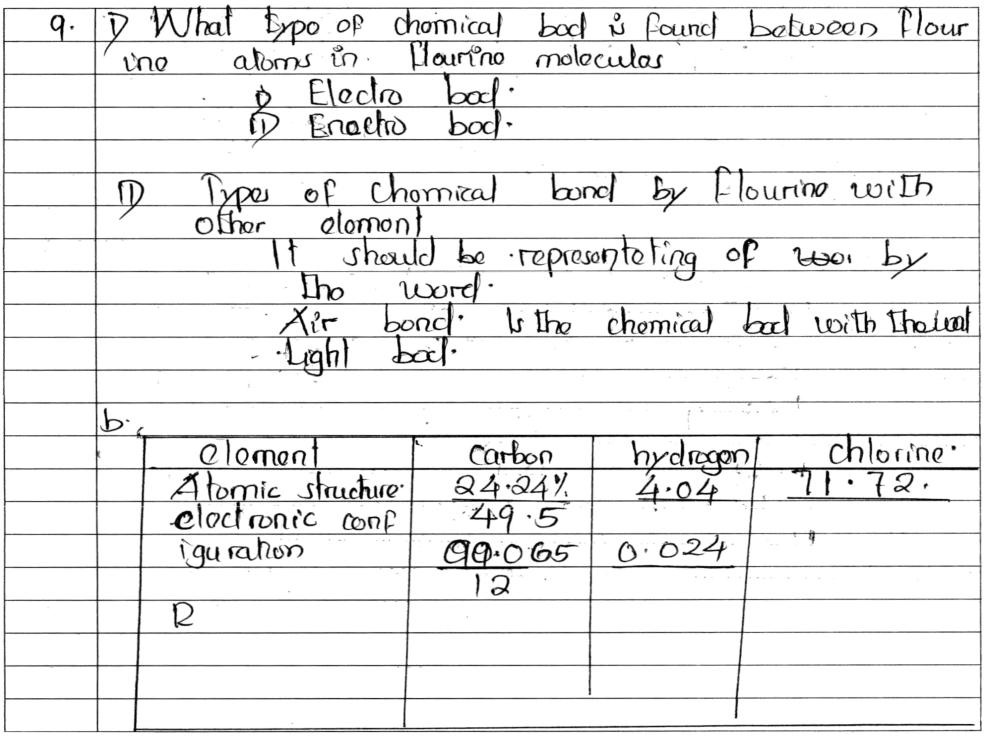
The candidates who scored a zero mark in this question failed to name the chemical bond found between fluorine atoms in the fluorine molecule and did not manage to name other types of chemical bond formed when fluorine combines with other elements. For example, one candidate wrote:

> *"Chemical bond is the bond which is found the two different element which have the same molecular formula but different mass number. Other types of chemical bond which is found to fluorine element and flainne molecule are: -Physical bond"*

Such irrelevant answer is an indication of inadequate knowledge of the concept of covalent bond.

The candidates also failed to recognize that the given percentages are not exact masses but relative masses. The candidates were also unaware that in order to find the relative number of moles of atoms present, the given percentages should be divided by the molar mass of the respective elements. The analysis also revealed that some of the candidates failed to relate vapour density with relative molecular mass. As a result, they failed to calculate the molecular formula of compound and consequently failed to draw the isomers of the compound. Extract 9.2 illustrates one of the poor responses.

Extract 9.2



In Extract 9.2, the candidate gave incorrect types of bonds and provided irrelevant explanations about the bond formed between fluorine and other elements. She/he failed to calculate the molecular formula of compound X.

2.2.8 Question 10: Hardness of Water; Atomic Structure

This question was divided into two parts. Part (a) stated that: A student tested four samples of water, each 5 cm^3 from different areas of Kahama district by shaking with 3 drops of soap solution. The experiment was

repeated by boiling each sample of water (5 cm^3) with 3 drops of soap solution. The observations were recorded in Table 3.

Table 3

Sample	Observation with soap solution	Observation for boiled sample with soap solution
A	No lather	Lather
B	Lather	Lather
C	Lather	Lather
D	No lather	No lather

The candidates were required to identify the samples that contained hard water and those which contained temporary hard water by giving reasons for their answers.

In part (b) of the question, the candidates were provided with some information about protons, neutrons and electrons particles, as shown in Table 4 and required to fill in the missing information.

Table 4

Particles	Relative mass	Relative charge	Location
Proton			
Electron	$\frac{1}{1840}$		
Neutron		0	In the nucleus

The question was attempted by the majority 155,151 (90.2%) of the candidates, out of which 58.0 percent scored 2 marks or above out of 6 marks, implying that 42.0 percent scored below 2 marks. The candidates who scored 2 to 2.5 marks were 18.8 percent, while those who scored 3 to 6 marks were 39.2 percent. Figure 8 gives a summary of these statistics.

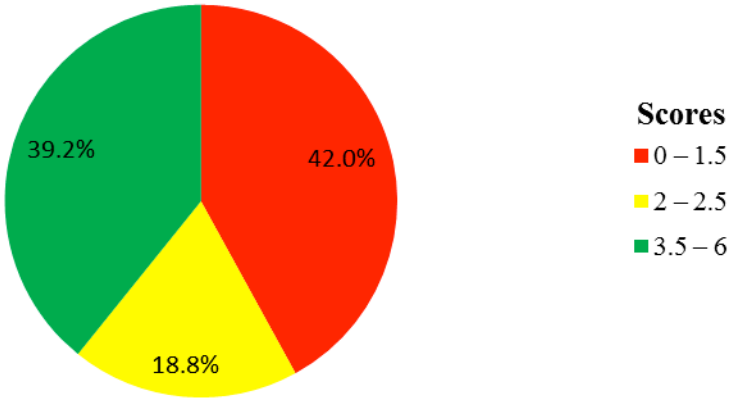


Figure 8: Performance of the candidates in this question.

Figure 8 shows that a total of 58% of the candidates scored 2 to 6 marks indicating a good performance in this question. The candidates who scored high marks had enough knowledge because they were able to identify that sample A and B contained hard water. They were also able to recognize that sample A contained temporary hard water. They also gave reasons that temporary hard water is softened by boiling since it contains bicarbonate that can easily be removed on boiling. Furthermore, they were able to fill in the missing information in the table provided. Extract 10.1 shows a sample of a good response from one of the candidates.

Extract 10.1

10. (a) (i) The samples which contain hard water are Sample A and Sample D

(ii) The sample which contain hard temporary water is a Sample A. This is because it forms a lather with a soap solution when it is hot (boiled).

(b) TABLE 4

Particles	Relative Mass	Relative charge	Location
Proton	1	+1	In the nucleus
Electron	1/1840	-1	In the shell
Neutron	1	0	In the nucleus

In Extract 10.1, the candidate correctly identified the samples which contained hardness of water and that which contained temporary hardness of water. The candidate also filled correctly the given table.

However, some of the candidates who scored a zero mark had inadequate knowledge of hardness of water and atomic structure, as most of them wrote answers which did not meet the requirement of the question. For example, one candidate wrote, "(*i) Which sample contain water- Lather.*
(ii) Which sample contain temporary hard water- hard water u in the layer of lather was used of the soft water was the washing in the victing". These answers indicate that the candidate resorted to writing anything regardless of whether it answers the question or not. Extract 10.2 shows a sample answer from the script of another candidate whose performance was also poor.

Extract 10.2

10 (i) Hard water: Is the Coaintain of the wate gaid from the home on movement surface area in water.
(ii) Temporary hard water Is the Comtain of the Surface are from the Instrument from Expe riment beter ainy in the nicate from the temporary
- It help us to iproveded human bidy
- It help us to Greening the Surface area.

(b)

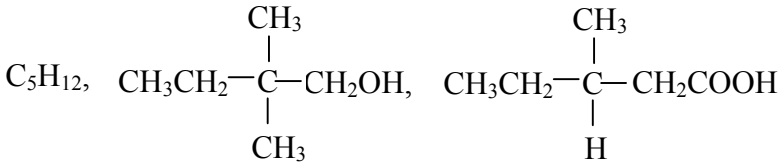
Particles	Relative mass	Relative Charge	Location
Proton			
Electron	$\frac{1}{1840}$		
Neutron		0	in the nucle us

Extract 10.2 shows the response of one of the candidates who failed to comprehend the questions requirement. The candidate wrote poor and meaningless sentences and in part (b), did not fill in the required responses.

2.2.9 Question 11: Ionic Theory and Electrolysis; Organic Chemistry

In part (a), the candidates were required to calculate the molar mass of metal X given that, when a steady current of 2A was passed through a solution

containing ions of a metal (X^{2+}) for nine minutes, 0.3552 g of metal X were liberated. Part (b) of the question required the candidates to name the following compounds according to the IUPAC system:



The majority of the candidates 148,808 (86.6%) attempted this question. The performance was poor as 71.8 percent of the candidates scored below 2 marks, of which 38 percent scored a zero mark. The percentage of the candidates who scored 2 to 2.5 marks was 8.3. Those who scored 3 to 6 marks were 19.9 percent, of which 0.3 percent scored all the 6 marks. Figure 9 gives a summary of performance of the candidates in this question.

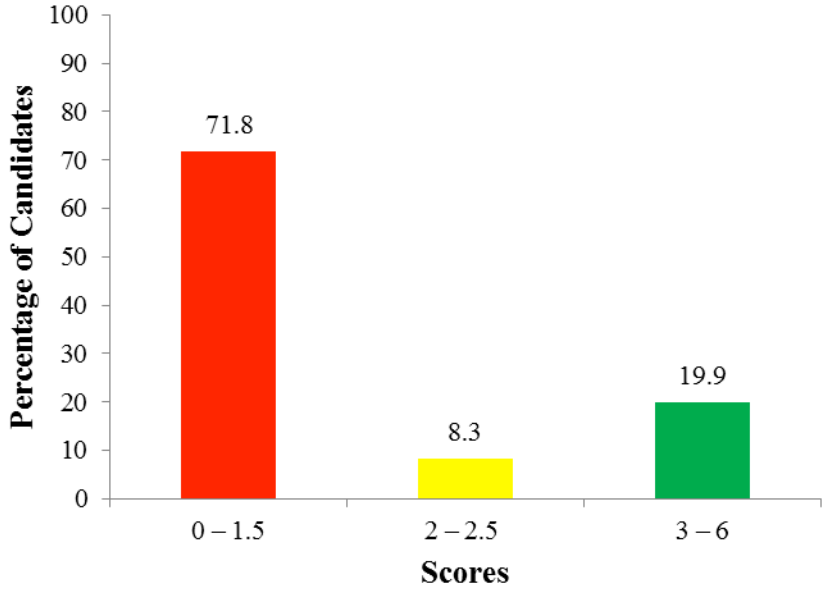
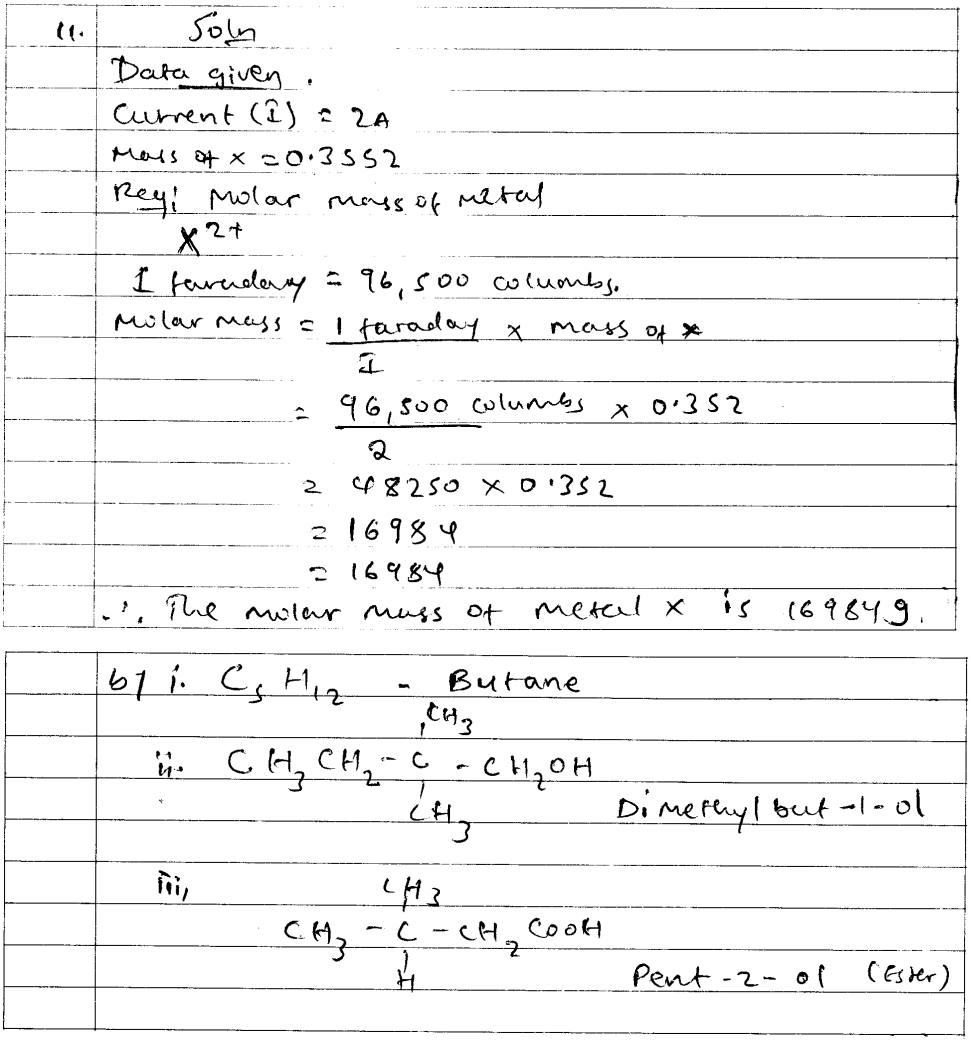


Figure 9: Performance of the candidates in question 11.

As Figure 9 shows, the majority of the candidates (71.8%) scored low (0 – 1.5) marks in this question. These candidates failed to use the Faraday's first law of electrolysis to associate with the liberated moles and the charges on metal X. Others did not recognize that metal X has two charges which means it requires 2 Faradays to liberate 1 mole of metal X. In other cases, some candidates just copied the question without providing an answer. This is an indication of lack of skills and knowledge on the concept of

electrolysis. Similarly, most of the candidates failed to name the given compounds according to IUPAC system, hence missing marks for part (b) of the question. Extract 11.1 shows a sample answer from the script of a candidate whose performance was poor.

Extract 11.1



In Extract 11.1 the candidate used wrong formula in calculating the molar mass of metal X. He/she also failed to apply IUPAC system to name the given compounds.

On the other hand, the candidates who scored high marks in this question managed to write a correct discharge equation. They made the correct manipulation of the data and substituted them into appropriate formula. Extract 11.2 shows a sample of a correct response to this question.

Extract 11.2

11. (a) Solution

Data given

Current, $I = 2A$

Metal, X^{2+}

time, $t = 9\ min\ (9 \times 60\ sec)$

Mass, $m = 0.3552\ g$, R.A.M of $X = ?$

11. (a) Then, from

1st Law of electrolysis

$m = ZIt$

$\therefore Z = \frac{m}{It}$

$= \frac{0.3552g}{2A \times 540s}$

$Z = 3.3 \times 10^{-4}\ g/C$

But

$Z = \frac{RAM}{V \times F}$ $\quad V = 2$, $F = 96500C$

$\therefore RAM = Z \times V \times F$

$= 3.3 \times 10^{-4}\ g/C \times 2 \times 96500C$

$= 3.3 \times 2 \times 9.65 \times 10^{-4} \times 10^{4}$

$= 63.969\ g/mol$

$\simeq 64\ g/mol$

$\therefore$ The Molar mass of element X is approximately to be 64 g/mol.

(b) (i) C_5H_{12} – (Pentane)

(ii) $CH_3CH_2-\underset{\underset{CH_3}{|}}{\overset{CH_3}{\overset{|}{C}}}-CH_2OH$

(2,2-dimethylbutan-1-ol)

(iii) $CH_3-\underset{\underset{H}{|}}{\overset{CH_3}{\overset{|}{C}}}-CH_2COOH$.

(3-methylbutanoic acid)

In Extract 11.2 the candidate managed to use the first Faraday's law of electrolysis to calculate the molar mass of metal X and correctly named the given compounds according to the IUPAC system.

2.3 Section C: Essay Questions

This section had two (2) questions; each carried a total of thirteen (13) marks. The pass score in each question was 4.0 marks or above.

2.3.1 Question 12: Extraction of Metals

The candidates were required to describe the extraction of iron from haematite ore and write all the chemical equations for the reactions involved in each stage of extraction.

This question was attempted by 54.4 percent of the candidates, whereby 88.8 percent of them scored below 4 out of 13 marks, with 37.9 percent scoring a zero mark. The candidates who managed to score 4 to 6 marks were 9.6 percent, 6.5 to 13 marks were 1.6 percent. It is only 6 candidates who managed to score all the 13 marks. Figure 10 gives a summary of the performance of the candidates in this question.

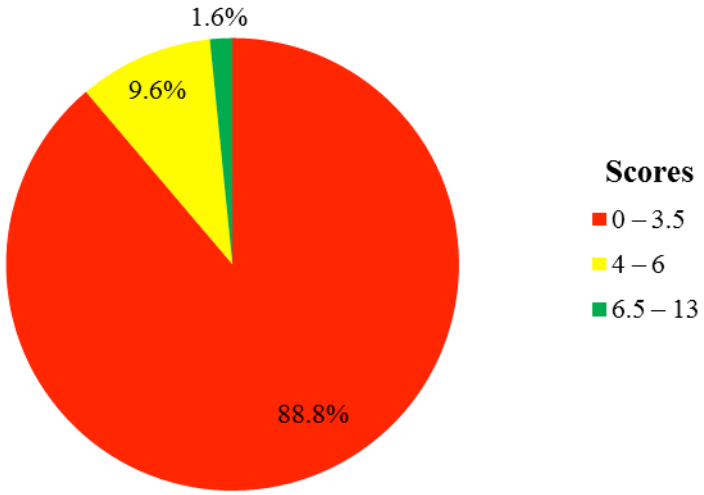
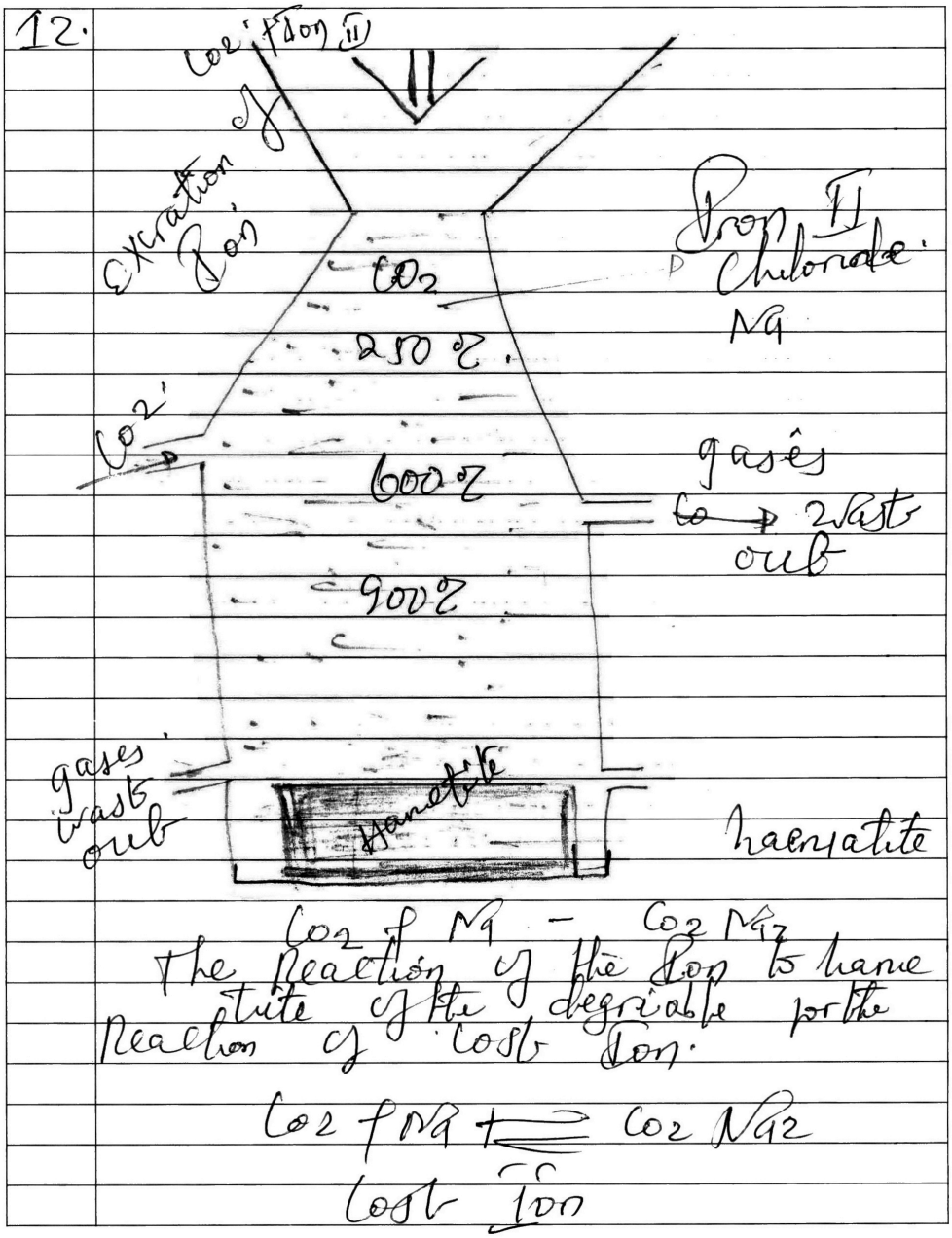


Figure 10: Performance of the candidates in question 10.

Figure 10 shows that the general performance of the candidates in this question was poor as many (88.8%) scored very low marks. Some of the candidates did not manage to write the correct balanced chemical equations for the reactions taking place in the blast furnace and also could not indicate the ranges of temperature during the process of reduction. Others failed to indicate the raw materials needed in the blast furnace, as well as their specific locations. In other cases, it was noted that some of the candidates

failed to express well their ideas in English language. Extract 12.1 illustrates this case.

Extract 12.1



In Extract 12.1 the candidate made a mistake by considering the raw materials (haematite) as a product instead of iron. The candidate also provided irrelevant chemical equations in the blast furnance.

The candidates who scored high marks in this question wrote a good introduction of the occurrence of iron. They described well the stages used in the extraction of iron and provided a good discussion on each stage. Other candidates supported their description with a well drawn diagram of the blast furnace and indicated all parts clearly. They also wrote correct balanced chemical equations which take place at each stage. In addition, the correct temperature ranges were indicated. Extract 12.2 illustrates this case.

Extract 12.1

12 The extraction of iron is mainly obtained from the ore called haematite (Fe_2O_3). The following are the stages involved in the extraction of iron

(i) Concentration of the ore

(ii) Roasting

(iii) Extraction of the iron by reduction using carbon

(iv) Refining of the crude (pig) iron.

(i) Concentration of the ore.

- The haematite ore is firstly concentrated to remove earth impurities and other non-magnetic impurities. The stage does not involve physical alteration of the ore

(ii) Roasting

In this stage, the ore is heated in the presence of oxygen (air) below its melting point. The following reactions take place during this stage

- The moisture present in the ore is removed by evaporation

$$Fe_2O_3 \cdot xH_2O_{(s)} \xrightarrow{\Delta} Fe_2O_{3(s)} + xH_2O_{(g)}$$

- Iron carbonate which might be probably present in the ore as impurity is decomposed into iron(II) oxide

$$FeCO_{3(s)} \xrightarrow{\Delta} FeO_{(s)} + CO_{2(g)}$$

- The ferrous oxide (FeO) formed by the decomposition of iron(II) carbonate is oxidized into iron(III) oxide. This reduces the chances for the iron to be lost since FeO react with sand to form slag.

$$4FeO_{(s)} + O_{2(g)} \longrightarrow 2Fe_2O_{3(s)}$$

- Non-metallic impurities such as antimony, arsenic and sulphur are oxidized into their respective oxides and escape as gases. For example.

$$4As_{(s)} + 3O_{2(g)} \longrightarrow 2As_2O_{3(g)}$$

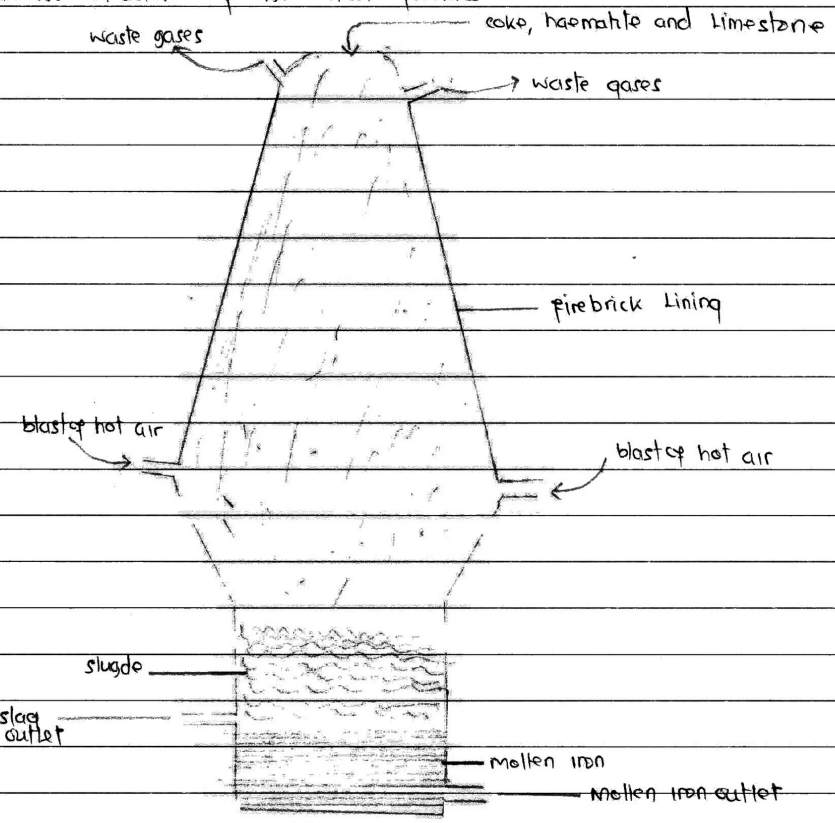
12 $4Sb_{(s)} + 5O_{2(g)} \longrightarrow 2Sb_2O_{5(g)}$

$S_{(s)} + O_{2(g)} \longrightarrow SO_{2(g)}$

After that the remaining haematite is taken for smelting

(iii) Smelting of the ore to produce iron

The reduction process of haematite take place in the blast furnace. This is a tall structure which is about 30M tall and 15M in diameter. It has two pipes near the top for removing waste gases, a charging door at the top and two pipes at the bottom for the removal of molten pig iron and slag. The following is the structure of the blast furnace.



The coke, limestone and haematite are mixed together and put into the blast furnace through the charging door at the top The blast furnace is divided into three main zones due to their

12 temperature differences. They include

(i) The upper zone of reduction

The temperature at this zone varies from 300°c – 800°c. The following reactions take place in the upper zone of reduction.

- The carbon (coke) reacts with oxygen to form carbon dioxide $C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$
- The carbon dioxide formed react with coke to produce carbon monoxide

$$CO_{2(g)} + C_{(s)} \longrightarrow 2CO_{(g)}$$

- The haematite iron (III) oxide is reduced to iron by the carbon monoxide

$$Fe_2O_{3(l)} + 3CO_{(g)} \longrightarrow 2Fe_{(l)} + 3CO_{2(g)}$$

- Some of the lime stone is decomposed at 800°c to form calcium oxide

$$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(l)} + CO_{2(g)}$$

- The carbon dioxide formed then react with coke to produce carbon monoxide

$$C_{(s)} + CO_{2(g)} \longrightarrow 2CO$$

(ii) Middle zone of reduction

The temperature in this zone is ranging from 900°c – 1200°c. The following reactions take place in this zone.

- The limestone continue to decompose into calcium oxide

$$CaCO_{3(s)} \xrightarrow{\Delta} CaO_{(l)} + CO_{2(g)}$$

- The quicklime formed react with sand to form fusible slag. In this reaction, the quicklime acts as a flux.

$$CaO_{(l)} + SiO_{2(s)} \longrightarrow CaSiO_{3(l)}$$

12 The slag being less denser float over the molten iron

(iii) Lower zone of reduction

It is the hottest zone of the furnace with the temperature ranging from 1200°C to 1500°C. The following reactions take place in the Lower zone of reduction.

- The spongy iron melts into Molten iron.
- The iron (II) oxide is reduced to iron by carbon

$$2FeO_{(s)} + C_{(s)} \longrightarrow 2Fe + CO_2$$

The iron obtained in this furnace is impure and hence it is called pig iron. The iron being more denser sinks at the bottom of the furnace and removed from the bottom pipe. It is prevented from being oxidized by a layer of fusible slag. The slag and the pig iron are then removed periodically.

(iv) Refining of the pig iron

The pig iron is then refined and purified by resmelting using another blast furnace. The iron obtained is called cast iron as it is relatively pure compared to the pig iron.

In Extract 12.2, the candidate wrote a good introduction of the occurrence and concentration of iron, explained well the stages of extraction, presented well a labeled diagram of the blast furnace and finally, gave a clear refining process of iron.

2.3.2 Question 13: Soil Chemistry

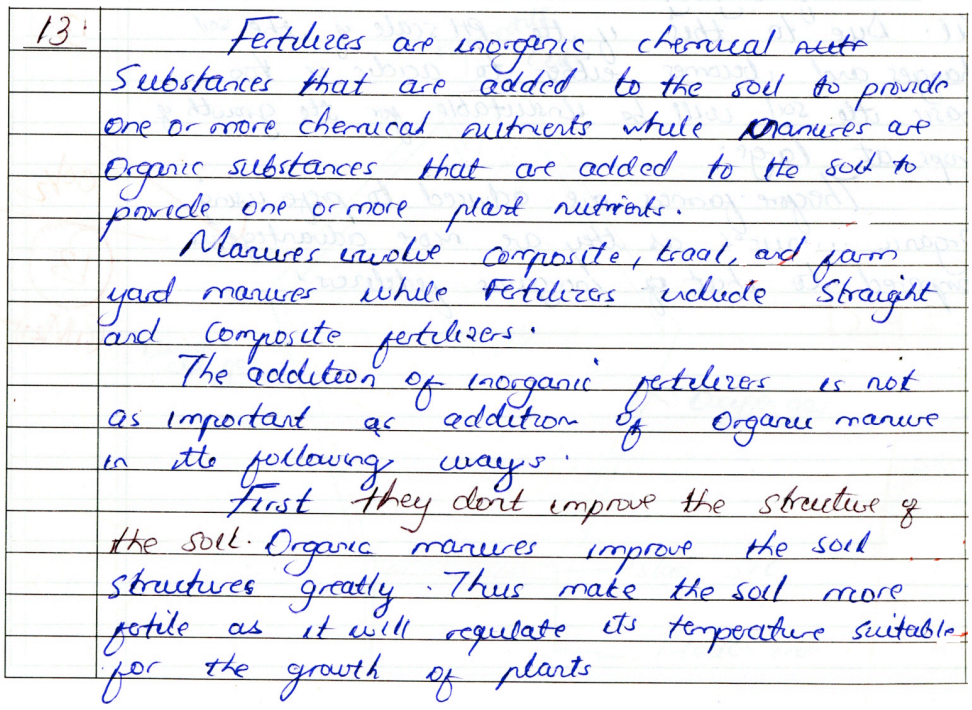
In this question, the candidates were required to discuss four points that, "*additional of inorganic fertilizers in the farm is not as important as addition of organic manures*".

The question was attempted by 134,436 (78.2%) candidates and 51 percent scored 4 or above, out of 13 marks. The candidates who scored 4 to 6.5 marks were 20.6 percent and those who scored 7 to 10 marks were 20.6 percent. The data show that 9.5 percent managed to score 10.5 to 13 marks, while 44.6 percent scored 0 to 3 marks. Thus, the overall performance in this question was average.

The candidates who scored high marks in this question managed to write a good essay following the requirement of the question. They started with an introduction in which they agreed with the statement given. Their work was

presented in paragraphs, depending on the four reasons required. Finally, they concluded according to what they discussed. Extract 13.1 is a sample answer in which the candidate scored high marks.

Extract 13.1

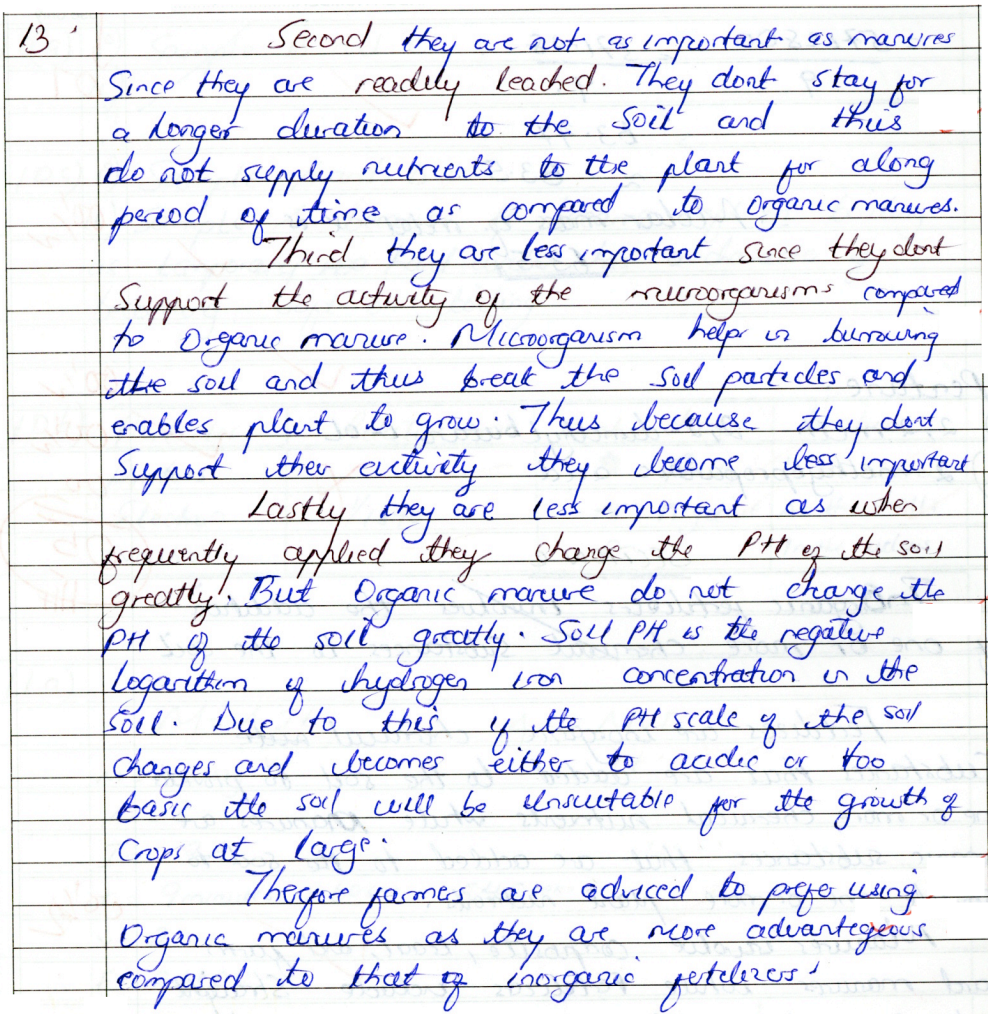

13:

Fertilizers are inorganic chemical ~~auto~~ substances that are added to the soil to provide one or more chemical nutrients while manures are organic substances that are added to the soil to provide one or more plant nutrients.

Manures involve composite, kraal, and farm yard manures while fertilizers include straight and composite fertilizers.

The addition of inorganic fertilizers is not as important as addition of organic manure in the following ways.

First they dont improve the structure of the soil. Organic manures improve the soil structures greatly. Thus make the soil more fotile as it will regulate its temperature suitable for the growth of plants


13 '
Second they are not as important as manures since they are readily leached. They dont stay for a longer duration to the soil and thus do not supply nutrients to the plant for along period of time as compared to organic manures.
Third they are less important since they dont support the activity of the microorganisms compared to Organic manure. Microorganism help in burrowing the soil and thus break the soil particles and enables plant to grow. Thus because they dont support ther activity they become less important
Lastly they are less important as when frequently applied they change the PH of the soil greatly. But Organic manure do not change the PH of the soil greatly. Soil PH is the negative logarithm of hydrogen ion concentration in the soil. Due to this if the PH scale of the soil changes and becomes either to acidic or too basic the soil will be unsuitable for the growth of crops at large.
Therefore farmers are advised to prefe using Organic manures as they are more advantegeous compared to that of inorganic fetelizers'

Extract 13.1 shows that the candidate had introduced well the concept and explained precisely the importance of organic manure over inorganic fertilizers.

However, the candidates who scored low marks in this question presented their work in a disorganized way and the reasons explained were not relevant. For example, instead of writing the importance of organic manures over inorganic fertilizers, some wrote the importance of inorganic fertilizers over organic manures. Furthermore, some wrote statements which did not associate with the importance of organic manures over inorganic fertilizers. In addition, their English language proficiency was poor. Extract 13.2 shows a sample of poor responses.

Extract 13.2

13.	Orgeanic Manure. Is the proces of manure to
	Product the plant. not as important of orga
	nic Manure is.
	Manure of humen. this is a eped of
	people because Manure of humen is danger
	for speed of disease. like cholera. coz ele
	ctricity is a very important of the people.
	Speed of disease. This is a problem
	of plant because inorganic fertilizers is
	usecel for prodaction.
	decrease plant. inorganic fertilizer
	is decrease Manure for production so Inorgen
	c Manure is problem for product plant.
	~~decrees~~ increase disease for plant. In orgonic
	fertilities not important because it increase
	~~X~~ disease of plant so inorgenic fertilitie
	is danger for plant.
	All in All inorgonic fertilities is
	danger for plent because it increase
	disease of plant so inorgonic fertilities
	is bad for plant.

In Extract 13.2 the candidate presented irrelevant arguments in a disorganized way.

3.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH TOPIC

The question – wise analysis of the candidates' responses reveals that the multiple choice items were performed well. The items of the question were set from the topics of, *Atomic structure; The Mole concept and related calculations; Chemical kinetics, equilibrium and energetics; Ionic theory and electrolysis; Organic chemistry; Acids, bases and salts; Non-metals and their compounds; Compounds of metals; Non-metals and their compounds and Matter.* Other questions which had good performance were 2, 3, 4, 5, 6,10 and 13. The topics which were examined in these questions were *Compounds of Metals; Extraction of metals; Qualitative analysis; Periodic*

classification; Non-metals and their compounds. Energy and fuels; Chemical kinetics, equilibrium and energetics, Air, combustion, fire fighting and rusting; metals. Atomic structure, Acids, bases and salts; Matter. Hardness of water, Soil chemistry, Extraction of metals. Air, combustion, fire – fighting and rusting.

On the other hand, two questions had an average performance. These questions were set from the topics of: *Formula, bonding and nomenclature; Organic chemistry; Oxygen; Hydrogen; Non-metals and their compounds; Volumetric analysis.* Moreover, three questions had poor performance. The question were from the topics of: *Ionic theory and Electrolysis; Acids, bases and salts; Compounds of metals; Extraction of metals and Organic chemistry.*

The analysis indicates that poor performance of the stated topics was attributed to poor mastery of English Language. In addition, the analysis has shown that some of the candidates had inadequate knowledge of various topics. Furthermore, other candidates failed to get correct answers due to the failure to apply the correct formulae to some of the questions. For example this was the case in question 11, which required calculation of *molar mass* of *metal X* .

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The overall analysis showed that the general performance of the candidates in Chemistry was good. However, the analysis indicated that some candidates faced challenges in attemping some of the examinations questions, hence scoring low marks. The following are the factors that contributed to the failure of some candidates to respond correctly to some of the questions.

(a) Failure to identify the requirement of the question.

(b) Lack of knowledge in some topics as they provided responses which had no relationship with the questions.

(c) Lack of English proficiency. This led to failure to understand the requirement of the questions.

(d) Failure to apply the required formula in some of the questions, hence leading to incorrect responses.

4.2 Recommendations

In order to improve the performance of the candidates in this subject the following are steps recommended:

4.2.1 Teachers should teach and guide the students to read the question(s) carefully in order to identify the demand of questions before attempting them.

4.2.2 Heads of schools should emphasize to the students, English speaking and writing skills to enable the candidates understand the requirements of the questions and write their answers in a good language.

4.2.3 Teachers should help students to revise all topics in the Chemistry Syllabus to ensure that they have enough knowledge on various concepts, definitions and formulae.

Appendix

AN ANALYSIS OF THE CANDIDATES' PERFORMANCE PER TOPIC

S/N	Topic	Question Number	The % of Candidates Who Scored an Average of 30 % or Above	Remarks
1	Atomic structure and periodic classification.	5	80.8	Good
2	Air, combustion, fire fighting and rusting; Extraction of metals.	3	67.3	Good
3	Hardness of water and Atomic structure.	10	58.0	Good
4	Compounds of metals; Extraction of metals; Qualitative analysis; Periodic classification; Non-metals and their compounds.	2	52.8	Good
5	Acids, bases and salts; Matter.	6	52.7	Good
6	Atomic structure; The Mole concept and related calculations; Chemical kinetics, equilibrium and energetics; Ionic theory and electrolysis; Organic chemistry; Acids, bases and salts; Non-metals and their compounds; Compounds of metals; Non-metals and their compounds and Matter.	1	51.4	Good
7	Soil chemistry.	13	51.0	Good
8	Energy and fuels; Chemical kinetics, equilibrium and energetics.	4	49.5	Good
9	Formula, bonding and nomenclature; Organic chemistry.	9	43.3	Average
10	Oxygen, Hydrogen, Non-metals and their compounds; Volumetric analysis.	8	33.9	Average
11	Ionic theory and electrolysis; Organic chemistry.	11	28.2	Weak
12	Compounds of metals; Acids, bases and salts.	7	20.9	Weak
13	Extraction of metals.	12	11.2	Weak