THE NATIONAL EXAMINATIONS COUNCIL OF TANZANIA

ANDIDATES' ITEM RESPONSE ANALYSIS REPORT FOR THE CERTIFICATE OF SECONDARY EDUCATION EXAMINATION (CSEE) 2018

032 CHEMISTRY

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FOREWORD

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

The Candidates' Items Response Analysis Report in Chemistry subject in the Certificate of Secondary Education Examination (CSEE) 2018 is prepared in order to provide feedback to students, teachers, parents, policy makers and the public in general about the performance of the candidates and the challenges they faced in attempting the examination.

The analysis presented in this report is intended to contribute towards understanding some of the reasons behind the performance of candidates in Chemistry subject. The report highlights some of the factors that made some of the candidates unable to score high marks in this paper. Such factors include; inadequate knowledge on various topics, failure to present appropriate chemical equations and inadequate numerical skills. The feedback provided will enable the educational administrators, school managers, teachers, students and other educational stake holders to identify proper measures to be taken in order to improve candidates' performance in future examinations administered by the Council.

The Council would like to thank the 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) 2018 in Chemistry subject. The examination was set according to the CSEE format which was developed from the 2010 Chemistry syllabus for Secondary School Education.

The paper consisted of sections A, B and C. Section A consisted of two (2) objective questions, each carrying 10 marks. Section B had nine (9) short answer questions, each carrying 06 marks while Section C comprised of two (2) essay questions carrying 13 marks each. The candidates were required to answer all questions from section A, B and C.

A total of 165,776 candidates sat for the Chemistry examination in CSEE 2018 and the performance was average as 102,464 candidates equivalent to 62.15 percent passed with different grades as shown in Table 1.

Table 1: Candidates' Grades in CSEE 2018 Chemistry Examination

Grades	**A**	**B**	**C**	**D**	**F**
% of Candidates	1.23	4.49	24.66	31.77	37.85

The performance in CSEE 2018 has increased by 8.76% relative to the performance in 2017 where 160,126 candidates sat for the examination. Further information about the performance of candidates in CSEE 2018 is shown in table 2.

Table 2: Candidates' Grades in CSEE 2017 Chemistry Examination

Grades	**A**	**B**	**C**	**D**	**F**
% of Candidates	0.61	2.87	19.00	30.91	46.61

This report is divided into four sections. The first section covers the introduction while the second section focuses on the analysis of the candidates' performance in each question. The third section comprises the analysis of performance in each topic and finally conclusion and recommendations are given in the fourth section.

Furthermore, the analysis of the performance in each question starts by indicating the demand of the question. Figures (graphs, charts) and samples of candidates' responses (extracts) have been used for more clarification in the analysis. Due to the fact that questions do not carry the same weight,

the pass mark in each question corresponds to 30 percent of the total marks assigned to the individual question. Hence the marks scored has been categorized as good, average or weak/poor if it falls in the ranges of 65-100 (green), 30-64 (yellow) or 0-29 (red) respectively. At the end of the report there is an appendix which summarises the general performance in each topic.

2.0 ANALYSIS OF THE CANDIDATES' PERFORMANCE IN EACH QUESTION

In this analysis, the level of performance in each question has been categorized as good, average or weak as shown in the table 3.

Table 3. Categories of Marks in Question 1-13

Question number	Category	Marks	Colour in figures
1-2	Good	7.0-10	Green
	Average	3.0-6.0	Yellow
	Weak/poor	0-2.0	Red
3-11	Good	4.0-6.0	Green
	Average	2.0-3.5	Yellow
	Weak/poor	0-1.5	Red
12-13	Good	8.5-13	Green
	Average	4.0-8.0	Yellow
	Weak/poor	0-3.5	Red

Highlights of misconceptions observed and reasons behind the candidates' performance has been included as well in this analysis.

2.1 Section A: Objective Questions

This section consisted of objective question 1 and 2 each having 10 items. Each item carried 1 mark, making a total of 10 marks per question. The pass mark was 03 marks.

2.1.1 Question 1: Multiple Choice Items

The items in this question were composed from the following eight topics: *Introduction to Chemistry; Heat Sources and Flames; Chemical Kinetics, Equilibrium and Energetics; Ionic Theory and Electrolysis; Organic Chemistry; Non-metals and their Compounds; Compounds of Metals* and

Extraction of Metals. The candidates were required to choose the correct answer from five alternatives (A to E) and write its letter beside the item number in the answer booklet provided.

The statistics show that, 165,619 (99.91%) candidates attempted this question. The analysis of candidates' performance indicates that, 17.5% of the candidates scored 0 to 2.0 marks, 67.5% scored 3.0 to 6.0 marks while 15.0% scored 7.0 to 10 marks with 0.5% scoring full marks. These statistics are displayed in Figure 1.

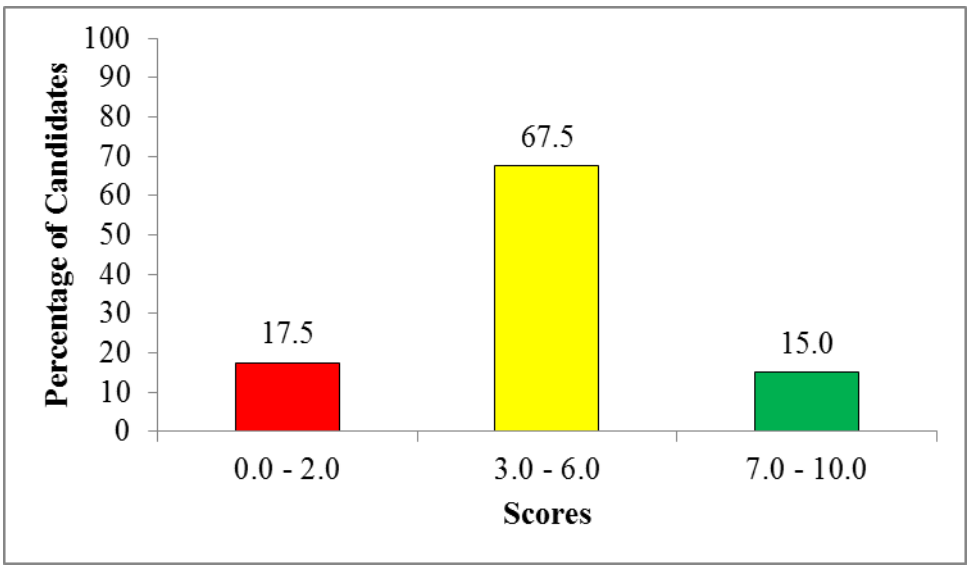


Figure 1: *Performance of candidates in question 1.*

Figure 1 shows that, 82.5% of the candidates scored 3.0 to 10 marks, an indication of good performance in this question. The correct responses given by most of the candidates to items extracted from different topics indicates that candidates had adequate knowledge on the content examined. However, some candidates (17.5%) scored low marks following their incorrect choices. Items (ii), (iv) and (vii) appeared to be more difficult and were even attempted incorrectly by some of the high scoring candidates. Item (ii) required candidates to select the correct quantity of electricity in coulombs produced by passing 0.2A for 16 minutes and 40 seconds in an electrolyte. The correct option was *C, 200 C* but majority of the candidates selected distractors. In order to identify the correct option, candidates were supposed to use the correct formula derived from Faraday's first law of electrolysis to manipulate the given data. Lack of enough numerical skills

and inability to apply the correct formula led to the failure of the candidates.

Item (iv) asked the candidates to select a carbonate which is most stable to heat from; A. *Calcium carbonate*, *B, Copper (II) carbonate*, *C, Lead (II) carbonate*, *D, Zinc carbonate*, *E, Iron (II) arbonate*. Majority of the candidates chose incorrect alternative *B, copper(II) carbonate* instead of the correct one, *A, Calcium carbonate*. These candidates had a misconception that Copper (II) carbonate is stable to heat than calcium carbonate. This is an indication that more emphasis has to be put when guiding students on the stability of compounds of metals.

Item (vii) asked candidates to choose a condition which would increase the production of sulphur trioxide by reacting sulphur dioxide and oxygen gas at equilibrium (the forward process being exothermic). Majority of the candidates opted for the incorrect alternative *E, Adding a catalyst*. This indicates that the candidates had inadequate knowledge on the factors affecting the equilibrium position. They did not understand that catalysts do not affect the yield in reactions at equilibrium instead they help to achieve the equilibrium faster.

2.1.2 Question 2: Matching Items

This question was comprised of items from topics of *Compounds of Metals, Organic Chemistry and Non-metals and their Compounds.* The question consisted of list A comprising of ten (10) items which were to be matched with the correct answers in list B which had 15 responses.

The question was attempted by 165,468 (99.81%) candidates. The general performance was average as 52.8% of the candidates scored 3 marks and above. Figure 2 shows that candidates who scored 0 to 2.0 marks were 47.2% while 36.4% scored 3.0 to 6.0 marks and 16.4 % scored 7.0 to 10 marks with 0.5% scoring all the 10 marks. Further statistics of performance are shown in Figure 2.

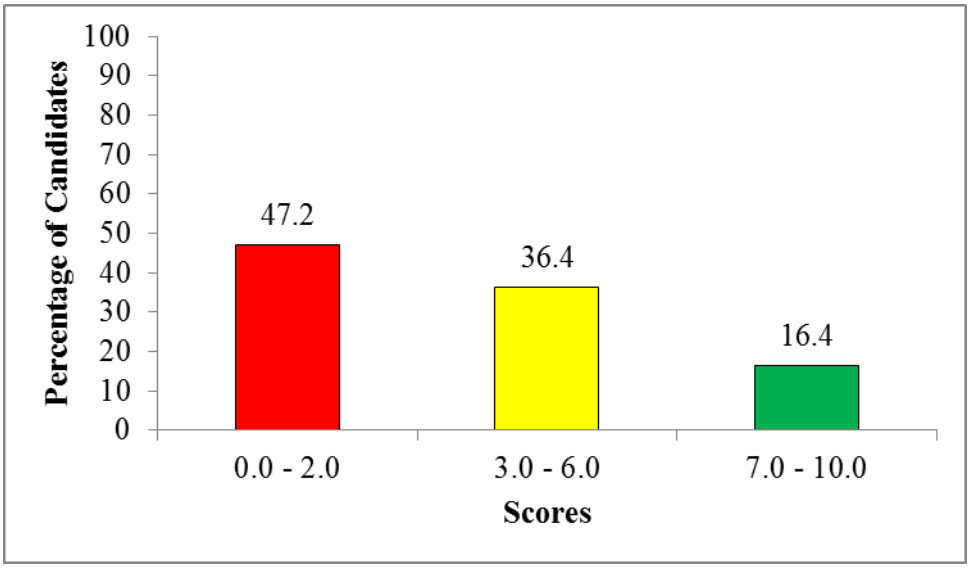


Figure 2: *Performance of the candidates in question 2.*

Candidates who scored high marks in this question managed to match correctly most of the items. This indicates that the candidates were competent in identifying the statements connected to the chemical species in list B.

Candidates who scored low marks associated the terms in list A and B incorrectly especially item (v), (vi) and (x). Item (v) required the candidates to choose from list B a compound used in domestic water softening. Most of the candidates responded incorrectly by writing *K, Chlorine* instead of *F, sodium carbonate*. Chlorine is used as a disinfectant to treat drinking water rather than softening it. It is this association of chlorine with water which made some of the candidates to respond by writing *K, chlorine*.

Item (vi) required the candidates to choose a compound prepared by fermentation of carbohydrates. The correct match was *J, Ethanol* but some responded by writing *B, carboxylic acid*. They did not know that carboxylic acids are organic compounds with the general formula $C_nH_{2n+1}COOH$ and correspond to item (vii). This implies that the candidates lacked sufficient knowledge on methods of preparation of alcohols.

Item (x) required candidates to choose a substance which is amorphous form of carbon. The correct answer was *O, Coke*, but some candidates incorrectly opted *I, Graphite*. The candidates were attracted to this response because graphite is the soft allotrope of carbon, so they failed to differentiate between the terms amorphous and soft.

2.2 Section B: Short Answer Questions

This section consisted of nine (9) short answer questions each carrying a total of 6.0 marks. The pass score in this section was 2.0 marks.

2.2.1 Question 3: Acids, Bases and Salts, Matter, Chemical Equations and Soil Chemistry

The question was comprised of part (a) and (b). In part (a), candidates were asked to define the terms; (i) Neutralization, (ii) Unsaturated solution and (iii) Thermal decomposion. In part (b), candidates were required to give two advantages of liming and state two roles of climate in the process of soil formation.

The question was responded by 155,844 candidates equivalent to 94.01 percent. The general performance was good because 63.5% of the candidates scored 2.0 marks and above. Further statistics are displayed in Figure 3.

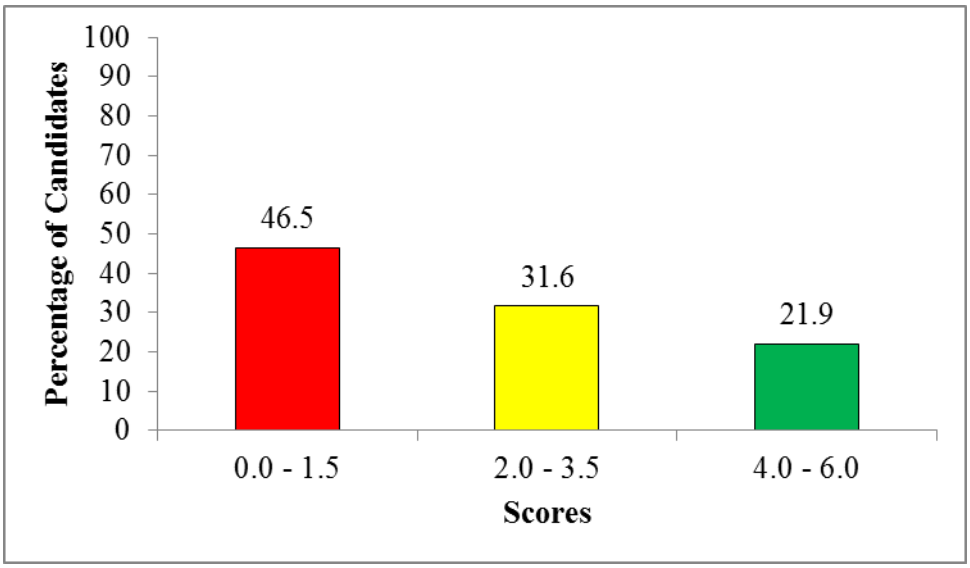
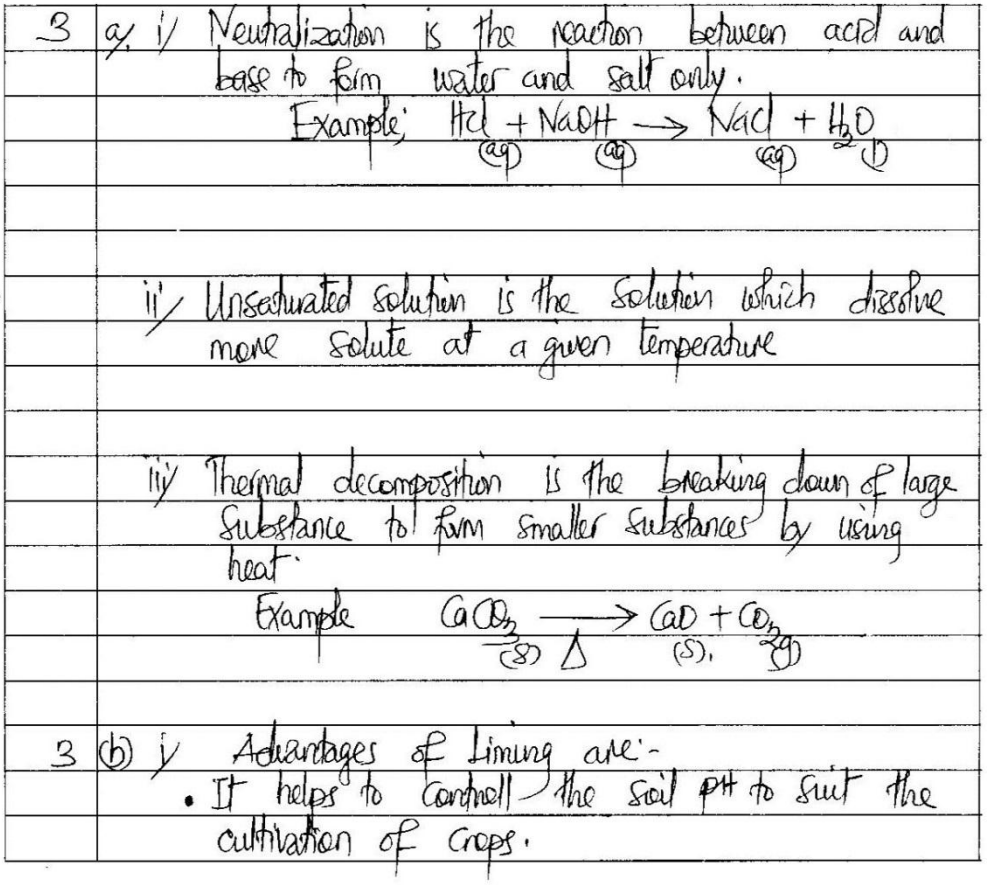


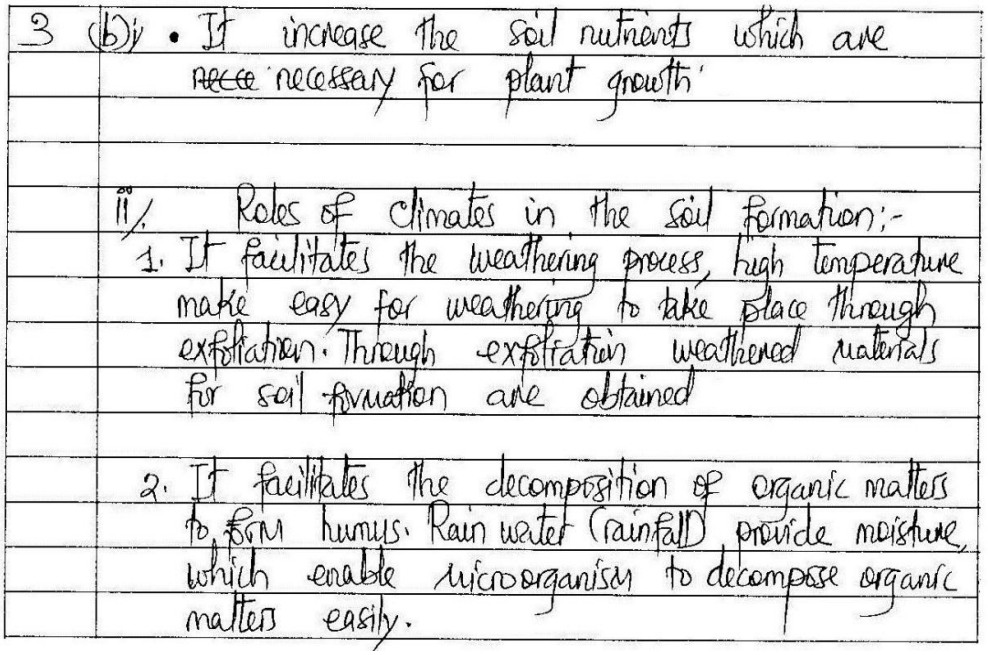
Figure 3: *Performance of the candidates in question 3.*

Figure 3 shows that 21.9% of the candidates scored 4.0 to 6.0 marks, 31.6% scored 2.0 to 3.5 marks whereas 46.5% scored 0 to 1.5 marks. Candidates who performed well in this question managed to correctly define the terms neutralization, unsaturated solution and thermal decomposition .They also gave advantages of liming precisely and stated two roles of climate in the

process of soil formation appropriately. This shows that those candidates understood the demand of the question and were knowledgeable on the importance of liming, soil formation and types of chemical reactions. Extract 3.1 shows an example of a response from a candidate who performed well.

Extract 3.1

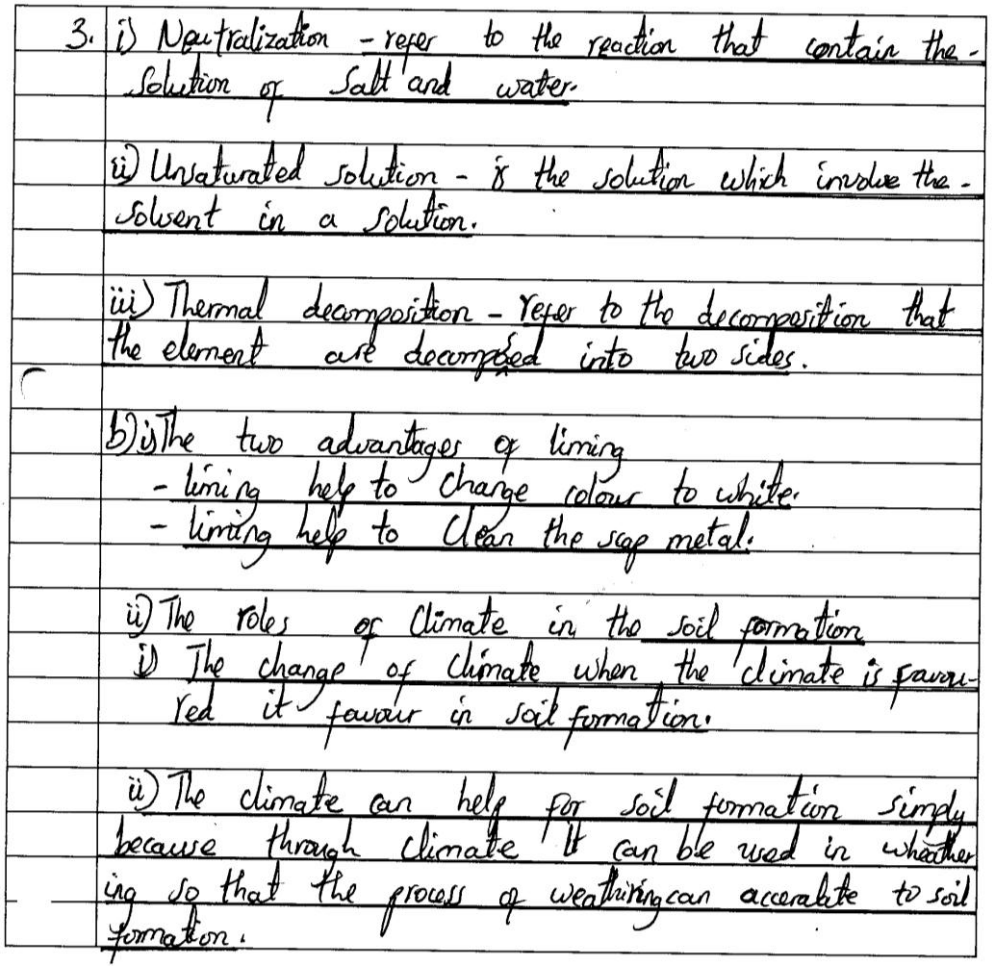




In Extract 3.1, the candidate gave correct definitions of neutralization, unsaturated solution and thermal decomposition. The stated advantages of liming and the roles of climate in soil formation were correct as well.

Candidates who scored low marks (46.5%) gave incorrect answers while others skipped some parts of the question. For example, in answering part (a) (i), one of the candidates defined neutralization as, "*the process in which reaction occur when the catalyst was added in the substance".*
Moreover, some of the candidates wrote irrelevant answers. For instance, in part (b) (i) one of the candidates responded by writing: "*It is good for useage and it does not waste time"* which is not an advantage of liming. This implies that the candidate lacked understanding of the term liming. Likewise in part (b) (ii) some candidates wrote incorrect responses including those who guessed for the answers. For example, one candidate wrote "*parent material and organism"* which does not sound sensibly. Basically candidates who scored low marks lacked adequate knowledge on the subject content and some of them had poor English language proficiency. Extract 3.2 represents an example of candidates' poor responses.

Extract 3.2


3. i) Neutralization - refer to the reaction that contain the - Solution of Salt and water.

ii) Unsaturated solution - is the solution which involve the - solvent in a solution.

iii) Thermal decomposition - Refer to the decomposition that the element are decomposed into two sides.

b) i) The two advantages of liming
- liming help to change colour to white.
- liming help to clean the soap metal.

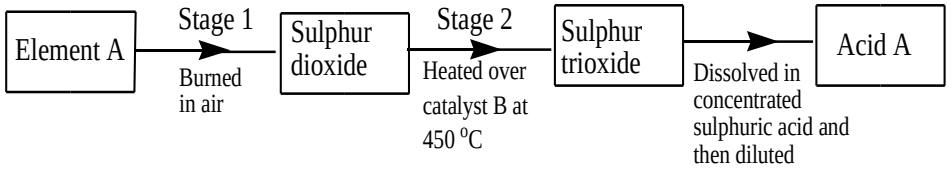
ii) The roles of climate in the soil formation
i) The change of climate when the climate is favoured it favour in soil formation.

ii) The climate can help for soil formation simply because through climate it can ble used in whether ing so that the process of weathering can accerabte to soil formation.

Extract 3.2, shows the responses of a candidate who gave incorrect definitions, advantages of liming and roles of climate in soil formation.

2.2.2 Question 4: Extraction of Metals and Non-metals and their Compounds

The question consisted of two parts: (a) and (b). In part (a) (i) candidates were required to name the electrolyte and electrodes which are used during electrolysis of impure copper obtained from copper pyrites and item (a) (ii) required candidates to give the observations that can be made during the electrolysis in (a) (i). In part (b) the candidates were provided with the following diagram showing stages involved in the contact process.



Thereafter, candidates were required to give the names of element A, catalyst B and an acid C. They were also required to write a balanced chemical equation for the formation of sulphur trioxide.

The statistics shows that this question was attempted by 128,861 candidates equivalent to 77.73%. The performance was poor as 12.2% of the candidates scored 3.0 marks and above with 29.3% scoring 0 mark. Most candidates (87.8%) who attempted this question scored 0 to 1.5 marks. The data indicated that, 10.1 % of the candidates scored 2.0 to 3.5 marks and 2.1% scored 4.0 to 6.0 marks. Statistical data are shown in Figure 4.

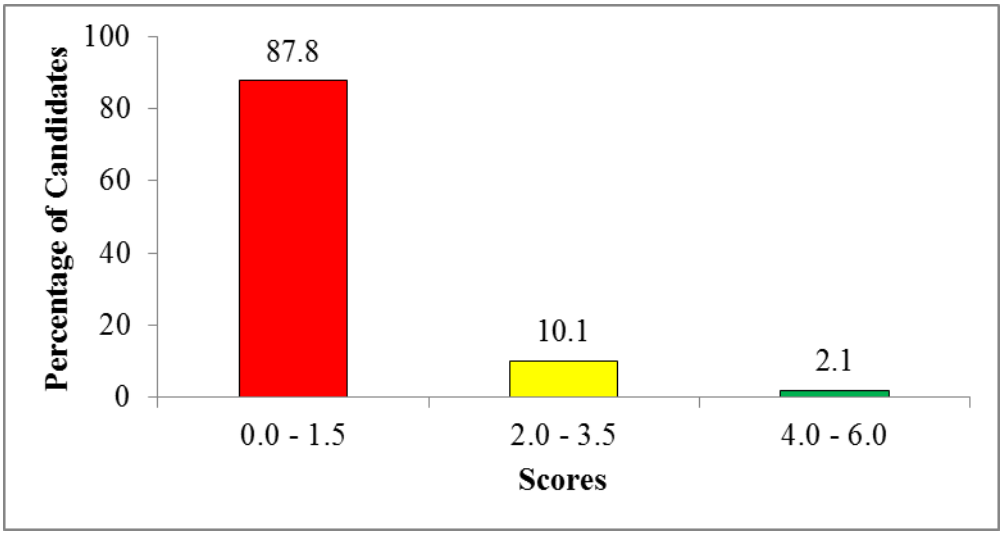


Figure 4: *Performance of the candidates in question 4*.

Candidates who scored low marks in this question gave incorrect names for the electrolyte and the electrodes in part (a). For instance some of them named the electrolyte as "*sodium chloride*" instead of *copper (II) sulphate* solution. Some of them incorrectly named the cathode and the anode as "*carbon* and *platinum*". The fact is that during extraction of copper, the anode is made of the impure copper whereas the cathode is made of pure copper.

Most of the low achievers did not respond to item (a) (ii). Some of them responded by giving a general statement that "*anions will migrate to anode and the cations will move to the cathode*". However, they were supposed to give specific details that the impure copper will dissolve in the solution to form copper (II) ions which will migrate to the pure copper according to the following equation:

$$Cu(s) \longrightarrow Cu^{2+}(aq) + 2e^{-}$$

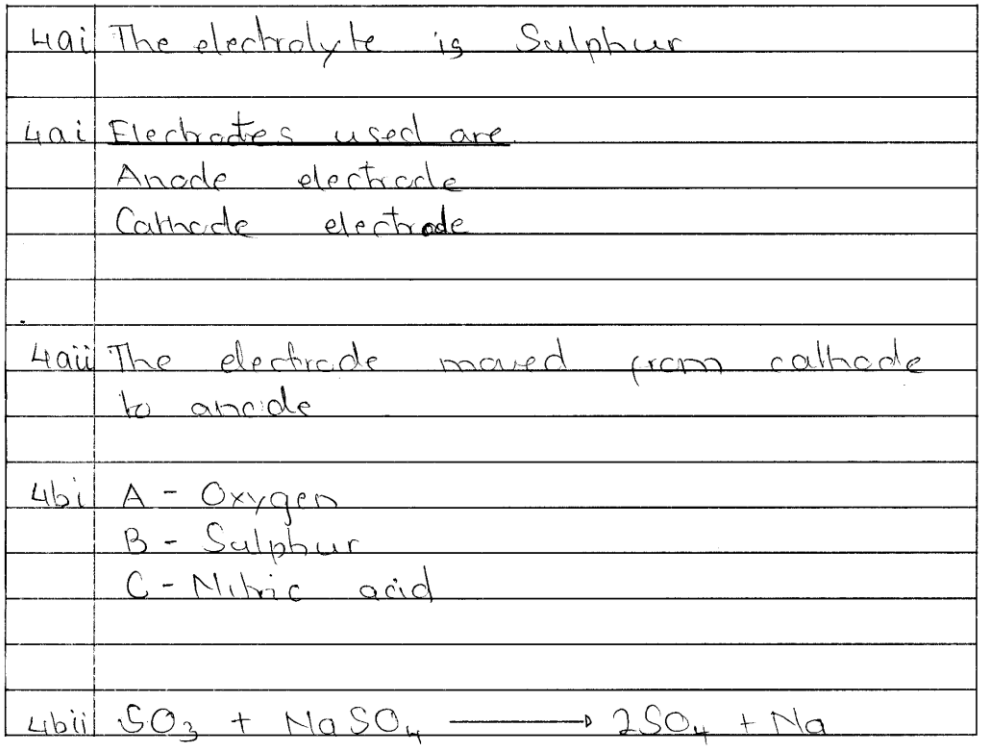
The copper ions will gain electons and get deposited at the cathode and hence the mass of the cathode (pure copper) will be increasing due to the deposition of copper metal according to equation:

$$Cu^{2+}(aq) + 2e^{-} \longrightarrow Cu(s)$$

In part (b) (i), the candidates mentioned incorrect ores such as "*sulphide ores or sulpher ore",* while they were required to give the names of the element A, catalyst B and an acid C indicated in the provided flow diagram that showed stages in the contact process which were *Sulphur*, *Vanadium pentoxide* and c*oncentrated sulphuric acid,* respectively. Another candidate attempted to define the terms element, catayst and acid. This implies that some candidates did not understand the requirement of the question.

Part (b) (ii) required candidates to write a balanced chemical equation for the formation of sulphur trioxide in stage two in the flow diagram. Most of the candidates were not able to write the correct chemical equation for the formation of sulphur trioxide. Nevertheless, those few who managed to write the chemical equation did not balance it. This implies that candidates had inadequate knowledge of writing chemical equations in the contact process. Extract 4.1 indicates one of the poor responses from one of the candidates.

Extract 4.1



In Extract 4.1, the candidate incorrectly identified the electrolyte, electrodes and could not give explanation about the mechanism of electrolysis. He/she also gave incorrect answers for element A, catalyst B and an acid C and the chemical equation.

Minority of the candidates who scored high marks (3 to 6), managed to give correct responses to most items, though in part (b) (ii) some candidates faced difficulty to write the balanced chemical equation for the formation of sulphur trioxide in stage 2. They also managed to apply principles of electrolysis to explain correctly the observations that can during electrolysis. Extract 4.2 shows an example of a good response.

Extract 4.2

4.	a) Electrolysis of copper from Copper Pyrites ($CuFeS_2$)
	i) Required
	Electrolyte - Copper (II) Sulphate solution
	Electrodes - Blister copper/impure copper serving as
	an anode
	- Pure copper rod which serve as
	the cathode.

4. a) ii) Observations during electrolysis

The anode (blister copper) dissolves into solution leaving other substances which are not copper. In this copper atoms are oxidized to copper ions according to equation

$$Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e^-$$

Also the mass of cathode (pure copper rod) will be increasing due to deposition of copper atoms around it as result of reduction of copper ions from solution in respect to equation

$$Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu_{(s)}$$

Lastly, the blue colour of copper two sulphate will remain unaltered to end of chemical electrolysis because no ions are drawn from it but drawn from anode and deposited to cathode

b) i) Names

Element A is Sulphur

Catalyst B is Vanadium Pentaoxide

Acid C is Concentrated Sulphuric acid

ii) equation for SO_3 formation

$$2SO_{2(g)} + O_{2(g)} \xrightarrow[450^\circ C]{V_2O_5} 2SO_{3(g)}$$

Extract 4.2 shows response of a candidate who correctly named the electrolytes, electrodes, element A, catalyst B and the acid C, and wrote a balanced chemical equation for the formation of sulphur trioxide.

2.2.3 Question 5: Matter and Periodic Classification

There were two parts in this question, part (a) and part (b). In part (a), the candidates were required to suggest one method of separating (i) green solution from leaves and (ii) alcohol from water. In part (b), candidates were provided with elements K, L, M and N with atomic numbers 6, 8, 9 and 20, respectively and were tasked to classify each element into its respective period and group in the Periodic Table.

Statistics show that, 158,209 (95.44 %) candidates attempted this question out of which 64.3% scored 4.0 to 6 marks with 14.7% scoring full marks. Candidates who scored 2.0 to 3.5 marks were 13.8 % while those who scored 0 to 1.5 marks were 21.9%. Generally, the performance was good as 78.1% of the candidates scored 2.0 marks and above. Figure 5 summarises the performance in question 5.

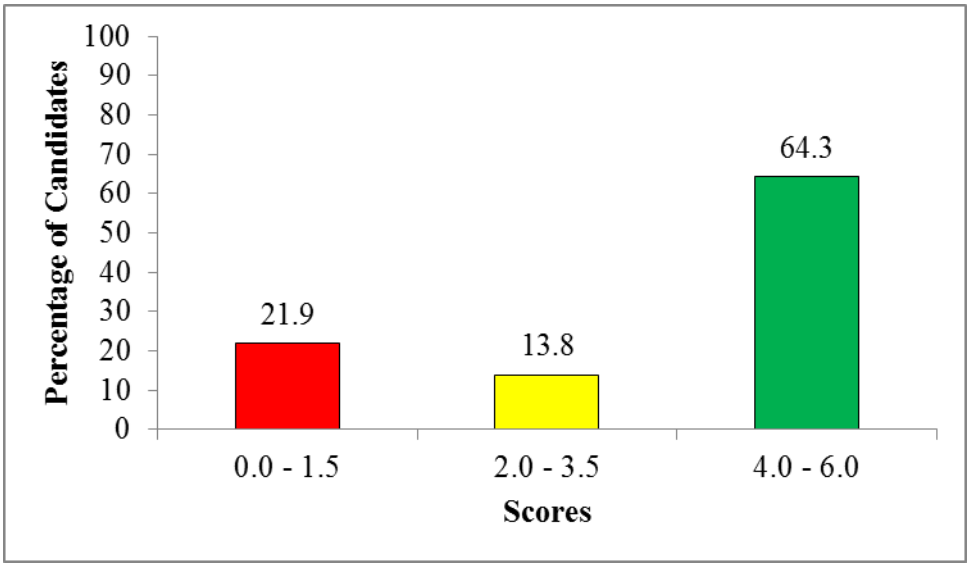
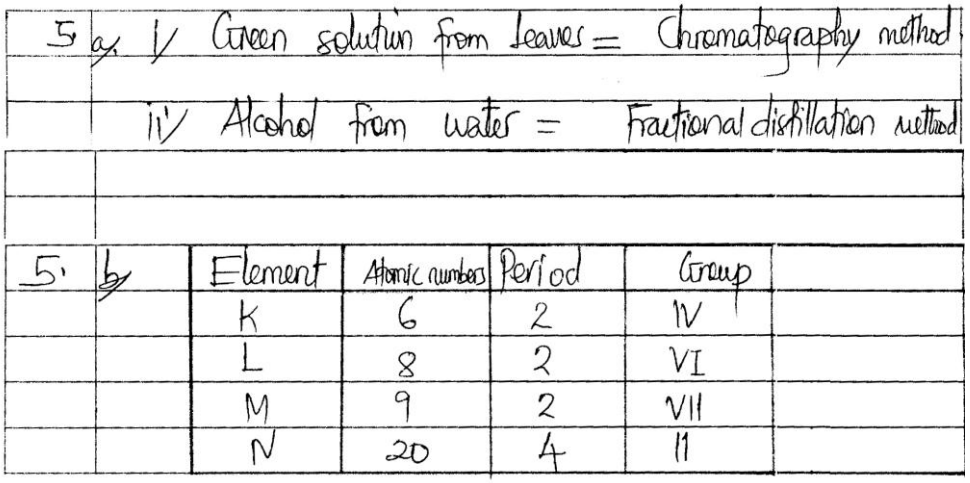


Figure 5: *Performance of the candidates in question 5.*

Candidates who scored high marks in this question managed to give the correct methods of extracting green solution from leaves and the method of separating alcohol from a mixture of water and alcohol in part (a). However, some few candidates in this group wrote incorrect spellings for the term chromatography. For instance some wrote *chlomatography*, *chormatography*, *chotomography*, *chloromatography*, *chotomography*, and *gramotoggraphy* instead of chromatography. In part (b), candidates in this category gave the correct groups and periods of elements K, L, M and N

based on their atomic numbers. The correct answers of the candicates indicates that they had adequate knowledge of methods of separating mixtures as well as placement of elements in the Periodic Table based on their atomic numbers. Extract 5.1 shows good responses from one of the candidates.

Extract 5.1


5 a. i. Green solution from leaves = Chromatography method

ii. Alcohol from water = Fractional distillation method

5. b.

Element	Atomic number	Period	Group
K	6	2	IV
L	8	2	VI
M	9	2	VII
N	20	4	II

In Extract 5.1, the candidate correctly stated the methods of separating the the mixtures and classified the elements into their respective groups and periods.

On the other hand, candidates who scored low marks failed to give correct methods of separating the mixtures and gave incorrect groups and periods of the elements. For instance, in part (a), some candidates incorrectly wrote *decantation* as a method of separating alcohol and water. Others stated the *separating funnel* instead of paper chromatography as a means of separating green solution from leaves. In part (b), some candidates incorrectly classified element M as a member of goup I and period 3. Basically, candidates in this group had insufficient knowledge on the methods of separating mixtures and relationship between atomic numbers and position of elements in the Periodic Table. Extract 5.2 illustrates one of the incorrect response given by the candidates.

Extract 5.2

05. (a) The best method of separating substance.
(i) Green solution from leaves
- Decantation.

(ii) Alcohol from water.
- Layer separation.

Extract 5.2, shows a response of a candidate who wrote decantation and layer separation instead of paper chromatography and fractional distillation respectively in part (a).

2.2.4 Question 6: Matter and Periodic Classification

In part (a), the candidates were required to give one example for each of the following; (i) alkali earth metals, (ii) noble gases and (iii) transition elements. In part (b), the candidates were required to name the processes of changing (i) gas to liquid, (ii) gas to solid and (iii) solid to gas.

The question was attempted by 160,528 (96.83%) candidates of which 22.3% scored 4.0 to 6.0 marks, 34.9 % scored 2.0 to 3.5 marks and 42.8% scored 0 to 1.5 marks. Generally, the performance in this question was average as 57.2% of the candidates scored 2.0 marks and above. Figure 6 shows the distribution of candidates' scores in question 6.

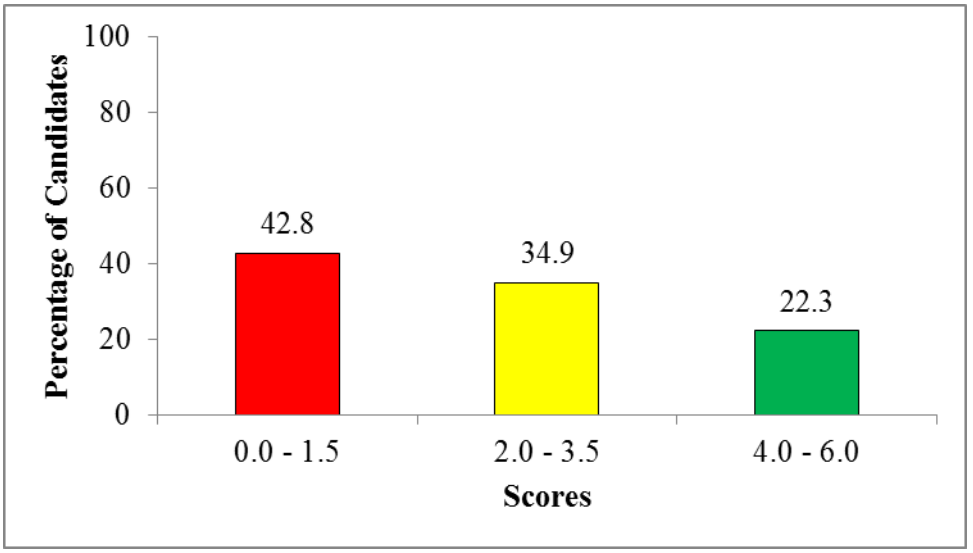
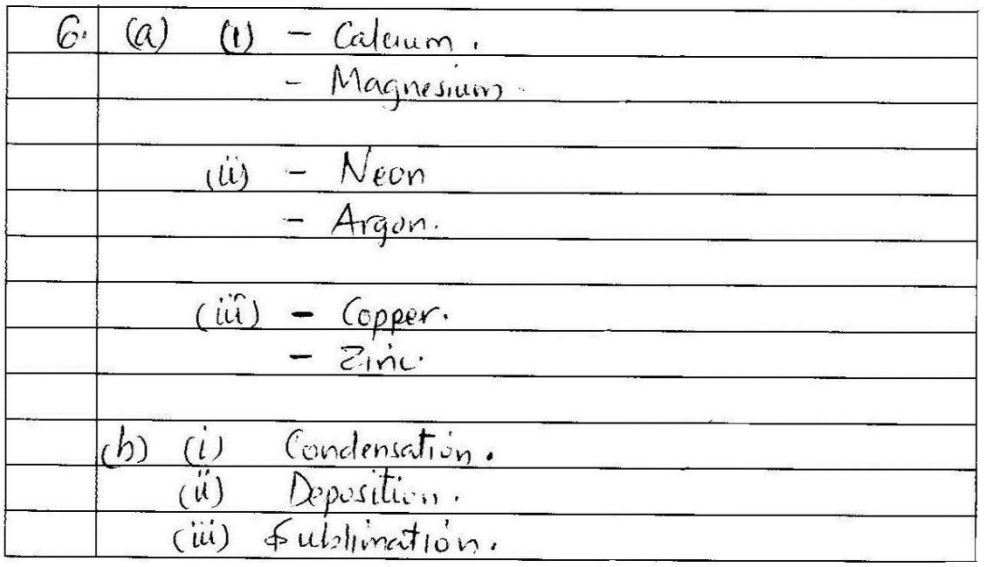


Figure 6: Performance of candidates in question 6.

Candidates who scored high marks gave correct examples of alkali earth metals, noble gases and transition elements. They also managed to name the processes of change of states in part (b) correctly which were (i) condensation (ii) deposition and (iii) sublimation. Basically, the candidates had adequate knowledge about periodic classification of elements and change of states of matter. Extract 6.1 portrays an example of good responses from one of the candidates.

Extract 6.1

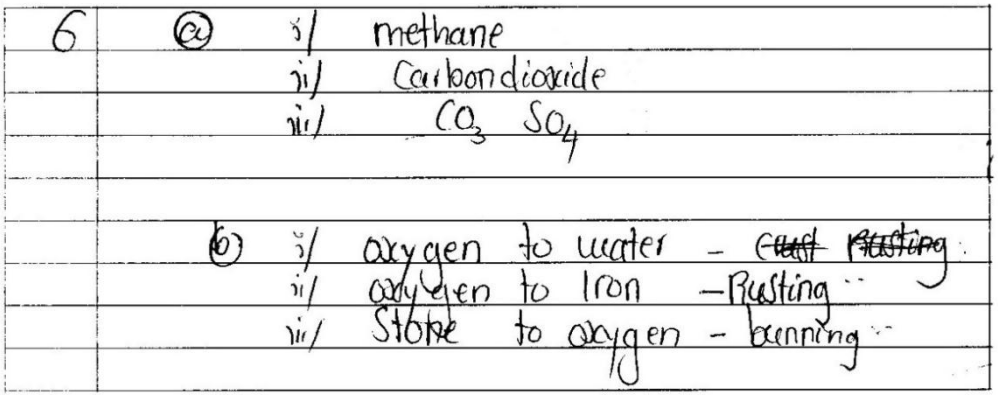


In Extract 6.1, the candidate correctly gave the required examples of the elements and named of the processes of change of states of matter.

On the contrary, candidates who scored low marks (0 to 1.5 marks) gave improper examples of alkali earth metals, noble gases and transition elements in part (b). Some of them resorted into writing elements from other groups while others left the question unanswered. For example, some candidates mentioned sodium (alkali metal) as an alkali earth metal whereas others mentioned compounds instead of elements. This implies that the candidates had inadequate knowledge on the Periodic Table. In attempting part (b), some of the candidates listed names of irrelevant processes such as transpiration, fermentation, chemical change and physical change. Chemical change and physical change were incorrect since the candidates were tasked to give specific names of the processes stated in the question. Other candidates swapped the names of the processes of change of states of matter. The incorrect answers given indicate that the candidates

had inadequate knowledge about change of states of matter. Extract 6.2 shows a sample of responses which do not suit the requirement of the question.

Extract 6.2



In Extract 6.2, the candidate wrote compounds instead of elements, incorrectly copied the question in part (b) and gave incorrect responses.

2.2.5 Question 7: Mole Concept and Related Calculations

The question consisted of two parts; part (a) and part (b). Part (a) required the candidates to define the terms mole and molar mass. In part (b), the candidates were provided with the information that "*112 dm^3 of oxygen gas was collected at s.t.p when a sample of lead nitrate was completely decomposed by heat*" and required to calculate the volume of nitrogen dioxide gas produced.

The question was attempted by 156,905 (94.65%) candidates in which 72.6% scored 0 to 1.5 marks with 42.6 % scoring zero mark. Candidates who scored 2.0 to 3.5 marks were 23.5% and those who scored 4.0 to 6.0 marks were 3.9%. The general performance in this question was poor as only 27.4% of the candidates scored 2.0 marks and above. Summary of performance is presented in Figure 7.

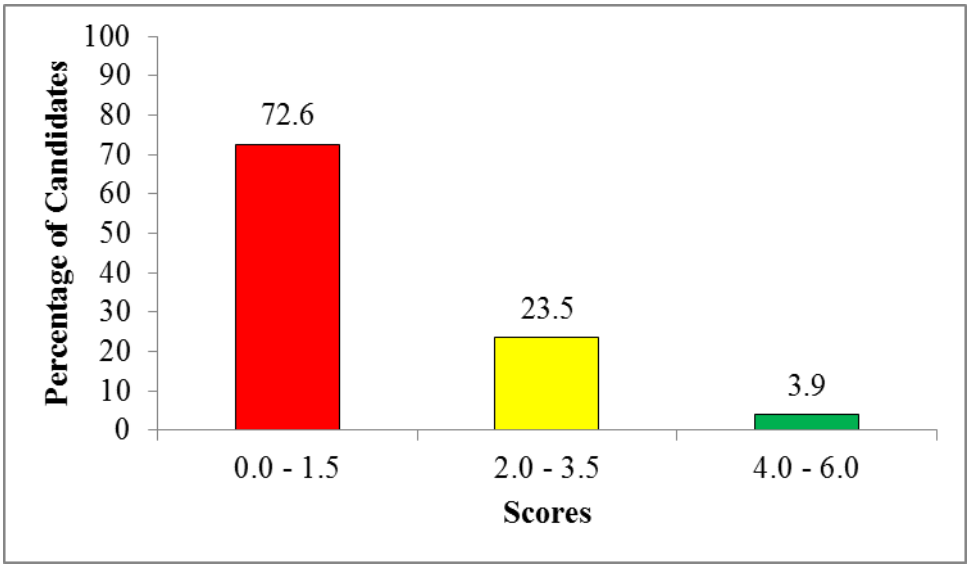


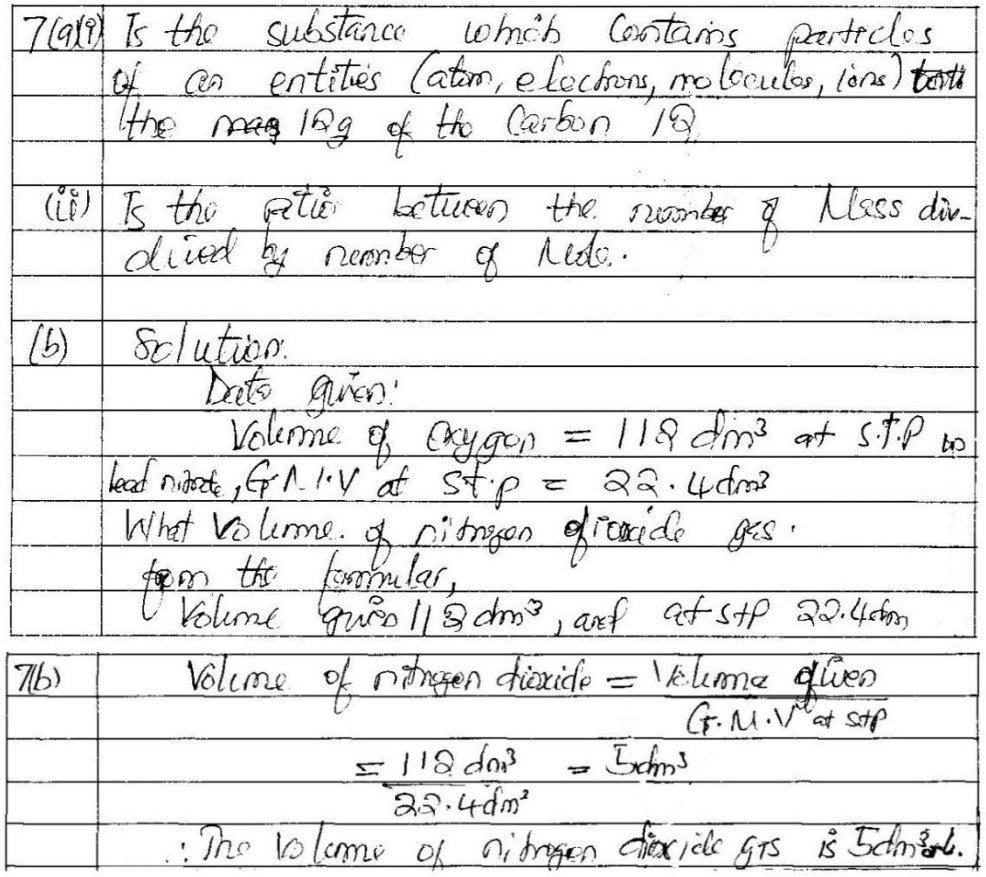
Figure 7: *Performance of candidates in question 7.*

The candidates who scored low marks defined the two terms in part (a) incorrectly. There were few candidates who gave incomplete sentences about the meaning of mole. In most cases, their definitions did not indicate the quantity of entities present in a mole. In some of the responses, the candidates could not state properly the link between mole and carbon 12 isotope which is the basis of mole. For example, one candidate defined mole incorrectly as "*the amount of substance contained in one gram of the substance to carbon 12 isotope"*. In defining molar mass, some of the candidates gave vague statements while others left the item unanswered. For instance, one candidate incorrectly defined molar mass as "*substance which formed when different chemical composition are joined together"*.

In part (b), most of the candidates did not manage to calculate the actual volume of nitrogen dioxide. For the candidates to calculate the required volume correctly, they were supposed to follow a number of stages. Firstly, they were required to write the balanced chemical equation for the process before starting the calculations. Many candidates skipped this step and thus ended up getting incorrect answers. After the first step, the candidates were supposed to calculate the number of moles of oxygen gas. Finally, the mole ratios and and moles of oxygen gas could be used to calculate moles and volume of nitrogen gas. On the contrary, majority of the candidates did not followed the steps correctly and used improper approach and hence got incorrect answers. Poor performance of candidates in this question was

attributed by lack of adequate knowledge on mole concept and related calculations. Extract 7.1 illustrates one of the poor responses in this question.

Extract 7.1


7(a)(i) Is the substance which contains particles of an entities (atom, electrons, molecules, ions) that the mass 12g of the carbon 12.

(ii) Is the ratio between the number of Mass divided by number of Mole.

(b) Solution.
Data given:
Volume of oxygen = 11.2 dm³ at S.T.P to lead nitrate, G.M.V at S.T.P = 22.4dm³
What Volume of nitrogen dioxide gas.
from the formular,
Volume given 11.2 dm³, and at STP 22.4dm³

7(b) Volume of nitrogen dioxide = $\frac{\text{Volume given}}{\text{G.M.V at STP}}$

$= \frac{11.2\ dm^3}{22.4\ dm^3} = 5dm^3$

∴ The volume of nitrogen dioxide gas is $5dm^3$ ans.

Extract 7.1, shows response of a candidate who defined the terms mole and molar mass incorrectly and applied inappropriate approach in the calculation part.

On the other hand, candidates who scored high marks managed to define mole and molar mass correctly. Most of them used proper approaches to calculate the volume of nitrogen dioxide which was 448 dm^3. This means that the candidates had adequate knowledge about the meaning of terms related to mole concept. They also had adequate understanding of the calculations associated with amount of substance in terms of mole and volume. Extract 7.2 shows response of a candidate who attempted the question correctly.

Extract 7.2

7. a) i) Mole is the amount of substance containing as many particulate entities as there are carbon atoms in 12g of Carbon-12.

7. a) iii) Molar mass is the mass contained in one mole of substance.

b) Data.

Volume of Oxygen = 112 dm^3

Volume of nitrogen dioxide = ?

$$2Pb(NO_3)_{2(s)} \longrightarrow 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$$

∴ Mole ratio Oxygen : Nitrogen dioxide

1 : 4

from, 1 mole contains 22.4 dm^3 at stp

1 mol ≡ 22.4 dm^3

? ≡ 112 dm^3

$$\frac{112\ dm^3 \times 1\ mol}{22.4\ dm^3} = 5\ mol$$

∴ There are 5 moles of Oxygen

from, mole ratio 1 : 4

5 : ?

$$= \frac{5 \times 4}{1} = 20\ mol$$

1 mol — 22.4 dm^3

20 mol — ?

$$\frac{20\ mol \times 22.4\ dm^3}{1\ mol}$$

∴ 448 dm^3

∴ Volume of nitrogen dioxide is 448 dm^3

In Extract 7.2, the candidate correctly defined mole and molar mass. He/she also calculated the exact volume of nitrogen dioxide gas by using appropriate procedure.

2.2.6 Question 8: Soil Chemistry and Chemical Kinetics, Equilibrium and Energetics

This question consisted of parts (a) and (b). Part (a) required candidates to distinguish manures from fertilizers by giving an example for each. In part (b), candidates were provided with a chemical equation showing the reversible reaction between hydrogen and iodine gas to form hydrogen iodide gas; $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ ΔH = -800 kJ/mol. The candidates were supposed to explain by giving reason the impact of the following on the position of equilibrium; (i) lowering temperature and (ii) adding hydrogen iodide gas into the system.

This question was attempted by 146,633 (88.45%) candidates out of which 52.9% scored 0 to 1.5 marks, 30.1% scored 2.0 to 3.5 marks and 17.0% scored 4.0 to 6.0 marks. Candidates who scored 2.0 marks and above were 47.1% indicating that the general performance was average. Pictorial presentation of performance in this question is shown in Figure 8.

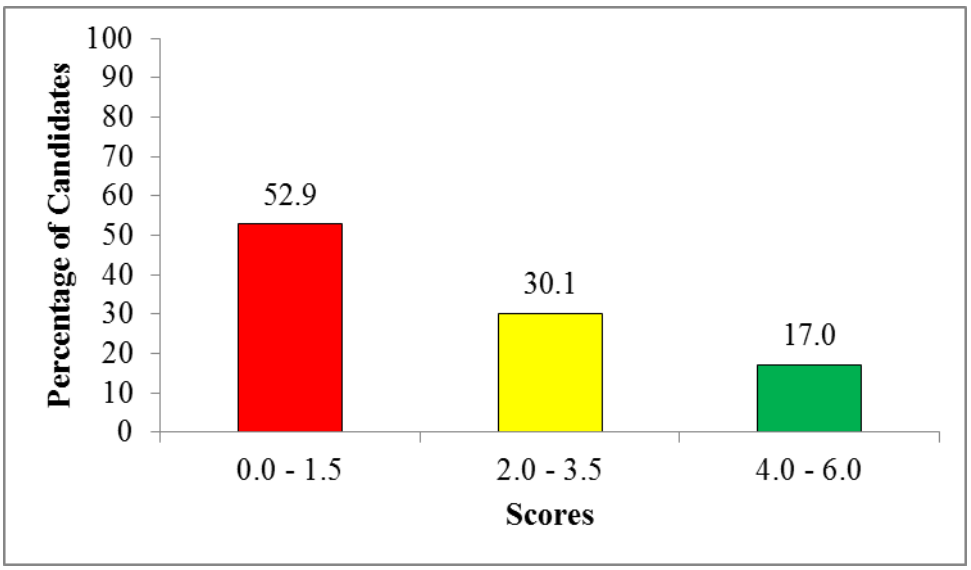
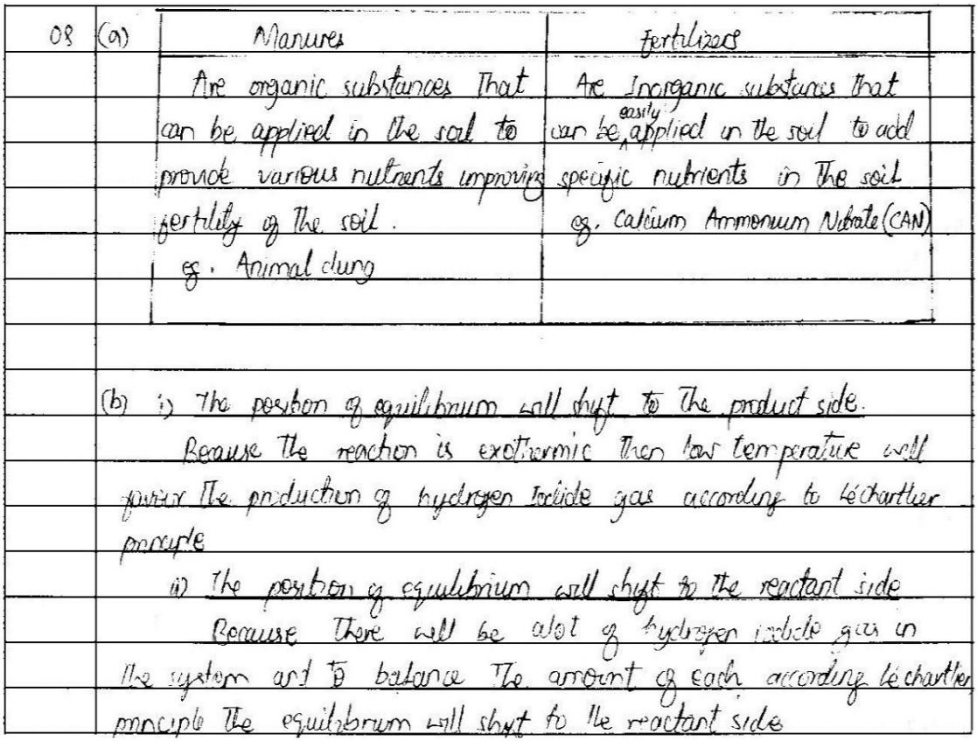


Figure 8: *Performance of candidates in question 8.*

The candidates who scored high marks managed to distinguish manures from fertilizers with the aid of relevant examples for each. The main point is that manures are organic in nature whereas fertilizers are inorganic in nature. Another acceptable answer is that manures (such as cow dung and green manure) are originated from plants and animals while fertilizers (such as NPK and CAN) are manufactured in industries. In addition, the

candidates were conversant with manures and fertilizers as sources of nutrients in the soil. In part (b), candidates in this category gave proper explanation that; (i) the position of the equilibrium will move to the right and (ii), the position of the equilibrium will move to the left to favour production of the reactants. The candidates were able to explain the correct outcomes about position of the equilibrium because they had adequate knowledge on the Le Chatelier's principle which govern chemical equilibrium. A sample of good responses to this question is shown in Extract 8.1.

Extract 8.1



In Extract 8.1, the candidate distinguished manures from fertilizers and correctly explained the effects of the stated conditions on the position of the equilibrium.

On the contrary, candidates who scored low marks failed to give proper distinction between manures and fertilizers. Some of them swapped the meanings of manures and fertlizers. Others gave statements which were partial while others gave vague ones. For instance, one candidate wrote that

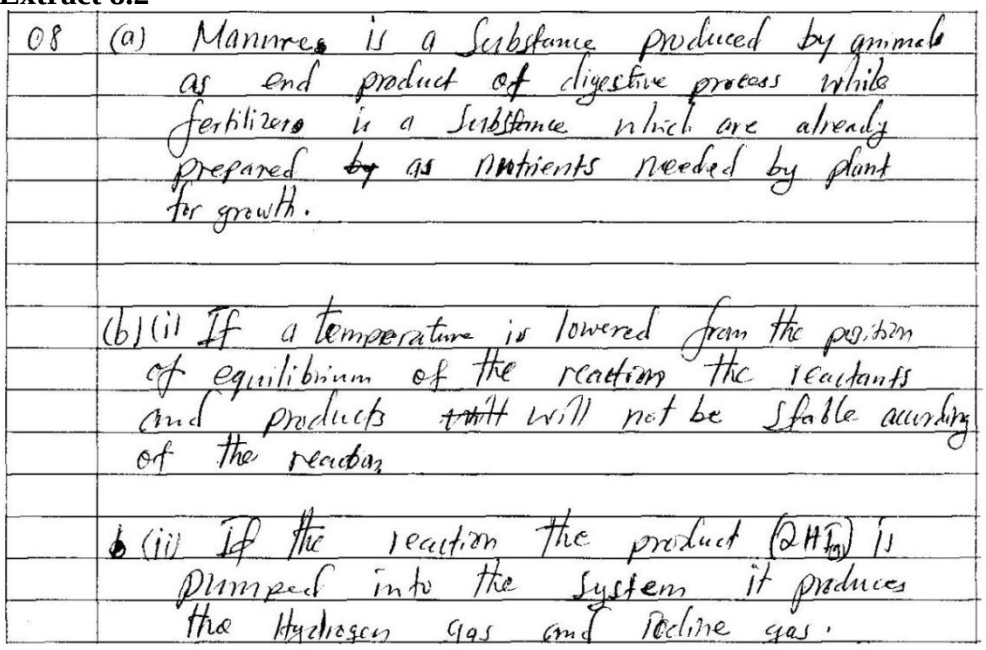
> *"manure are the organic compound which obtained from different animal and which enable the plant nuetrient from the soil and*

increase the structure of the soil to be sponges examples green manure, kraal manure and farm yard manure while fertilizer are the compound formed when two or more joined together, examples mixed fertilizer, complete fertilizers and straight fertilizers".

Responses of such kind reveal that the candidate had inadequate knowledge about manures and fertilizers.

In part (b), most of the candidates could not explain appropriately the effects of lowering temperature and introducing hydrogen iodide gas into the system. The candidates were supposed to know that; lowering temperature in an exothermic reaction favours formation of the products thus, the position of the equilibrium shifts to the right. Another thing is that, adding hydrogen iodide into the system is the same as increasing the concentration of hydrogen iodide which is a product. As a result, hydrogen iodide will react to form the reactants, hence the equilibrium will shift to the left. Together with other factors, lack of inadequate knowledge about the effect of temperature and concentration on equilibrium accounted for the failure of candidates in this question. Extract 8.2 depicts a sample of poor responses in question 8.

Extract 8.2



Extract 8.2 shows responses of a candidate who gave partial distinction between manures and fertilizers. His/her explanation in (b) (i) was incorrect and the explanation in (b) (ii) was incomplete.

2.2.7 Question 9: Non –metals and their Compounds and Hardness of Water

The question consisted of part (a) and (b). Part (a) required the candidates to name the products formed when hydrogen sulphide reacts with chlorine gas and to mention two uses of hydrochloric acid. In part (b) (i) the candidates were asked to name the compounds which cause temporary and those which cause permanent hardness of water. Part (b) (ii) required candidates to show how to remove temporary and permanent hardness of water with the aid of balanced chemical equation in each case.

A total of 152,363 (91.91%) candidates attempted this question. Candidates who scored 0 to 1.5 marks were 61.2%, those who scored 2.0 to 3.5 marks were 27.7% and those who scored 4.0 to 6.0 marks were 11.1%. The general performance of the candidates in this question was average as 38.8% scored 2.0 marks and above. Statistics of performance are summarized in Figure 9.

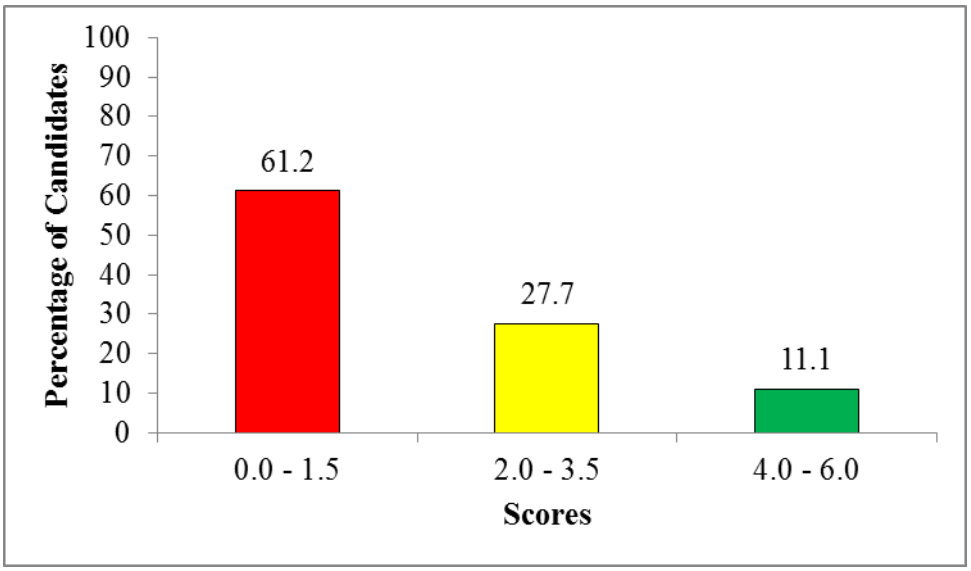
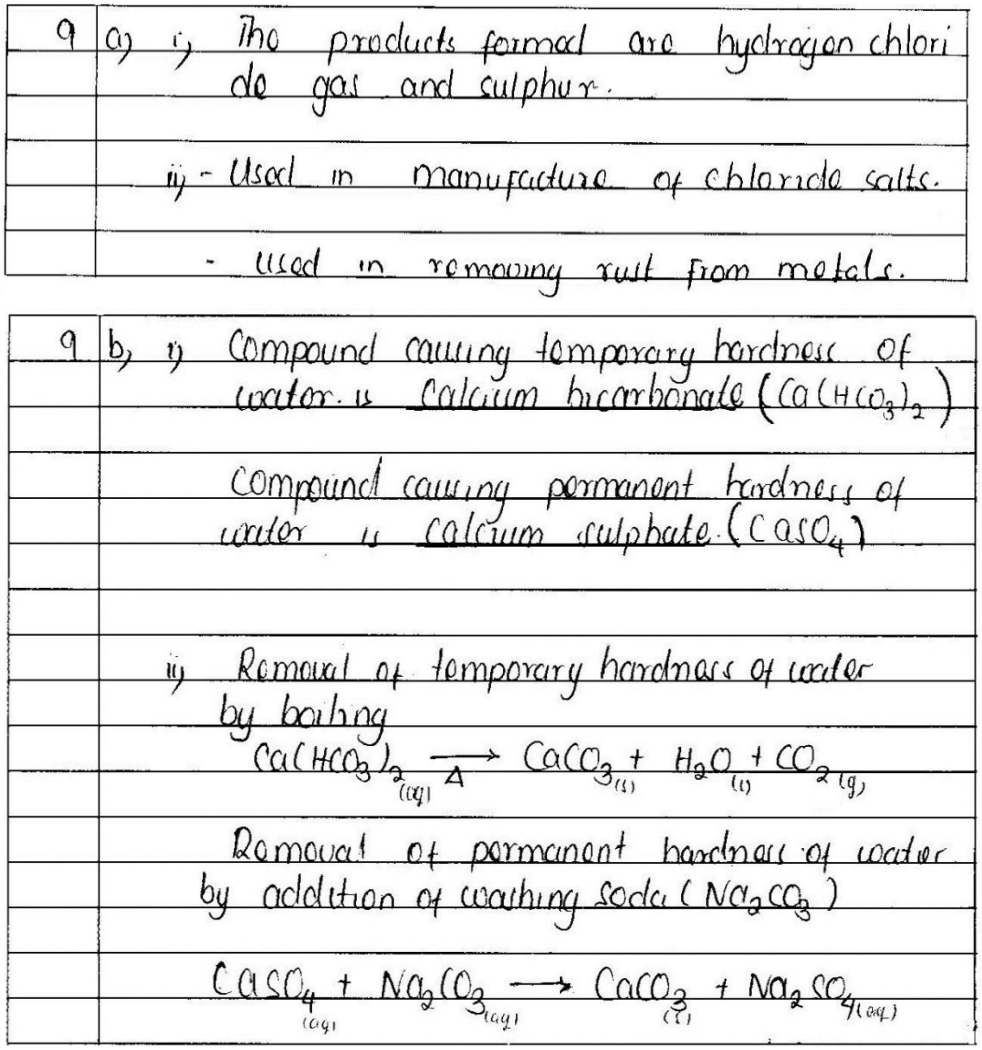


Figure 9: *Performance of candidates in question 9.*

The candidates who scored high marks were able to name the products formed when hydrogen sulphide reacts with chlorine gas. Those products were hydrogen chloride gas and sulphur. Uses of hydrochloric acid were correctly mentioned by candidates in this category. Furthermore, they managed to name the compounds which are responsible for temporary and

permanent hardness of water. Some candidates went a step ahead by giving chemical formulae of the compounds. Majority of them wrote correct balanced chemical equations showing how to remove temporary and permanent hardness of water as enquired. Extract 9.1 illustrates a good response in this question.

Extract 9.1



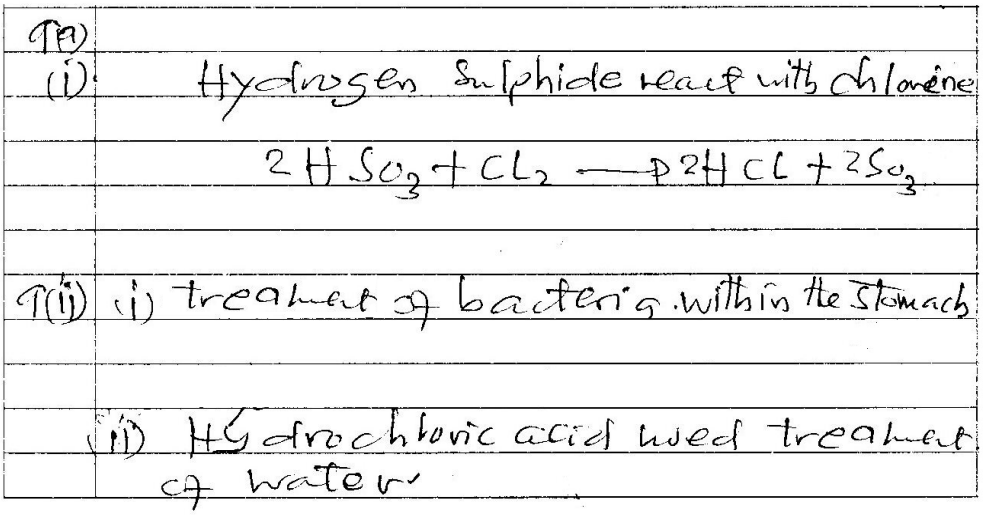
In Extract 9.1, the candidate correctly named the products of the reaction of hydrogen sulphide with chlorine gas, gave uses of hydrochloric acid, named the compounds which cause hardness of water and wrote balanced chemical equation on how to remove each type of hardness of water.

On the other hand, candidates who scored low marks (0 to 1.5 marks) failed to name the products formed when hydrogen sulphide gas reacts with

chlorine gas and gave incorrect uses of hydrochloric acid. Some of them uses irrelevant chemical symbols in an attempt to write the products for the reaction in part (a) (i). For instance, some wrote incorrect products such as hydrochloric acid instead of hydrogen chloride gas and sulphur. There were those who incorrectly wrote sulphur chloride, hydrogen gas, SCl and SO_3. In responding to the uses of hydrochloric acid, some wrote improper uses while others generalized the uses in a variety of places. For instance, one candidate wrote "*It is used in schools and hospitals*". In another incidence, a candidate wrote "*It is used as a salt at home*". This indicates that the candidates had inadequate knowledge on the use of hydrochloric acid.

Furthermore, most of the candidates failed to cite the compounds that causes hardness of water and in return wrote invalid chemical equations on how to remove the hardness of water. Others swapped the compounds that cause temporary hardness for those that cause permanent hardness of water. There were few candidates in this group who confused between the compounds that cause hardness of water with those that are used to treat hard water. Generally, the candidates had inadequate knowledge on the causes and remedies for temporary and permanent hardness of water. Extract 9.2 illustrates a sample of poor responses from one of the candidates.

Extract 9.2



In Extract 9.2, the candidate wrote incorrect reaction equation between hydrogen sulphide and chlorine gas and also failed to give the correct uses of hydrochloric acid and left part (b) unanswered.

2.2.8 Question 10: Organic Chemistry and Compounds of Metals

Question 10 was comprised of part (a) and part (b). In part (a) (i) the candidates were required to define isomerism and in part (a) (ii) the candidates were required to draw and name two structural isomers of C_4H_8. In part (b), candidates were required to write a balanced chemical equation between calcium carbonate and a named acid. Then they were required to name all the products formed from the reaction.

The question was attempted by 153,920 (92.85%) candidates out of which 61.7% scored 0 to 1.5 marks, 23.3% scored 2.0 to 3.5 marks and 15.0% scored 4.0 to 6.0 marks. The candidates who scored 2.0 marks and above were 38.3% implying that the performance was average. Figure 10 gives summary of statistics in question 10.

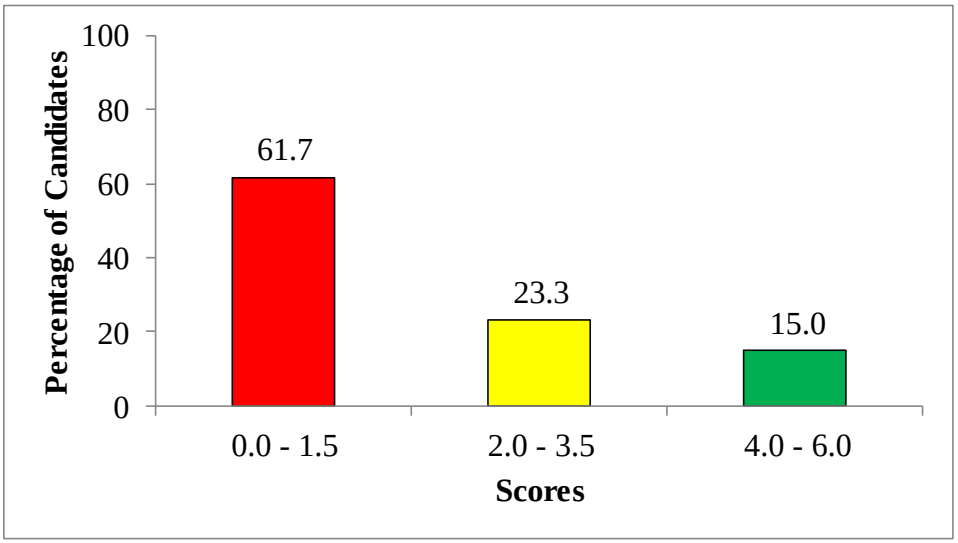
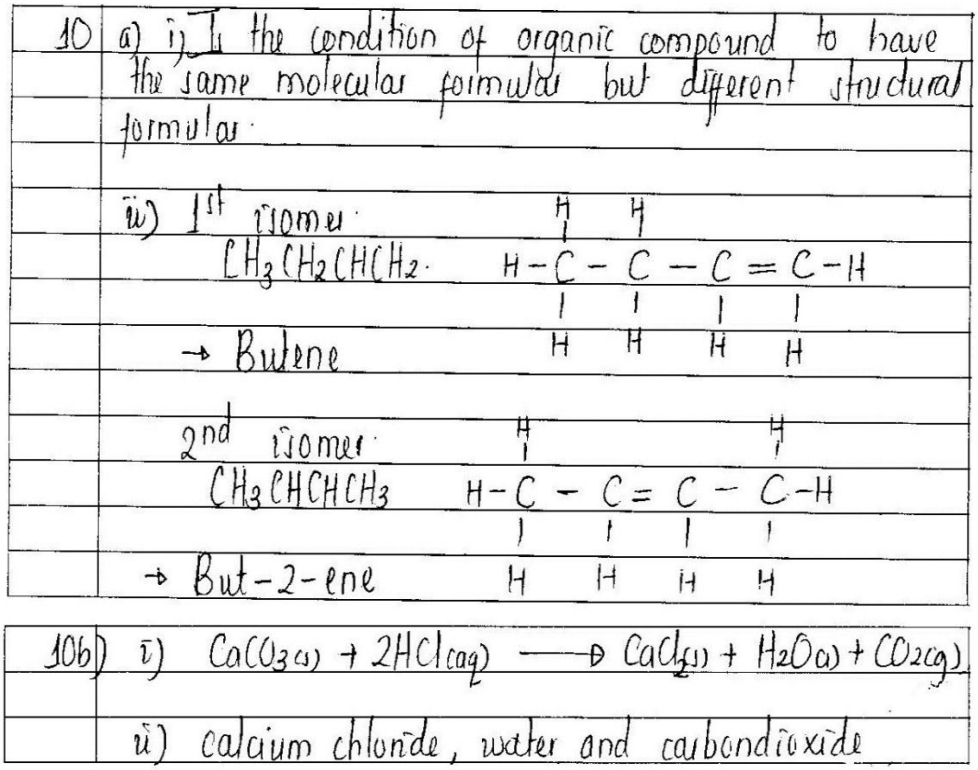


Figure 10: *Performance of candidates in question 10.*

The candidates who scored high marks in this question managed to define the term isomerism and correctly drew diagrams for two isomers of C_4H_8. They also managed to name the two isomers appropriately. However, there were few candidates who mistakenly wrote similar isomers twice. Majority of candidates in this category wrote well balanced chemical equation for the reaction between calcium carbonate and an acid of interest in which hydrochloric acid was oftenly preferred. They finally named the products to be formed correctly including water, carbondioxide and salt (depending on the acid choosen). Generally, the candidates had adequate knowledge on

isomerism and were competent in using chemical equations. Extract 10.1 shows a sample of good response from one of the candidates in question 10.

Extract 10.1

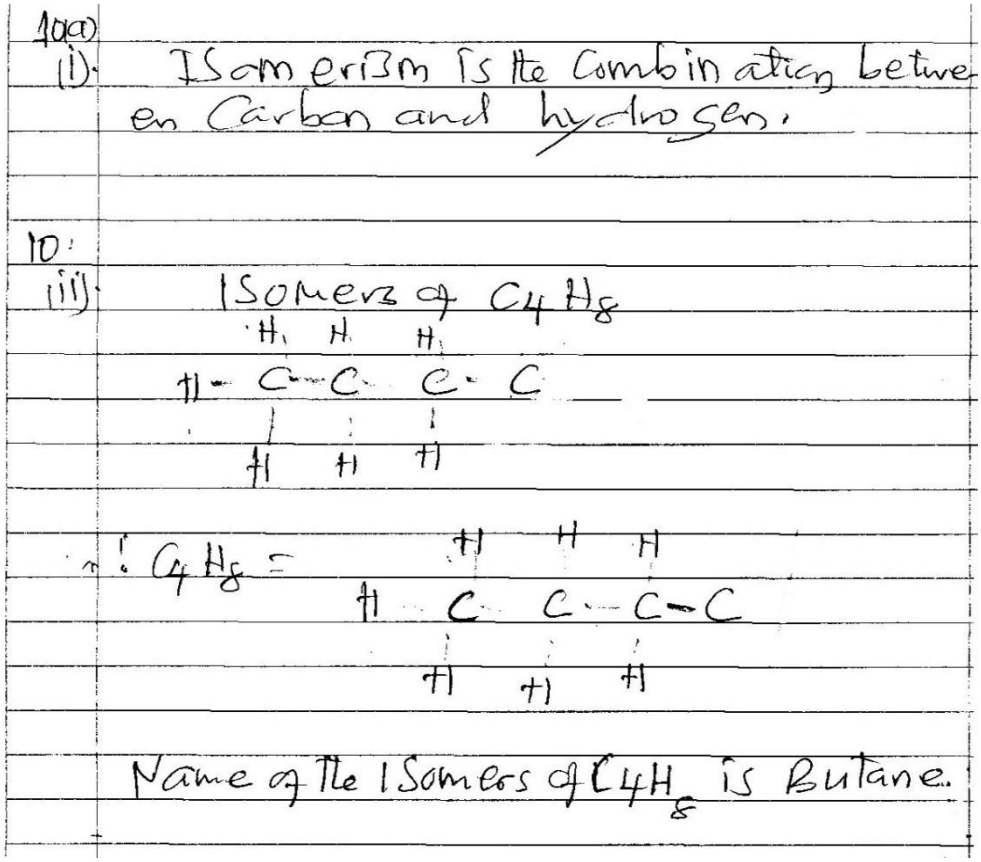


Extract 10.1, the candidate correctly defined the term isomerism, drew and named the two isomers of C_4H_8, wrote a balanced chemical equation for the reaction of calcium carbonate and HCl to produce carbondioxide and named all the products formed.

Conversely, candidates who scored low marks (0 to 1.5), failed to define the term isomerism. Some of them gave incorrect definitions including those who defined isomers instead of isomerism. Others gave definitions in which they incorrectly regarded that isomers have different molecular masses whereas they do have the same molar mass. In order to write the appropriate isomers, candidates had to understand that the formula given belongs to alkenes. Few others drew structures having 3 carbon atoms insteady of 4 carbon atoms. Whereas some candidates ended up writing structures which belong to alkanes. Similarly some structures were drawn in such a way that hydrogen atoms were not properly linked to the carbon

atoms. Part (b) was frequently skipped by candidates in this category. Those who attempted this part wrote invalid chemical symbols. Some chemical symbols which should be capitalized were written in lower case. For instance, some candidates incorrectly wrote calcium carbonate as $CaCo_3$ instead of $CaCO_3$ and water as H_2o instead of H_2O. This indicates that the candidates were not conversant with isomerism and writing chemical reactions. Extract 10.2 shows a sample of a poor responses from one of the candidates.

Extract 10.2



Extract 10.2, the candidate incorrecty defined the term isomerism, drew incorrect isomers of C_4H_8 and consequently gave incorrect name to the isomer.

2.2.9 Question 11: Acids, Bases and Salts and Fuels and Energy

The question had two parts, namely (a) and (b). In part (a), the candidates were required to describe how to prepare pure solid sodium chloride by the action of an acid and a base with the aid of a chemical equation. Part (b)

required the candidates to explain why petroleum and coal are non-renewable sources of energy. They were also required to give three alternatives to non-renewable sources of energy.

This question was attempted by 139,218 (89.98%) candidates in which 68.4% scored 0 to 1.5 marks, 19.9% scored 2.0 to 3.5 marks and 11.7% scored 4.0 to 6.0 marks. The general performance was average as 31.6 % of the candidates scored 2.0 marks above. Figure 11 provides summary of performance in this question.

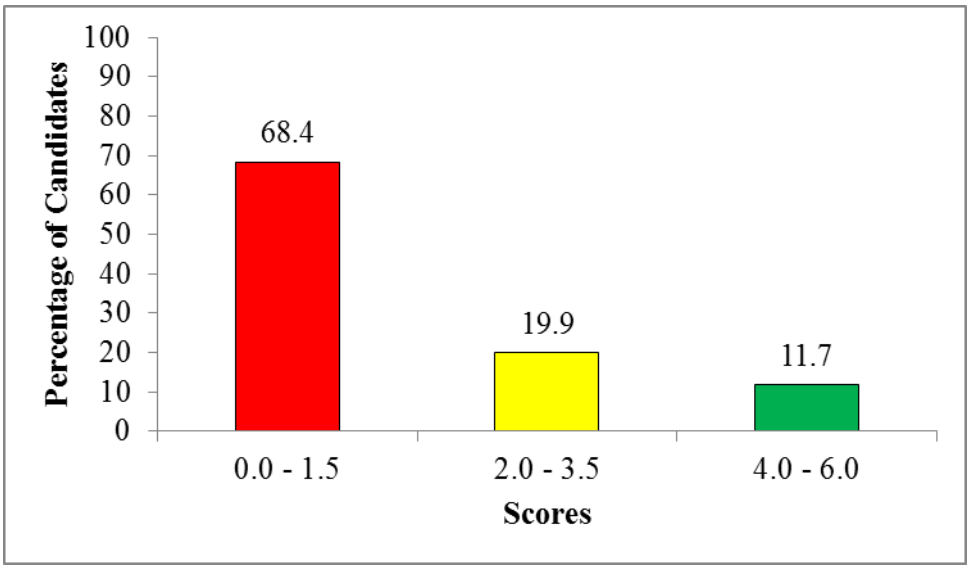
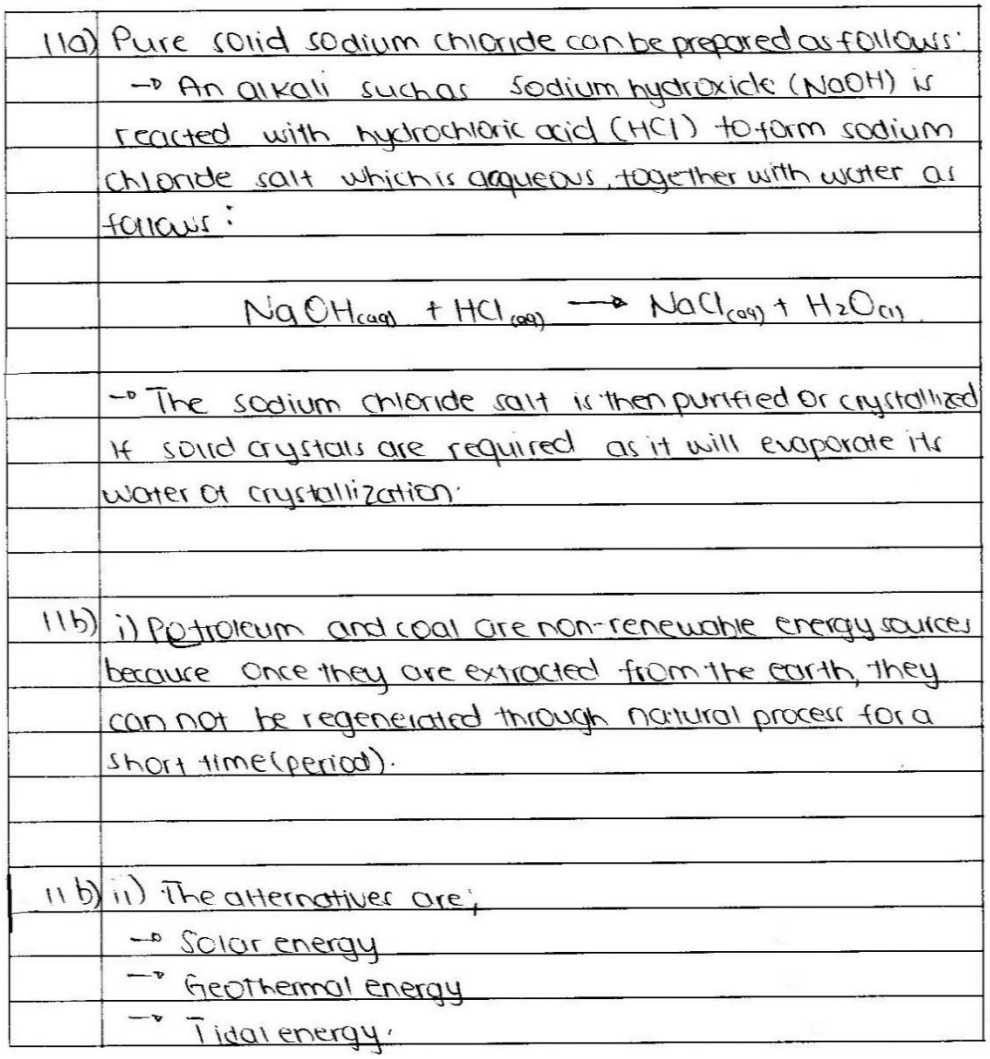


Figure 11: *Performance of candidates in question 11.*

The candidates who scored high marks in this question managed to describe clearly how solid sodium chloride can be prepared from the reaction of an acid and a base. They supported their descriptions with the aid of well balanced chemical equation. Similarly, some candidates managed to explain why petroleum and coal are non-renewable sources of energy precisely. Extract 11.1 shows a sample of correct responses to this question.

Extract 11.1

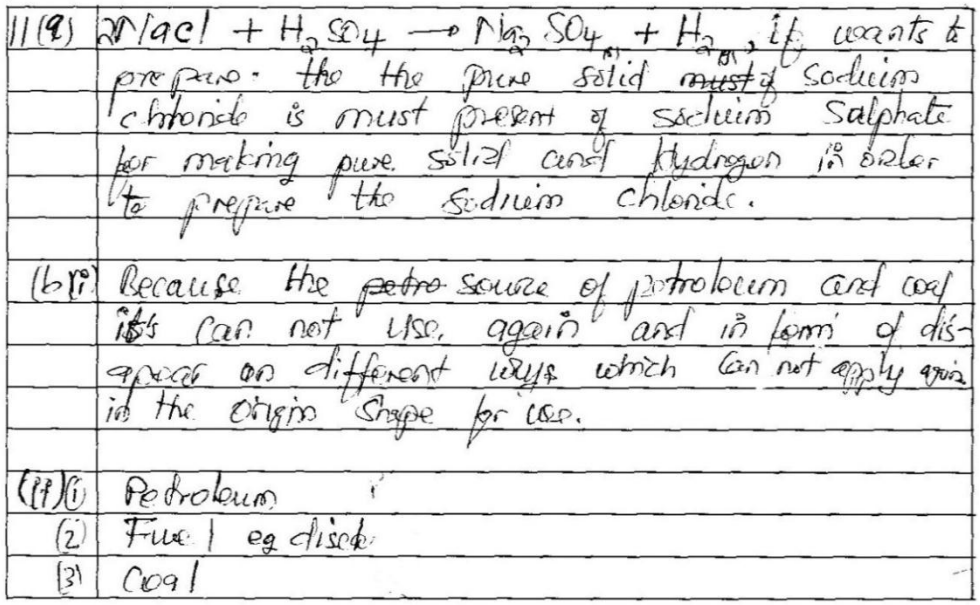


Extract 11.1 shows responses of a candidate who correctly explained the preparation of solid sodium chloride and explained why petroleum and coal are non-renewable sources of energy. He/she also mentioned three proper alternatives to non-renewable sources of energy.

On the other hand, the candidates who scored low marks failed to describe how pure solid sodium chloride can be prepared by action of acid and base with the aid of chemical equation. This was attributed by inadequate knowledge on chemical reactions and inadequate skills of writing balanced chemical equations. In part (b) (i), some candidates just copied the question without providing any answer. Others wrote vague sentences in attempt to explain why petroleum and coal are non-renewable sources of energy while others resorted into guessing. For example, one candidate wrote; "*Because*

petroleum and coal are deposited". Similarly, the candidates failed to give three alternatives to non-renewable sources of energy as some mentioned forms of energy instead. The incorrect answers indicate that the candidates had inadequate knowledge about non-renewable sources of energy. Extract 11.2 shows a sample of responses from one of the candidates.

Extract 11.2


11(a) $2NaCl + H_2SO_4 \rightarrow Na_2SO_4 + H_2$, if wants to prepare the the pure solid ~~must~~ of Sodium chloride is must present of Sodium Salphate for making pure solid and hydrogen in order to prepare the Sodium chloride.

(b)(i) Because the ~~petro~~ source of petroleum and coal it's can not use again and in form of disapear on different ways which can not apply again in the origin shape for use.

(ii)(1) Petroleum
(2) Fuel eg diesel
(3) Coal

Extract 11.2 shows an incorrect description on the preparation of pure solid sodium chloride by the action of an acid and a base, wrong reasons of why petroleum and coal are non-renewable sources of energy and incorrect alternatives of non-renewable sources of energy.

2.3 Section C: Essay Questions

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

2.3.1 Question 12: Mole Concept and Related Calculations

The question consisted of four parts as follows:
Three moles of nitrogen gas combines with five moles of hydrogen gas to form ammonia gas by Haber process.

(a) Which reactant is present in smaller amount?
(b) Calculate the grams of the reactant left in the container.

(c) How many moles of NH_3 are produced?
(d) How many litres of NH_3 are produced STP?".

This question was attempted by 117,654 (70.97%) candidates, being the least attempted as well as the least performed. Candidates who scored 0 to 3.5 marks were 97.5% with 54.1% scoring zero mark. Those who scored 4.0 to 8.0 marks were 2.2% whereas the remaining 0.3% scored 8.5 to 13 marks. The general performance in this question was poor as only 2.5% of the candidates scored 4.0 marks and above. Figure 12 gives summary of the performance of the candidates in this question.

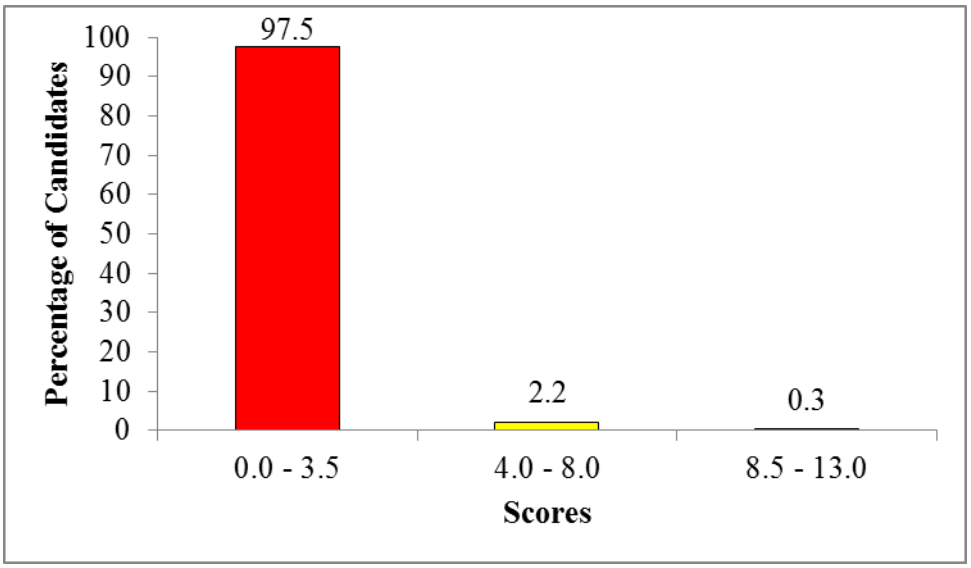
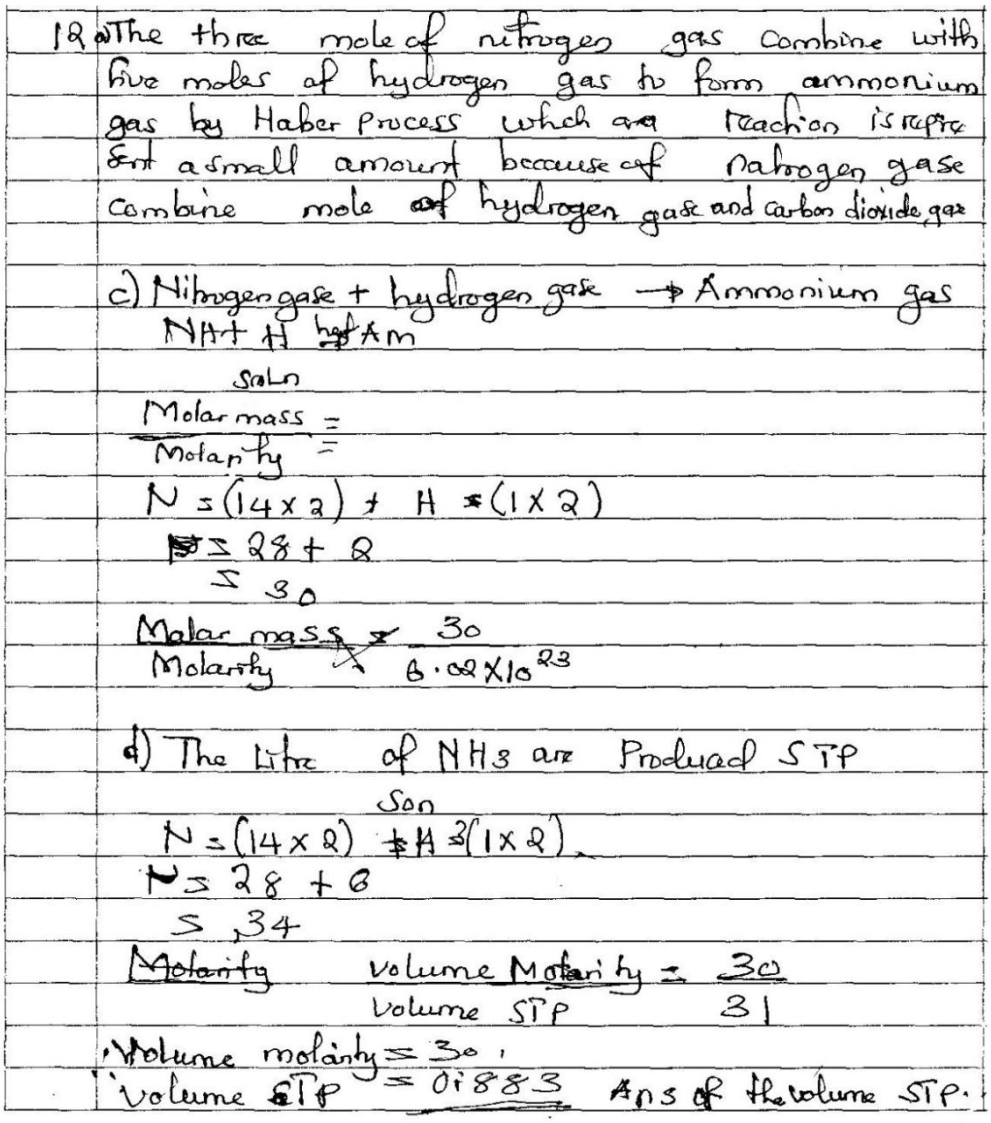


Figure 12: *Performance of the candidates in question 12.*

The candidates who scored low marks did not manage to calculate and decide precisely the reactant which was present in smaller amount. The candidates did not manage to write a balanced chemical equation representing the Haber process which was an inevitable step before calculations. Furthermore, the candidates failed to calculate the values of mass, number of moles and volume which were required in the subsequent parts. A few number of students tried to carry out some calculation procedures which were not logical. For instance, one candidate subtracted the number of moles of nitrogen from the number of moles of hydrogen (5 - 3 = 2) and concluded incorrectly that nitrogen gas was in smaller amount in part (a). Generally, the candidates had inadequate knowledge on mole concept and related calculations.

Extract 12.1 illustrates a sample of poor responses from one of the candidates.

Extract 12.1


12 a) The three mole of nitrogen gas combine with five moles of hydrogen gas to form ammonium gas by Haber Process which are reaction is repre Ent a small amount because of nabrogen gase combine mole of hydrogen gase and carbon dioxide gas

c) Nibrogen gase + hydrogen gase → Ammonium gas

NH3 + H

Soln

Molar mass =
Molarity =

N = (14 x 2) + H = (1 x 2)

= 28 + 2

= 30

Molar mass = 30
Molarity = 6.02 x 10^23

d) The Litre of NH3 are Produced STP

Soln

N = (14 x 2) + H = (1 x 2)

= 28 + 2

= 30

Molarity Volume Molarity = 30
Volume STP 31

Volume molarity = 30

Volume STP = 0.883 Ans of the volume STP.

Extract 12.1 shows response of a candidate who followed incorrect mathematical approach in attempt to solve for the parameters related to mole.

The candidates who scored high marks in this question managed to write the balanced chemical equation for the Haber process and calculate the required values through a correct mathematical approach. The proper procedure followed in calculation enabled them to identify hydrogen gas

being the reactant present in smaller amount. Extract 12.2 illustrates a sample of good responses from one of the candidates.

Extract 12.1

12. Haber process;

$N_2 + 3H_2 \rightleftharpoons 2NH_3$

(g) (g) (g)

overall equation.

Given;

3mols - Nitrogen

5 mols - Hydrogen

a) If; 1 mole of $N_2 \longrightarrow$ 3 moles of H_2

3 mols of $N_2 \xrightarrow{\times}$?

$x = \frac{3 \text{ mols of } N_2 \times 3 \text{ mols of } H_2}{1 \text{ mole of } N_2}$

= 9 mols of H_2 will be needed

But there are only 5 mols of Hydrogen gas present.

∴ The reactant which is present in smaller amount is Hydrogen gas.

b) If;

1 mol of $N_2 \longrightarrow$ 3 mols of H_2.

? mols of $N_2 \longrightarrow$ 5 mols of H_2.

$x = \frac{5 \text{ mols of } H_2 \times 1 \text{ mol of } N_2}{3 \text{ mols of } H_2}$.

∴ x = 1·667 mols of Nitrogen are used.

12. b) ∴ 1.667 moles of N_2 are used out of 3 moles.

Remaining moles = 3 mols − 1.667 mols

⇒ 1.333 mols remained.

but; $n = \frac{\text{mass}}{\text{Molar mass}}$

$1.333 \text{ mols} = \frac{\text{mass}}{28 \text{ g mol}^{-1}}$

mass = $28 \text{ g mol}^{-1} \times 1.333 \text{ mols}$

= 37.324 grams.

but; Molar mass $N_2 = 2 \times 14$

$\therefore = 28 \text{ g mol}^{-1}$

∴ The grams of the reactant left in the container is 37.324 grams.

c) i) 1 mol of $N_2 \longrightarrow$ 3 mols of H_2

? $\xrightarrow{\times}$ 5 mols of H_2

$x = \frac{5 \text{ mols of } H_2 \times 1 \text{ mol of } N_2}{3 \text{ mols of } H_2}$

= 1.667 mols of N_2.

but; 3 mols of $H_2 \longrightarrow$ 2 moles of NH_3

5 mols of $H_2 \xrightarrow{x}$?

$x = \frac{5 \text{ mols of } H_2 \times 2 \text{ moles of } NH_3}{3 \text{ mols of } H_2}$

$= \frac{10 \text{ mols of } NH_3}{3} = 3.333 \text{ mols}$

The moles of NH_3 produced are 3.333 mols of ammonia gas.

Extract 12.2 shows response of a candidate who keenly followed step by step mathematical manipulation of the mole concept and obtained correct answers to all parts of the question.

2.3.2 Question 13: Soil Chemistry

In this question, the candidates were required to explain six methods that are used to manage loss of plant nutrients from the soil.

The question was attempted by 154,532 (93.22%) candidates of which 31.0% scored 0 to 3.5 marks, 36.9% scored 4.0 to 8.0 marks and 32.1% scored 8.5 to 13 marks. The percentage of candidates who scored 4.0 marks and above was 69.0% implying that the overall performance was good. Figure 13 gives summary of the performance in this question.

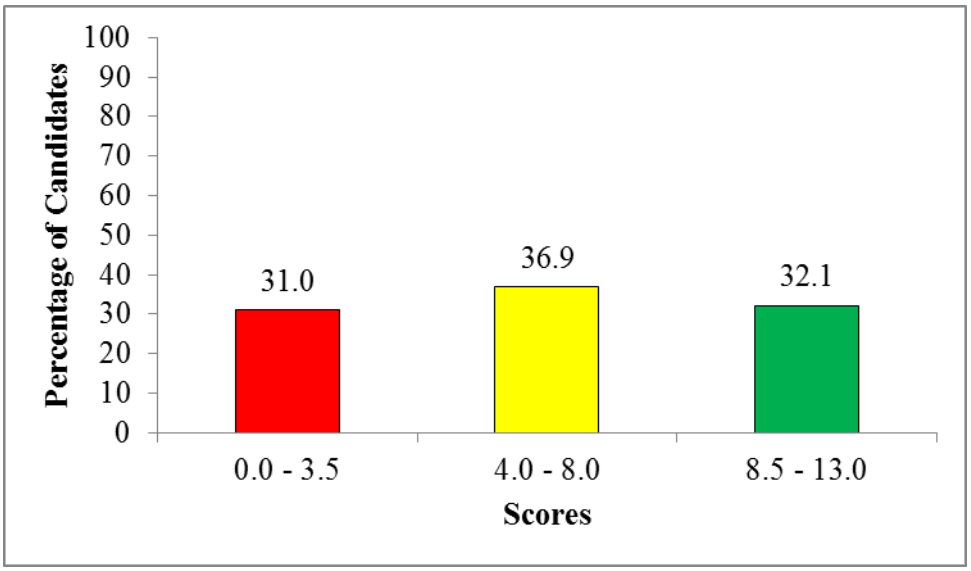


Figure 13:*Performance of candidates in question 13.*

The candidates who scored high marks in this question managed to write a good essay following the requirements of the question. They started by writing a brief and convincing introduction. Their responses were presented in paragraphs (one paragraph for each point) explaining six methods that are used to manage loss of plant nutrients from the soil in Tanzania. Finally, they gave a relevant conclusions which were related to the discussion in the main body. Extract 13.1 shows sample of good responses in in this question.

Extract 13.1

13. Soil refers to an Organic matter that has been formed by disintegration of the parent rock due to weathering. Soil is formed due to various factors like parent rock, Climate, relief, organisms and time. Soil Conservation is the act of protecting and maintaining the soil nutrients from the loss of nutrients. They following are the methods of preventing the loss of soil nutrients.

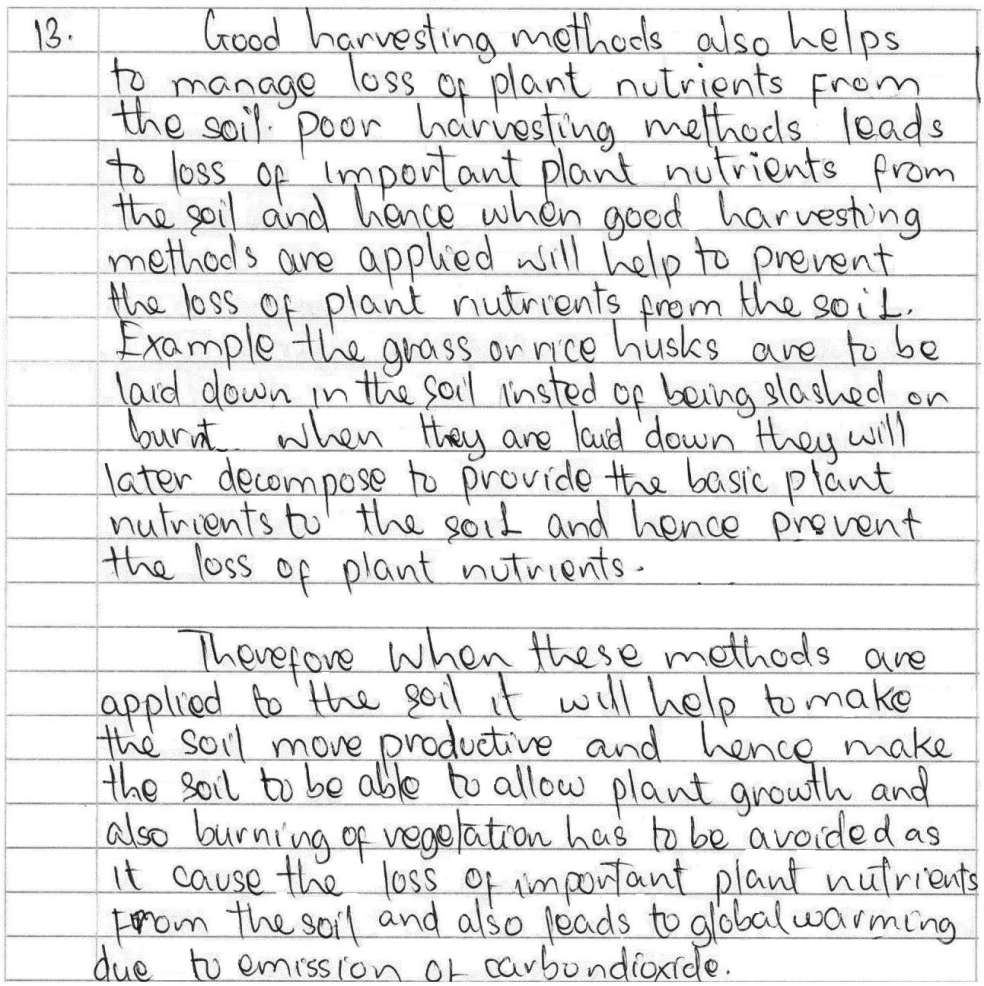
Mulching is one of the method to prevent the loss of soil (plant) nutrients. Mulching refers to the process of covering the bare soil with the layers of organic matters like the rice husks, grasses. These organic matters maintain the soil moisture and also when they decompose they release important nutrients to the soil and also covering the bare soil will prevent the loss of soil nutrients (plant nutrients).

Addition of manure and fertilizer also is an important method of preventing the loss of soil or plant nutrients. When manure is added to the soil, it helps to release important nutrients that are required by the plants and to make the soil productive and thus when manure and fertilizer are added to the soil helps to prevent the loss of plant nutrients.

13. Intercropping is also one of the method of preventing the loss of plant nutrients. Since monocropping leads to loss of soil nutrients then intercropping should be encouraged. Monocropping makes the crops to use only the required plant nutrients and the rest are lost but when there is intercropping there will be no loss of plant nutrients.

Controlled grazing is also one of the method of preventing the loss of plant nutrients Whenever there is Overgrazing on one piece or tract of land the animals grazed tend to cause soil erosion into which the soil is removed and thus leading to loss of the soil nutrients of the particular area and thus whenever there is controlled grazing then the loss of plant nutrients will be prevented.

Avoiding burning of vegetation, is also one of the method of preventing the loss of the plant nutrients. When the vegetation are burnt, it leaves the soil bare and hence the soil becomes more prone to soil erosion and when the soil erosion occurs the valuable plant nutrients are washed away and thus leading to loss of plant nutrients, therefore avoiding burning vegetation will help in preventing the loss of soil nutrients.


13. Good harvesting methods also helps to manage loss of plant nutrients from the soil. poor harvesting methods leads to loss of important plant nutrients from the soil and hence when good harvesting methods are applied will help to prevent the loss of plant nutrients from the soil. Example the grass or rice husks are to be laid down in the soil insted of being slashed on burnt when they are laid down they will later decompose to provide the basic plant nutrients to the soil and hence prevent the loss of plant nutrients.

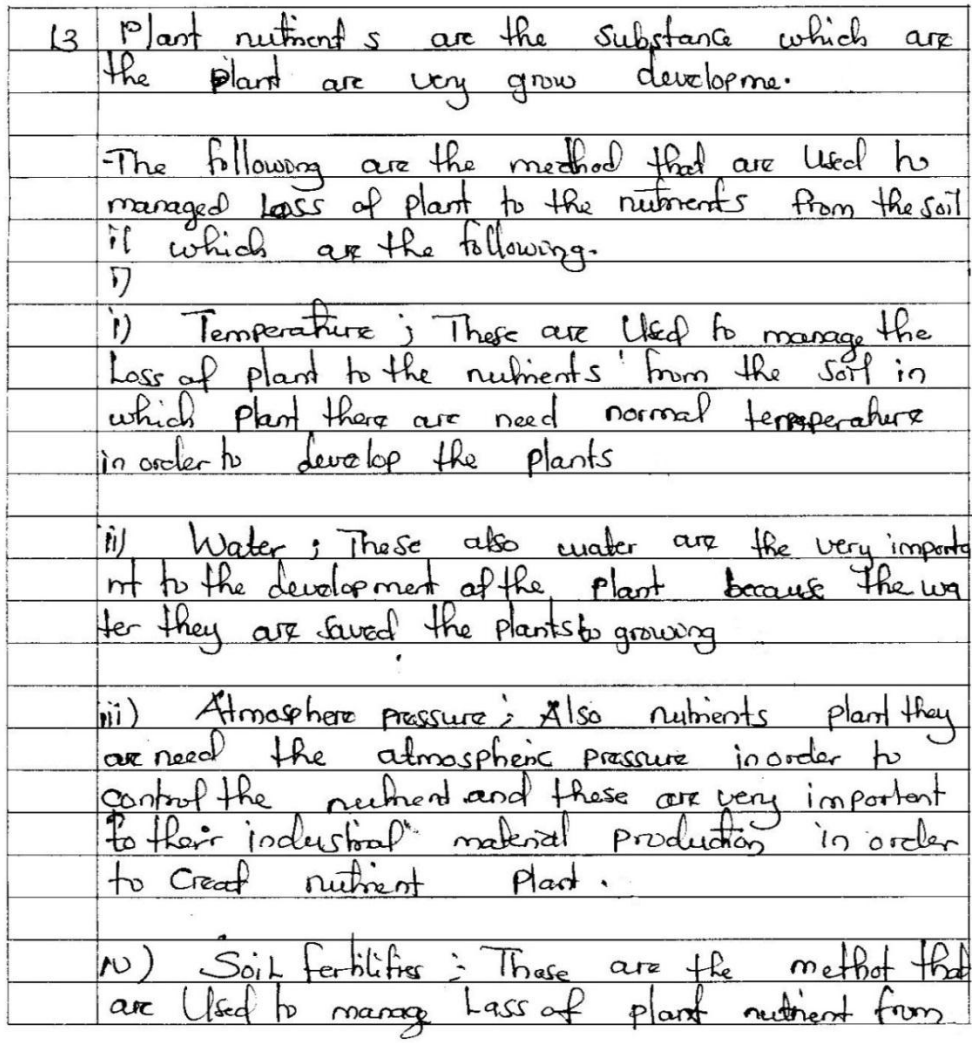
Therefore when these methods are applied to the soil it will help to make the soil more productive and hence make the soil to be able to allow plant growth and also burning of vegetation has to be avoided as it cause the loss of important plant nutrients from the soil and also leads to global warming due to emission of carbondioxide.

Extract 13.1 shows a good essay by a candidate who started with a good introduction followed by mainbody and then gave a precise conclusion at the end.

However, the candidates who scored low marks in this question failed to write relevant introduction in relation to the given question. Others switched to responses addressing other topics. For example, instead of explaining the methods that are used to manage loss of plant nutrients from the soil, some wrote about the importance of soil conservation in Tanzania. This was due to inability to understand the demand of the question. Some candidates scored low marks just because they demonstrated poor English language proficiency in such a way that their sentences were merely vague. There were also some candidates who mentioned some points without elaborating them. Others presented their work in disorganized manner and concluded by giving unrelated comments. Examples of such cases can be

revealed in the responses such as, *"it help to save time, it help to controlling the industry*, it *help to get good materials"*. Such statements indicate that the candidate had inadequate knowlegde thus gave indefinite points. It also implies poor organization of ideas and concepts towards composing coherent and meaningful essay. Extract 13.2 shows a sample of poor responses given by one of the candidates.

Extract 13.2


13 Plant nutrients are the substance which are the plant are very grow developme.

-The following are the method that are Used to managed Loss of plant to the nutrients from the soil if which are the following.

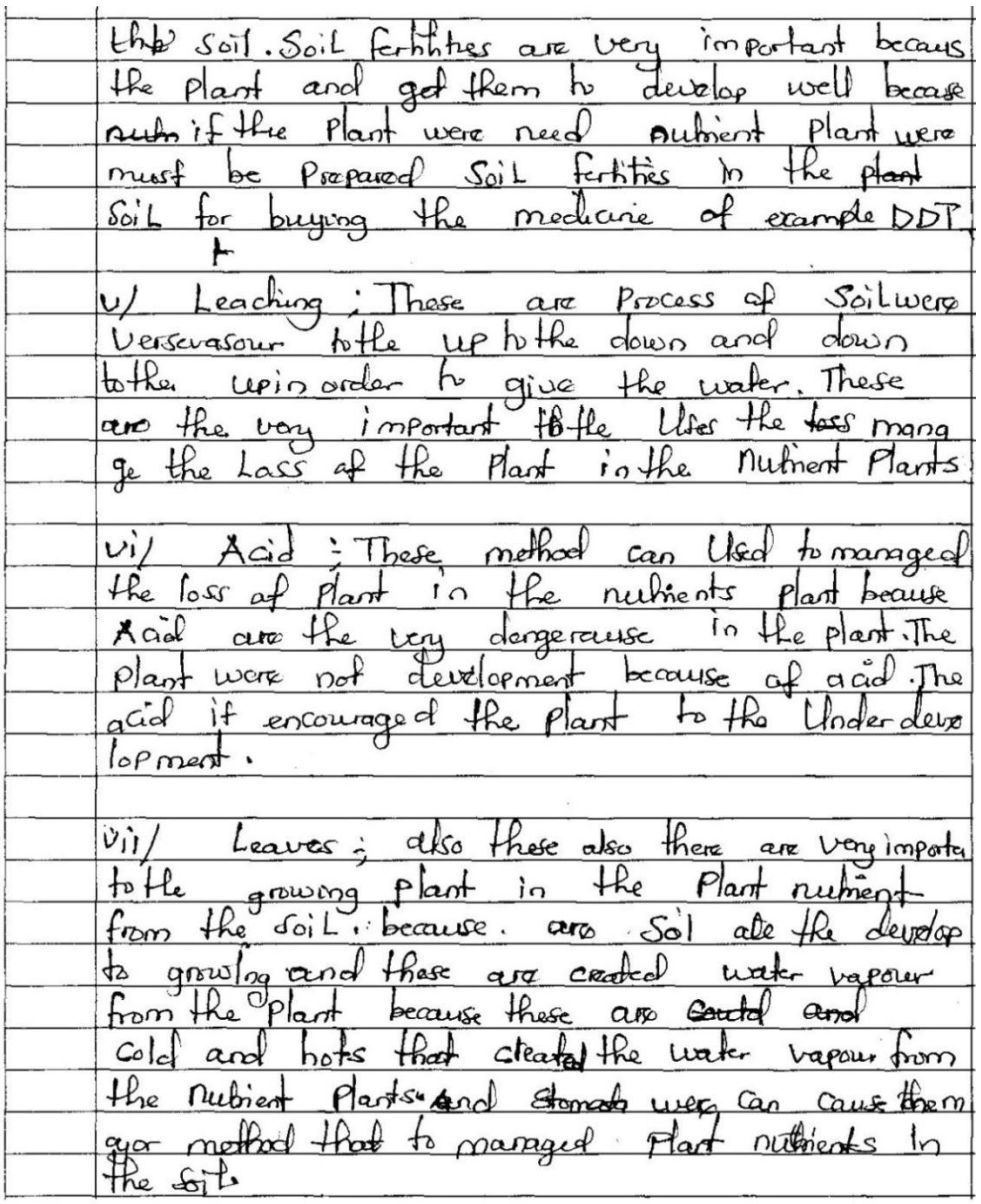
i)

i) Temperature ; These are Used to manage the Loss of plant to the nutrients from the soil in which plant there are need normal temperature in order to develop the plants

ii) Water ; These also water are the very importa nt to the development of the plant because the wa ter they are saved the plants to growing

iii) Atmosphere pressure ; Also nutrients plant they are need the atmospheric pressure in order to control the nutrient and these are very important to their industrial material production in order to Creat nutrient Plant.

iv) Soil fertilifies ; These are the methot that are Used to manage Lass of plant nutrient from



In Extract 13.2, the candidate did not start with key sentences and the mainbody instead presented irrelevant arguments in a disorganized way. The irrelevant points are not written in an essay form but are just listed from (i)-(vii).

3.0 ANALYSIS OF CANDIDATES' PERFORMANCE IN EACH TOPIC

In CSEE 2018, a total of 15 topics out of 27 topics were examined in Chemistry. The general performance in all topics was 93.3% as the candidates scored above the average in 14 topics. Candidates' performance in question 1 was the highest by 82.5%. The items of the question were set

from the topics of *Introduction to Chemistry; Compounds of Metals; Extraction of Metals; Heat Sources and Flames; Chemical Kinetics, Equilibrium and Energetics; Ionic Theory and Electrolysis; Organic Chemistry; Non-metals and their Compounds.* Topics of *Matter and Periodic Classification* combined together attained a good performance of 67.7%. Candidates' performance was average in 8 topics: *Chemical Kinetics, Equilibrium and Energetics; Soil Chemistry; Non-metals and their Compounds; Compounds of Metals; Acids, Bases and Salts; Organic Chemistry; Hardness of Water; Fuels and Energy.*

On the contrary, the topic of *Mole Concept and Related Calculations* was poorly performed by candidates. This topic had a performance of 15.0%. The same topic was among the poorly performed in CSEE 2017. Poor performance of candidates in the topic of *Mole Concept and Related Calculations* was caused by inadequate numerical skills. For example, the parameters related to mole concept in questions 7 and 12 were incorrectly calculated by majority of the candidates. Summary of the candidates' performance in all topics examined is shown in the appendix.

4.0 CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

The overall analysis showed that the general performance of the candidates in Chemistry for CSEE 2018 was average (62.15%) since candidates' scores in most of the questions were above the average. However, performance of candidates on some topics was weak because some candidates faced challenges in attempting the questions. The following are the factors which caused failure of some candidates.

(a) Inadequate knowledge in various topics as some of the candidates' responses were far from the required answers. There were cases in which candidates skipped some items or gave incomplete answers.

(b) Inappropriate use of chemical symbols, chemical formulae and inability to write well balanced chemical equations. For instance, some candidates wrote incorrect chemical equations in question 9.

(c) Poor numerical skills including the use of incorrect mathematical relationships in calculations. This was evident in response to question 12.

(d) Poor English language proficiency as shown by some responses in which candidates wrote vague sentences.

(e) Inability to identify demand of the questions. Some responses of candidates referred to processes which were different from those asked.

(f) Lack of individual skills to organize ideas and concepts when giving explanations especially in essay type questions.

4.2 Recommendations

In order to improve the performance of the candidates in Chemistry subject the following suggestions are recommended.

(a) Teachers and school administrators are advised to emphasize English speaking and writing programs in their schools.

(b) The topic of *Mole Concept and Related Calculations* should be given a special consideration such as, the use of more examples which involve calculations during teaching and learning process.

(c) Teachers should regularly make use of teaching aids such as models of molecules and charts showing formulae of reaction equations during teaching various chemistry topics.

(d) Students are advised to spend more time practicing writing chemical formulae and balancing chemical equations.

(e) Students are advised to read questions carefully before attempting them.

Appendix

ANALYSIS OF CANDIDATES' PERFORMANCE PER TOPIC

S/N	Topic	Question	Score of 30% and above	Remarks
1	Introduction to Chemistry; Compounds of Metals; Extraction of Metals; Heat Sources and Flames; Chemical Kinetics, Equilibrium and Energetics; Ionic Theory and Electrolysis; Organic Chemistry; Non-metals and their Compounds.	1	82.5	Good
2	Matter; Periodic Classification.	5 & 6	67.7	Good
3	Soil Chemistry; Chemical Kinetics, Equilibrium and Energetics.	3 &8 & 13	59.2	Average
4	Hardness of Water.	9	38.8	Average
5	Organic Chemistry; Compounds of Metals; Non-metals and their Compounds.	2 & 4 & 10	34.4	Average
6	Acids, Bases and Salts; Fuels and Energy.	11	31.6	Average
7	The Mole Concept and Related Calculations.	7 & 12	15.0	Weak