CHEMISTRY TOP SCHOOLS AND JOINT MOCKS 2021

NAME ……..…….. **DATE** ……

INDEX NO. ……..……..……...…..… **SIGNATURE** ……...……..

233/1
CHEMISTRY
(THEORY)
PAPER 1
TIME: 2 HOURS.

KENYA HIGH SCHOOL

POST MOCK EXAMINATIONS

FORM 4

2021

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATES

a) Write your **NAME** and **INDEX NUMBER** in the space provided above
b) Sign and write the date of examination in the spaces providedabove
c) Answer **ALL** the questions in the spaces provided
d) **ALL** working must be clearly shown where necessary.
e) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1 31	80	
Total score	80	

This paper consists of 9 printed pages.

1. An element K has atomic number 20 while element M has atomic number 8.

a) Write the electronic configuration for K and M

K

…….. **1mark**

M

……. **1mark**

b) Write the symbol of the most stable ion of K and M

K

……. **1mark**

M

……. **1mark**

2. Molten Lead (II) bromide is electrolyzed using carbon electrodes. Write the half equations of the reactions that occur at the anode and the cathode.

a) Anode

……..…… **1mark**

b) Cathode

……...…….…… **1mark**

3. Explain why the conductivity of metals decreases with increase in temperature. **2marks**

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4. Three metal oxides XO, YO, and ZO are heated with powdered metal Y. Hot powdered Y will remove oxygen from XO but not from ZO. Arrange the metals in order of reactivity, starting with the most reactive. **1mark**

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5. Some sodium chloride was found to be contaminated with copper (II) oxide. Describe how a sample of sodium chloride can be separated from the mixture. **2marks**

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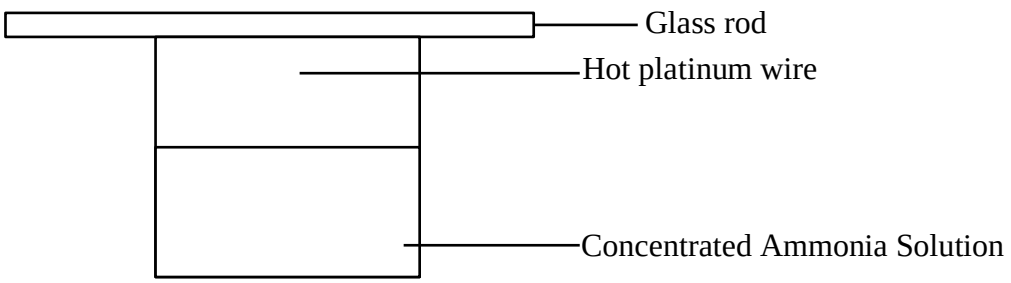
6. Hot platinum wire was lowered into a flask containing concentrated ammonia solution as shown below.



State and explain the observations made. **3marks**

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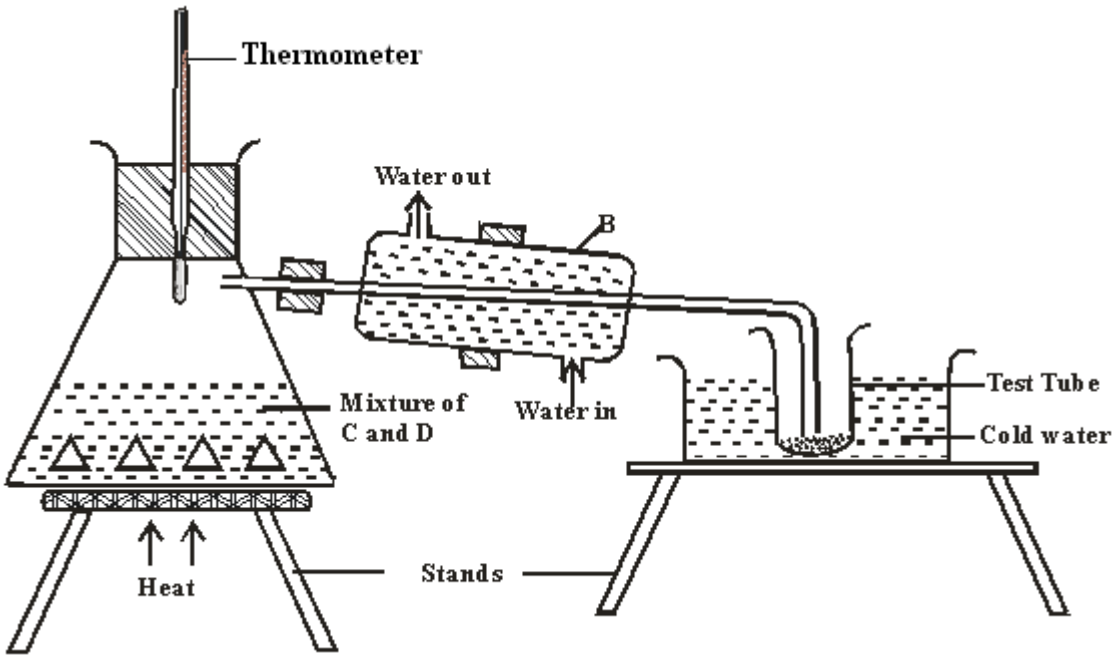
7. The set up below represents the apparatus that may be used to separate a mixture of two miscible liquids C and D whose boiling points are 80^0C and 110^0C.



a) Name B

…….. **1mark**

b) What is the purpose of the thermometer **1mark**

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c) Which liquid was collected in the test tube? **1mark**

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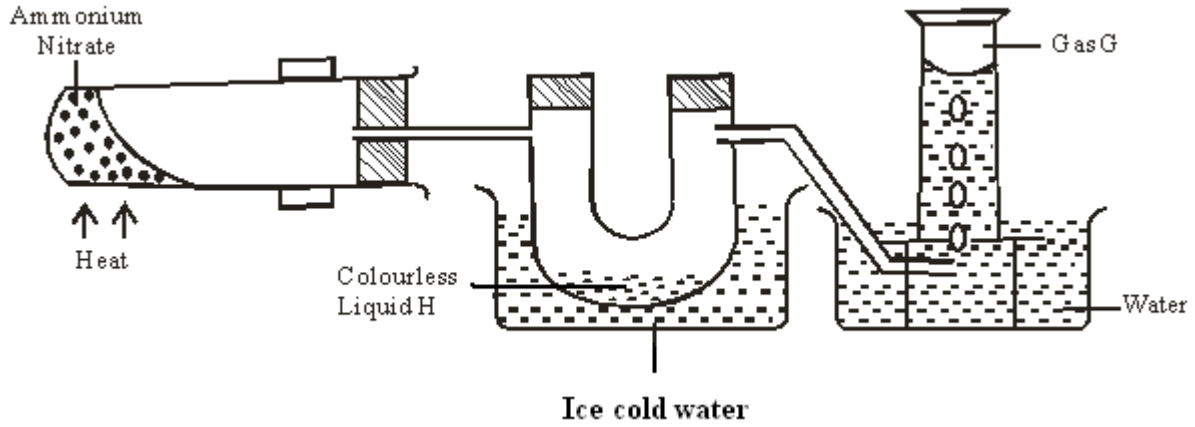
8. Draw a dot (.) and cross (x) diagram to show bonding in carbon (II) oxide. **2marks**



9. Ammonium nitrate was gently heated and the products collected as shown in the diagram.

a) Identify:

i. Colourless liquid H

…… **1mark**

ii. Gas G

…… **1mark**

b) Describe one physical and one chemical test that can be used to identify gas G. **2marks**

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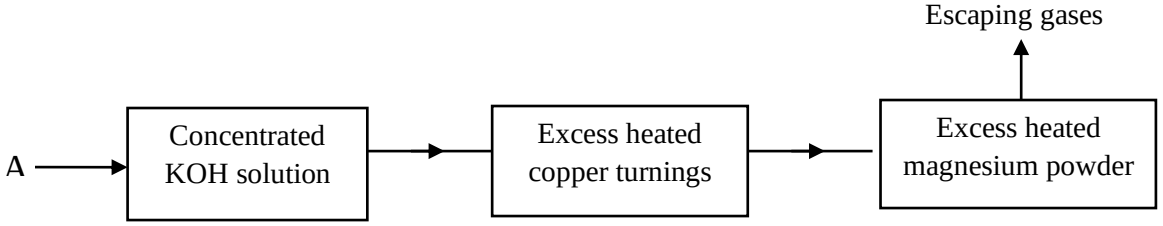
10. Air was passed through several reagents as shown in the flow chart below.



a) What is the purpose of concentrated potassium hydroxide solution? **1mark**

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b) Write an equation for the reaction which takes place in the chamber with magnesium powder. **1mark**

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……..

c) Name one gas which escapes from the chamber containing magnesium powder.

……..

Give a reason for your answer **2marks**

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11. Name the following substances.

a) $CH_2\,CH\,CH_2\,CH_3$ **1mark**

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b) $CH_3\,CH\,CH\,CH_2\,CH_3$ **1mark**

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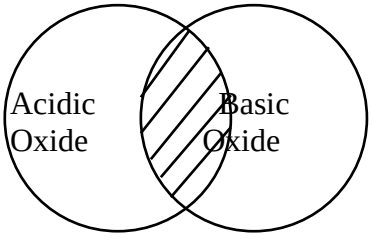
12. The diagram below shows the acidic and basic oxides fit into the general family of oxides.



a) State the name given to the type of oxide that would be placed in the shaded area. **1mark**

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b) Give the name of any oxide that would be placed in the shaded area. **1mark**

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13. Study the information in the table below and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Substance	**Solubility in water**	**Electrical conductivity**	
		Solid	**Molten**
A	Insoluble	Good	Good
B	Soluble	Poor	Good
C	Insoluble	Poor	Poor

i) Which of the substances is highly likely to be sodium chloride? Explain **2marks**

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……

……

ii) What type of bond exists in substance A? **1mark**

……

……

ii) State a possible structure in substance C? **1mark**

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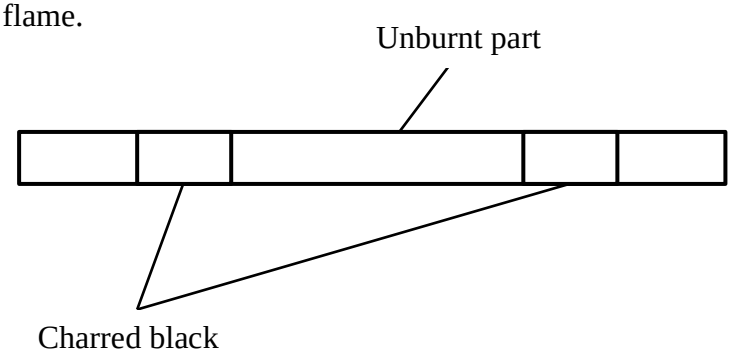
14. Laboratory results showed the composition of a compound to be 58.81% barium, 13.72%, sulphur and 27.47% Oxygen. Calculate the empirical formula of the compound. Ba=137, S = 32, O = 16. **2marks**

15. The diagram below shows a wooden splint that was placed horizontally across the middle part of a non-luminous flame.



a) Explain the observation made **2marks**

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b) Explain why non-luminous flame is preferred for heating than the luminous flame. **2marks**

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16. 200cm^3 of oxygen gas took 60 seconds to diffuse through a porous plug. Determine the time taken by 300cm^3 of sulphur (IV) oxide to diffuse through the same plug under the same conditions. (O=16, S = 32) **3marks**

17. Explain why?

i) Both methane and diamond are covalently bonded. Methane is a gas but diamond is a solid with very high melting point. **2marks**

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ii Ammonia is dissolved in water using an inverted funnel. **1mark**

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18. Explain giving reasons why?

a) Sulphuric acid is not used with marble in the preparation of carbon (IV) oxide **2marks**

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……..……..

b) Water cannot be used to distinguish oil fire. **1mark**

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19. A gas occupies 4dm^3 at -23^{0}C and 152 mmHg. At what pressure will its volume be halved, if the temperature then is 227^{0}C.? **2marks**

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20. a) Sodium, Magnesium and Aluminium are elements in the periodic table. Explain why aluminium has a higher melting and boiling point than sodium and magnesium. **2marks**

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b) The ionization energy of an atom is strongly influenced by three atomic parameters. State two of these parameters. **2marks**

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21. $15cm^3$ of a solution containing $2.88g/dm^3$ of an alkali XOH completely reacts with $20cm^3$ of 0.045M sulphuric acid. Calculate the molarity and relative atomic mass of X present in the alkali. **3marks**

22. Describe how a solid sample of calcium sulphate can be prepared using the following reagents; dilute nitric (v)acid, dilute sulphuric (vi) acid and solid calcium carbonate **4marks**

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23. Crude oil is the main source of organic compounds such as hydrocarbons. The hydrocarbons in the crude oil have to be separated.

a) Name two important hydrocarbons obtained from crude oil. **2marks**

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b) Give the uses of the two hydrocarbons named in (a) above. **2marks**

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24. A hydrocarbon Q was found to decolourise potassium manganate (vii) solution. When two moles of Q were burnt completely six moles of carbon (iv) oxide and six moles of water were formed.

a) Write the structural formula of Q. **1mark**

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b) Name the homologous series to which Q belongs **1mark**

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25. Dilute sulphuric acid was added to a compound X, of magnesium. The solid reacted with the acid to form a colourless solution, Y and a colourless gas Z which formed a white precipitate when bubbled through lime water.
Name:-

(i) Compound X **1mark**

……

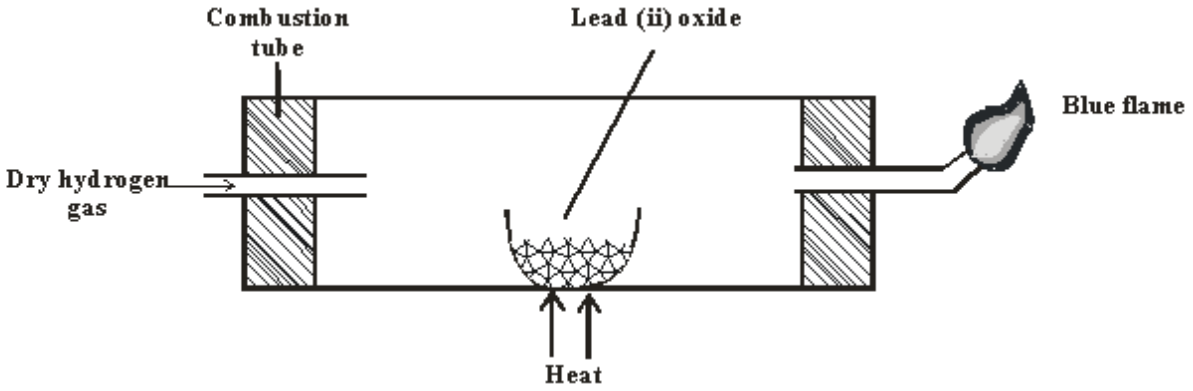
(ii) Solution Y **1mark**

……

(iii) Colourless gas Z **1mark**

……

26. When dry hydrogen gas passed over heated Lead (II) oxide in combustion tube, a grey solid was formed.



a) Identify the grey solid. **1mark**

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b) Write the equation of the reaction taking place in the combustion tube. **1mark**

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c) Write the equation involving the blue flame. **2marks**

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27. What do (C F C' S) mean? **1mark**

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28.

a) What is meant by the term allotrophy? **1mark**

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b) Explain in terms of structure and bonding why graphite is soft with greasy feeling. **2marks**

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NAME ……..…….. **DATE** ……

INDEX NO. ……..……..……...…..… **SIGNATURE** ……..……..

233/2
CHEMISTRY
PAPER 2
(THEORY)
TIME: 2 HOURS.

KENYA HIGH SCHOOL

POST MOCK EXAMINATIONS

FORM 4

2021

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATES

- Write your name and index number in the spaces provided above.
- Sign and write the date of exam in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- Mathematical tables and silent electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.

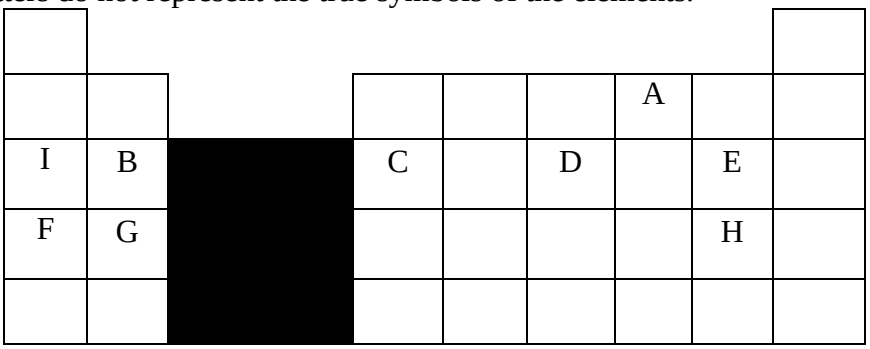
FOR EXAMINER'S USE ONLY

Questions	Maximum score	Candidates score
1	13	

2	11	
3	13	
4	10	
5	10	
6	12	
7	11	
Total score	**80**	

This paper consists of 10 printed pages.
Candidates should check to ensure that all pages are printed as indicated and no questions are missing

1. The grid below shows part of the periodic table. Study it and answer the questions that follow. The letters do not represent the true symbols of the elements.



a) Which element forms an ion of charge - 2? Explain your answer **2marks**

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b) What is the nature of the oxide formed by element C? **1mark**

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c) How does the reactivity of H compare with that of E? Explain. **2marks**

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d) Write the chemical equation for the reaction between B and chlorine? **1mark**

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e) Explain how the atomic radii of the following compare; **2marks**

i) F and G

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ii B and G

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f) The oxides of B and D are separately dissolved in water. State the effect of each product on litmus paper. **2marks**

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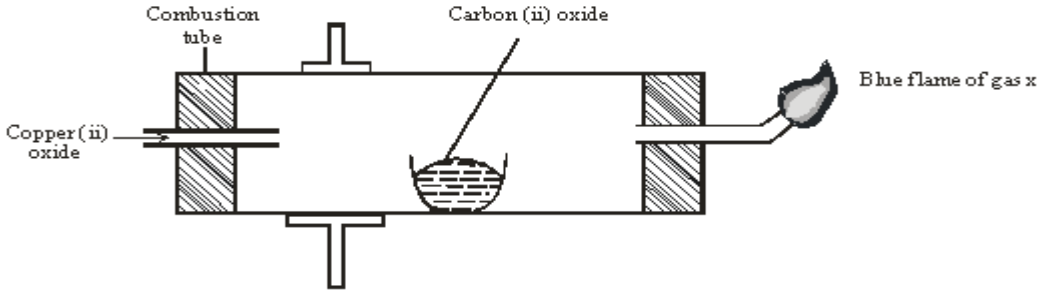
g) $20cm^3$ of a solution of a hydroxide of I completely neutralizes $17.5cm^3$ of 0.5M sulphuric (VI) acid. Calculate the concentration in moles/litre of solution of the hydroxide of I **3marks**

2. The diagram below shows an experiment set-up to investigate a property of carbon (ii) oxide. Study it and answer the questions that follow.



a) Name one condition that is missing in the set up that must be present if the experiment to proceed. **1mark**

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b) If the experiment was carried out properly. What observation would be made in the combustion tube? **1mark**

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c) Give an equation for the reaction that occurs in the combustion tube. **1 ½ mark**

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d) Give an equation for the reaction that takes place as gas x burns. **1 ½ marks**

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e) Why is it necessary to burn gas x? **1mk**

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f) Name the reducing and oxidizing agent. **2marks**

Reducing agent

……

Oxidising agent

……

g) Identify any other substance that would have the same effect on copper (ii) oxide as carbon (ii) oxide. **1mark**

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h) What would happen if copper (ii) oxide was replaced with sodium oxide? Explain **2mark**

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3. a) Sulphur occurs naturally in two different forms called allotropes;
What are allotropes? **1mark**

……

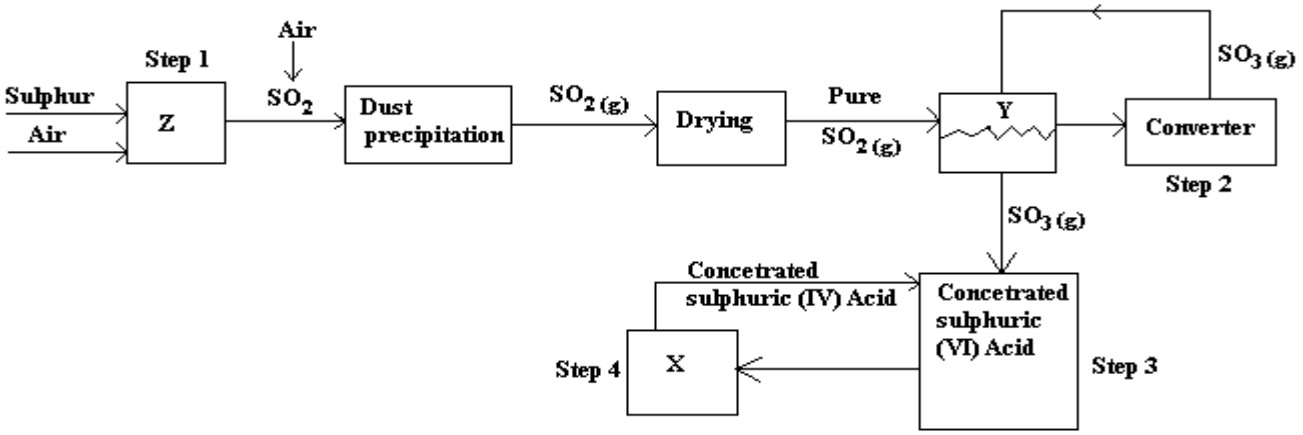
The two allotropes of sulphur are stable at different temperatures, as shown in the equation below.

$$\text{Rhombic sulphur} \underset{\text{Below } 95.5^0\text{C}}{\overset{\text{Above } 95.5^0\text{C}}{\rightleftharpoons}} \text{Monoclinic sulphur}$$

Give a name to the temperature 95.5^0C **1mark**

……

b) Below is a flow chart diagram for the contact process for the manufacture of sulphuric (VI) acid.



Give the name of chambers labeled **1 ½ mark**

X

……

Y

……

Z

…….

State the three conditions in the converter. **1 ½ mark**

……

……

……

Explain why gases are passed through ; **2marks**

I – The dust precipitator and drying power

……

……

II- The chamber labeled Y

……

……

Write the balanced equations for the reactions in; **3marks**

Step 2:

……

Step 3:

……

Step 4:

……

c) Calculate the volume of sulphur (VI) oxide gas in litres that would be required to produce 178kg of Oleum in step 3. (Molar gas volume at s.t.p.=22.4l, H=1, O=16, S=32) **3marks**

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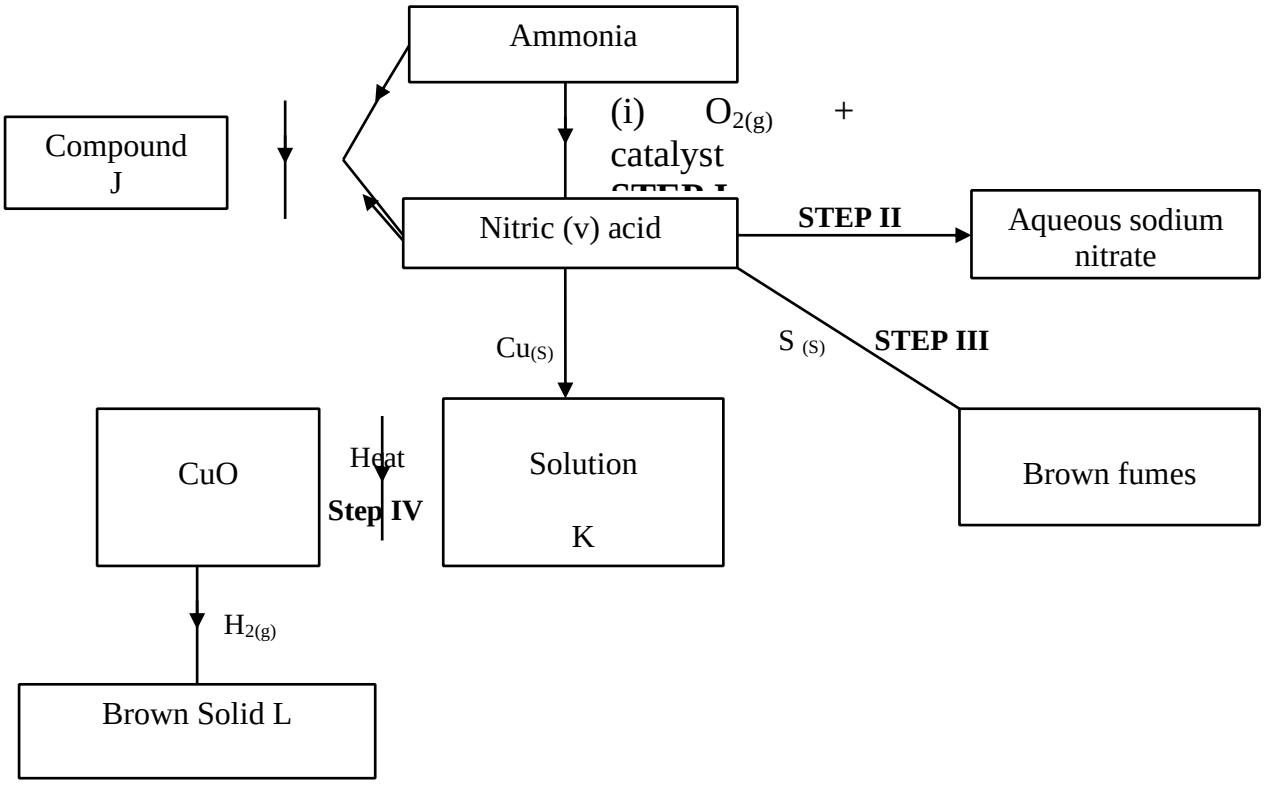
4. a) The scheme below shows various reactions starting with ammonia. Study it and answer the questions that follow.



List the raw materials used in the manufacturer of ammonia gas. **1mark**

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What catalyst is used in step I? **1mark**

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Write an equation for the reaction that occurs between ammonia and oxygen gas in the presence of a catalyst. **1mark**

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(i) Identify the process is step II? **1mark**

……

(ii) Using an appropriate equation, explain how the reaction in step III occurs **(1 mark)**

……

(vi) What should be added to solution K to form solid L? **(1 mark)**

……

(iii)

(a) I. Write the formula of compound J.

……...

II. Calculate the mass of compound J that would contain 14g of nitrogen. (N=14, O=16, H= 1) **(2marks)**

b) Explain the advantage of using ammonium phosphate fertilizer over the other nitrogenous fertilizers.

(**1mark)**

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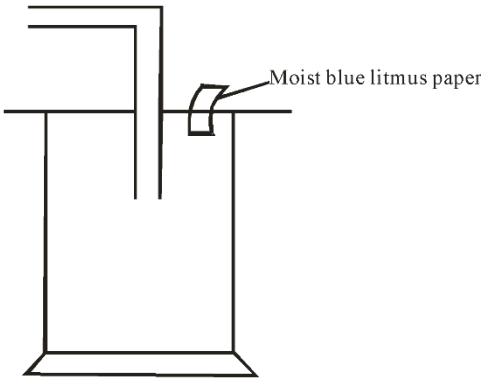
5. Dry chlorine was collected using the set up below.



a) Name a suitable drying agent for chlorine gas? **1mark**

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……

b) State one property of chlorine gas which facilitates this method of collection. **1mark**

……

……

c) State the observations on the moist blue litmus paper. **2marks**

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d) Chlorine gas was bubbled through distilled water. With aid of an equation show the formation of chlorine water. **1mark**

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……..……

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e) Write the formula of the compounds formed when chlorine gas reacts with warm dry phosphorous. **2marks**

……

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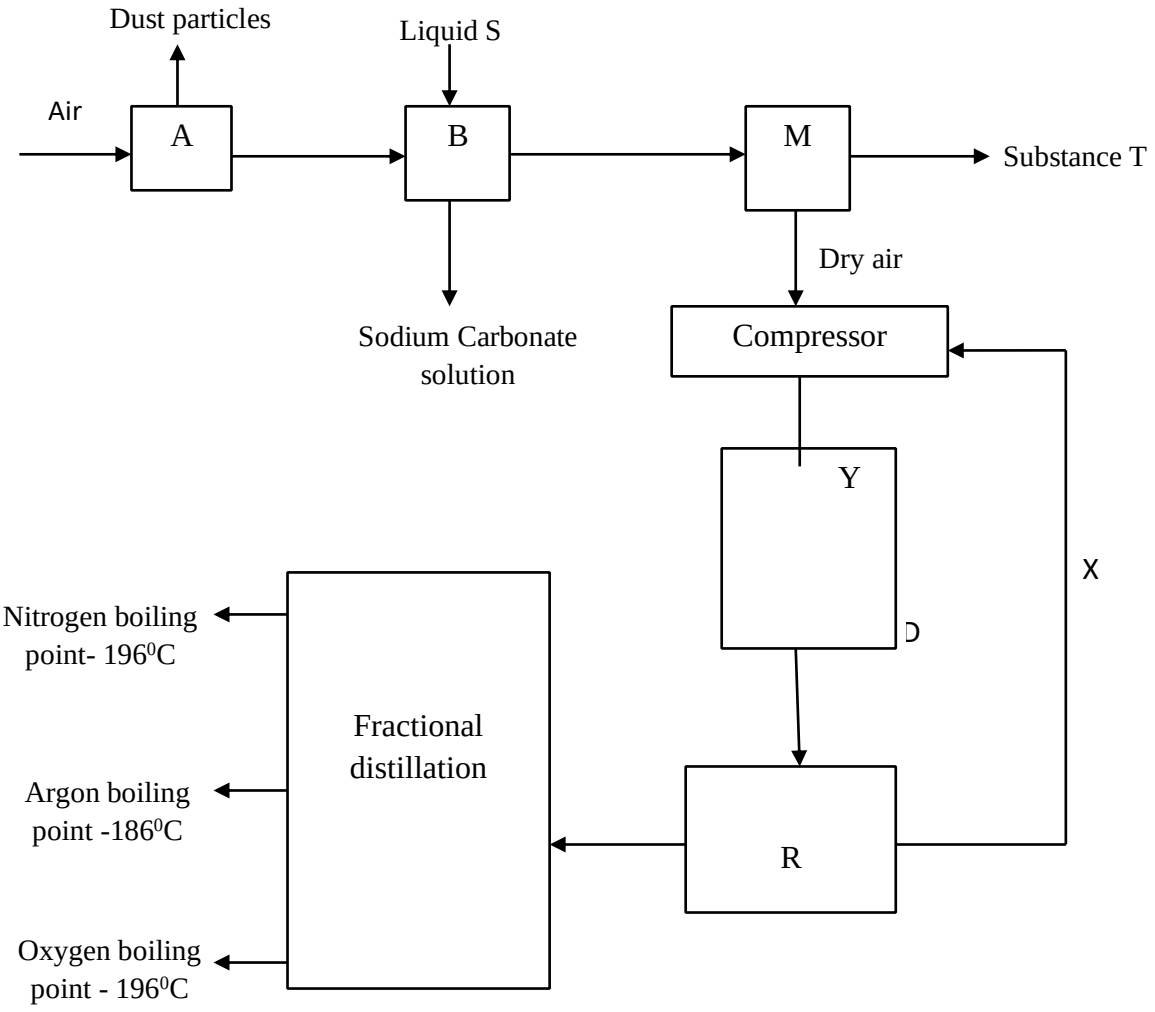
f) Chlorine gas is mixed with moist hydrogen sulphide gas, state and explain the observations **2marks**

g) Give one use of chlorine gas. **1mark**

6. Fractional distillation of air is used in the industrial manufacture of oxygen. The diagram below shows the process.



a) What processes are taking place in chamber A,B,M and D **2marks**

A

……..……..……..

B

……..……..

M

……..……...……

D

……..……..……...……

b) Name;

(i) Liquid S

……..……..……

(ii) Substance T

……..……..……

c) Explain why part Y in chamber D is curved? **1mark**

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d) Give two industrial uses of oxygen gas? **2marks**

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……

e) In the laboratory preparation of oxygen, manganese (iv) oxide and hydrogen peroxide are used. Write an equation to show how oxygen gas is formed. **1mark**

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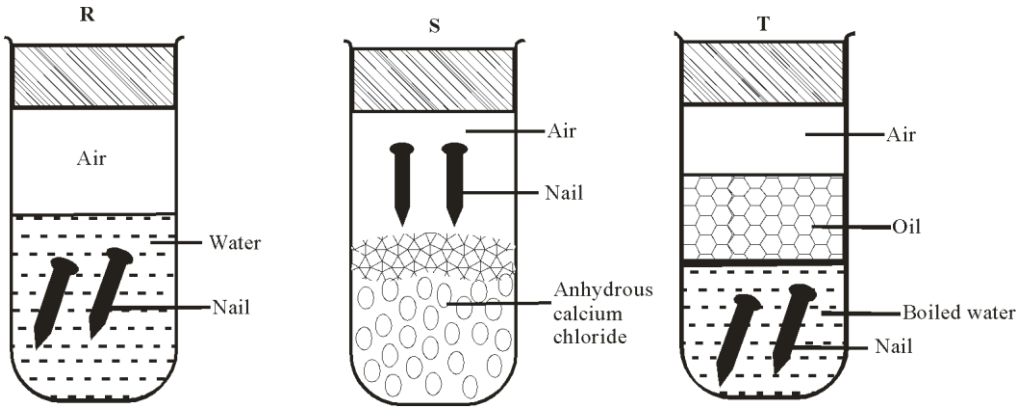
f) An investigation was carried out using the set-up below. Study it and answer the questions that follow.



(i) State and explain what will happen in the three test-tubes R, S and T after seven days. **3marks**

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(i) Give one reason why some metals are electroplated. **1mark**

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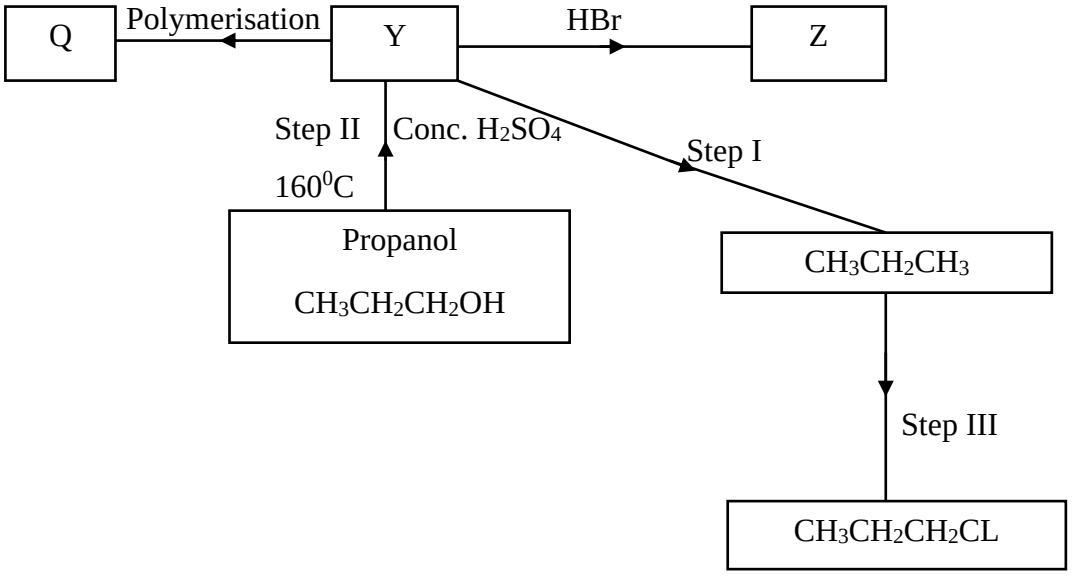
7. Below is a scheme of some reactions of propanol. Study it and answer the questions that follow.



(a) State the reagents and conditions required to effect step I **3marks**

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(b) Draw the structural formulae and name product Z. **1mark**

……

……

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(c) Name product Q **1mark**

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(d) Explain how product Y can be distinguished from the product formed after step I has taken place. **2marks**

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(e) What name is given to the process in Step II and step III **2marks**

Step II

……

……

Step III

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(f) (i) Define the term hydrocarbon 1mark

……

……

(ii) Draw the structure of 1, 2 – dibromopropane 1mark

NAME ……..…….. **DATE** ……

INDEX NO. …….…….……...…..… **SIGNATURE** ……..……..

233/3
CHEMISTRY
PRACTICAL
PAPER 3
TIME: 2¼ HOURS.

KENYA HIGH SCHOOL

POST MOCK EXAMINATIONS

FORM 4

2021

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATES

- Write your name and index number in the spaces provided above.
- Answer **ALL** the questions in the spaces provided.
- You are not allowed to start working with the apparatus for the first 15 minutes of the 2¼ hours allowed time for the paper.
- Use the 15 minutes to read through the question paper and note the chemicals you require
- Mathematical tables and electronic calculators may be used.
- All working **MUST** be clearly shown where necessary.

FOR EXAMINER'S USE ONLY.

Question	Maximum score	Candidate's score
1	17	
2	8	
3	15	
Total score	40	

This paper consists of 6 printed pages.
Candidates should check to ensure that all pages are printed as indicated and no questions are missing

1. Solution A is prepared by dissolving 6.3g of the organic acid $H_2C_2O_4.nH_2O$ in water to make a litre of the solution.
Solution B: 0.1M NaOH solution
Phenolphthalein indicator
Clamp and stand
Burette and pipette.

You are required to determine the value of n in the organic acid $H_2C_2O_4.\ nH_2O$
Procedure.
Fill the burette with solution A and adjust the volume to zero mark.

Add 2 to 3 drops of phenolphthalein indicator and titrate solution A against solution B until thecolour just permanently changes. Record your results in the table below. Repeat the procedure two more times to obtain concordant results.

a)

Titration	**1**	**2**	**3**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

4marks

b) Calculate the average volume of solution A used. **1mark**

c) Calculate the moles of sodium hydroxide in the volume of solution B used. **2marks**

d) Given that solution B - Sodium hydroxide and solution A organic acid react in the ration of 2:1, calculate the number of moles of the organic acid –solution A used? **2marks**

e) Calculate the moles of organic acid solution A used per litre of solution **2marks**

f) Calculate the relative formula masses of the organic acid solution A **3marks**

g) Calculate the value of n in $H_2C_2O_4.nH_2O$(H=1, C=12, O=16) **3marks**

2. You are provided with CBI. Carry out the test below. Write your observation and inferences in the spaces provided.

a) Using a clean spatula, heat about one third of the solid CBI in a non- luminous Bunsen burner flame.

Observation	Inferences

1mark **1mark**

b) Put a half spatula endful of CBI in a test tube. Heat gently and then strongly. Test for any gas produced using litmus papers.

Observation	Inferences

1mark **1mark**

c) Put 2cm^3 of dilute hydrochloric acid into a test tube. Add ¼ endful of CBI into the test tube. Test for any gas procedure.

Observation	Inferences

2marks **2marks**

3. You are provided with solid Q, carry out the test below. Record your observations and inferences in the table. Identify any gas (es) evolved.

   Place all the solid Q provided into boiling tube and add distilled water until the tube is ¼ full. Divide it into five portions.

   a) To the 1st portion add ammonia solution drop wise until excess.

Observation	Inferences

1mark **1mark**

   b) (i) To the 2nd portion add sodium hydroxide solution dropwise until in excess. Keep the resulting mixture for the next test.

Observation	Inferences

1mark **1mark**

   ii) Warm the preserved mixture from b (i) above

Observation	Inferences

1mark **1mark**

c) i) To the 3rd portion add silver nitrate solution. Preserve the mixture for the next test.

Observation	Inferences

1mark **1mark**

ii) To the preserved mixture in c (i) above add diluted nitric acid.

Observation	Inferences

1mark **1mark**

d) To the 4th portion add dilute Barium nitrate solution followed by dilute nitric acid.

Observation	Inferences

1mark **1mark**

e) To the 5th portion add 2-3 drops of conc. Nitric acid.
Warm the mixture and allow to cool. Add sodium hydroxide solution dropwise until in excess.

Observation	Inferences

1mark **1mark**

NAME…… …….. ADM NO:……

SIGNATURE ……..……. DATE: ……..……CLASS…….

PEAK EVALUATION EXAMINATIONS
TERM 3 – JANUARY 2021
FORM 4 – CHEMISTRY PAPER 1

233/1
CHEMISTRY
PAPER 1
THEORY
TIME: 2 HOURS

INSTRUCTIONS TO CANDIDATES

- ✓ Write your **name** and Admission **number** in the spaces provided above
- ✓ **Sign** and write the **date** of examination in the spaces provided.
- ✓ Answer ***all*** the questions in the spaces provided.
- ✓ Mathematical table and silent electronic calculators may be used.
- ✓ All working **must** be clearly shown where necessary.
- ✓ Candidates should answer the questions in ***English.***

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-29	80	

Candidates should check the question paper to ascertain all the pages are printed as indicated and no questions are missing.

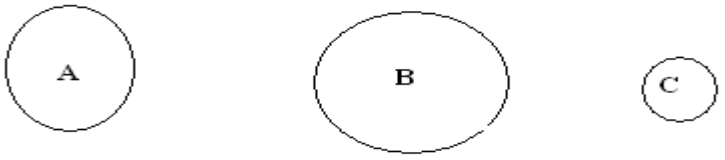
1. a) Give one example of laboratory apparatus made of ceramics. (1 mark)

   b) State two reasons why some laboratory apparatus are made of ceramics. (2 marks)

2. a) State Gay-Lussac's law. (1 mark)

   b) $10cm^3$ of gaseous hydrocarbon was mixed with $90cm^3$ of oxygen and sparked. The resulting volume at r.t.p was $70cm^3$ which was reduced by $30cm^3$ on shaking with sodium hydroxide solution. Determine the empirical formula of the hydrocarbon. (2 marks)

3. The diagram below represents elements extracted from group one of the periodic table.



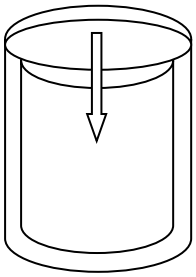
   a) What is the general chemical family name of the above elements. (1 mark)

   b) Arrange the elements in order of increasing reactivity. Explain. (2 marks)

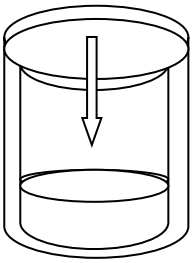
4. Sulphur has both crystalline and non crystalline forms.
   a) Name one crystalline and one non crystalline forms of sulphur. (2 marks)
   (i) Crystalline.....
   (ii) Non crystalline.....

b) Which other element exhibit allotrophy? (1 mark)

5. The set up below shows an experiment used to investigate a certain aspect of gas law.



V=1 L
T= 298k



V=0.25L
T= 298k

a) State which gas law is being investigated. (1 mark)

b) Calculate the value of A. (2 marks)

6. When sodium sulphate was added to a portion of calcium chloride, a white precipitate was formed.
(i) Name the white precipitate. (1mark)

(ii) Write the ionic equation for the formation of the white precipitate. (1 mark)

(iii) State one use of the white precipitate. (1 mark)

7. The equation below illustrate how phenolphthalein indicator exists.

$$\underset{\text{(colourless molecule)}}{Hph} \rightleftharpoons H^{+}_{(aq)} + \underset{\text{(Pink anion)}}{ph^{-}_{(aq)}}$$

(i) State and explain the observations made when dilute sodium hydroxide is added to the solution above.
(2marks)

(ii) Which principle explains the above reaction? (1 mark)

8. a) A radioactive substance gave an account of 240 counts per minute but after 6 hours the count rate was 30 counts per minute. Calculate the half life period of the substance. (2 marks)

b) State one use of radioactive isotopes in medicine. (1 mark)

9. Classify the following as either chemical or physical.

Process	**Type of change**
a) Heating copper (II) sulphate crystals	
b) Obtaining kerosene from crude oil.	
c) Souring of milk	

(3 marks)

10. The PH values of some solutions labelled E to I are given below.
Use the information to answer the questions that follow.

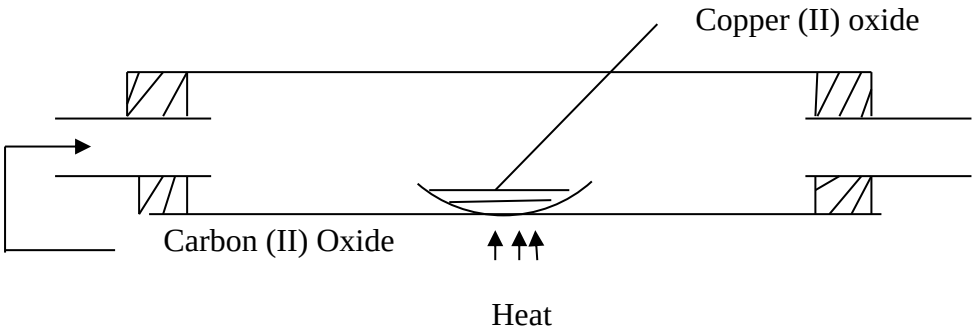
PH	14.0	1.0	8.0	6.5	7.0
SOLUTION	E	F	G	H	I

a) Identify the solution with the highest concentration of hydroxide ions. (1 mark)

b) Which solution can be used as a remedy for acid indigestion in the stomach? (1 mark)

c) Which solution would react most vigorously with magnesium ribbon? (1 mark)

11. The set up below shows an experiment where carbon (II) oxide gas was passed over heated copper (II) oxide gas was passed over heated copper (II) oxide.



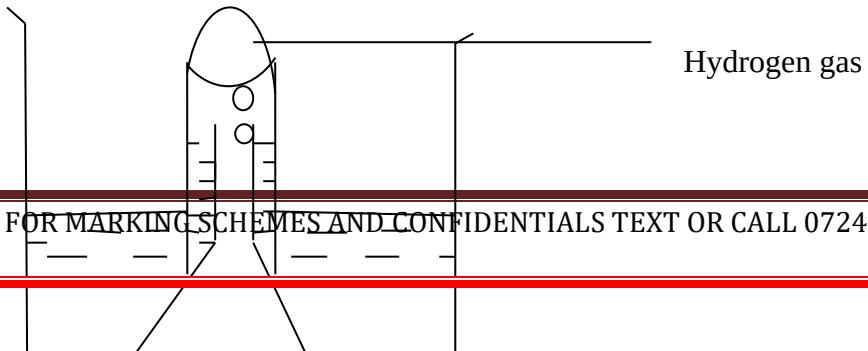
a) State and explain the observations made in the combustion tube during the experiment. (1mark)

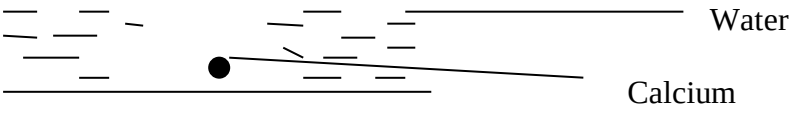
b) Explain the precaution taken during this experiment. (1mark)

c) Name another gas that can be used instead of carbon (II) oxide in this reaction. (1 mark)

12. The relative formula mass of a hydrocarbon is 58. Draw and name two possible structures of the hydrocarbon. (c=12.0, O=16.0, H= 1.0) (3 marks)

13. The set up below was used to prepare and collect hydrogen gas.





a) (i) Write an equation for the reaction that produces hydrogen gas. (1 mark)

(ii) Explain why hydrogen gas is collected over water. (1 mark)

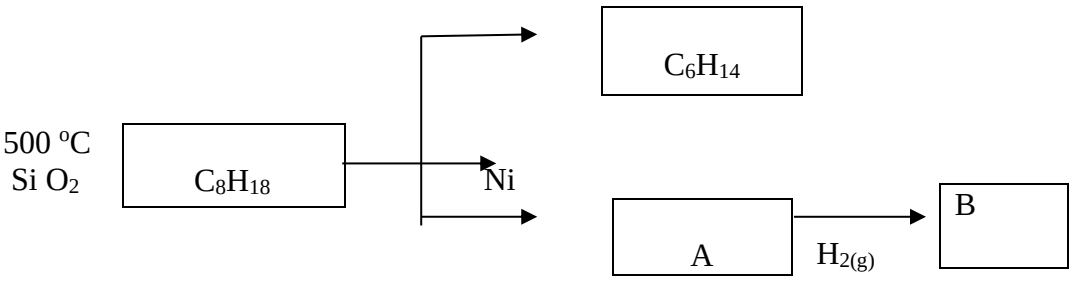
14. Identify the functional group in each of the following compounds.

(i) $CH_3CH_2\ C(CH_3)_2\ CH\ CH_3$ (1 mark)

(ii) CH_3CH_2COOH (1 mark)

(iii) $CH_3CH_2CH_2CH_2OH$ (1 mark)

15. Study the following flow diagram and answer the questions that follow.



a) Write the molecular formula and the name of compound A. (1 mark)

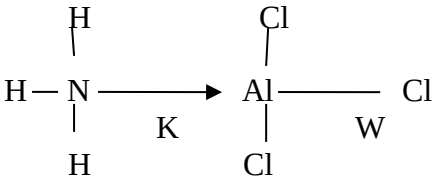
b) What type of reaction produces A and C_6H_{14}? (1mark)

16. An oxide of element K has the formula K_2O_5.

a) Determine the oxidation number of K. (1 mark)

b) To which group of the periodic table does K belong? (1 mark)

17. The diagram below shows the bonding between Alluminium Chloride and ammonia.



a) Name the bonds K and W.

k…… (½ mark)

w…….. (½ mark)

b) How many electrons are used in bonding in the molecule. (1 mark)

c) Using dots (.) and crosses (x) to represent electrons, show bonding in hydroxonium ion H_3O^+.
(1 mark)

18. a) What is an electrolyte? (1 mark)

b) State how the following substances conduct electricity.

(i) Molten sodium sodium chloride. (1 mark)

(ii) Copper metal (1 mark)

19. During an experiment to prepare dry sample of sulphur (IV) oxide gas, $50cm^3$ of 2M hydrochloric acid was heated with sodium sulphite. Determine the volume of the gas in cm^3 produced at r.t.p. (molar gas volume = $24dm^3$) (3 marks)

20. Starting with barium nitrate solution, describe how a pure sample of barium carbonate can be prepared in the laboratory. (3 marks)

21. A compound whose general formula is $M(OH)_3$ reacts as shown by the equation.

$M(OH)_{3(s)} + OH^-_{(aq)} \longrightarrow M(OH)_4^-$

$M(OH)_{3(s)} + 3H^+_{(aq)} \longrightarrow M_{(aq)}^{3+} + 3H_2O_{(l)}$

a) What name is given to compounds which behave like $M(OH)_3$ in the two reactions. (1 marks)

b) Name two elements whose hydroxides behave like that of M. (2 marks)

22. $RCOO\text{-}Na^+$ and $RC6H5SO_3^-Na^+$, represent two cleansing agents where R is along hydrocarbon chain.
a) Write the formulae of the salts that would be formed when each of these cleansing agents is added to water containing calcium ions. (1 mark)

b) Explain how the solubilities of the two calcium salts in (a) above affect the cleansing properties of each of the cleaning agents. (2 marks)

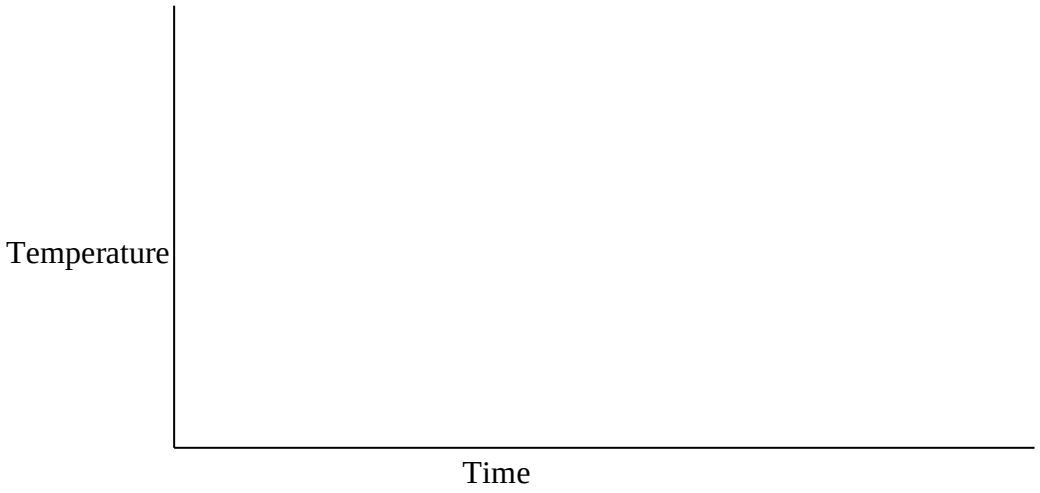
23. Give the name of a suitable method that can be used to extract potassium from its ore. Explain your answer. (2 marks)

24. With reference to its atomic number of one, explain why hydrogen can be placed in either group 1 or VII of the periodic table. (2 marks)

25. A compound has an empirical formula, C_3H_6O and a relative formular mass of 116.
a) Determine its molecular formula. (H=1.0, C= 12.0, O=16.0) (2 marks)

b) Calculate the percentage composition of carbon by mass in the compound. (1 mark)

26. The curves below represent the variation of temperature with time when pure and impure samples of a solid were heated separately.



Which curve shows the variation in temperature for the pure solid? Explain. (2 marks)

27. The table below gives the distances between atoms (bond lengths) in halogens molecules and the energies required to break the bonds (bond energies) between the atoms.

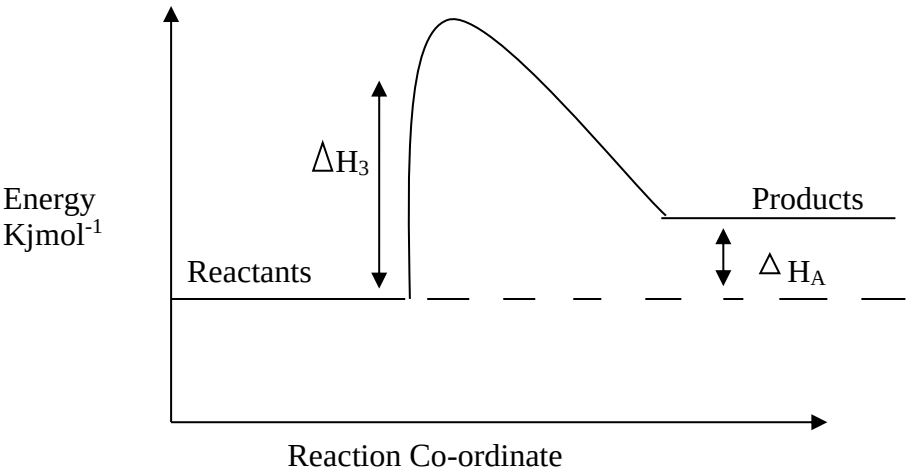
Molecules	Bond length (nm)	Bond energy ($kjmol^{-1}$)
Cl-Cl	0.20	240
Br-Br	0.23	195
I - I	0.26	150
At - At	0.29	_____

(i) Predict the energy required to break the At - At bond. (1 mark)

(ii) What is the relationship between bond length and bond energy for the halogen molecules?
(1 mark)

28. When 34.8g of hydrated sodium carbonate ($Na_2CO_3.xH_2O$) were heated to a constant mass, 15.9 g of anhydrous sodium carbonate were obtained. Calculate the value of x in the hydrated carbonate. (Na=23.0, O=16.0, C= 12.0, H = 1.0) (3 marks)

29. Study the energy level diagram below and answer the questions that follow.



a) Give the name of $\triangle H_A$. (1 mark)

b) How can $\triangle H_B$ be reduced? Give a reason. (2 marks)

NAME ……..……...…. …….. ADM NO…….…..…

CLASS …….SIGNATURE ……..……..…CLASS…….

PEAK EVALUATION EXAMINATIONS
TERM 3 – JANUARY 2021
FORM 4 – CHEMISTRY PAPER 2

233/2
CHEMISTRY
PAPER 2
(THEORY)
TIME: 2 HOURS

INSTRUCTIONS

a) Write your name and the Admission Number in the spaces provided above.
*b) Answer **ALL** the questions in the spaces provided after each question.*
c) Use of Mathematical sets and electronic calculators may be used.
*d) **All** working should be clearly shown.*

FOR OFFICIAL USE ONLY

QUESTIONS	EXPECTED SCORE	CANDIDATES SCORE
1	13	
2	11	
3	08	
4	11	
5	14	
6	13	
7	10	
TOTAL	**80**	

1. i) What is ionization energy (1mk?)

ii) Why is the second ionization energy usually higher than the first ionization energy (1mk?)

b) Study the periodic table below showing selected elements denoted by letters A,C,E,G,W,N and Y. the symbols do not represent actual symbols of the elements.

A									
G								E	Y
M	N		W		C				

i) Compare the melting points of elements M and N. Explain your answer (2mks)

ii) Which element is the strongest reducing agent? Explain (1mk)

iii) Compare the ionic radii of elements Wand C. Explain (1mk)

iv) The chloride of element W vapourises easily while its oxide has a higher melting point. Explain difference (1mk)

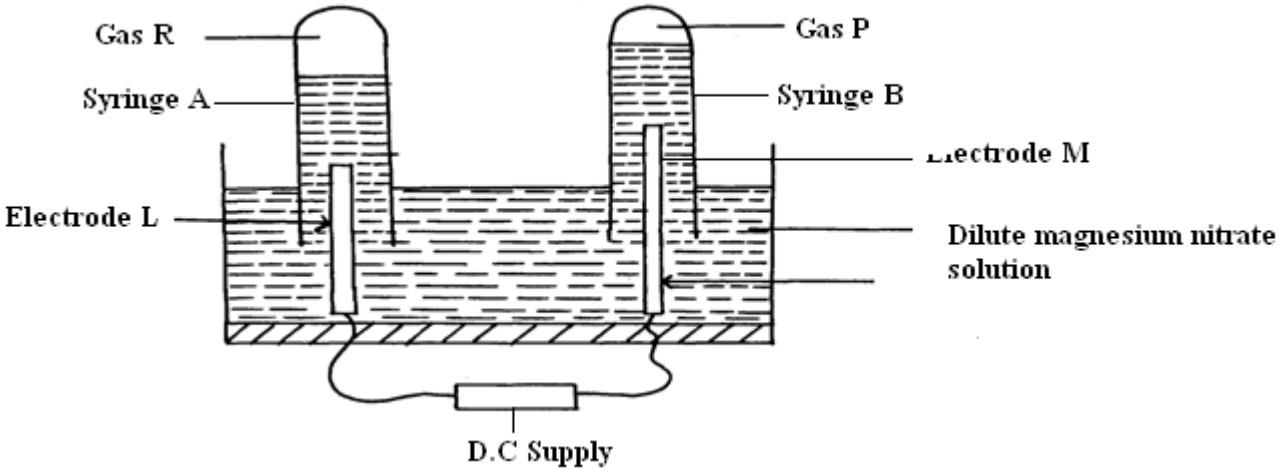
V) Select two elements that would react most explosively with each other (1mk)

vi) State one use of the element Y. (1mk)

vi) Write an equation to show the action of heat on the nitrate of element M (1mk)

(viii) when three litres of chlorine gas were completely reacted with element W, 11.1206g of the product were formed. Determine the relative atomic mass of element W. (Relative atomic mass of chlorine = 35.5, Molar gas volume at r.t.p = 24 litres. (3 marks)

2. a) An aqueous solution of magnesium nitrate was electrolyzed using platinum electrodes as shown in the diagrams below



The volume of gases collected in syringes A and B were 2 cm^3 and 4cm^3 respectively.

i) Write the equation for the reaction taking place at the electrode L. (1mk)

(ii) Comment on the effect of the experiment on the PH of the solution. (1 mark)

b) 0.261g of metal T was deposited by electrolysis when a current of 0.6 amperes was passed through an electrolyte containing ions of T for 30 minutes. (T=70, 1 faraday = 96500 coulombs)

(i) Calculate the number of moles of electrons passed through the electrolyte. (2 marks)

(ii) Determine the value of x in the metallic ion T^{x+}. (1 mark)

c) The following are some standard electrode potentials for given elements. The letters do not represent actual symbols of elements.

Half - reaction	**E^0 (v)**
$A^{2+}_{(aq)} + 2e \rightleftharpoons A_{(s)}$	-0.28
$B^{+}_{(aq)} + e^{-} \rightleftharpoons B_{(s)}$	+ 1.68
$D^{2+}_{(aq)} + 2e \rightleftharpoons D_{(s)}$	-0.40
$E^{2+}_{(aq)} + 2e \rightleftharpoons E_{(s)}$	+ 0.85
$G^{2+}_{(aq)} + 2e \rightleftharpoons G_{(s)}$	-2.38
$J^{+}_{(aq)} + e^{-} \rightleftharpoons J_{(s)}$	+ 0.80

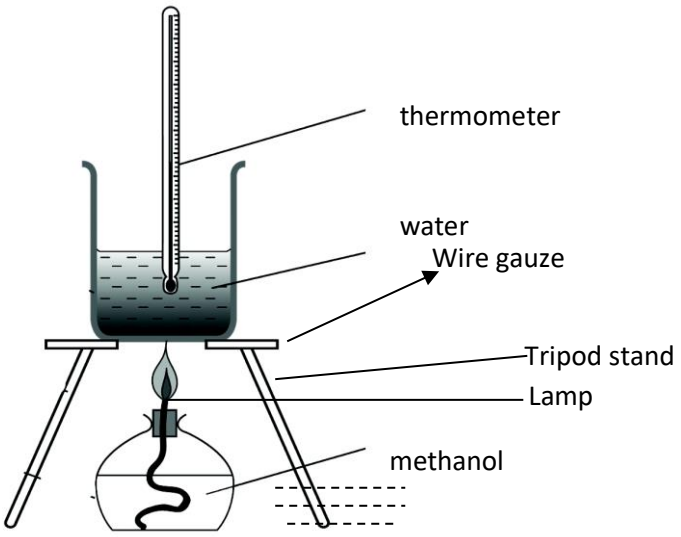
(i) Identify the strongest oxidizing element (1 mark)

(ii) Write down the cell representation for the cell that would have the highest voltage when two half- cells are combined. (1 mark)

(iii) Calculate the e.m.f of the cell represented in (ii) above. (1 mark)

d) Electroplating is one of the methods used to prevent rusting. By use of a well labelled diagram, briefly outline a method that may be used to electroplate an iron spoon with silver. (3 marks)

3. In an experiment to determine the heat of combustion of methanol,CH_3OH student used asset-up like the one shown in the diagram below. Study it and answer the questions that follow



During the experiment the data given below was recorded.
Volume of water = $500cm^3$
Initial temperature of water = 20^0C
Final temperature of water = 27^0C
Final mass of Lamp+ Mass of methanol = 22.11g
Initial mass of Lamp+Mass of methanol = 22.98g
Density of water = $1g/cm^{-3}$,
Specific heat capacity = $4.2Jg^{-1}k^{-1}$

a) Write equation for the combustion of methanol (1 mark)

Calculate the;

(i) The number of moles of methanol used in the experiment (1 mark)

(ii) Heat changes in this experiment. (1 mark)

(iii) The heat of combustion per mole of methanol. (C = 12, H = 1, O = 16) (1 ½ marks)

(iv) Explain why the value of the molar heat of combustion for methanol obtained in this experiment is different from the theoretical value. (1 mark)

(v) On the axis below draw an energy level diagram for the combustion of methanol. (1 ½ marks)

4. a) In an experiment, a student measured the amount of carbon (IV) Oxide produced when excess 1M hydrochloric acid was reacted with marble chips. The results obtained at room temperature and pressures are shown on the table below.

Time (mins)	Volume of CO_2 (cm^3)
0	0
0.5	20
1.0	32
2.0	52
5.0	86
7.5	103
10.0	112
12.0	118
14.0	120
16.0	120

(i) on the grid provided, plot a graph of volume of carbon ((IV) oxide gas against time. (3 marks)

(ii) On the same graph, sketch a graph for an experiment using 2M hydrochloric acid instead of 1 M hydrochloric acid. (1 mark)

(iii) From the graph, determine the time at which half of the original amount of marble chips will have reacted. (1 mark)

b) Write down the equation for the reaction in the experiment. (1 mark)

c) Calculate;

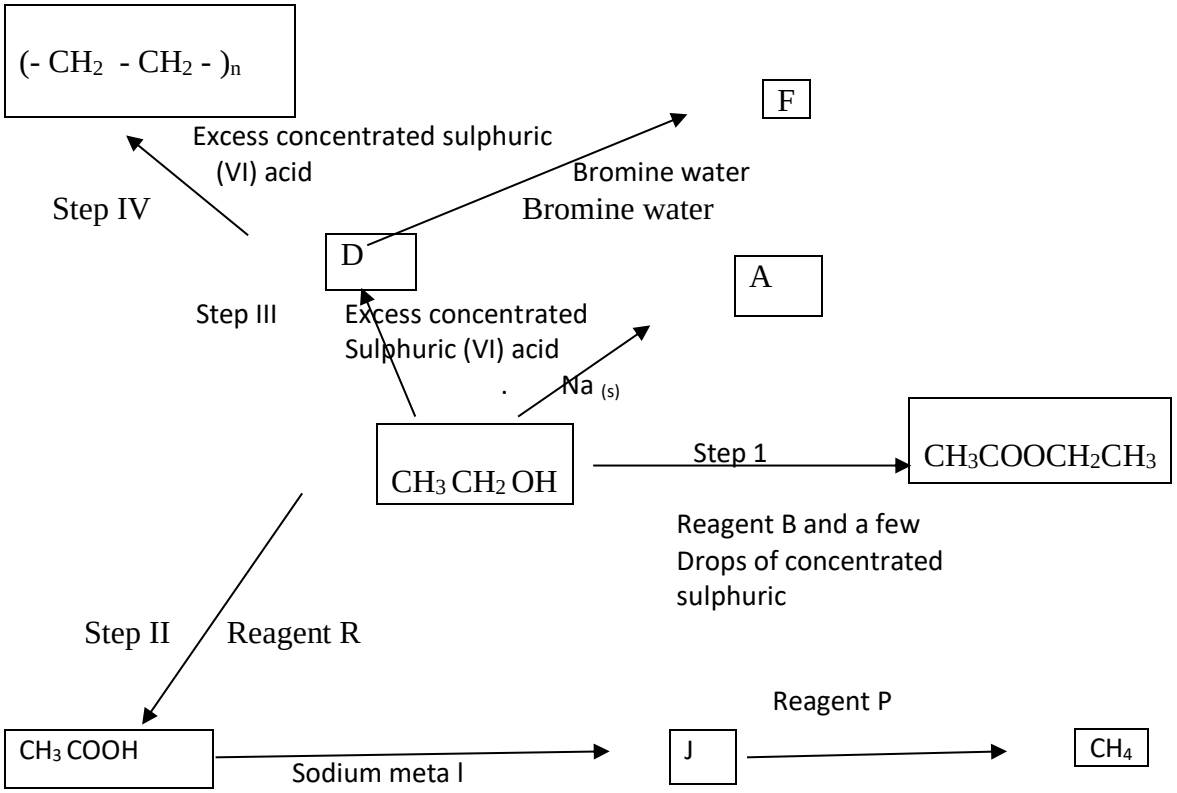
(i) The maximum number of moles of carbon (IV) oxide produced in the reaction. (2 marks)

(ii) The number of moles of hydrochloric acid used in this reaction. (1 mark)

(iii) The volume of hydrochloric acid used when the reaction stopped. (1 mark)

d) Why is the volume of carbon (IV) oxide after the 14^{th} minute constant? (1 mark)

5. Study the reaction given in the diagram below carefully and then answer the questions that follow.



a) Identify the following; (3 marks)

(i) Reagent B……..

(ii) Reagent P…….

(iii) Reagent R ……..

(iv) Substance A……..

(v) Substance F…….

(vi) Substance D……..

b) Write an equation to show the formation of J. (1 mark)

(c) Explain one disadvantage of the continued use of items made from the compound formed in step (IV). (1 mark)

d) What observation would be made when D is bubbled through bromine water? (1 mark)

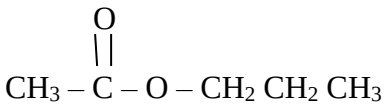
e) The compound D reacts with hydrogen gas in the presence of a catalyst G to form a compound H.

Name;

(i) Compound H (1 mark)

(ii) Catalyst G

f) The structure below represents a sweet smelling compound.

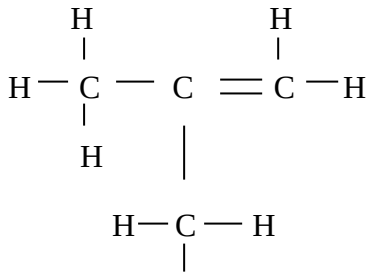


(i) Suggest the name of the above compound. (1 mark)

(ii) Give the names of the two organic compounds that can be used to prepare this compound in the laboratory. (1 mark)

g) Give the IUPAC names of the following compounds. (1 mark)

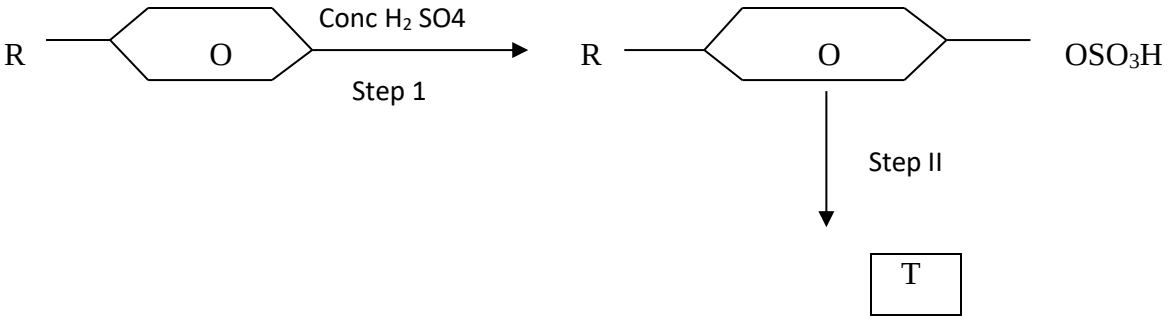
(i)



H

(ii) $CH_3CH_2COOCH_2CH_3$

h) The diagram below was used to prepare a cleansing agent T. Study it and answer the questions that follow.



(i) Name the type of cleansing agent being prepared. (½ mark)

(ii) Name the chemical substance being added in step II. (½ mark)

(iii) What is the advantage of using cleansing agent T in washing? (1 mark)

(iv) Explain how an aqueous solution of the cleansing agent removes oil during washing. (2 marks)

6. a) Write balanced ionic equation for the following reactions;

(i) $NaOH_{(aq)} + H_2SO_{4(aq)} \longrightarrow$

(ii) $CuSO_{4\,(aq)} + Zn_{(s)} \longrightarrow$

(iii) $Mg_{(s)} + Hcl_{(aq)} \longrightarrow$

b) When a mixture of iron and sulphur is heated, the mixture becomes red hot and continues to glow even when the heating is stopped.

(i) Write an equation for the reaction. (1 mark)

(ii) What is the effect of a magnet on the product in b(i) above? (1 mark)

c) 12g of a mixture of sodium carbonate and sodium sulphate were mixed with distilled water in a flask and topped up to $1000cm^3$. $250cm^3$ of this solution required $12.5cm^3$ of 0.2M of sulphuric acid for complete reaction.

(i) Which substance in the mixture reacted with dilute sulphuric acid? (1 mark)

(ii) Write a chemical equation for the reaction which took place between sulphuric acid and the substance named in (i) above. (1 mark)

(iii) Calculate the number of moles of sulphuric acid which reacted with the named substance. (2 marks)

(iv) Determine the number of moles of the substance in (a) which took part in the reaction. (1 mark)

v) Determine the molarity of the substance. (1 mark)

(vi) What is the percentage by mass of the substance in the mixture which reacted with sulphuric acid.

(1 mark)

7. a) Draw a well labelled diagram to show how you can prepare and collect a dry sample of sulphur (IV) oxide gas. (3 marks)

b) Describe two chemical methods that can be used to test the presence of sulphur (IV) oxide gas.

(3 marks)

c) Other than manufacture of sulphuric (VI) acid, state two uses of sulphur (IV) oxide gas. (2 marks)

d) In the large scale manufacture of sulphuric acid, sulphur (IV) oxide is oxidized to sulphur (VI) oxide in the presence of a catalyst before dissolving it in concentrated sulphuric acid.

(i) Name the catalyst used in the process. (1 mark)

(ii) Why is the sulphur (VI) oxide gas dissolved in concentrated sulphuric (VI) acid? (1 mark)

Name……ADMNo……

Class……Signature……..Date……..

233/3
CHEMISTRY
PAPER 3
(PRACTICAL)
2 ¼ hours

PEAK EVALUATION EXAMINATIONS

TERM 3 – JANUARY 2021

FORM 4 - CHEMISTRY PRACTICAL

Instructions

- ✓ *Write your name, admission number and class in the spaces provided above.*
- ✓ *Sign and write the date of examination in the spaces provided above.*
- ✓ *Spend the first 15 minutes of the 2 ¼ hours to read through the paper and make sure you have all the apparatus and chemicals required.*
- ✓ *Answer **all** the questions in the spaces provided in the question paper.*
- ✓ *Electronic calculators may be used.*
- ✓ *All working **must** be clearly shown where necessary.*
- ✓ *This paper consists of **7**printed pages. Confirm this and that no questions are missing.*

For Examiner's Use Only

Question	Maximum Score	Candidate's score
1	19	
2	11	
3	10	
Total	40	

1. You are provided with;

- Solution M, hydrochloric acid
- Solution N, containing 8.8g per litre of sodium hydroxide.
- 0.5 g of an impure carbonate, solid P

You are required to determine the;

a) Concentration of solution M in moles per litre.

b) Percentage purity of the carbonate, solid p.

Procedure I.

Fill the burette with sodium hydroxide, solution N. Pipette 25.0 cm^3 of hydrochloric acid, solution M in a conical flask. Add 2-3 drops of screened methyl orange indicator and titrate. (The colour of the indicator changes from pink to green. Record your results in table I below. Repeat the titration two more times and complete the table.

Table 1

	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution N used (cm^3)			

(4 marks)

What is the average volume of solution N used? (1 mark)

Determine;

a) The concentration of solution N in moles per litre (Na= 23.0, O=16.0, H=1.0) (1 mark)

b) Concentration of solution M in moles per litre. (1 mark)

Procedure II.

Using a measuring cylinder, measure 100cm^3 of solution M into a 250cm^3 beaker. Add all of solid P into the beaker containing solution M. Swirl the mixture and allow the reaction to proceed for about 4 minutes. Label the solution as solution Q. Fill the burette with sodium hydroxide solution N. Pipette 25.0 cm^3 of solution Q into a conical flask. Add 2-3 drops of screened methyl orange indicator and titrate with solution N from the burette. Repeat the titration two more times and complete the table.

Table 2

	I	II	III
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution N (cm^3)			

What is the average volume of solution N used? (1 mark)

a) Calculate the;

(i) Moles of hydrochloric acid in 25.0cm^3 of solution Q. (1 mark)

(ii) Moles of hydrochloric acid in 100cm^3 of Q. (1 mark)

(iii) Moles of hydrochloric acid in 100cm^3 of the original hydrochloric acid solution M.

(1 mark)

(iv) Moles of hydrochloric acid that were used up in the reaction with solid P. (1 mark)

(v) Moles of the carbonate that reacted with hydrochloric acid. (1 mark)

b) Given that the relative formula mass of the carbonate is 72, Calcualte the;

(i) Mass of the carbonate that reacted. (1 mark)

(ii) Percentage purity of the carbonate, solid P. (1 mark)

2. You are provided with solid S. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Place about one third of solid S in a clean dry test-tube. Heat the solid gently and then strongly. Test any gases produced with red and blue litmus papers.

Observations	Inferences

(2 marks)	(1mark)

b) Place the remaining amount of substance S in a boiling tube. Add about 10cm^3 of distilled water and shake well. Divide the solution into four portions.

(i) To the first portion, add aqueous sodium hydroxide drop wise until in excess.

Observations	Inferences
(1 mark)	(1mark)

(ii) To the second portion, add aqueous ammonia drop wise until in excess.

Observations	Inferences
(1 mark)	(1mark)

(iii) To the third portion, add 10 cm^3 of barium chloride solution.

Observations	Inferences
(1 mark)	(1mark)

(iv) To the fourth portion, add 1 cm^3 of Lead (II) nitrate solution.

Observations	Inferences
(1 mark)	(1mark)

3. You are provided with solid F. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Place all the solid f into a boiling tube. Add 10cm^3 of distilled water and shake well. Retain the mixture for use in test (b).

Observations	Inferences
(1 mark)	(1mark)

b) Divide the solution into four portions.

(i) Test the first portion with both blue and red litmus papers.

Observations	Inferences
(1 mark)	(1mark)

(ii) To the second portion, add three drops pf bromine water.

Observations	Inferences

(1 mark)	(1mark)

(iii) To the third portion, add 2 drops of acidified potassium permanganate and shake well.

Observations	Inferences
(1 mark)	(1mark)

(iv) Warm the fourth portion slightly and add a little solid G, sodium hydrogen carbonate.

Observations	Inferences
(1 mark)	(1mark)

NAME……..… INDEX NUMBER……..…

SCHOOL …….. CANDIDATE SIGN ……..

DATE ……..

233/1

CHEMISTRY

PAPER 1

TIME: 2 HOURS

MURANG`A EAST 2021 EXAMS [K.C.S.E

INSTRUCTIONS TO CANDIDATES

a) Write your name and index number in the spaces provided above
b) Sign and write the date of examination in the spaces provided
c) Answer all questions in the spaces provided
d) KNEC mathematical tables and silent electronic calculators may be used
e) All workings must be clearly shown where necessary
f) Candidates should answer all questions in ENGLISH

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1 - 32	80	

1 a) What is meant by allotropy? (1mk)

b) Identify the two crystalline allotropes of carbon. (1mk)

c) Give one use of carbon black. (1mk)

2. When hydrated sample of iron (II) Sulphate $FeSO_4$. nH_2O was heated until there was no further change in mass, the following data was recorded.

Mass of evaporating dish = 78.94g
Mass of evaporating dish + hydrated salt = 84.14g
Mass of evaporating dish + residue = 81.78g
Determine the empirical formula of the hydrated salt
(Relative formula Mass of $FeSO_4$ = 152, H_2O =18) (3mks)

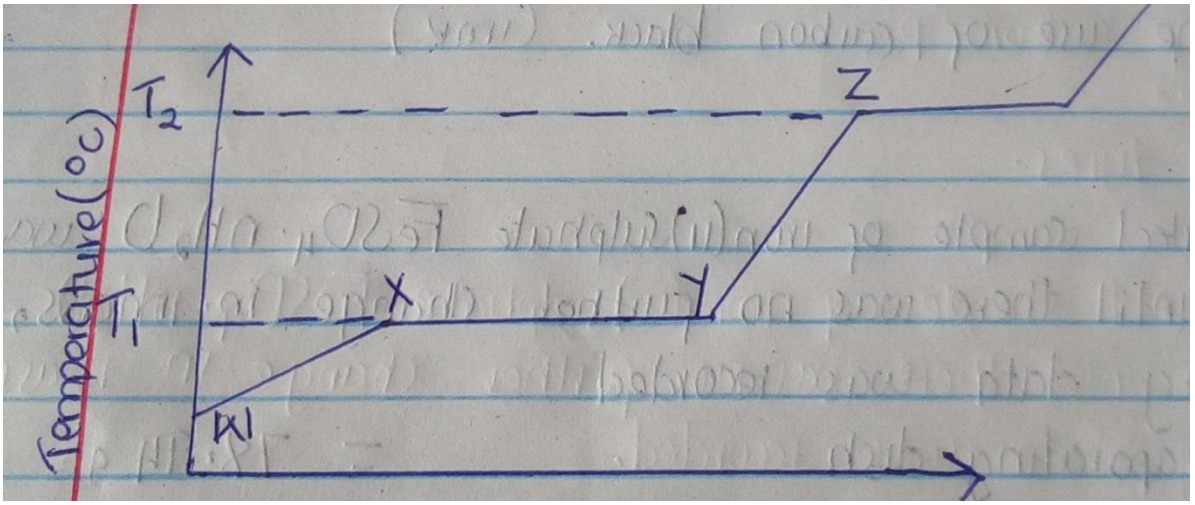
3. Equal volumes of 2M monobasic acids R and S were each reacted with excess magnesium ribbon. The table below shows the volume of the gas produced after one minutes

Acid	Volume of gas (cm^3)
R	80
S	30

a) Write the ionic equation for reaction which took place (1mk)

b) Explain the difference in the volumes of the gas produced (2mks)

4. The graph below shows the changes which takes place when a solid is heated.



a) What happened to the molecules between W and X? (1mk)

b) What is the significance of temperatures T_1 and T_2 (1mk)

c) Explain why the temperature does not rise between X and Y (1mk)

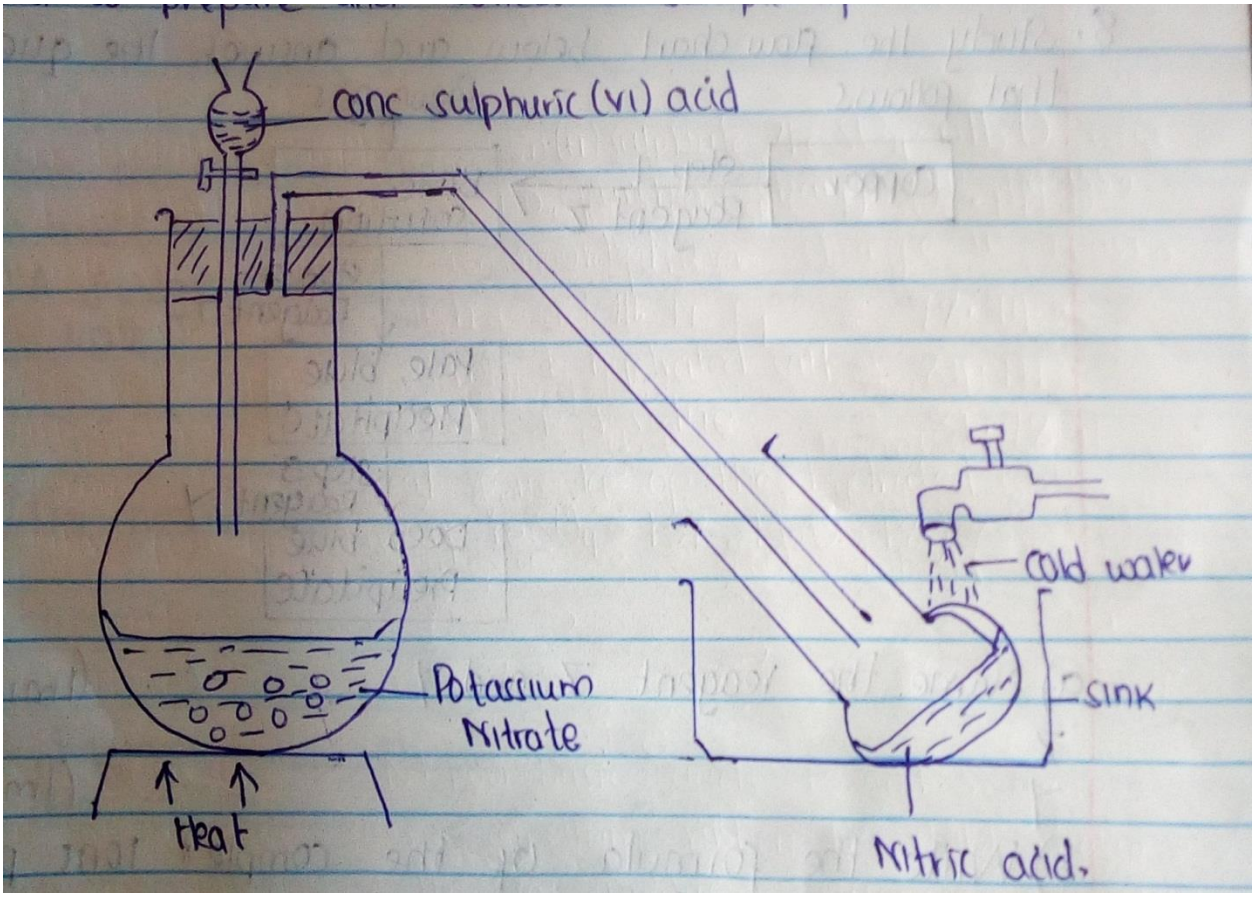
5. In an experiment to determine the solubility of potassium nitrate at 30^0c, a saturated solution was heated in an evaporating dish until there was no further change in mass. The following

data was obtained.

Mass of dish + solution	= 128.9 g
Mass of dish + dry salt	= 103.9 g
Mass of empty dish	= 94.3 g

Determine the solubility of potassium nitrate at 30^0c. (3mks)

6. The diagram below shows a set up that was used to prepare and collect a sample of nitric acid.

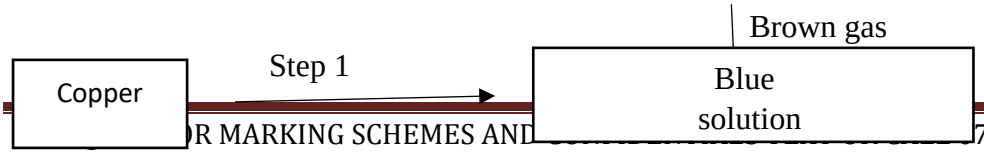


a) Give a reason why it is possible to separate nitric acid from Sulphuric acid in the set up. (1mk)

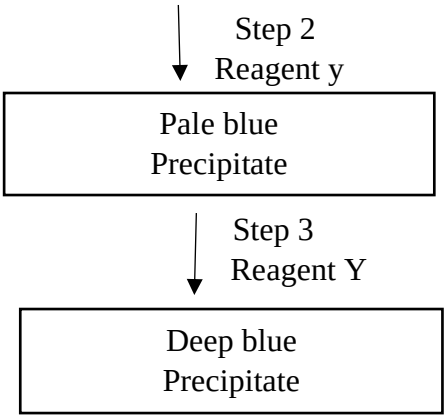
b) Name another substance that can be used instead of potassium nitrate. (1mk)

7. Starting with lead oxide, nitric acid, sodium sulphate, water and all necessary apparatus, describe how you would prepare a dry sample of lead (II) sulphate (3mks)

8. Study the flow chart below and answer the questions that follows:



Reagent Z



a) Name the reagent Z and Y

Z (1mk)

Y (1mk)

b) Write the formula of the complex ions presented in the deep blue solution (1mk)

9. The equations below shows the molar enthalpies of combustion of carbon, hydrogen and methane.

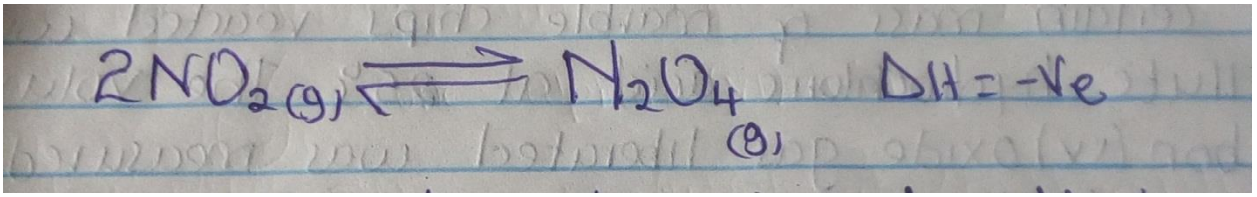
$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\quad \Delta H_c = -393\ KJmol^{-1}$

$H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(l)$ $\quad \Delta H_c = -285\ KJmol^{-1}$

$CH_4(g) + O_2(g) \longrightarrow CO_2(g)$ $\quad \Delta H_c = -890 KJmol^{-1}$

Use the energy cycle diagram to calculate the heat of formation of methane (3mks)

10. NO_2 and N_2O_4 gases exist in equilibrium at 20^0c

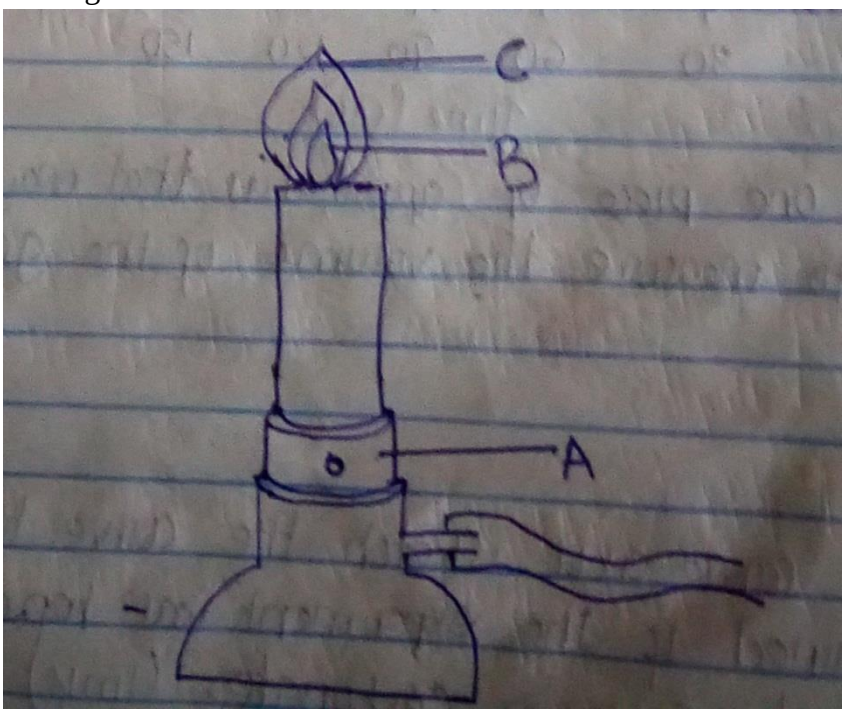


State and explain the observation that would be made when

a) A syringe containing the mixture 20^0c is heated to 40^0c (1mk)

b) The gaseous mixture in a syringe is compressed. (1mk)

11. The diagram below shows a Bunsen burner when in use



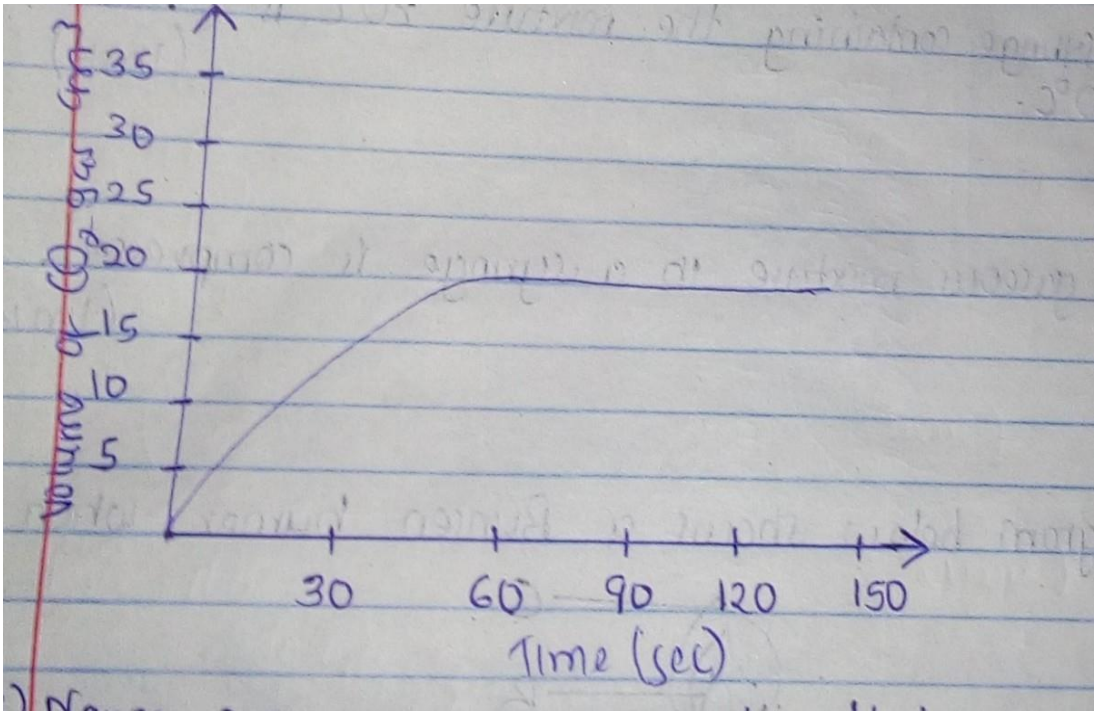
a) Name the regions labelled B and C (1mk)

B

C

b) What is the function of the part labelled A? (1mk)

12. A certain mass of marble chips reacted with excess dilute hydrochloric acid at 25^0c. The volume of carbon (iv) oxide gas liberated was measured after 30 seconds. The results were presented as shown in the graph below.



a) Name one piece of apparatus that may have been used to measure the volume of the gas liberated. (1mk)

b) On the same axis sketch the curve that would be obtained if the experiment was repeated using powdered calcium carbonate. (1mk)

13. When hydrogen Sulphide gas was bubbled into an aqueous solution of iron (iii) chloride, a yellow precipitate was deposited.

a) State another observation that would be made (1mk)

b) Write an equation of the reaction that took place. (1mk)

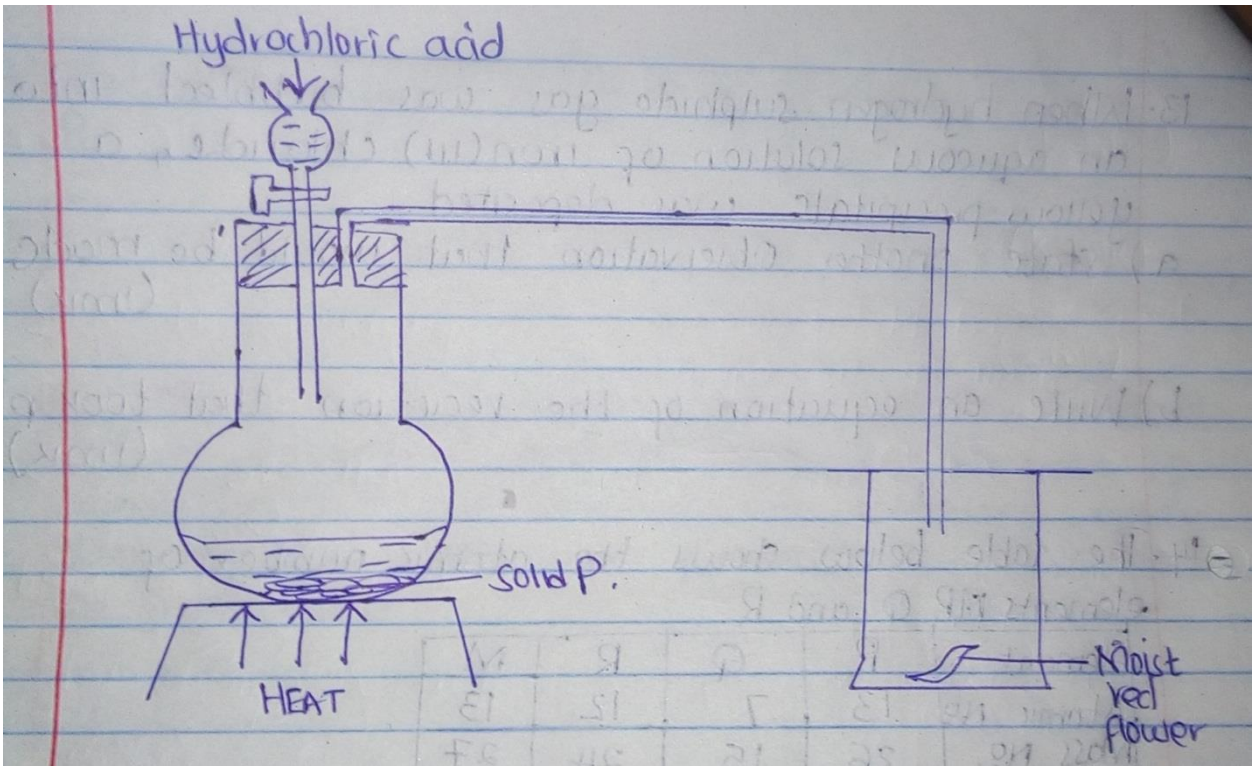
14. The table below shows the atomic number of elements M, P, Q and R.

Element	P	Q	R	M
Atomic No	13	7	12	13
Mass No	26	15	24	27

a) Which two letters represent the same element? Give reasons (1mk)

b) Give the number of neutrons of an atom of element Q (1mk)

15. The diagram below show the set up that was used to prepare and collect Sulphur (iv) oxide gas.



a) Identify the solid P (1mk)

b) i) Why is it possible to collect Sulphur (iv) oxide as shown? (1mk)

ii) What happened to the red flower? (1mk)

16 a) State Charles' law (1mk)

b) The volume o f a sample of nitrogen gas at temperature of 298k and 600mmHg pressure was 0.048m^3, calculate the temperature at which the volume of the gas would be 0.032m^3 if pressure remains the same. (2mks)

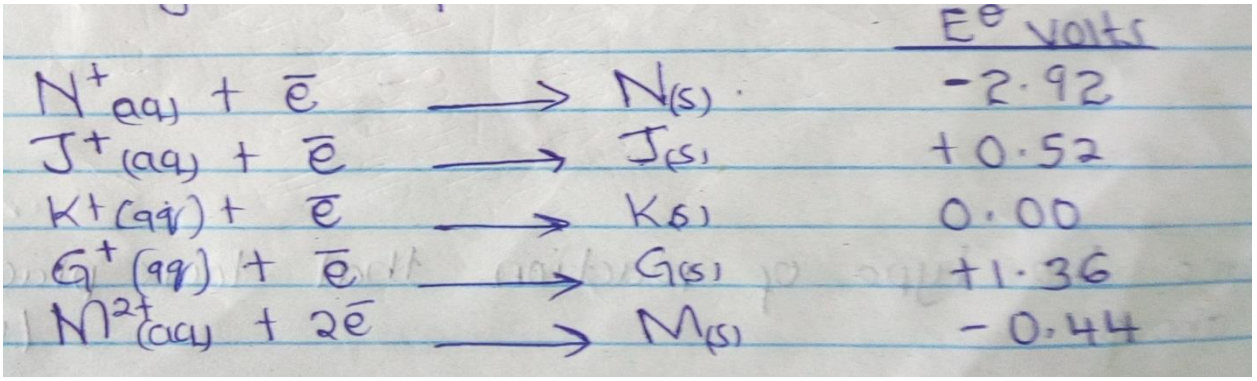
17. Element T consists of two isotopes ^{62}T and ^{64}T in the ratio 7:3 respectively. Calculate the Relative atomic mass of element T (3mks)

18. Name the process which takes place when

a) Solid carbon (iv) oxide changes directly into gas (1mk)

b) Butanol reacts with hexanoic acid in the presence of Sulphuric (iv) acid. (1mk)

19. Study the standard electrode potentials for the half-cells give below and answer the questions that follows (the letters do not represent the actual symbols of the elements)



a) Identify

i) The strongest reducing agent (½ mks)

ii) The strongest oxidizing agent (½mks)

b) Calculate the e.m.f of the cell (2mks)
$N_{(s)}/N^{+}_{(aq)}$ // $G^{+}_{(aq)}$ / $G_{(s)}$

20. Study the table below and answer the questions that follow

Bond type	Bond energy KJ/mol
C - C	346
C = C	610
C - H	413
C - Br	280
Br - Br	193

a) Calculate the enthalpy of the following reaction. (2mks)

$C_2H_{4(g)} + Br_2(g) \longrightarrow C_2H_4Br_2(g)$

b) Name the type of reaction that took place in a) above (1mk)

21. Briefly explain how you would obtain pure sample of lead (ii) chloride from a mixture of lead (ii) chloride and silver chloride (3mks)

22. Explain the following observations: very little carbon (iv) oxide is evolved when lead carbonate reacts with dilute hydrochloric acid (2mks)

23. The table below gives some properties of compounds P, Q, R and S

Compound	B.P^{0}C	M.P^{0}C	Conductivity in water
P	77	-23	Does not conduct
Q	74	-19	Does not conduct
R	-161	-85	Conduct
S	2407	714	Conduct

a) Which one of the compounds in the table is ionic?
Explain (1mk)

b) Give the compound that is liquid at room temperature. (1mk)

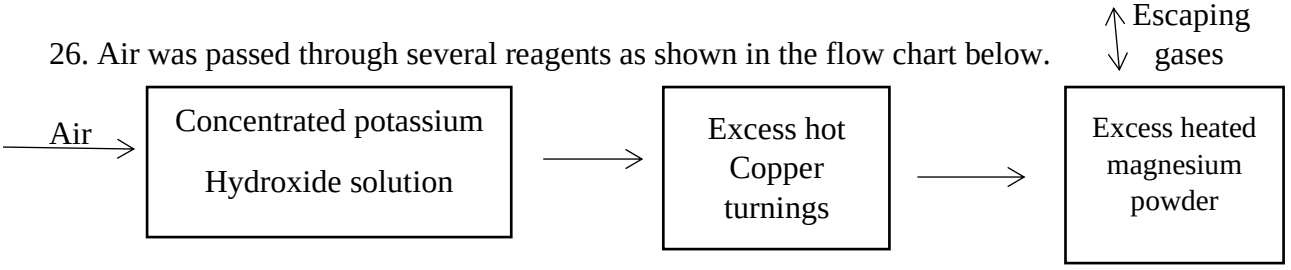
24. When butan – 1 – 0L is oxidized by acidic potassium dichromate, a weak organic acid is formed. Draw and name the structure formula of the acid obtained from the above reaction. (2mks)

25. When a hydrocarbon fuel burns, one of the main products is acidic gas R

i) Identify gas R (1mk)

ii) What two effects does gas R have when its concentration in the atmosphere exceeds its acceptable level. (2mks)

26. Air was passed through several reagents as shown in the flow chart below.



a) Write an equation for the reaction that took place in the chamber with the magnesium powder (1mk)

b) Name one gas that escapes from the chamber containing magnesium powder. Give a reason for your answer. (1mk)

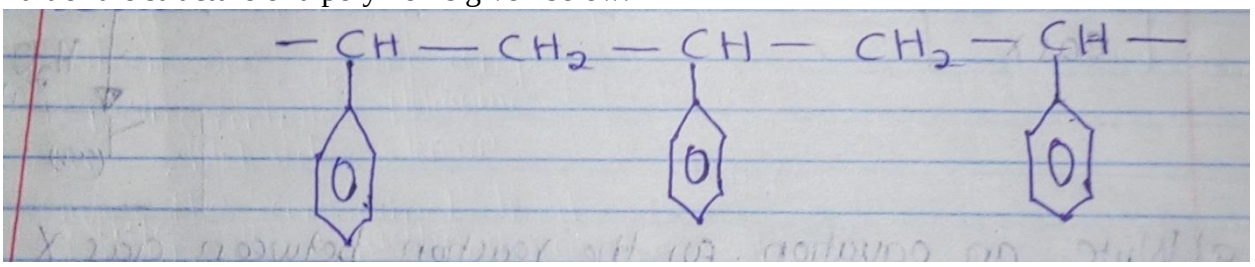
27. When a current of 6.42 Amperes was passed through an electrolyte Y^{2+} for 10 minutes, 2.74g of Y were deposited. (1mk)

i) Calculate the quantity of the electricity passed in the experiment.

ii) Determine the relative atomic mass of (1 faraday = 96,500 coulombs) (2mks)

28. Explain why aluminium metal is not extracted from aluminium chloride (2mks)

29. Part of the structure of a polymer is given below.



i) Identify the polymer. (1mk)

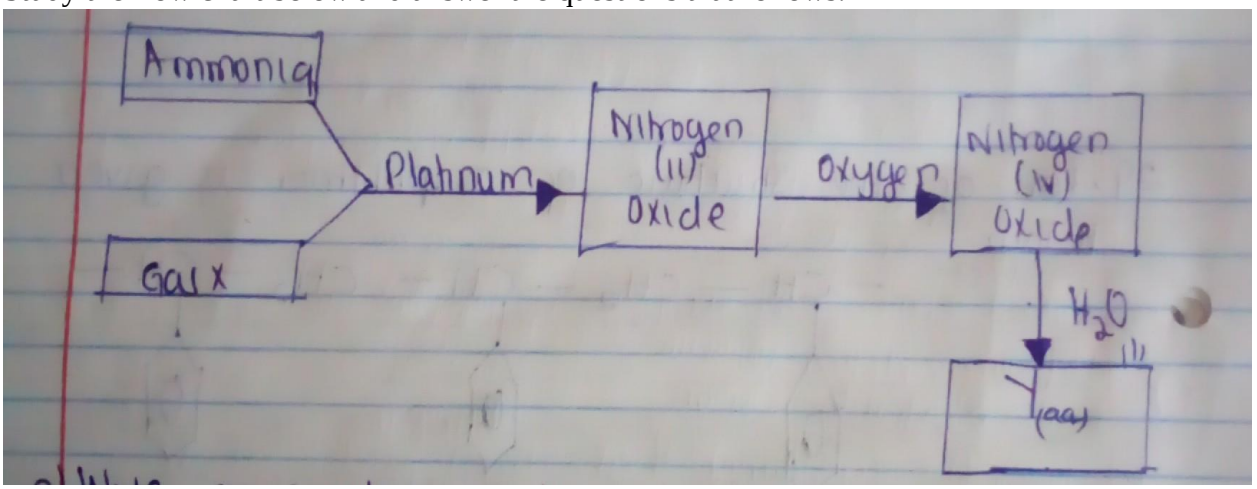
ii) State one disadvantage of continued use of this polymer (1mk)

30. The table below gives the rate of decay for a radioactive element M

Number of days	Mass (g)
0	12.8
280	0.8

Determine the half – life of the radioactive element M (2mks)

31. Study the flow chart below and answer the questions that follows.



a) Write an equation for the reaction between gas X and ammonia (1mk)

b) Write the formulae of the substance present in the mixture Y(aq) (2mks)

32. When the air hole is fully opened, the Bunsen burner produces a non-luminous flame
Explain (1mk)

NAME……..… INDEX NUMBER……..…

CANDIDATE SIGN ……..… DATE ……

MURANG`A EAST 2021 [K.C.S.E TRIAL EXAMINATION]

233/2

CHEMISTRY PAPER 2

TIME: 2 HOURS

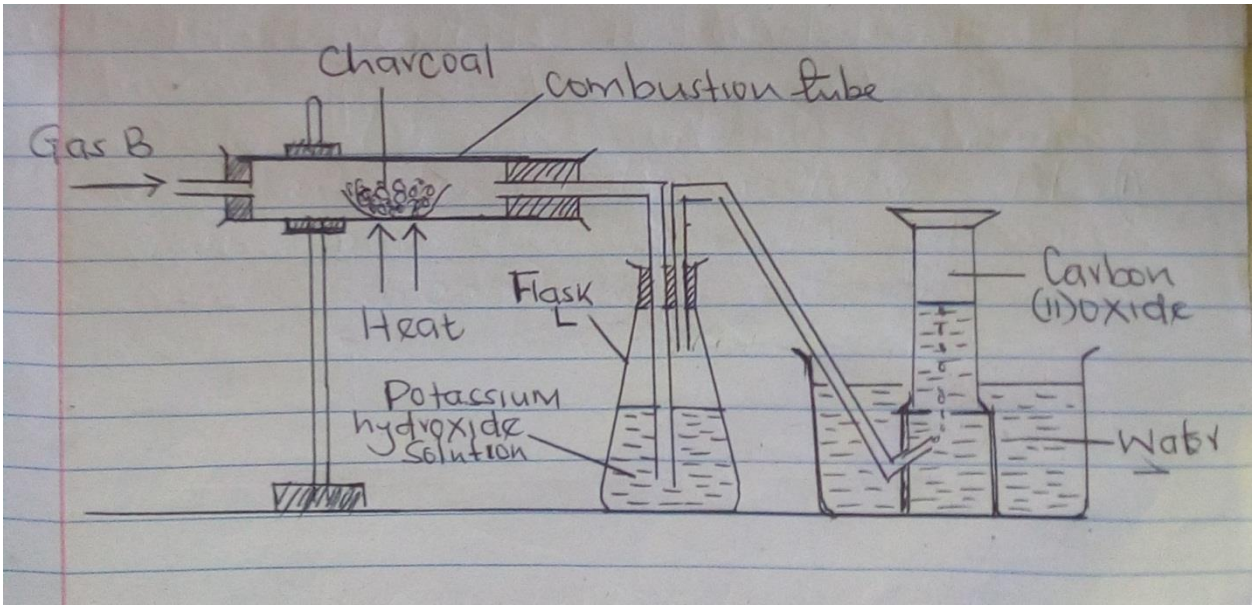
INSTRUCTIONS TO CANDIDATES

a) Write your name and index number in the spaces provided above
b) Answer **all** the questions in the spaces provided
c) KNEC mathematical tables and silent electronic calculators may be used
d) All workings must be clearly shown where necessary
e) Candidates should answer all questions in ENGLISH

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1	12	
2	14	
3	12	
4	12	
5	10	
6	10	
7	10	
Total score	80 marks	

a) A student set-up the following apparatus to prepare carbon (II) oxide from charcoal in the laboratory.



a) State the purpose of potassium hydroxide solution (1mk)

b) Identify gas B (1mk)

c) Name **two** substances that react together to produce gas B (2mks)

d) Write balanced equations for reactions in
   a) Combustion tube (1mk)

   b) Flask L (1mk)

e) Describe **two** simple test that you would use to distinguish between Carbon (IV) oxide and Carbon (II) oxide. (2mks)

f) In another experiment, the student reacted charcoal with excess hot concentrated nitric (v) acid.
   a) State one observation made (1mk)

b) Write balanced equation for the reaction (1mk)

g) State two use of Carbon (II) oxide (1mk)

b) Use the information in the table below to answer the questions that follow. The letters are not the actual symbols of the elements.

Element	Atomic Number	M.P (^{0}c)
A	11	97.8
B	13	660
C	14	1410
D	17	-95
E	20	839

i) Write the electronic arrangement for the ions formed by elements D and A (2mks)

ii) Select an element which is :

i) A poor conductor of electric current (1mk)

ii) The strongest reducing agent (1mk)

iii) Has a giant covalent structure (1mk)

iv) In which state will element B exists at 661^0c Explain. (1mk)

iii) Compare the electrical conductivity of element A and B. Give a reason (1mk)

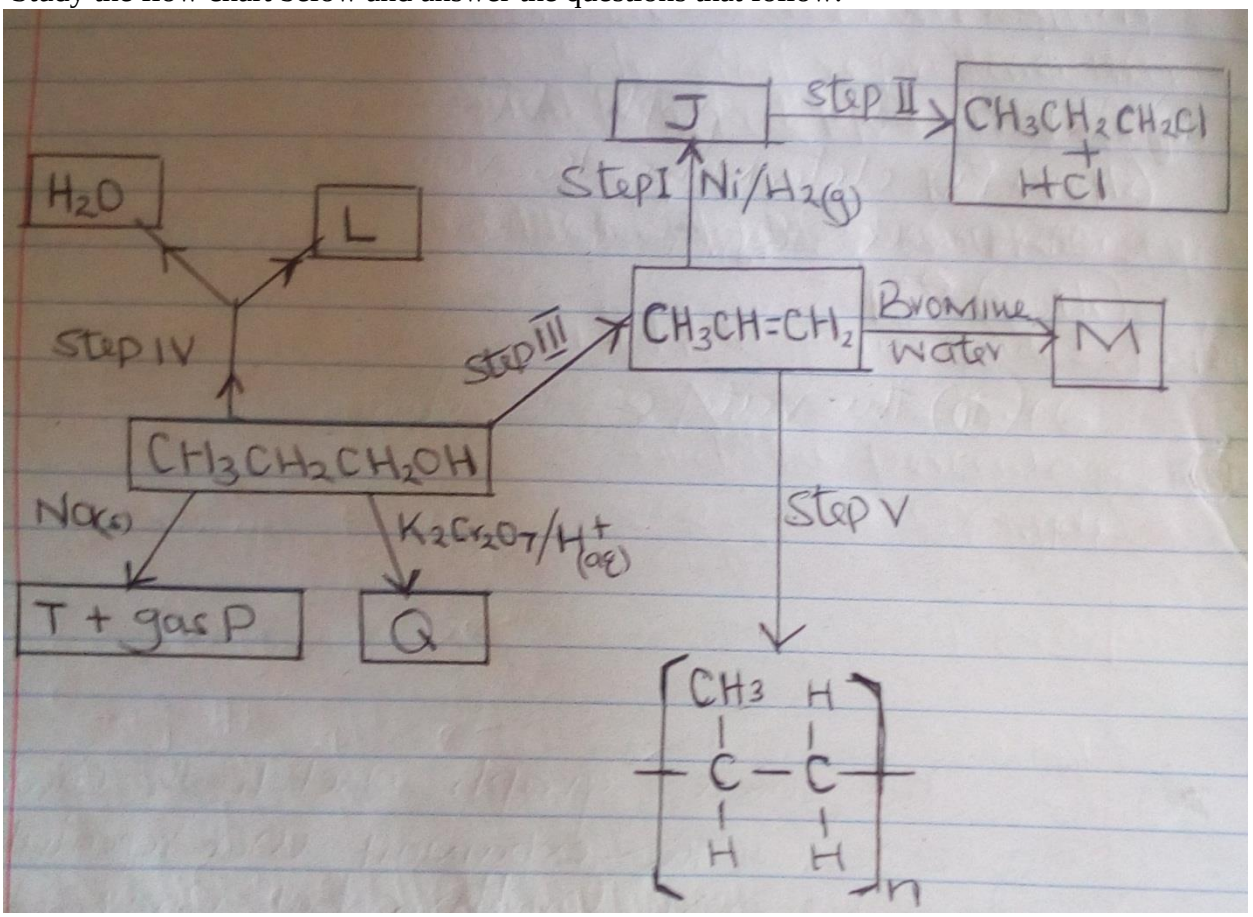
iv) Using dots (.) and crosses (x) to represent the outermost electrons, show the bonding in the compound formed between elements C and D. (2mks)

v) Explain the difference in melting points in elements B and A (2mks)

vi) Write an equation for the reaction that takes place between element E and steam. (1mk)

vii) Describe how a solid mixture of the Chloride of E and lead (II) Sulphate can be separated into solid sample. (2mks)

c) Study the flow chart below and answer the questions that follow.



a) Name substance J and draw its structural formula: (2mks)
Name

Structural formula

b) What reagents and conditions are necessary for:
a) Step (III) : Reagent (1mk)

Condition

b) Step II: Reagent (1mk)

Condition

c) Name the following

i) L (1mk)

ii) Gas P (1mk)

iii) Q (1mk)

iv) M (1mk)

d) Write the equation of the reaction that occur in step (IV) (1mk)

e) Give the name of process in step (V) (1mk)

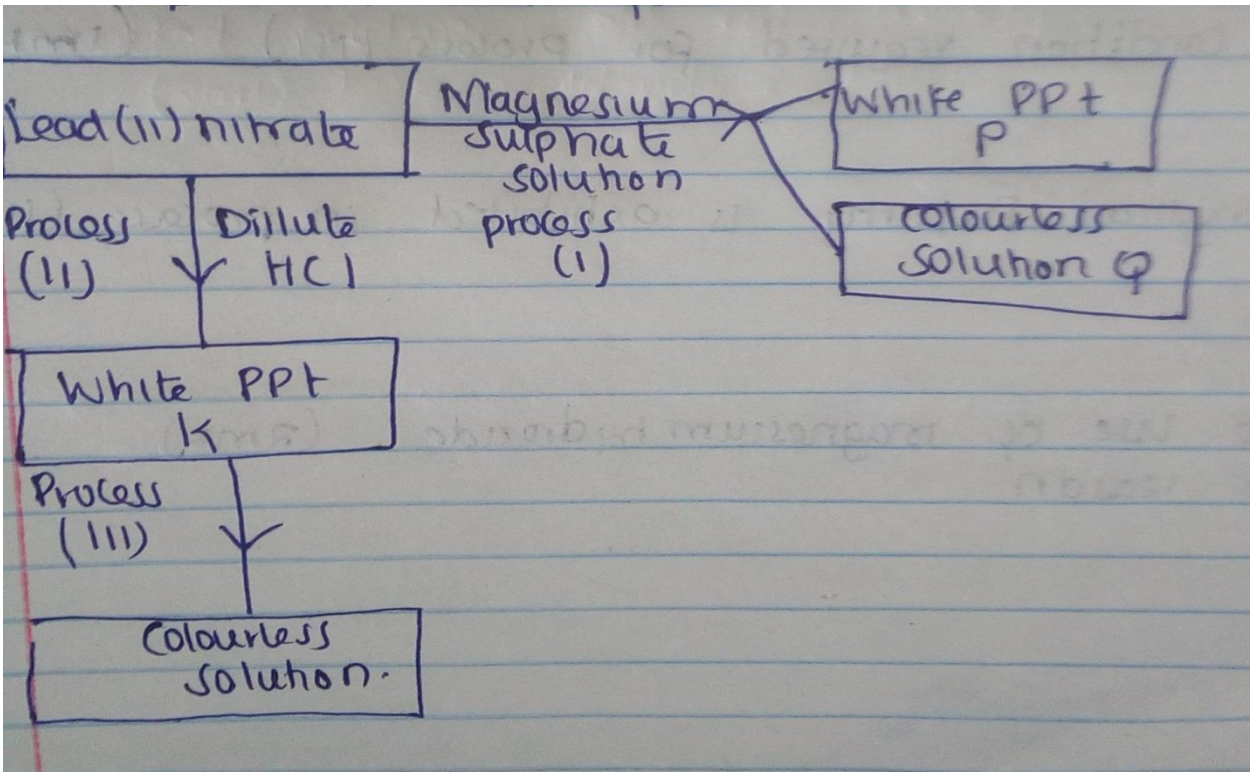
f) If the relative Molecular Mass of R is 21,000, determine the value of n. (C = 12.0, H = 1.0) (2mks)

d) a) Define an electrolyte (1mk)

b) Explain why the following substances conduct an electric current (2mks)
i) Magnesium metal

ii) Molten magnesium Chloride

c) Study the reaction scheme below and answer the questions that follow.



i) Write the formula of P and Q (2mks)

ii) Write an ionic equation for the formation of P (1mk)

iii) Name process (i) (1mk)

iv) Write a balanced equation for the formation of white precipitate K (1mk)

v) State the condition required for process (III) (1mk)

vi) Which physical property is exhibited in process (III) (1mk)

vii) State one use of magnesium hydroxide (2mks)
Give one reason

5 a) At 25^0c, 50g of potassium nitrate were added to 100g of water to make a saturated solution. What is meant by a saturated solution? (1mk)

b) The table below gives the solubilities of potassium nitrate at different temperatures.

Temperature (^{0}c)	12	20	28	36	44	52
Solubility g/100g of water	22	31	42	55	70	90

i) Plot a graph of the solubility of potassium nitrate (vertical axis) against temperature (3mks)

ii) Using the graph

i) Determine the solubility of potassium nitrate at 15^0c. (1mk)

ii) Determine the mass of potassium nitrate that remained undissolved given that 80g of potassium nitrate were added to 100cm^3 of water and water to 40^0c. (2mks)

c) Determine the molar Concentration of potassium nitrate at 15^0c.
(Assume there is no change in density of water at this temperature)
(K = 39.0, N = 14.0, O = 16.0) (3mks)

6 a) Aluminium oxide reacts with both acids and bases
i) Write an equation for the reaction between aluminium oxide and hydrochloric acid (1mk)

ii) Using the equation in (a) above, calculate the number of moles of hydrochloric acid that would react completely with 153.0g of aluminium oxide (Al = 27.0, O = 16.0) (3mks)

b) Sodium hydroxide pellet were accidentally mixed with sodium chloride, 8.8g of the mixture were dissolved in water to make one litre of solution. $50cm^3$ of the solution was neutralized by $20.0cm^3$ of 0.25M Sulphuric (vi) acid.

i) Write the equation for the reaction that took place. (1mk)

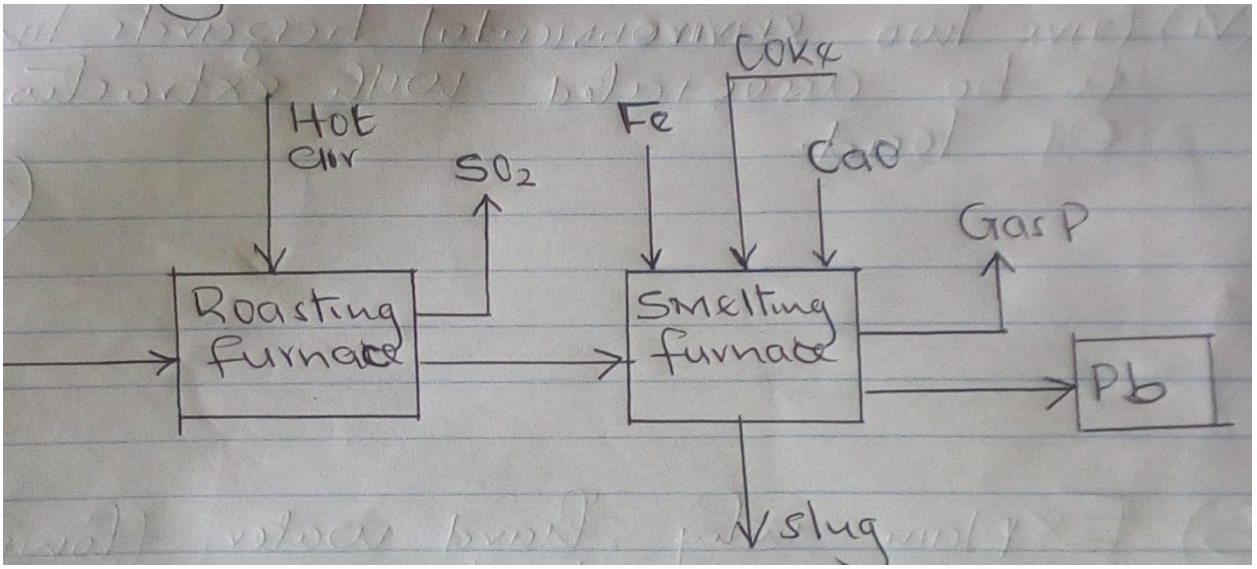
ii) Calculate the:

i) Number of moles of the substance that reacted with Sulphuric (vi) acid (2mks)

ii) Number of moles of the substance that would react with Sulphuric (vi) acid in the one litre solution. (1mk)

iii)The percentage of sodium chloride in the mixture. (2mks)

7. The flow chart below illustrates the industrial extraction of lead metal.
Study it and answer the questions that follow.



a) i) Name the ore that is commonly used in the process (1mk)

ii) Explain what takes place in the roasting furnace (1mk)

c) Identify gas P (1mk)

d) Write the equation for the main reaction that takes place in the smelting furnace. (1mk)

e) What is the purpose of adding iron in the smelting furnace? (1mk)

f) Give two environmental hazards likely to be associated with extraction of lead. (2mks)

b) Explain why hard water flowing in lead pipes may be safer for drinking than soft water flowing in the same. (2mks)

c) State one use of lead other than the making of lead pipes (1mk)

NAME: …….. INDEX.NO: ……..……

SCHOOL: ……CANDIDATES SIGN: ……..…..…

DATE: ……

233/3

CHEMISTY PAPER 3
PRACTICAL
FORM 4

MURANGA EAST 2021
KENYA CERTIFICATE OF SECONDARY EDUCATION (KCSE)

Instructions to candidates

1. *Write your name, index number and school in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *Answer **ALL** the questions in section in the spaces provided.*
4. ***ALL** working **MUST** be clearly shown.*

FOR EXAMINERS USE ONLY

QUESTION	**MAXIMUM SCORE**	**CANDIDATE SCORE**
1 2 3	18 12 ½ 9 ½	
TOTAL	**40**	

c) You are provided with:

viii) Solution A, Dilute hydrochloric acid

ix) Solution B, made by dissolving 0.5g of sodium hydroxide in water and made to 250cm^3 of solution

x) Solid C, Magnesium ribbon

xi) Phenolphthalein in indicator

You are required to:

d) Standardize solution A

e) Determine the rate of reaction between solution A and magnesium

PROCEDURE

c) Measure exactly 10cm^3 of solution A using a burette and transfer into a 250ml volumetric flask. Top up to the mark using distilled water. Label this solution D.

d) Drain the remaining solution A in the burette, rinse the burette thoroughly and fill the burette with solution D.

e) Pipette 25cm^3 of solution B into a conical flask. Add three drops of phenolphthalein indicator

f) Titrate solution D with solution B. Record your results in the table below. Repeat procedure (i) to (iv) to complete the table. (3 marks)

	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution D used (cm^3)			

v) Calculate the average volume of solution D used (1 mark)

vi) Calculate:

e) Number of moles of solution B used (1½ marks)

f) Number of moles of solution D in 250cm3 of solution (1½ marks)

g) Morality of solution A (1 mark)

PROCEDURE II

a) Cut solid C into equal pieces, each 2cm long.

b) Using a burette, measure 12cm^3 of solution A, into a clean boiling tube.

c) Drop one piece of solid C into the boiling tube containing solution A and start stopwatch immediately. Stop the stopwatch when all solid C has just reacted. Record your results in the table below.

d) Repeat steps (ii) and (iii) above using 10cm3, 8cm3, 6cm3 and 4cm3 of solution A. Top up each with distilled water to make 12cm3 of solution and complete the table below.

(4 marks)

Volume of solution A (cm^3)	Volume of distilled water (cm^3)	Concentration of solution a (moles/l	Time(s)	$\frac{I}{t}(s^{-1})$
12	0			
10	2			
8	4			

6	6			
4	8			

c) Plot a graph of $\frac{I}{t}(y-axis)$ against the concentration of solution A (3 marks)

d) From the graph, determine the time taken for the reaction to reach completion when 1.5 moles of solution A are used (2 marks)

e) Comment on the shape of the graph (1 mark)

d) You are provided with solid Q. Carry out the tests below and record your observations and inferences in the spaces provided.

g) Strongly heat a spatula-end full of solid Q in a dry test tube (1 mark)

Observation	Inference

h) (i) Place the remaining solid Q in a boiling tube. Add 10cm3 of distilled water. Divide the solution into five portions. (2 marks)

Observation	Inference

(ii) To the first portion, add aqueous lead (II) nitrate solution (1 mark)

Observation	Inference

f) To the second portion add dilute nitric (V) acid, followed by barium nitrate solution (2marks)

Observation	inference

g) To the third portion add a few drops of sodium hydroxide until excess observation (2marks)

Observation	Inference

h) To the fourth portion, add a few drops of aqueous ammonia until is excess. (2 marks)

Observation	Inference

i) To the fifth portion, add a few drops of hydrochloric acid (1½ marks)
Warm the contents.

Observation	Inference

e) You are provided with solid R. carry out the tests below and record your observations and inferences.

h) Place a spatula-end full of solid R in a dry boiling tube and add about $10cm^3$ of distilled water. Shake thoroughly and heat to boil. Divide the solution into five portions.
(1½ marks)

Observation	inference

i) (i) Test the first portion with the universal indicator solution provided. (1½ marks)

Observation	Inference

(ii) To the second portion, add a few drops of acidified potassium manganite (VII) solution
(2 marks)

Observation	Inference

(iii) To the third portion, add a few drops of bromine water (2 marks)

Observation	Inference

(iv) To the fourth portion, add half spatula of sodium hydrogen carbonate (1 mark)

Observation	Inference

e) To the fifth portion in a boiling tube, add 5cm3 of ethanol followed by a few drops of concentrated sulphuric (VI) acid. Warm the mixture. (1 ½ Marks)

Observation	Inference

Name: …… Index No.…….....

School: ……. Class ……..

Date: ……

233/1

CHEMISTRY THEORY

PAPER 1

TIME: 2 HOURS

KASSU JET EXAMINATIONS

JANUARY 2021

Instructions to Candidates

(a)Write your name and index number in the spaces provided above.

(b) Sign and write the date of examination in the spaces provided above

*(c) Answer **ALL** the questions in the spaces provided in the question paper*

(d) KNEC Mathematical tables and electronic calculators may be used for calculations

*(e) All working **MUST** be clearly shown where necessary*

(f) This paper consists of 12 printed pages

(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing

(h) Candidates should answer the questions in English

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1 – 29	80	

This paper consists of 12 printed pages. Candidates should check to ascertain that all pages are printed as indicated and that no questions are missing.

1. Study the diagram below then use it to answer the questions that follow.

a) Draw the wooden splint at the end of the experiment. If it was slipped then removed. (1 mark)

b) Explain the appearance of the wooden splint in (a) above. (2 marks)

……

……

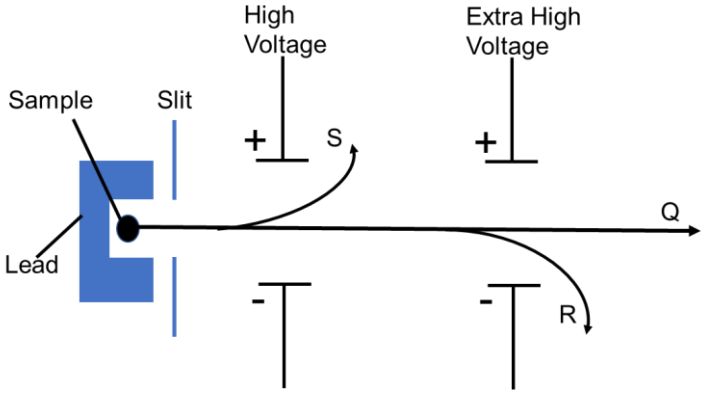
……

2. (a) The half-life of $^{210}_{83}M$ is 7 days. Determine the mass of remaining if 100g decayed in 35 days. (1 mark)

……

……

(b) The diagram below shows the radiations emitted by a radioactive sample.



(i) Identify radiation particles **S** and **R**. (1 mark)

S……

R……

(ii) Which emission causes most harm to human cells. Give a reason. (1mark)

……

……

3. a) Starting with copper metal, describe how a solid sample of copper (II) carbonate can be prepared. (3 marks)

……1……

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……

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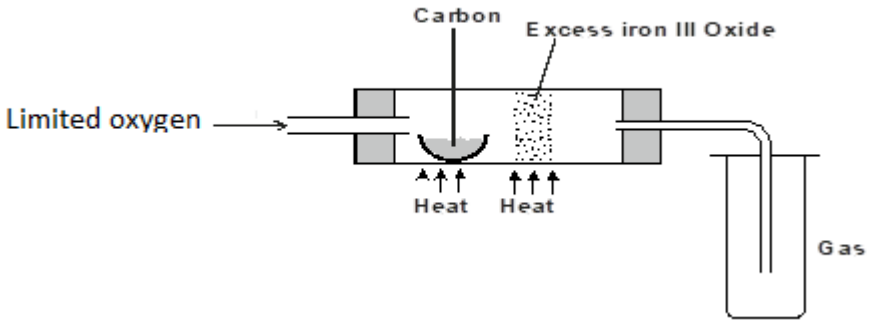
……

4. The set-up below was used to obtain a sample of iron.



Write two equations for the reactions which occur in the combustion tube. (2 marks)

……

……

……

5. Below are the bond dissociation energies of some elements.

Bond	**Bond dissociation energy**
C – C	343 kJ mol^{-1}
C – H	414 kJ mol^{-1}
H – H	435 kJ mol^{-1}
C = C	612 kJ mol^{-1}

Use this information to calculate the heat of reaction for (3 marks)

$$C_2H_{4(g)} + H_{2(g)} \rightarrow C_2H_{6(g)}$$

6. Sulphur (IV) oxide is oxidized catalytically to sulphur (VI) oxide in the reaction.

$$2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)} \quad \Delta H = -197kJ$$

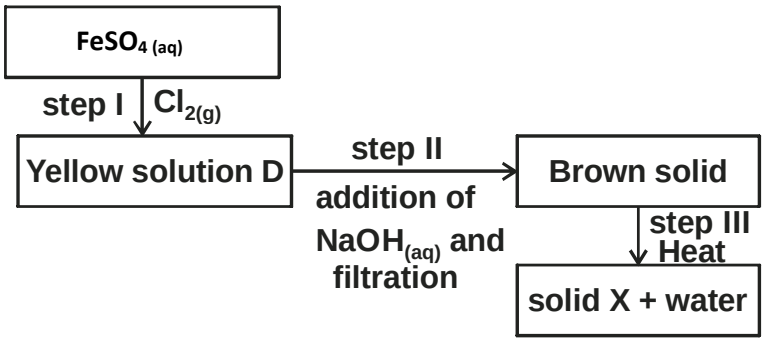
a) What information about the reaction is given by ΔH = -197kJ ? (1 mark)

……

b) Name one catalyst that can be used in this reaction. (1 mark)

……

7. Study the scheme below and answer the questions that follow.



a) Write the formula of the cation present in solution D. (1 mark)

……

b) What property of chlorine is shown in step 1. (1 mark)

……

c) Write an equation for the reaction which occurred in step III. (1 mark)

……

8. 0.63g of lead powder were dissolved in excess nitric (V) acid to form lead (II) nitrate solution. All the lead (II) nitrate was then reacted with sodium sulphate solution.

a) Write an ionic equation for the reaction between sodium sulphate solution and lead (II) nitrate solution. (1 mark)

……

b) Determine the mass of the lead salt formed in the reaction in (a) above (Pb = 207, S = 32, O = 16) (2 marks)

……

……

……

……

9. Use the cell representation below to answer the questions that follow.

$$Cr_{(s)} / Cr^{3+}_{(aq)} // Fe^{2+}_{(aq)} / Fe_{(s)}$$

a) Write an equation for the cell reaction. (1 mark)

……

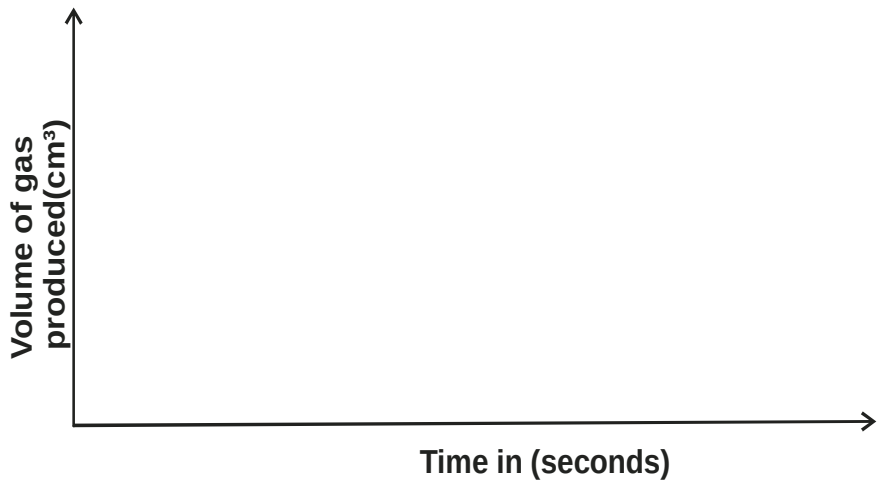
b) If the emf of the cell is 0.30V and the E^0 value for $Fe^{2+} / Fe_{(S)}$ is -0.44V. Calculate the E^0 value for $Cr_{(s)} / Cr^{3+}_{(aq)}$ (2 marks)

10. An element Q has a relative atomic mass of 88. When a current of 0.5A was passed through the fused chloride of Q for 32 minutes and 10 seconds, 0.44g of Q were deposited at cathode. Determine the charge on the ion of Q. (1 Faraday = 96500 coulombs) (3 marks)

11. The table below gives three experiments on the reaction of excess sulphuric (VI) acid and 0.5g Zinc done under different conditions. In each case the volume of gas liberated was recorded at different time intervals.

Experiment	Form of Zinc	Sulphuric (VI) acid
I	Powder	0.8M
II	Powder	1.0M
III	Granules	0.8M

On the axes below, draw and label the three curves that would be obtained from the results above.
(3 marks)



12. a) Starting with red roses, describe how a solution containing the red pigments may be prepared? (2 marks)

……

……

……

b) How can the solution be shown to be an indicator. (1 mark)

……

13. The table below provides data on the successive ionisation energies of carbon.

Ionisation numbers	1st	2nd	3rd	4th	5th	6^{th}
Ionisation energy (kJ/mol)	1090	2350	4610	6220	37800	47300

a) Explain why each ionisation energy increase in nature. (2 marks)

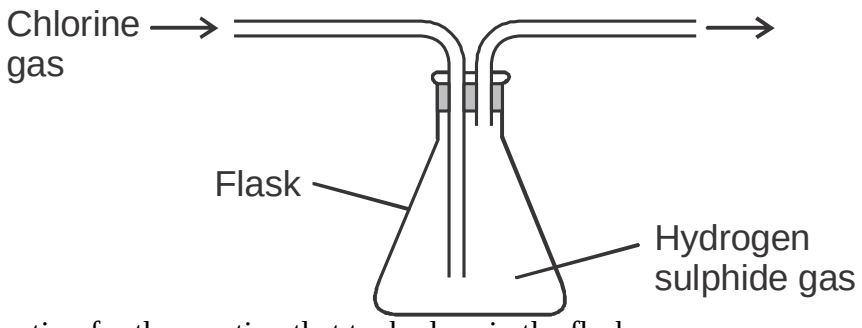
……

……

b) Write an equation for the 5th ionisation energy of carbon. (1 mark)

……

14. The figure below was set by a student to investigate the reaction between chlorine gas and hydrogen sulphide gas.



a) Write an equation for the reaction that took place in the flask. (1 mark)

……

……

b) What observation was made in the flask ? (1 mark)

……

c) What precaution should be taken in carrying out the experiment ? (1 mark)

……

……

15. A certain carbonate, QCO_3, reacts with dilute hydrochloric acid according to the equation given below.

$$QCO_{3(S)} + 2HCl_{(aq)} \rightarrow QCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$$

If 1g of the carbonate reacts completely with 20cm³ of 1M hydrochloric acid. Calculate the relative atomic mass of Q.(C = 12.0, O=16.0) (3 marks)

16. When bismuth (III) chloride is added to water, a reaction occurs and a white precipitate forms as shown below.

$BiCl_{3(aq)} + H_2O_{(l)} \rightleftharpoons BiOCl_{(s)} + 2HCl_{(aq)}$

What would be the effect on the amount of the precipitate formed if sodium hydroxide solution is added to the equilibrium mixture? Explain your answer. (2marks)

……

……

……

17. (a) State the Gay Lussac's Law. (1 mark)

……

……

(b) $10cm^3$ of a gaseous hydrocarbon, C_2H_X required $30cm^3$ of oxygen for complete combustion. If steam and $20cm^3$ of carbon (IV) oxide were produced, what is the value of X? (2 marks)

18. (a) Give Bronsted and Lowry definition of an acid (1mk)

……

……

(b) Differentiate between a strong acid and a concentrated acid (2mks)

……

……

……

19. When a hydrated sample of $CaSO_4.xH_2O$ was heated until all water was lost, the following data was recorded

Mass of crucible = 30.296 g
Mass of crucible + hydrated salt = 33.111 g
Mass of crucible + anhydrous salt = 32.781 g

Determine the empirical formula of the hydrated salt. *($CaSO_4=136, H_2O=18$).* (3marks)

……

……..

……

……

20. Describe a chemical test used to distinguish butane from butene in the laboratory. (2marks)

……

……

……

21. The table below gives the atomic numbers of elements W, X, Y and Z.

Element	W	X	Y	Z
Atomic number	14	17	16	19

a) Name the type of bonding that exist in the compound formed when **X** and **Z** reacts. (1mark)

……

……

b) Select the letter representing the strongest reducing agent. Give a reason for your answer. (2mks)

……

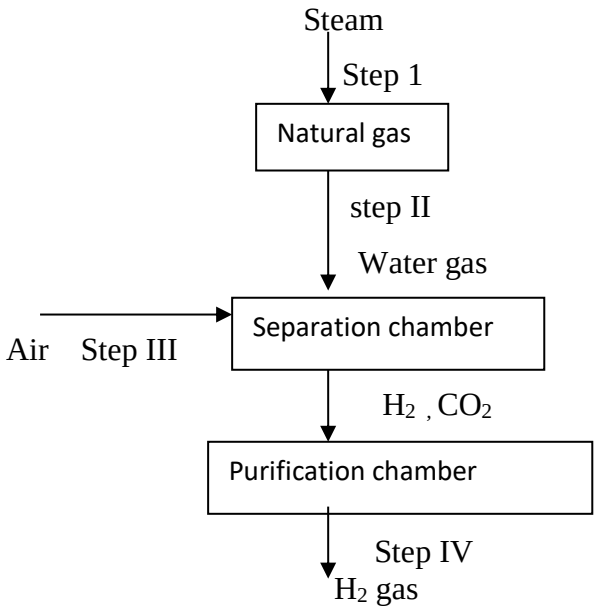
……

……

22. In an electrochemical cell, the standard hydrogen electrode uses platinized platinum. State **three** functions of the platinized platinum. (3 marks)

……

23. The flowchart below shows the scheme for extraction of Hydrogen from hydrolysis of natural gas, study it and answer the questions that follow.



a) In step II water gas is formed. State one use of water gas. (1marks)

……

b) When air is added in step III CO is converted to CO_2 name one chemical substance that can be used to separate CO_2 from H_2 in step IV (1marks)

……

c) State one large scale use of Hydrogen gas formed. (1marks)

……

24. Aluminium is obtained from the ore with the formula Al_2O_3. $2H_2O$. The ore is first heated and refined to obtain pure aluminium oxide (Al_2O_3). The oxide is then electrolysed to get Aluminium and oxygen gas using carbon anodes and carbon as cathode.

i) Give the common name of the ore from which aluminium is extracted. (1 mark)

..... ii)

What would be the importance of heating the ore first before refining it ? (1 mark)

.....

iii) The refined ore has to be dissolved in cryolite first before electrolysis. Why is this necessary?

……. (1 mark)

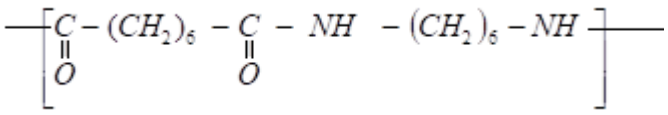
iv) Why are the carbon anodes replaced every now and then in the cell for electrolysing aluminium oxide?

(1 mark)

.....

.....

26. Nylon polymer has the structure below.



i) Determine the structures of the monomers. (2mks)

……

……

……

ii) State the type of polymerization. (1mk)

……

……

27. (a) Define the term solubility. (1 mark)

……

……

b) The following were the results obtained in an experiment to determine solubility of potassium nitrate at room temperature.

Mass of evaporating dish = 14.32 g

Mass of evaporating dish + saturated solution = 35.70 g

Mass of evaporating dish + salt (residue) = 18.60 g

Calculate the solubility of potassium nitrate from the above results. (2 marks)

……

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28. Describe a simple laboratory experiment that can be used to distinguish between sodium sulphide and sodium carbonate. (2mks)

29. (a)Give **one** reason some of the laboratory apparatus are made of ceramics.

(1 mark)

……

(b) Name **two** apparatus that can be used to measure approximately 75 cm^3 of dilute sulphuric (VI) acid. **(2 marks)**

……

……

Name ……Index No……..……

School……..…..…….. Date……

233/2
CHEMISTRY
Paper 2
THEORY
Jan 2021
2 hours

KASSU EXAMINATIONS

Kenya Certificate of Secondary Education
CHEMISTRY
Paper 2
THEORY
2 hours

Instructions

Write your name, Index number and class in the spaces provided above.
*Answer **ALL** the questions in the spaces provided.*
Mathematical tables and silent electronic calculators may be used.
*All working **MUST** be clearly shown where necessary.*

For Examiner's use only

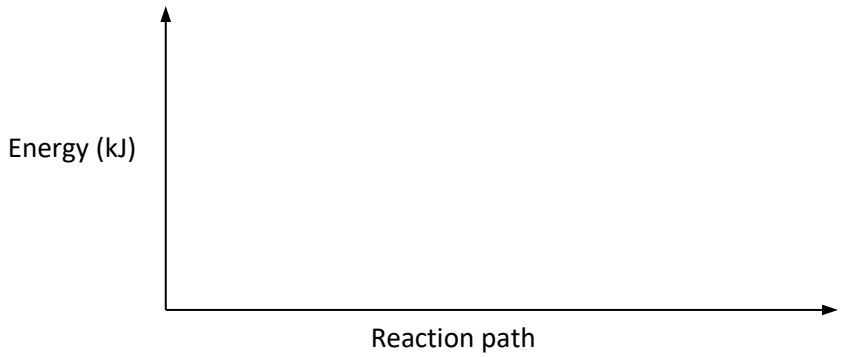
Question	Maximum Score	Candidate's Score
1	**11**	
2	**12**	
3	**12**	
4	**12**	
5	**11**	
6	**11**	
7	**11**	
Total	**80**	

*This question paper has **10** printed pages.*
Confirm that all the pages are printed as indicated and
***No** questions are missing.*

1. a) Consider the following reaction:

$A_{2(g)} + B_{2(g)} \rightleftharpoons 2AB_{(g)}$, $\Delta H = +75$ kJ

Sketch an energy level diagram showing the relative activation energies for the catalysed and uncatalysed reactions using the axes below. (2mks)



b) Given that; $\Delta H_f (Al_2O_3) = -$ **1590** kJmol^{-1}

$\Delta H_f (Cr_2O_3) =$ **-1134**kJmol^{-1}

Calculate the heat of reaction for; $2Al_{(s)} + Cr_2O_{3(s)} \longrightarrow Al_2O_3 + 2Cr_{(s)}$ **(2mks)**

c) The following data was obtained during an experiment

Mass of ethanol burnt	=	0.2g
Mass of water in the calorimeter	=	200g
Specific heat capacity of water	=	4.2 jg^{-1}k^{-1}
Initial temperature of water	=	23.5 ^{0}C
Final temperature of water	=	28.0 ^{0}C

i) **How** was the mass of ethanol that burnt determined? (1mk)

……

……

ii) **How** much heat was required to raise the temperature of water from 23.5 ^{0}C to 28.0^{0}C? (2mks)

……

……

iii) Two assumptions were made in calculating the enthalpy of combustion for ethanol. **State them.** (1mk)

……

……

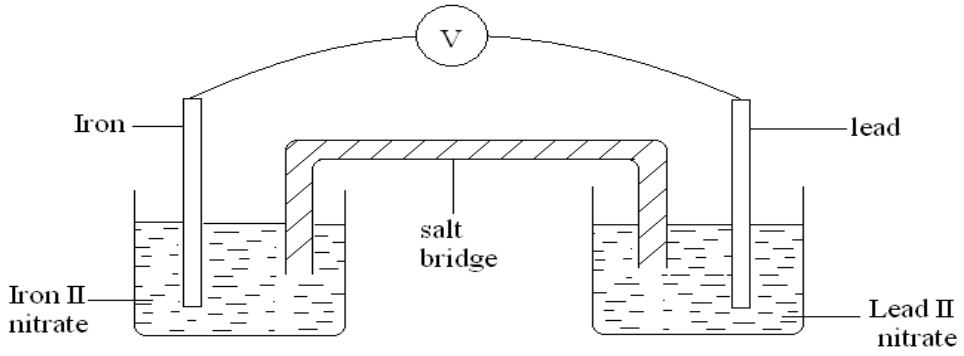
iv) **Determine** the molar enthalpy of combustion of ethanol.(C= 12,H=1, O=16)

(2mks)

v) **Write** a thermochemical equation for the combustion of ethanol given the accurate value for enthalpy of combustion is – 1368 $kJmol^{-1}$. (1mk)

……

2. Two half cells were connected as shown to form a voltaic cell. The reduction potentials are given.



$Pb^{2+}_{(aq)} + 2e \longrightarrow Pb_{(s)}$ $\quad E^{\Theta} = -0.13V$

$Fe^{2+}_{(aq)} + 2e \longrightarrow Fe_{(s)}$ $\quad E^{\Theta} = -0.44V$

a) **Calculate** the e.m.f of the cell. (1mk)

b) **Sodium chloride is used as the salt bridge. State the** two functions of the salt bridge. (2mks)

……

……

c) **Show** the direction of the electron flow in the external circuit. (1mk)

d) The e.m.f of the cell will reduce with time. Give a reason for this. (1mk)

……

……

e) During electrolysis of water acidified with Sulphuric acid, two gases were produced at the electrodes:

i) **State** which ions are preferentially discharged at the electrodes. **Explain** with aid of half ionic equations.

Anode.

(2mks)

……..…….

……..…….

Cathode.

(2mks)

……..…….

……..…….

ii) **Calculate** the volume of the gases at s.t.p produced when a current of 0.025A is passed for 4 hours. (1 Faraday=96500C) (3mks)

3. a) The fermentation of glucose is catalysed by enzymes from yeast. Yeast is added to aqueous glucose, the solution starts to bubble and becomes cloudy as more yeast cells are formed.

$$C_6H_{12}O_{6(aq)} \xrightarrow{} 2C_2H_5OH_{(aq)} + 2CO_{2(g)}$$

The reaction is exothermic. Eventually the fermentation stops when the concentration of ethanol is about 12%.

(i) On a large scale, the reaction mixture is cooled. Suggest a reason why this is necessary.

(1mk)

…….……

……..

(ii) Why does the fermentation stop? Suggest one reasons. (1mk)

……

……

(iii) What technique is used to concentrate the aqueous ethanol? (1mk)

……

……

b) A compound X contains carbon, hydrogen and oxygen only. X contains **54.54**% of carbon by mass, **9.09**% of hydrogen by mass and **36.37**% of oxygen by mass. (C=12, O=16, H=1)

(i) Determine the empirical formula of compound X. (2mks)

(ii) Compound X has a relative molecular mass of 88. Draw the structural formula of compound X. (2mks)

c) The table below gives formulae of three organic compounds A, B and C

Compound	Formulae
A	$C_2H_4O_2$
B	C_2H_6O
C	C_2H_6

Giving a reason in each case, select the letter(s) which represent a compound that

i) Decolourises acidified potassium manganate (VII). (1mk)

……

……

ii) .Gives effervescence with sodium hydrogen carbonate. (1mk)

……

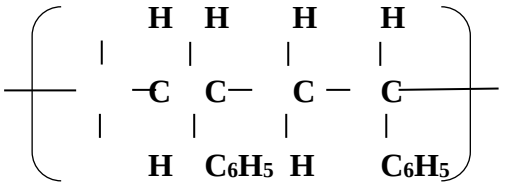
……

iii) Undergoes substitution reaction with chlorine gas. (1mk)

……

……

d) The following is a small reaction of polystyrene polymer. Study it and answer the questions that follow.



(i) Draw the structure of the monomer unit of polystyrene. (1mk)

(ii) Calculate the number of monomers used to form the polystyrene of relative molecular mass of 18096.
(H = 1, C = 12) (1mk)

4. An experiment was carried out using magnesium ribbon and dilute hydrochloric acid of different concentrations. The time needed to produce $50cm^3$ of the gas for every experiment was recorded in a table.

Concentration of HCl (moles per litre)	2.0	1.75	1.50	1.25	1.00	0.75	0.50	0.25

Time (seconds)	8.8	10.0	11.7	14.0	17.5	18.7	35.0	70.0
$\frac{1}{time}$ (Sec^{-1})								

a) Complete the table above for $^{1}/_{time}$. (4mks)

b) Plot a graph of rate i.e $^{1}/_{time}$ against concentration. (3mks)

c) From your graph determine the concentration needed to produce $50cm^3$ of hydrogen gas when time is 15.0 seconds (1mks)

……

……

d) From your graph state the relationship between the rate of reaction and concentration. Give a reason. (1mk)

……

……

e) A state of equilibrium between dichromate (vi) and chromate ions is established as shown below

$Cr_2O_7^{2-}{}_{(aq)} + 2OH^-{}_{(aq)} \rightleftharpoons 2CrO_4^{2-}{}_{(aq)} + H_2O_{(l)}$

Orange **(Yellow)**

i) What is meant by dynamic equilibrium?
(1mk)

……

……

……

ii) State and explain observation made, when a few pellets of Hydrochloric acid are added to equilibrium mixture (2mks)

……

……

……

……

5. I) The table below shows properties of some elements represented by symbols W,X,Y and Z. Study the information in the table and answer the questions that follows

Element	**No. Of protons**	**Atomic radius(nm)**	**Boiling point ^{0}C**
W	2	0.93	-269
X	10	1.31	-246
Y	18	1.54	-186
Z	36	1.89	-152

a) Write down the electron arrangement for elements W and X (1mk)

……

……

b) In which group of the periodic table are the elements in the table above? Give the name of the group (2mks)

……

……..

c) Explain why the atomic radius of W is smaller than that of X (1mk)

……

……

d) state one use of element X
(1mk)

……

……

II. The section below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbol of the elements.

				Q				
X			**B**	**H**		**M**	**T**	
Y		**A**					**V**	
Z							**S**	

a) **Select** the least reactive non-metal. (1mk)

……

b) **Which** of the elements has the greatest tendency of forming covalent compounds in nature? **Explain** your choice. (1mk)

……

……

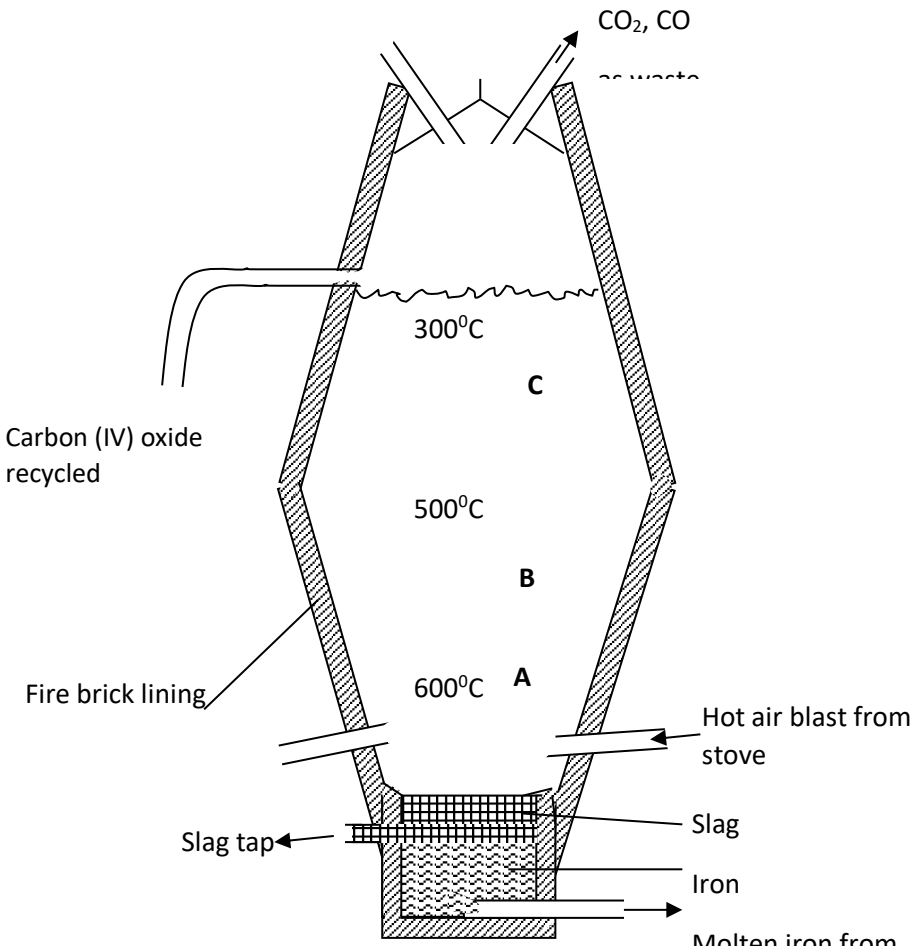
c) **Explain** why the atomic radius of **T** is smaller than that of **M**. (2mks)

……

……

d) Compare the electrical conductivity of element X and B. (2mks)

6. Extraction of iron involves two main processes, smelting and refining. Below is the blast furnace which is used to smelt iron from its ore.



a) (a) (i) The chief ore is Haematite. Name one other ore used in extraction of iron (1 mark)

……

…… (ii) Name the reducing agent in the process. **(1mk)**

……

……

(i) What is the role of the hot air blast in the process? **(2mks)**

……

……

(b) Write equations for the reactions that take place at the region marked A, B and C. **(3mks)**

A……

B……

C ……

(c) What is the purpose of limestone in the extraction process? **(1mk)**

……

(d) Write equations to show how impurities are removed from the ore. **(2mks)**

……

……..……

……..……

(e) State one environmental effect of the process. (1mk)

……

……

7. a) Read the following passage and answer the questions.

A salt K was heated with slaked lime (calcium hydroxide). A colourless gas L with a characteristic smell and turns red litmus paper blue was evolved. A large quantity of this gas was passed through an inverted filter funnel into Copper(II)sulphate solution, and a deep blue solution M was obtained.

a) Identify gas L
(1mk)

…..……

……

b) What is K most likely to be?
(1mk)

…..……

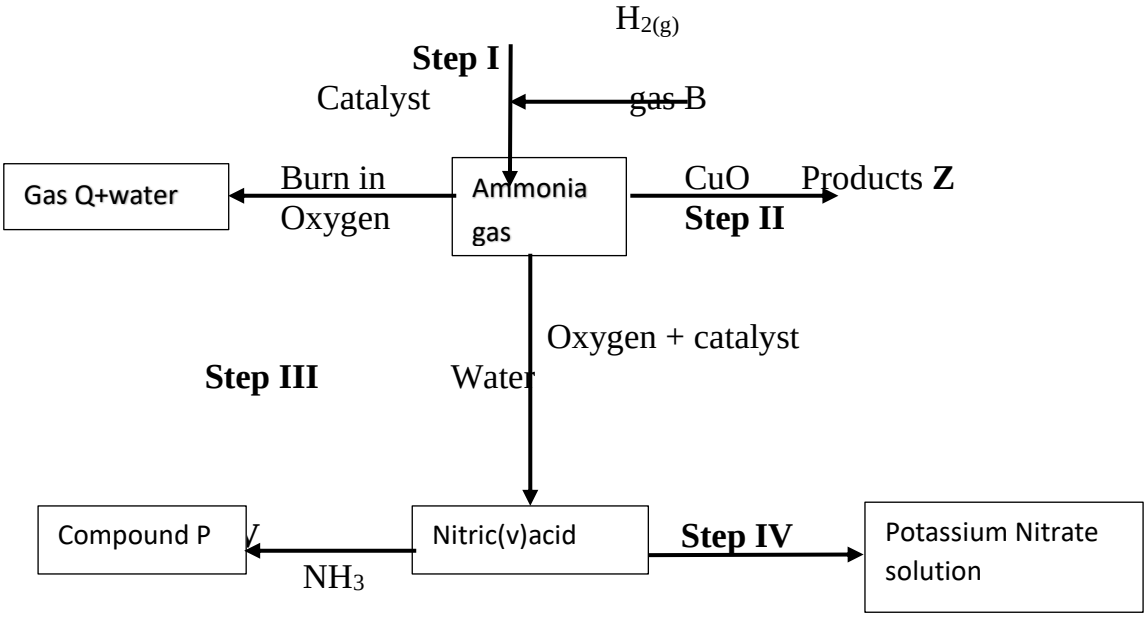
……

c) Write an equation for the reaction between K and slaked lime (1mk)

…..……..

d) Write an ionic equation for the reaction with copper(II) sulphate forming the deep blue solution
(1mk)

b) Study the flow chart below and answer questions that follow:



(i) State **one** source of gas B (1mk)

……

……

(ii) Name the catalysts used in; (1mk)

a) Step I

……

b) Step III

……

(iii) Write chemical equations for reactions in; (3mks)

a) Step I

……

b) Step II

……

c) Step V

……

(iv) Identify any other gas that can be used instead of Ammonia in step II (1mk)

……

(v) State one use of gas Q (1mk)

……

……

Name:……**.Index No:**……

School:……**Venue**……**Adm no:**……**Class:**……

Candidate's Signature:……

Date: ……

233/3
CHEMISTRY PRACTICAL
Paper 3
2021
TIME: *2 ¼* **HOURS**

KASSUJET JOINT EXAMINATIONS 2021

Kenya Certificate of Secondary Education (K.C.S.E)
233/3
Chemistry Practical
Paper 3
2 ¼ **Hours**

INSTRUCTIONS TO CANDIDATES:

- Answer all the questions in the spaces provided in the question paper.
- You are **NOT** allowed to start working within the first 15 minutes of the 2 ¼ hours allowed for this paper. This time is to enable you read the question paper and make sure you have all the chemicals and apparatus that you may need.
- All working **MUST** be clearly shown.
- Mathematical tables and silent scientific calculators may be used.
- This paper consists of **7 printed** pages.
- Candidates should check to ascertain that all papers are printed as indicated and that no questions are Missing

For Examiner's Use Only:

Question	Maximum score	Candidate's score	Examiner's initials
1	22		
2	11		
3	7		
Total score	40		

iii) You are provided with:

- ***5.0g*** *of* ***solid X*** *in a boiling tube*

- ***Solution Y,*** *which is acidified Potassium manganate (VII) containing* ***9.0g*** *of Potassium manganate (VII), $KMnO_4$, in 1000cm^3 of solution.*

You are required to determine:

(i) The solubility of solid X at different temperatures

(ii) The number of moles of water of crystallization in solid **X**

Procedure

i).Using a 10 cm^3 measuring cylinder add 4cm^3 of distilled water to solid **X** in the boiling tube. Heat the mixture while stirring with the thermometer to **about 85^{0}C.**When **all** the solid has dissolved allow the solution to cool while stirring with the thermometer.(You can occasionally immerse the boiling tube in a beaker of tap water).Note the temperature at which crystals of solid **X** first appear. Record this temperature in table 1.

ii) Add 2cm^3 of distilled water to the contents of the boiling tube warm the mixture while stirring with the thermometer until **all** the solid dissolves. Allow the mixture to cool while stirring. Note and record the temperature at which crystals of solid **X** first appear.

iii)Repeat procedure (ii) ***three*** more times and record the temperature in the table 1. **Retain the contents of the boiling tube** for use in the procedure (v).

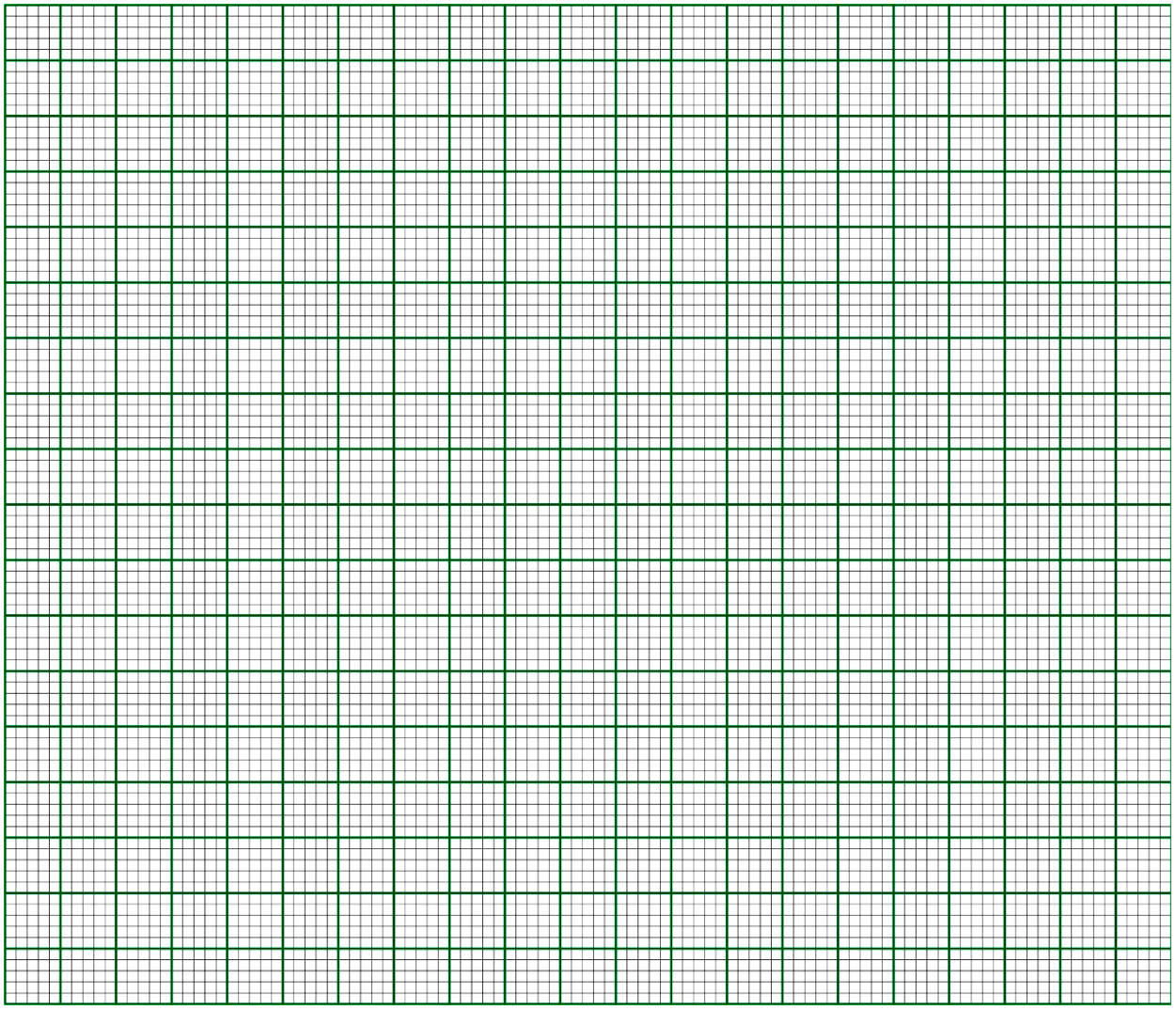
iv).a).Complete table 1 by calculating the solubility of solid **X** at different temperatures.

Table 1

Volume of water (cm^3)	**Temperature at which crystals(^{0}C)**	**Solubility of solid X (g/100g of water)**
4		
6		
8		
10		
12		

(6 marks)

b). On the grid provided, plot a graph of solubility of solid X (vertical axis) against temperature. (3 marks)



c).Using your graph, determine the temperature at which 100g of solid **X** would dissolve in 100cm^3 of water. (1 mark)

Procedure II

iv) a).Transfer the contents of the boiling tube into a 250ml volumetric flask, rinse both the boiling tube and the thermometer with distilled water and add to the volumetric flask. Add more distilled water to make up to the mark. Label this solution **X**. Fill a burette with solution **Y**. Using the pipette and pipette filler, place 25.0cm^3 of solution **X** into a conical flask. Warm the mixture to about 60^{0}C. Titrate the hot solution **X** with solution **Y** until a permanent pink colour persists. Continuously shake the mixture during the titration. Record your readings in table 2. Repeat the titration two more times and complete the table2.

Table 2

Titration	I	II	III
Final burette reading (cm^3)			

Initial burette reading (cm^3)			
Volume of solution Y used (cm^3)			

(4 marks)

b). Calculate the:

I. average volume of solution Y used (1 mark)

II. Number of moles of Solution Y, Potassium manganate (VII) used (K=39, Mn=55, O=16) (2 marks)

III. Number of moles of X in $25cm^3$ of solution X given that 2 moles of potassium manganate (VII) react completely with 5 moles of X (1 mark)

IV. Number of moles of X in $250cm^3$ of solution (1 mark)

V Relative formula mass of X, (1 mark)

c). The formula of **X** has the form $\boldsymbol{X}.Nh_2O$. Determine the value of n in the formula given that the relative mass of **X** is 90.0 (O=16.0, H=1.0) (2 marks)

v) You have been provided with **solid R.** Carry out the tests below

(a) Transfer all the solid R to a boiling tube. Add about $6cm^3$ of distilled water and shake the mixture thoroughly. Allow to settle

then carefully filter into another boiling tube. **Retain the residue for part (b)**

Divide the filtrate into ***three*** portions

vi) To the first portion of the **filtrate** in a test tube, add few drops of 2M lead (II) nitrate solution and warm

Observations	Inferences
(1 mark)	(1/2 mark)

vii) To the second portion of the **filtrate** in a test tube, add 2M sodium hydroxide solution drop wise until in excess

Observations	Inferences
(1 mark)	(1 mark)

(iii)

(I) Describe how you would carry out a **flame test** on the solution obtained.

Procedure	Expected observation
(1 mark)	(1 mark)

(II) On the third portion of the **filtrate**, carry out the flame test described above

Observations	Inferences
(1/2 mark)	(1/2 mark)

b). i).To the residue in a boiling tube add 2M hydrochloric acid provided drop wise until there is no more change. Test for any gas using a burning splint.

Divide the resultant solution into ***two*** portions

Observations	Inferences
(1 marks)	(1/2 mark)

ii). To the first portion, add 2M sodium hydroxide solution drop wise until in excess

Observations	Inferences
(1 mark)	(1/2 mark)

iii). To the second portion, add 2M ammonium hydroxide solution until in excess

Observations	Inferences
(1 mark)	(1/2 mark)

3. You are provided with solid **H**. Carry out the tests below. Write your observations and inferences in the spaces provided.

a). Using a clean metallic spatula, heat about one third of solid H in a Bunsen burner flame.

Observations	Inferences
(1 mark)	(1 mark)

b). Dissolve the remaining portion of **solid H** by adding about 6cm^3 of distilled water and divide the solution into **3 portions.**

i) To the first portion, add two drops of acidified potassium manganate (VII) solution

Observations	Inferences
(1 mark)	(1 mark)

viii) To the second portion, add two drops of bromine water

Observations	Inferences
(1 mark)	(1 mark)

ix) Determine the Ph of the third portion using universal indicator paper

Observations	Inferences
(1/2 mark)	(1/2 mark)

Name…… Index No……/…….

Candidates Signature……

Date ……..

233/1
CHEMISTRY
Paper 1
2 Hours

KAPSABET CANDIDATES 2020 TRIAL KCSE MOCK EXAM

Kenya Certificate of Secondary Education (K.C.S.E)

233/1
CHEMISTRY
Paper 1

2 Hours

Instructions to Candidates

(a) Write your name and index number in the spaces provided above.
(b) Sign and write the date of examination in the spaces provided above
*(c) Answer **ALL** the questions in the spaces provided in the question paper*
(d) KNEC Mathematical tables and electronic calculators may be used for calculations
*(e) All working **MUST** be clearly shown where necessary*
(f) This paper consists of 15 printed pages
(g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing
(h) Candidates should answer the questions in English

FOR EXAMINER'S ONLY

QUESTION	MAXIMUM SCORE	CANDIDATES SCORE
1-29	80	

This paper consists of 13 printed pages. Candidates should check the question paper to Ensure that all the pages are printed as indicated and no questions are missing

1. Give the name and formula of;

(i) A complex cation containing a transition metal (1mark)

……..……

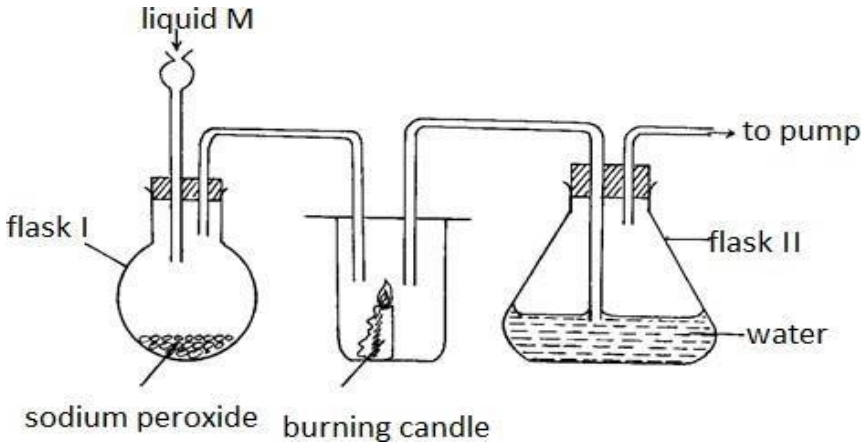
…….

(ii) A complex anion containing a transition metal (1mark)

……..……

……..

2. The diagram below shows a set up of apparatus used to prepare oxygen gas and pass it over burning candle. The experiment was allowed to run for several minutes.



(i) Identify liquid M. (1mark)

……..……

……

(ii) Write an equation for the reaction that forms oxygen gas in the set up. (1mark)

……..……

……

(iii) The pH of the solution in flask II was found to be less than 7. Explain. (1mark)

……..……

……

3. During heating of a hydrated copper (II) sulphate crystals, the following readings were got.

Mass of evaporating dish = 300g

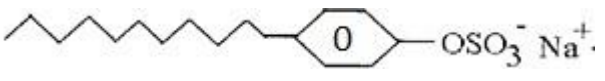
Mass of evaporating dish + hydrated salt = 305g

Mass of evaporating dish + dehydrated salt = 303.2g

Calculate the empirical formula of hydrated copper (II) sulphate. (Cu = 63.5, S=32, O=16, H=1)

(3marks)

4. (a). Identify the following cleansing agents. (1 mark)

i $CH_3(CH_2)CH_2-\underset{\underset{O}{\|}}{C}-O\text{-}Na^+$ ii 

…… ……

(b). State one disadvantage of using the cleansing agent in (a) (ii) above. (1mark)

……..……

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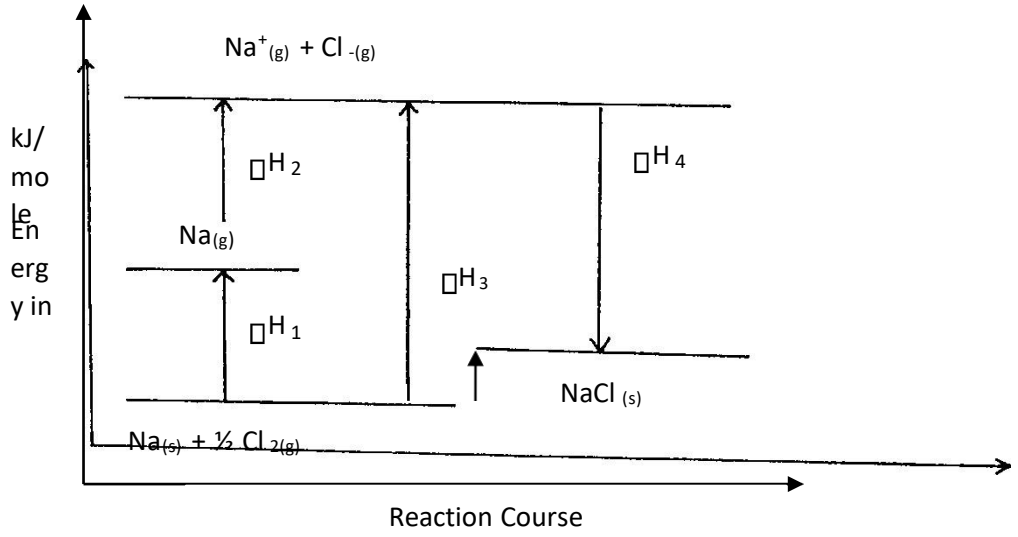
5. Study the energy level diagram below and answer the questions that follow.



(a). Identify the enthalpy changes represented by

ΔH_1 ..... ½ mark

ΔH_2 ..... ½ mark

ΔH_4 ..... ½ mark

(b). Given that

ΔH_1 = + 434 KJ/Mol

ΔH_2 = + 371 KJ/Mol ΔH_3 = + 483 KJ/Mol

ΔH_4 = - 781 KJ /Mol

Calculate the enthalpy change (Δ H) for the reaction. (1½ marks)

$Na_{(s)} + ½ Cl_{2(g)} \longrightarrow NaCl_{(s)}$

……..……

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……..……

……

6. Giving a reason in each case, identify an acid and a base in the equation.

$H_3O^+_{(aq)} + NH_{3(aq)}$ $NH_{4(aq)}^+ + H_2O$

$\longrightarrow$

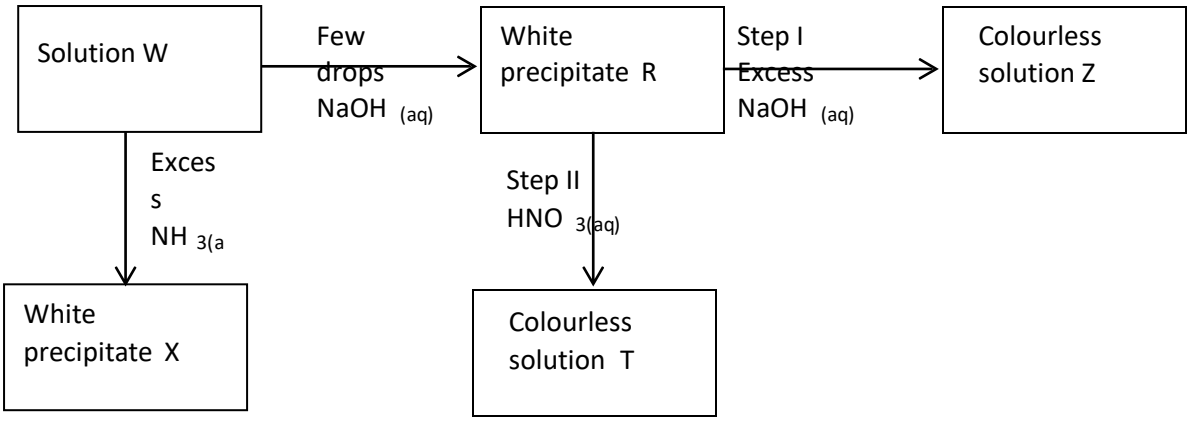
Acid .....½ mark

Reason ..... ½ mark

Base ..... ½ mark

Reason ..... ½ mark

7. Study the reaction scheme **below** and answer the questions that follow.



(a) What property of the white precipitate **R** is demonstrated by steps **I** and **II**. (1 mark)

……..……

……

(b)If the metal ion in solution **W** is divalent suggest its identity. (1mark)

……..……

……

(c)Write an ionic equation for the reaction taking place in step **I**. (1 mark)

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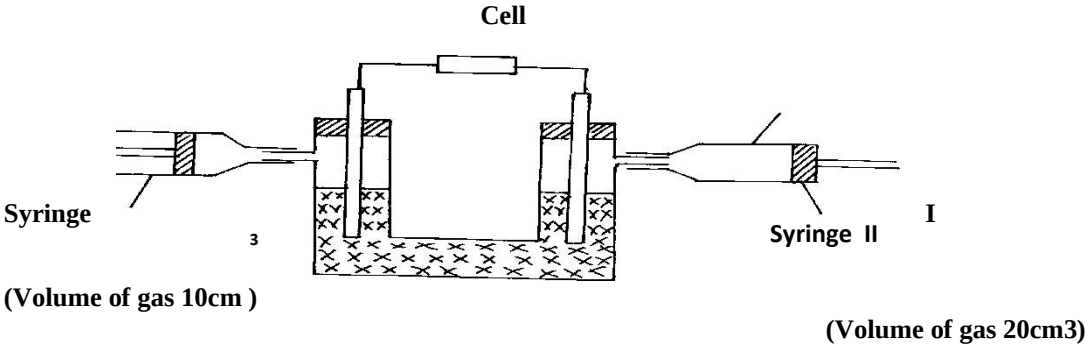
8. The diagram below shows a set up that was used to electrolyse aqueous magnesium chloride.



i) On the diagram above, using arrows, show the direction of flow of electrons. (1mark) ii) Identify the syringe in which oxygen gas would be collected. (1mark)

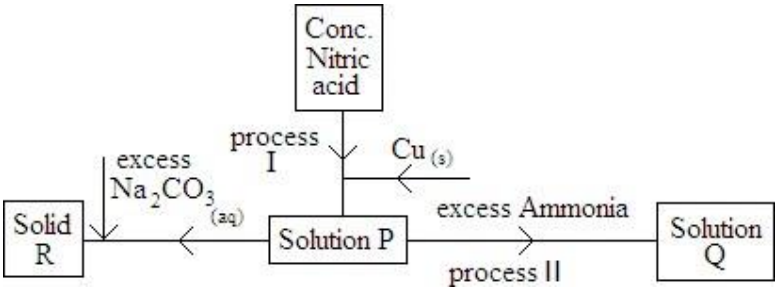
……..……

iii) State and explain the change of magnesium chloride concentration at the end of the experiment. (1 ½ marks)

……..……

……

9. Study flow chat below and answer the questions that follow.



(i).Write a chemical equation to show how solid R is formed. (1mark)

……..……

……

(ii).Write observation made in process (II). (1mark)

……..……

……

10. The table below shows the standard reduction potentials for four half–cells. Study it and answer the questions that follow (letter are not the actual symbols for the elements)

			E^{θ} (Volts)
$F_{2(aq)}$ +	⟶	2 e $2F_{-(aq)}$	+0.54
$G_{2+(aq)}$ +	⟶	2e $G_{(s)}$	-0.44
$H_{2+(aq)}$) +	⟶	2e $H_{(s)}$	+0.34
$2J_{+(aq)}$ +	⟶	2e $J_{2(g)}$	0.00

i. Identify the strongest reducing agent. (1mark)

……..……

……

ii. Write the equation for the reaction which takes place when solid G is added to a solution containing H^{2+} ions. (1 mark)

……..……

……. iii.

Calculate the E^0 value for the reaction in (ii) above. (1mark)

11. (a) State the Charles' law. (1mark)

……

……

(b) A certain mass of gas occupies 146dm^3 at 291K and 98.31kPa. What will be its temperature if its volume is reduced to 133dm^3 at 101.325 kPa? (2 marks)

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……..……

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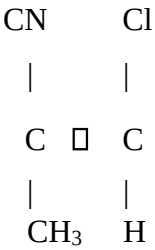
12. Below is the structure of a monomer used in polymerization.



a) Draw the structure of part of the polymer involving 3 units. (1mark)

b) What type of polymerisation takes place? (1mark)

……..……

……

c) Give one advantage of artificial fibres over natural ones. (1mark)

……..……

……

13. $20.0cm^3$ of NaOH solution containing $8.0gdm^{-3}$ were required for complete neutralization of 0.118g of a dibasic acid. Calculate the Relative Molecular Mass (R.M.M) of the acid.

(Na=23, O=16, H=1) (3marks)

……..……

……..……

……..……

……..……

……..……

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14. The table below shows the results obtained when a current of 2 amperes is passed through copper II sulphate solution for 15 minutes.

Initial mass of cathode	1.0g
Final mass on cathode	1.60g
Change in mass at the cathode	0.60g

Calculate the quantity of electricity required to deposit one mole of copper (Cu= 63.5) (2marks)

……..……

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……..……

……

15. The following equation shows a reversible reaction. $\Delta H = -74.4kJ$

$$H_{2(g)} + Br_{2(g)} \rightleftharpoons 2HBr_{(g)}$$

reddish brown *colourless*

(a). **State** and explain the observation that can be made when:-

(i). Temperature is increased. (1½marks)

……..

……

(ii).Pressure is reduced. (1½marks)

……

……

16. *You are provided with:* A clean metallic spatula
Distilled water
Lead (II) nitrate solution
Source of heat
A rack of test – tubes
A white solid suspected to be sodium chloride
Required
Draft a procedure you would use to enable you test and confirm that the white solid is a chloride compound. (3marks)

Test	**Observation**	**Inference**

17. Sulphur is one of the elements with varying oxidation States

(a) What is oxidation state? (1mark)

……..……

……

(b) Determine the oxidation state of sulphur in SO_3^{2-} (1mark)

……..……

……

(c) Give the electron pattern of sulphur in SO_3^{2-} (1mark)

……..……

……

18. When fuels burn in the internal combustion engine at high temperature, one of the products formed is nitrogen (II) oxide.

(a) Write the equation for the formation of nitrogen (II) oxide. (1mark)

……..……

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(b) Give a reason why nitrogen (II) oxide is not formed at room temperature. (1mark)

……

……

(c) Describe how formation of nitrogen (II) oxide in the internal combustion engine leads to gaseous pollution? (1mark)

……

……...

19. Use part of the periodic table grid below to answer questions that follow. (Letters do not represent actual symbols of the elements)

				A		B	C	
D			E	F			G	
							H	

a) Which is the most reactive non-metal? Explain. (1 mark)

……..……

……

b) Name the bond type formed when element A and B react. Explain. (1 mark)

……..……

……

c) Giving a reason compare the atomic radius of element D and E. (1mark)

……..……

……

20. Use the standard enthalpies of combustion given below to calculate the enthalpy of formation of ethane.

$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta H_C = -394 Kjmol^{-1}$

$H_{2(g)} + O_{2(g)} \rightarrow H_2O_{(l)}$ $\Delta H_C = -286 Kjmol^{-1}$

$C_2H_{6(g)} + 5O_{2(g)} \rightarrow 2CO_{2(g)} + 3H_2O_{l)}$ $\Delta H_c = -1300 Kjmol^{-1}$ (2 ½ marks)

21. Describe how a solid sample of Lead (II) Sulphate would be prepared using the following reagents.
Dilute Sulphuric (VI) acid, Nitric (V) acid, solid lead (II) Carbonate. (3marks)

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……..……

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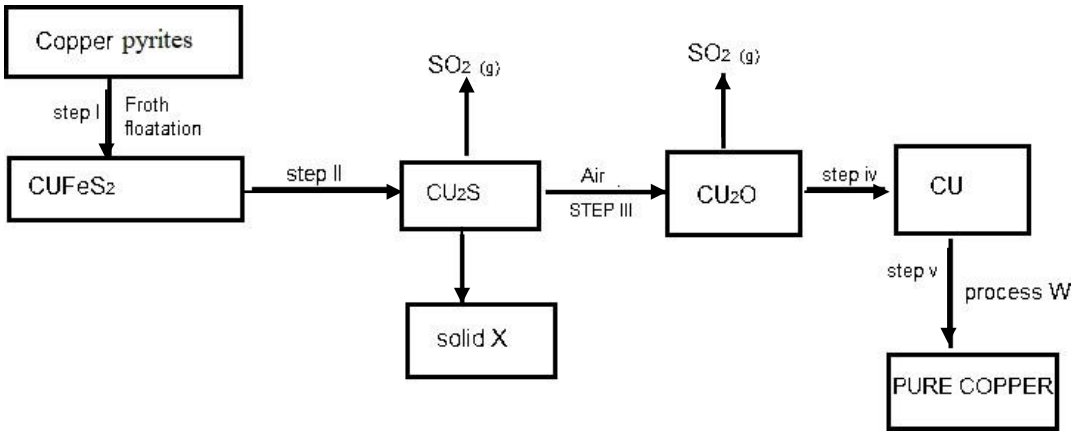
22. Study the flow chart below and answer the questions that follow



a. Identify

i. Solid X (½ mark)

……

ii. Process W (½ mark)

……

b. Write an equation for the reaction in step II. (1mark)

……..……

……

c. Explain why Copper is suitable in making soldering equipment. (1mark)

……..……

……

23. The table below gives the rate of decay for a sample of radioactive element P.

Mass of P(g)	**Number of days**
48	0
18	90
6	180

a) Determine its half-life (1mark)

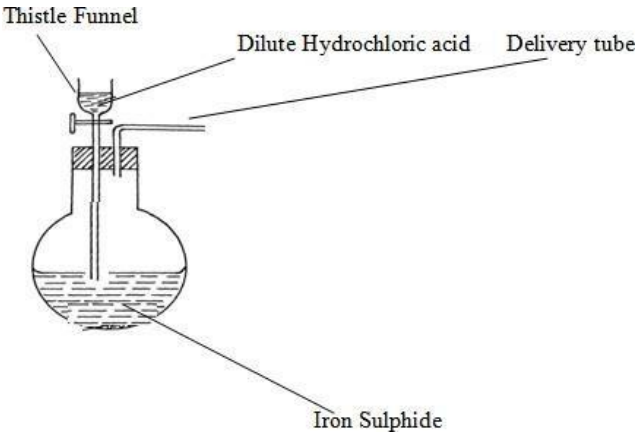
……..……

……

b) Complete the following nuclear equation (1mark)

$$^{14}_{6}C \longrightarrow \_\_\_\_\_ + {}^{0}_{-1}e$$

24. Complete this set up below for the preparation and collection of dry Hydrogen Sulphate. (3marks)

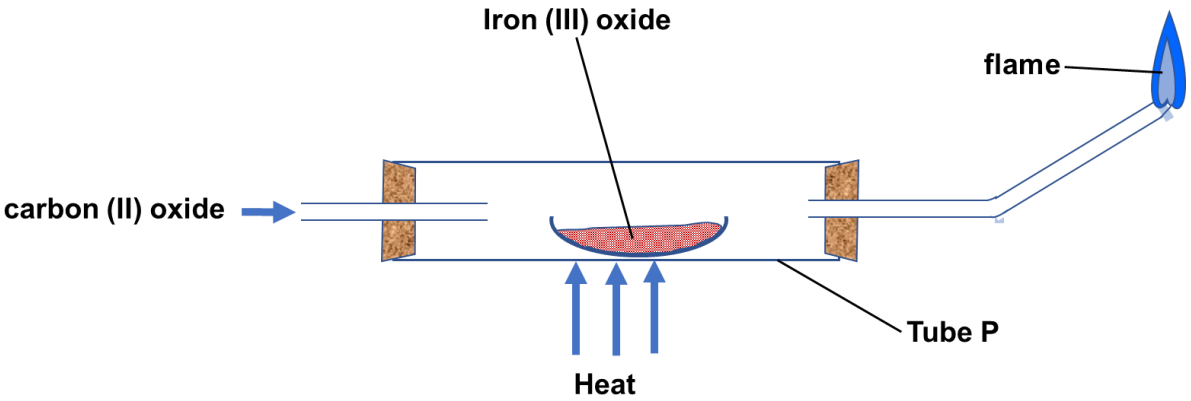


25. Using dots (**.**) and crosses (**x**) to represent elections draw diagram to represent

(i) NH_4^+ (1½ mark)

(ii) Mg_3N_2 (1½ mark)

26. A sample of carbon (II) oxide gas was passed through hot iron (III) oxide in a combustion tube P.



(i) State the observation made in **Tube P**. (1 mark)

……..……

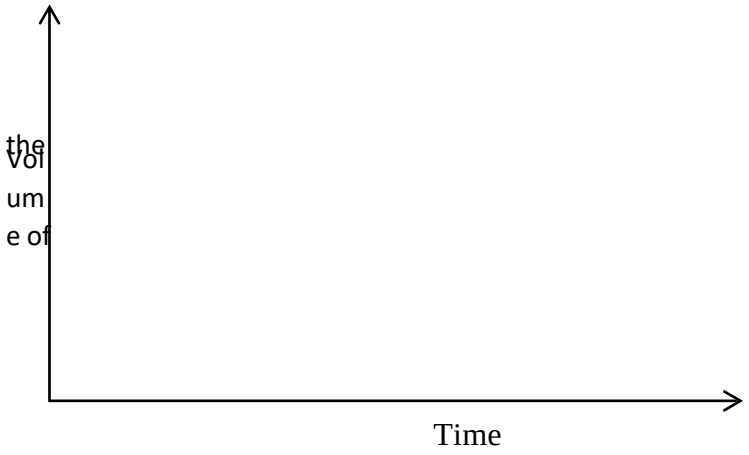
……. (ii)

Write a chemical equation for the reaction that took place in **Tube P**. (1 mark)

27. A student performed three experiments on the reaction of magnesium with dilute hydrochloric acid and collected the hydrogen gas evolved for each experiment.

(i) **Experiment I:** Reacted 2g of magnesium ribbon with 1M hydrochloric acid.
(ii) **Experiment II:** Reacted 2g of magnesium powder with 1M hydrochloric acid
(iii) **Experiment III:** Reacted 2g of magnesium ribbon with 0.5M hydrochloric acid

On the grid **below** sketch the graphs for each of the three experiments performed. (3marks)



28. In the manufacture of sodium carbonate by solvay process, ammoniated brine trickles down the carbonator while carbon (IV) oxide rises up the same tower.

a) What is ammoniated brine? (1/2 mark)

……..……

……

b) What is the main source of carbon (IV) oxide in the above process? (1/2 mark)

……..……

……

c) Write two equations for the reactions in the carbonator (2 marks)

29. The table below shows the solubility of a salt at various temperatures.

Temperature ^{0}C	Solubility (g/100g water)
0	36
40	30
80	25
100	22
120	20

Define the term **Fractional Crystallization.** (1 mark)

(a) A saturated solution of the salt at 40^0C was heated to 100^0C. State and explain the observation made. (1mark)

(b) Calculate the mass of salt formed when a saturated solution of the salt at 0^0C is place in a water bath maintained at 100^0C. (1 mark)

KAPSABET HIGH SCHOOL

233/2 (Kenya Certificate of Secondary Education) Paper 2

INTERNAL MOCK EXAM

CHEMISTRY

(THEORY)

Dec. 2020– 2 Hours

Name…… **Index No**……

Adm No…… **Date:**……

Signature …… **Stream:**……

Instructions to candidates

a) Write your Name, Index, Admission number and stream in the spaces provided above.
b) Sign and write the examination date on the spaces provided above.
c) Answer all the questions in the spaces provided.
*d) All workings **must** be clearly shown where necessary.*
e) KNEC mathematical tables and non-programmable silent electronic calculators may be used.
*f) **Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.***
*g) **Candidates must answer the questions in English.***

For Examiners use only

Question	Maximum Score	Candidate's Score
1	10	
2	13	
3	10	
4	13	
5	11	
6	10	
7	13	
Total Score	80	

1. a) Define radioactivity (1mark)

……

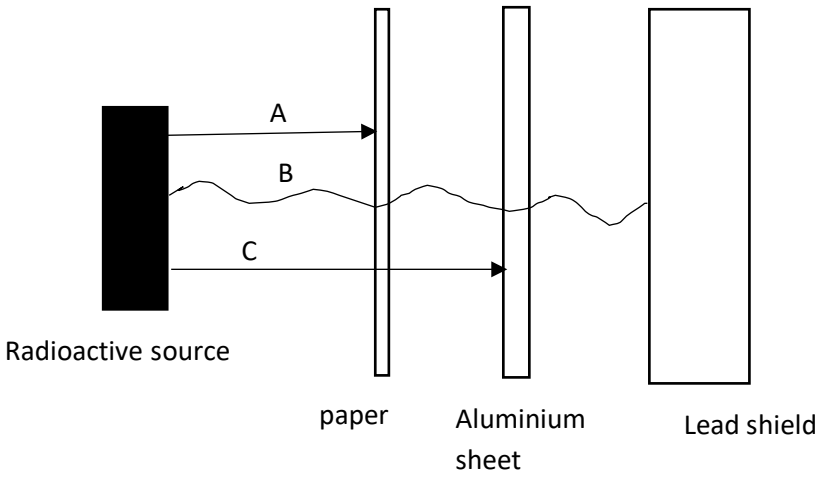
……

……

2. b) Give two differences between chemical reactions and nuclear reactions. (2marks)

Chemical reactions	Nuclear reactions

c) Study the diagram below and answer the questions that follow



i) What property of radiations is being investigated by the illustration above 1mark)

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ii) Give the name of the radiation B and give a reason. (1mark)

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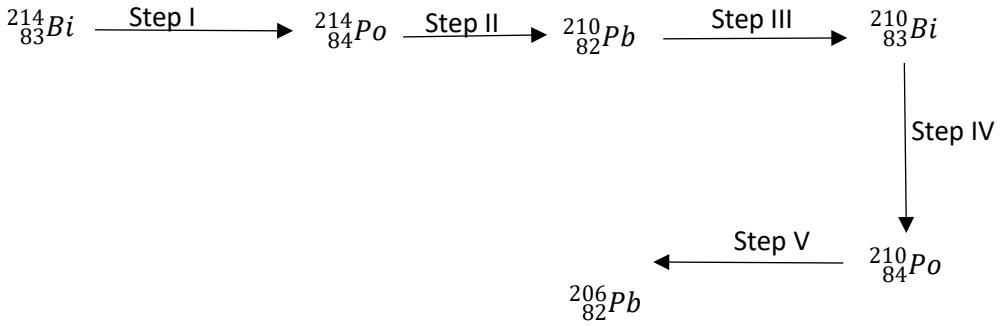
iii) B below is the radioactive decay starting with $^{214}_{83}Bi$, study it and answer the questions that follow.



i) Identify the radiations emitted at:

I. Step I …… (1mark)

II. Step V …… (1mark)

ii) Write a nuclear equation for step II (1mark)

……

……

……..…

e) State one danger associated with frequent exposure to radiations. (1mark)

……

……

……

3. a) The amount of salt A that can dissolve in water at different temperatures is shown in the table below

Temperature (^oC)	0	10	20	30	40	60	80	90
Solubility of salt A g/100g of water.	36.1	35.5	34.8	34.2	33.7	32.6	31.4	30.9

i) Draw a graph of solubility of salt A against temperature. (3marks)

ii) How does solubility of salt A vary with temperature? (1mark)

……

……

…… iii)

From the graph determine the:

I. Solubility when the temperature would be 50^0C (1mark)

……

…….

II. Temperature at which the solubility will be 31.8g/ 100g of water. (1mark)

……

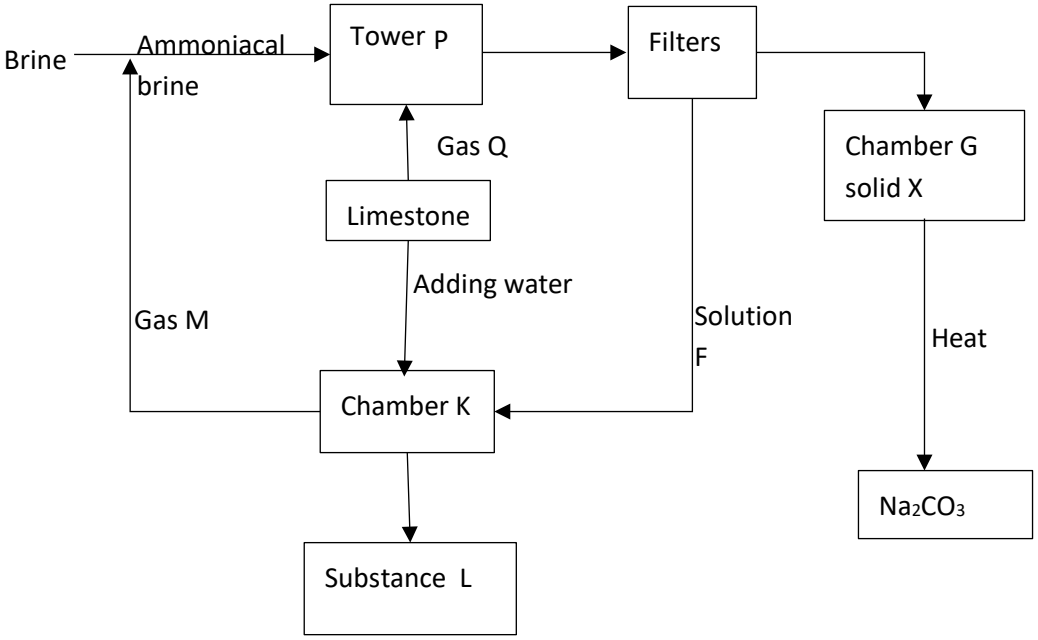
……

iv) State one industrial application of solubility (1mark)

……

……

b) The flow chart below shows industrial manufacture of sodium carbonate by solvay process. Study it and answer the questions that follow.



i) Name

I. Gas Q …… (½mark)

II. Gas M …… (½mark)

III. Solution F ……..…… (½mark)

IV. Substance L …… (½mark)

ii) Write equations for the reactions that occurred;

I. Chamber K (1mark)

……

……

II. Heating solid X (1mark)

……

……

iii) Give one use for each of the compounds:

I. Substance L (1mark)

……

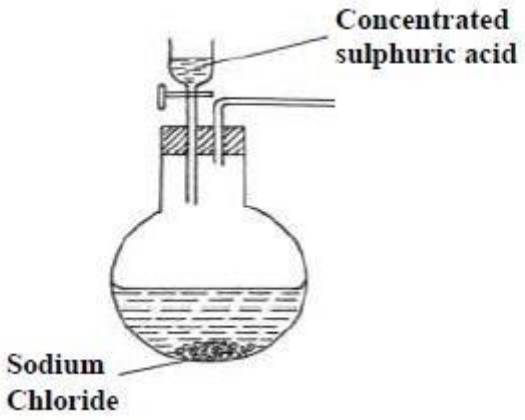
……..……

II. Na_2CO_3 (1mark)

……

……

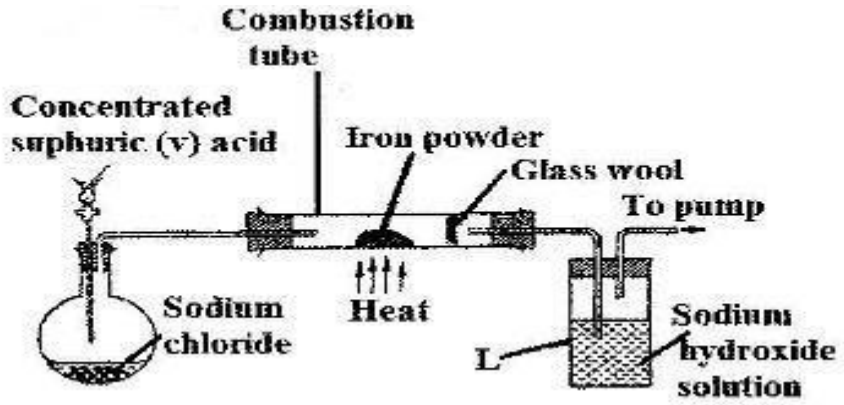
4. a) The diagram below was a setup used by a form three student in Kapsabet Boys to prepare, dry and collect hydrogen chloride gas.



i) Complete the diagram to show how a sample of hydrogen chloride gas was prepared, dried and collected. (3marks)

ii) Write a balanced chemical equation to shows how hydrogen chloride is formed in the flask. (1mark)

b) Dry hydrogen chloride gas was passed through hot iron filings as shown below.



i) State and explain observation that would be made in the combustion tube. (2marks)

……

……

……

ii) What is the purpose of having sodium hydroxide in beaker labelled L. (1mark)

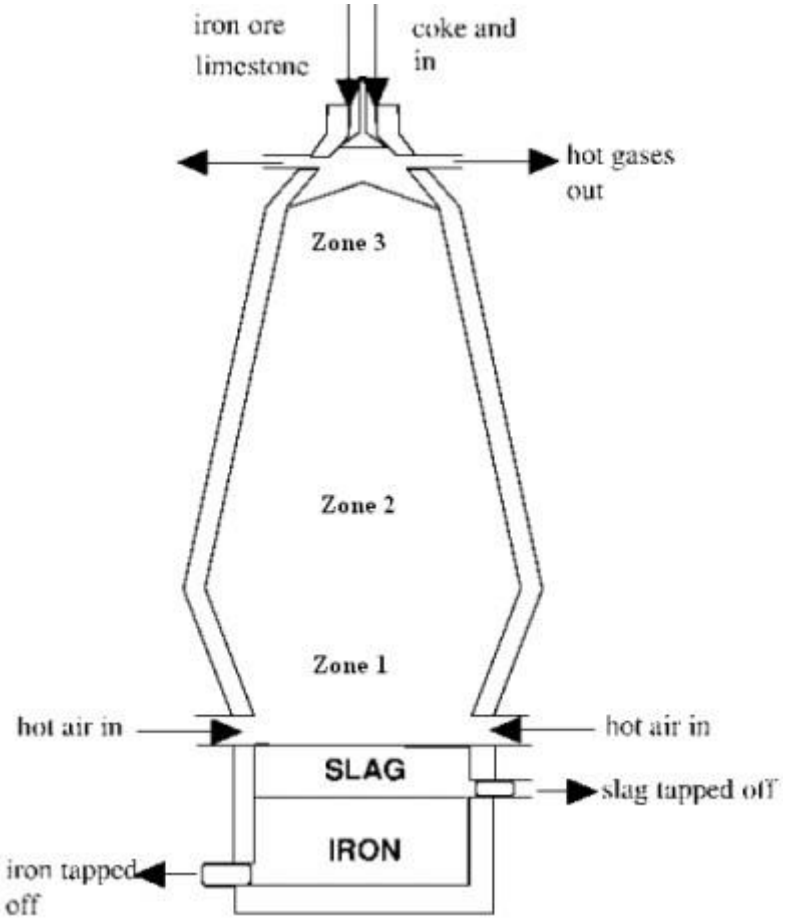
……

……

iii) In the experiment above 600cm^3 of hydrogen chloride gas were used completely. Determine the mass of the product that would be formed in the combustion tube.
(Fe = 56.0, Cl =35.5, Molar Gas Volume =22.4 litres at s.t.p) (3marks)

5. a) A sample of an ore was suspected to have a compound of iron, describe how it can be established that the ore contains iron. (3marks)

b) The diagram below represents a blast furnace used in the extraction of iron. Study it and answer the questions that follow.



i) Name two ores from which iron can be extracted. (2marks)

……

……

…… ii)

Write chemical equations for the reactions that occur in the zones:

Zone 1 (1mark)

……

……

Zone 2 (1mark)

……

……

Zone 3 (1mark)

……

……

iii) What are the two impurities found in the ore of iron? (1mark)

……

……

iv) Using chemical equations explain how the impurities are removed from the ore. (3marks)

v) State the effect of the gases produced in this process on the environment. (1mark)

……

……

6. a) The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters used are not the actual symbols of the elements.

				N		S		
K	Q		O			P	F	M
	R							

i) What name is given to the group of elements to which Q and R belong? (1mark)

……

……

ii) Write a chemical equation for the reaction that would occur when R and F react. (1mark)

……

……

iii) Compare the atomic radius of O and P. (2marks)

……

……

…… iv) Draw a dot (.) and across (X) diagram for the compound formed between N and F

(2marks)

v) Describe how a pure sample of carbonate of K can be obtained from a mixture with lead (II) carbonate. (3marks)

……

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……

b) The melting point of silicon (IV) oxide is 1728^{o}C while that of sulphur (IV) oxide is -76^{o}C. Explain (2marks)

……

……

……

7. a) Draw and give names of the structures of the compounds below.

$CH_3CHCHCH_3$ (1mark)

……

……

$CH_3CH_2CH_2COOH$ (1mark)

……

……

b) The formular below represent a type of detergent. $C_{17}H_{35}COONa$

i) Name the type of detergent represented (1mark)

……

……..

ii) Give one advantage and one disadvantage of using the detergent in (i) Above. (2marks)

……

……

c) Compound P whose formular is given below was a product of a reaction between compound M and compound N.

$CH_3CH_2C00CH_2CH_3$

i) Draw the structures of compounds M and N

M (1mark)

……

……

……

N (1mark)

……

……

……

ii) Name the process that took place for formation of compound P. State the conditions necessary for the process named. (2marks)

……

……

……

d) Compound Q has empirical formula CH_2 and molecular mass 42:

i) Determine the Molecular mass of Q. (1mark)

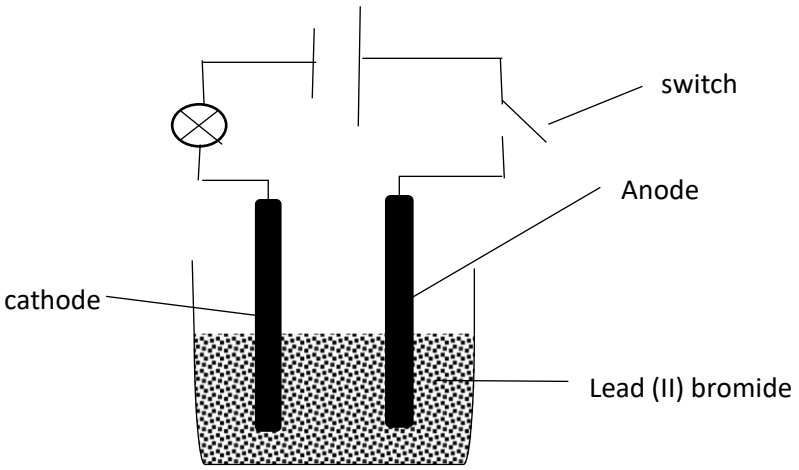
……

……

……

ii) Draw a structure of polymer having three units of the structure in i) (1mark)

a) The diagram below was used in electrolysis of lead (II) bromide. Study it and answer the questions that follow.



After the switch was closed, the bulb did not light. Explain. (1mark)

……

……

i) Write ionic equations for the reactions that occurred at:

I anode (1mark)

……

……

II Cathode (1mark)

……

……

ii) State the precaution that should be taken during carrying out this experiment. (1mark)

……

……

……..

iii) During the electrolysis above 51.75g of lead was deposited in 3hours, determine the amount of current that was used.(1F= 96500 coulombs, Pb = 207) (3marks)

……

b) Use the reduction potentials given below to answer the questions that follow.

Reaction	E^{Θ} (volts)
$A^{2+}(aq) + 2e^- \rightarrow A(s)$	-0.76
$B^{2+}(aq) + 2e^- \rightarrow B(aq)$	-0.44
$C^{+}(aq) + e^- \rightarrow C_2(g)$	0.00
$D^{2+}(aq) + 2e^- \rightarrow D(s)$	+0.34
$\frac{1}{2}E_2(g) + e^- \rightarrow E^-(aq)$	+1.09

i) Identify the strongest reducing agent. Give a reason. (1mark)

……

…… ii) Give two half-cell reactions that would produce the largest e.m.f when connected.

(1mark)

……

……

……

iii) Draw and label an electrochemical cell that can be obtained when the two half-cell reactions mentioned above would be connected (3marks)

iv) Is it possible to store a solution containing ions of A in a container made of B? (1mark)

KAPSABET HIGH SCHOOL

233/3 **(Kenya Certificate of Secondary Education)** **Paper 3**

INTERNAL MOCK EXAM

CHEMISTRY

(PRACTICAL)

Dec. 2020– 2 ¼ Hours

Name…… Index No……

Adm No…… Date:……

Signature ……
Stream:……

Instructions to candidates

a) Write your Name, Index, Admission number and stream in the spaces provided above.
b) Sign and write the examination date on the spaces provided above.
c) Answer all the questions in the spaces provided.
d) You are not allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours. Allowed for this paper. This time is to enable you to read the question paper and make sure you have all the apparatus and the chemicals you may need.
*e) All workings **must** be clearly shown where necessary.*
f) KNEC mathematical tables and non-programmable silent electronic calculators may be used.
g) Candidates should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.
h) ***Candidates must answer the questions in English.***

For Examiners use only

Question	Maximum Score	Candidate's Score
1	23	
2	09	
3	08	

Total Score	40	

1. **You are provided with**
   - Aqueous sulphuric acid labelled solution A
   - Solution B containing 8.0g per litre of Sodium Carbonate - An aqueous solution of substance C, labelled solution C. You are required to determine the:

   - Concentration of solution A
   - Enthalpy of reaction between sulphuric acid and substance C.

   Procedure

   - Using a pipette place 25.0cm^3 of solution A into a 250ml volumetric flask. Add distilled water to make 250cm^3 of solution. Label the solution D. Place solution D in a burette. Clean the pipette and use it to place 25.0cm^3 of solution B into a conical flask. Add 2 drops of methyl orange indicator provided and titrate with solution D. Record your results in table 1. Repeat the titration two more times and complete the table.

   Table 1

	I	II	III
Final burette reading			
Initial burette reading			
Volume of solution D used (cm^3)			

(4mks)

Calculate the

i. Average volume of solution D used. (1mk)

ii. Concentration of Sodium Carbonate in solution B (Na = 23.0, O =16.0, C = 12.0)

(1mk)

iii. Concentration of sulphuric acid in solution D. (2 mks)

iv. The concentration of sulphuric acid in solution A. (1mk)

B. Label six test tubes 1, 2,3,4,5 and 6. Empty the burette and fill it with solution A. From the burette place 2cm^3 of solution A into test tube number 1. From the same burette place 4cm^3 of solution A in test tube 2. Repeat the procedure for test tubes number 3, 4,5 and 6 as shown in table 2.

Clean the burette and fill it with solution C. From the burette, place 14cm^3 of solution C into a boiling tube. Measure the initial temperature of solution C to the nearest 0.5^{0}C and record it in table 2. Add the contents of test tube number 1 to the boiling tube containing solution C. Stir the mixture with thermometer. Note and record the highest temperature reached in table 2. Repeat the process with the other volumes of solution C given in table 2 and complete the table. Table 2

Test tube number	1	2	3	4	5	6
Volume of solution A (cm^3)	2	4	6	8	10	12
Volume of solution C (cm^3)	14	12	10	8	6	4
Initial temperature of solution C (^{o}C)						
Highest temperature of mixture (^{o}C)						
Change in temperature, ΔT(^{o}C)						

(6mks)

i. On the graph paper provided, draw a graph of ΔT (vertical axis) against volumes of solution A used. (3mks)

ii. From the graph, determine

I. The maximum change in temperature (1mk)

II. The volume of solution A required giving the maximum change in temperature. (1mk)

III. Calculate the

I. Number of moles of sulphuric acid required to give the maximum change in temperature. (1mk)

II. Molar enthalpy of reaction between sulphuric acid and substance C (kilojoules per mole of sulphuric acid). Assume the specific heat capacity of solution is $4.2Jg^{-1}K^{-1}$ and density of solution is $1gcm^{-3}$. (2mks)

2. You are provided with solid E. Carry out the following test and write your observations and inference in the space provided.
   a. Place about one –half of solid E in a dry test tube. Heat it strongly and test any gas produced using hydrochloric acid, solution K on a glass rod.

Observations	Inferences

(2mks) (1mk)

   b. Place the rest of solid E in a boiling tube. Add about $10cm^3$ of distilled water. Shake well and use $2cm^3$ portions of the mixture for each of the test below.
      i. To one portion, add aqueous ammonia drop wise until in excess.

ii. To a second portion, add about $1cm^3$ of hydrochloride acid.

Observations	Inferences
(1 mk)	(1 mk)

Observations	Inferences
(1 mks)	(1 mk)

iii. To the third portion, add three drops of aqueous lead (II) nitrate and heat the mixture to boiling.

Observations	Inferences
(1 mks)	(1 mk)

3. You are provide with liquid F carry out the following tests and record your observation and inferences in the spaces provided.

a. Place five drops of liquid F on a CLEAN DRY watch glass and ignite it

Observations	Inferences
(1 mks)	(1 mk)

b. Place $3cm^3$ of liquid F into a test tube followed by $3cm^3$ of distilled water and shake the mixture

Observations	Inferences
(1 mks)	(1 mk)

c. Place about $2cm^3$ of liquid F into a test, add about $1cm^3$ of acidified potassium magnate (VII) and warm the mixture.

Observations	Inferences
(1 mks)	(1 mk)

d). Place about $2cm^3$ of liquid F into a test tube add about $1cm^3$ of acidified potassium dichromate (VI) and warm the mixture.

Observations	Inferences
(1 mks)	(1 mk)

NAME ……..…….. **DATE** ……

INDEX NO. …….…….……...…..… **SIGNATURE** ……..……..

233/1
CHEMISTRY
(THEORY)
PAPER 1
TIME: 2 HOURS.

MOI GIRLS' HIGH SCHOOL

POST MOCK EXAMINATIONS

FORM 4

2021

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATES

f) Write your **NAME** and **INDEX NUMBER** in the space provided above
g) Sign and write the date of examination in the spaces providedabove
h) Answer **ALL** the questions in the spaces provided
i) **ALL** working must be clearly shown where necessary.
j) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1 31	80	
Total score	80	

This paper consists of 9 printed pages.
Candidates should check to ensure that all pages are printed as indicated and no questions are missing

1. State the observations made when a piece of sodium metal is dropped into a beaker containing water. (2mks)
2. During a class experiment, students passed gas X over heated copper metal, the metal changed its colour to black.

(a) Identify gas X. (1mk)
(b) Name the black substance formed. (1mk)

3. Aluminium is extracted from its ore by electrolysis.

(a) Name the main ore of Aluminium . (1mk)
(b) The Aluminium ore in (a) above has a very high melting point.(2015^0C),though it is electrolyzed at a lower temperature of about 900^0 C. Explain how the low temperature is achieved. (1mk)
(c) In the above process, graphite electrodes are used. What is the disadvantage of using this kind of electrodes (1mk)

4. A student added $50cm^3$ of 1.0M aqueous Sulphuric (VI) acid to $50cm^3$ of 2.0M Potassium Hydroxide and the temperature of the resulting solution rose by 4^0 C.

(a) Define the term Molar heat of neutralization. (1mk)
(b) Calculate the molar heat of neutralization
(C=4.2KJKg^{-1} K^{-1} ,Density of solution=1g/cm^3) (2mks)

5. Use the table below to answer the question that follow:

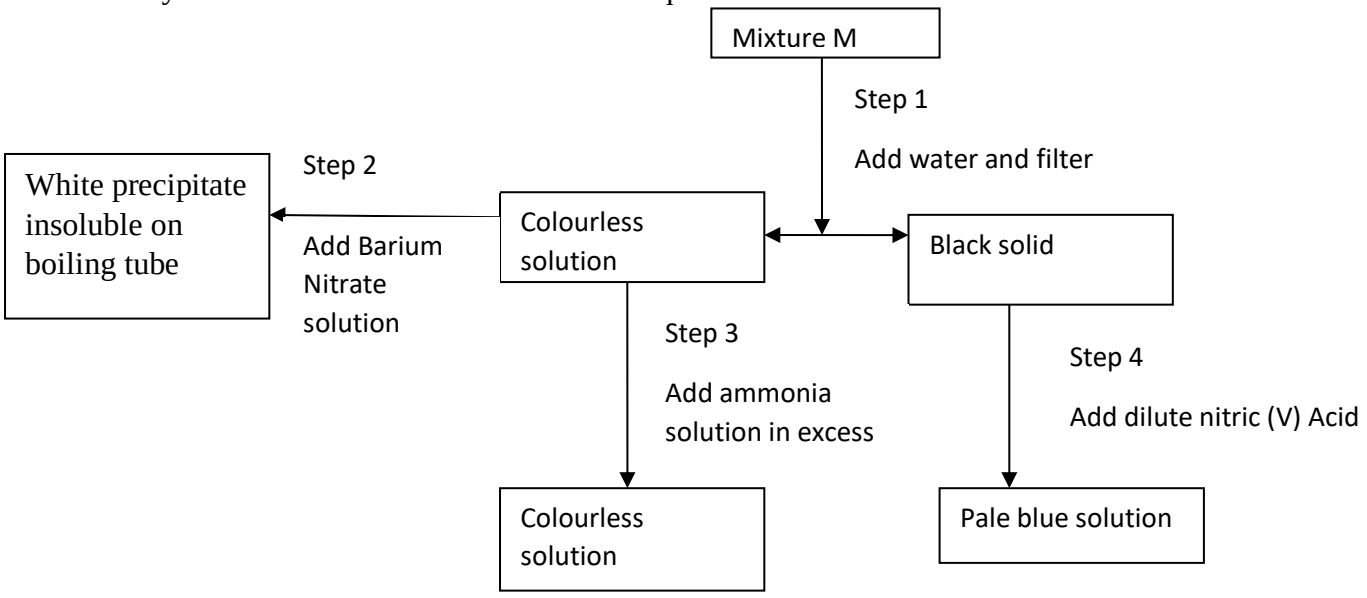
Element	Atomic number
A	11
B	13
C	14
D	17
E	19

(a) Write an equation for the reaction between element A and water. (1mk)
(b) Explain the trend of atomic radii between elements A and D. (2mks)

6. In terms of structure and bonding, explain why graphite is used as a lubricant. (2mks)
7. (a)State the Boyles Law. (1mk)

(b) A given mass of the gas occupies $20cm^3$ at 25^0 C and 670mmHg pressure. Find the volume it will occupy at 10^0 C and 335mmHg. (2mk

7. Study the flow chart below and answer the questions that follow



(a) Name

(i) Cations present in mixture M. (1mk)

(ii) Anion present in thecolourless solution. (1mk)

(b) Write an equation to show how the white precipitate in step 3 dissolves. (1mk)

(c) Name the process outlined in step 4 above. (1mk)

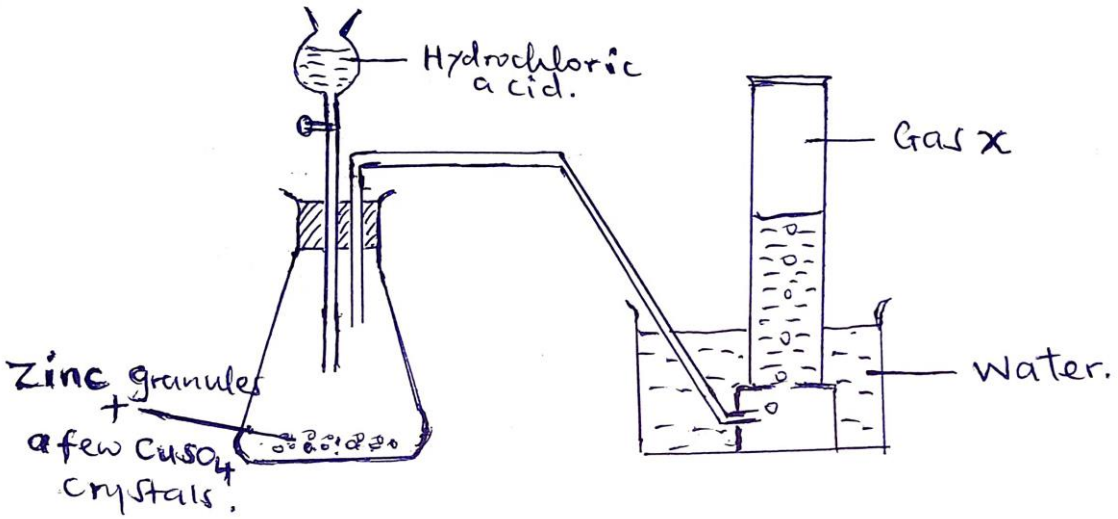
9.The solubility of potassium nitrate is 85g/100g of water at 50 ^{0} C and 32g/100g of water at 25 ^{0} C.

(a) Define the term solubility. (1mk)

(b) Calculate the mass of the crystals formed if a saturated solution of potassium nitrate in 50g of water at 50 ^{0} C is cooled to 25 ^{0} C. (2mks)

10.Magnesium Chloride dissolves in water to form a neutral solution while iron (III) chloride forms an acidic solution. Explain. (2mks)

11. The diagram below is a set up to prepare a certain gas X. Study it and use it to answer the questions



that follow.

(a)Identify gas X. (1mk)

(b)Why is the gas collected over water? (1mk).

(c)Why are Copper (II) Sulphate crystals added to the flask where the reaction takes place?

12. (a)Give the systematic names of the following organic compounds. (2mks)

(i) $CH_3CH_2CH_2CH_2OH$

(ii) $CH_3CH_2COOCH_2CH_3$

(b)Explain why an organic compound with the formula C_4H_8burns with a more sooty flame than C_4H_{10}. (2mks).

13. When solid Zinc Carbonate was added to a solution of Hydrogen Chloride in methylbenzene there was no observable change. On addition of some water to the mixture there was effervescence. Explain the observation. (2mks)

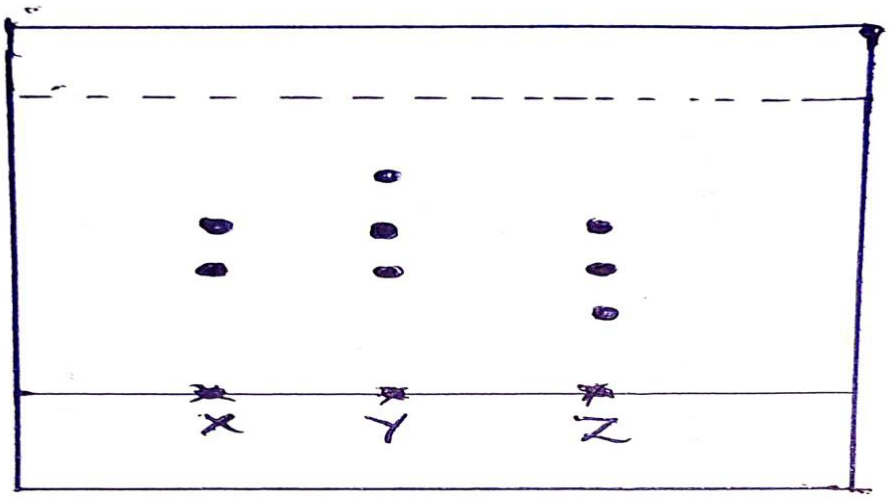
14. In titration experiment,25.0 cm^3 of sodium hydroxide containing 8.0 g per litre was required for complete neutralization of 0.245 g of a dibasic acid. Calculate the relative molecular mass of the acid. (3mks)

15. (a)100g of a radioactive isotope was reduced to 12.5g after 81 days. Calculate the half lifeof the radioisotope. (2mks)

` (b) $^{212}_{80}Y$ decays by beta emission. What is the mass number and the atomic number of the product after decay? (1 mk)

16.(a) Distinguish between ionization energy and electron affinity. ` (2mks)

17.The diagram below represents a paper chromatography for three brands of juice suspected to contain unwanted food additives.



From the results, it was found that unwanted additives are present in Y and Z only.

On the chromatogram;

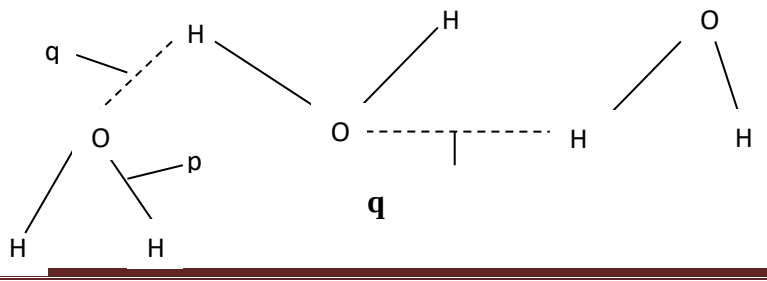
(a)Circle the spots which show unwanted food additives. (1mk)

(b)Name the solvent commonly used in paper chromatography. (1mk)

(c)State two applications of chromatography. (2mks)

18.(a)Show bonding in Aluminium Oxide. (1mk)

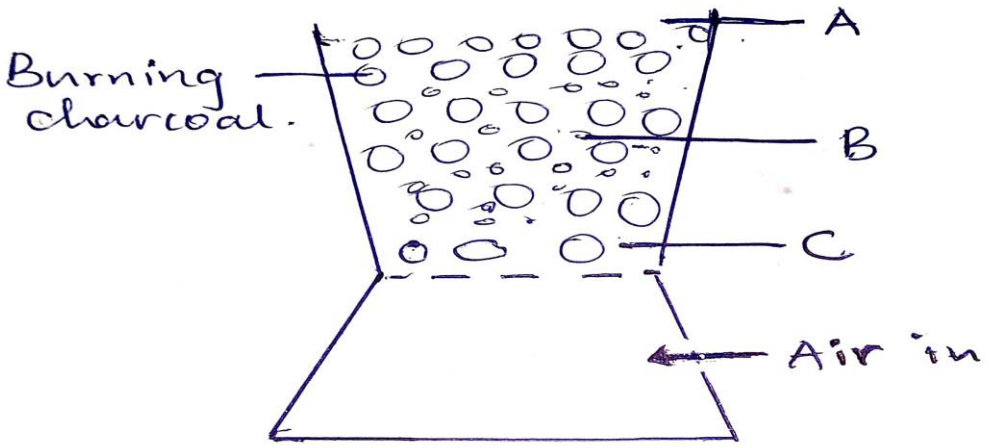
(b)Identify the type of bonds represented by p and q in the substances below.



p- (½ mk)

q- (½ mk)

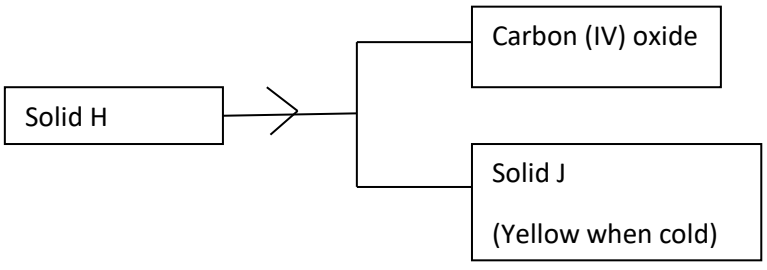
19.The following diagram represents a charcoal burner. Study it and answer the questions that follow:



Write the equations for the reactions at A,B and C regions. (3mks)

A -
B –
C -

20. Use the scheme below to answer the question that follow.



(a)Identify process N. (1mk)

(b)Identify the solids

H- (½ mk)

J- (½ mk)

21.Ammonia gas is prepared by Harber process according to the equation below:

$N_2(g)+3H_2(g) \longrightarrow 2NH_3(g)$ +Heat

State and explain the effect on equilibrium when the following conditions are applied.

(a)Pressure increased. (1mk)

(b)Temperature increased. (1mk)

(c)State Le Chatelier's principle. (1mk)

22. You are given the following half equations.

$I_2(s) + 2e^- \rightleftharpoons 2I^-(aq)$ $E^\Theta = +0.54V$

$Br_2(l) + 2e^- \rightleftharpoons 2Br^-(aq)$ $E^\Theta = +1.09V$

(a)Write an overall equation for the cell reaction. (1mk)

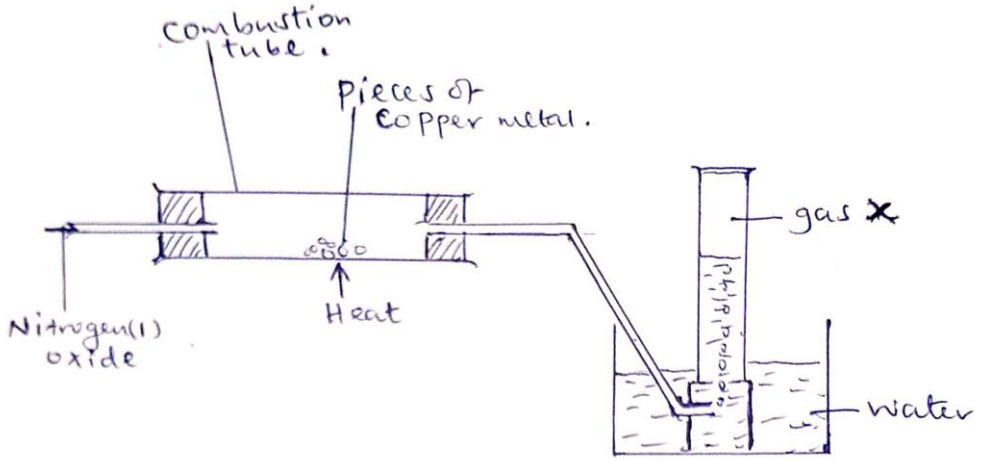
(b)Calculate the E^Θ value of the cell. (1mk)

(c)Name the oxidizing agent. (1mk)

23.When a current of 0.8Ampheres was passed for 44 minutes and 20 seconds through fused iodide of metal Z, 0.7167g of Z was deposited. Determine the charge of the ion of metal Z.

(1 Faraday=96500C,RAM of Z=65) (2mks)

24.The set up below shows how small pieces of copper are heated in nitrogen (I) Oxide.



(a)Write an equation for the reaction which occurs in the glass jar. (1mk)

(b)Give one use of the Nitrogen (I) Oxide. (1mk)

25.State what would be observed if concentrated Sulphuric (VI) Acid is added to:

(a)Sugar crystals. (1mk)

(b)Hydrated Copper (II) Sulphate crystals. (1mk)

(c)What type of reaction has taken place above. (1mk)

26.Explain why commercial indicators are preferred to flower extracts as acid base indicators. (2mks

27.(a)Magnesium reacts with hydrochloric acid according to the following equation.

$Mg(s) + 2HCl(aq) \longrightarrow MgCl_2(aq) + H_2(g)$

Identify the reducing agent. Give a reason for your answer. (2mks)

(b)Iron sheets are dipped in molten Zinc to prevent rusting .Name this process. (1mk)

28.Explain why a balloon filled with helium gas deflates faster than a balloon of the same size filled with argon gas. (2mks)

29.Complete the table below. (2mks)

Solution	**PH**	**Nature of Solution**
H	1.0	
I		Neutral
J		Weak acid
K	13.0	

30.A farmer intended to plant cabbages in his farm. he first tested the PH of the soil and found it to be 3.0.If cabbages do well in alkaline soils, explain the advice that would be given to the farmer in order to realize a high yield. (2mks)

31.Name an appropriate apparatus:

(a)That is used to prepare standard solutions in the laboratory. (1mk)

(b) That is used in heating solid substances strongly. (1mk)

(c)That can be used to separate two immiscible liquids. (1mk)

32.Some plants have seeds that contain vegetable oil.

(a)State the reagent and apparatus used to extract the oil from the seeds. (1mk)

Reagent-

Apparatus-

(b)Explain how it could be confirmed that the liquid obtained from the seeds is oil? (1mk)

(c)State an application of the method of extracting oil above. (1mk

NAME ……..…….. **DATE** ……

INDEX NO. …….…….……...…..… **SIGNATURE** ……..……..

233/1
CHEMISTRY
(THEORY)
PAPER 2
TIME: 2 HOURS.

MOI GIRLS' HIGH SCHOOL

POST MOCK EXAMINATIONS

FORM 4

2021

Kenya Certificate of Secondary Education

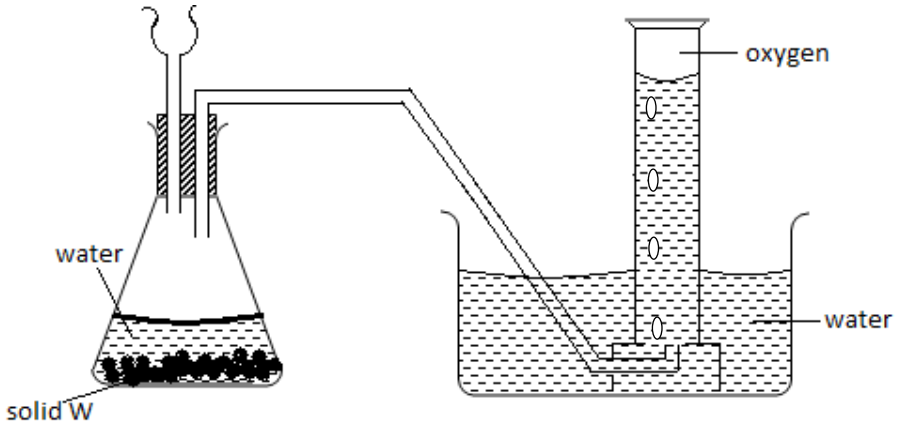
INSTRUCTIONS TO CANDIDATES

a) Write your **NAME** and **INDEX NUMBER** in the space provided above
b) Sign and write the date of examination in the spaces providedabove
c) Answer **ALL** the questions in the spaces provided
d) **ALL** working must be clearly shown where necessary.
e) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINER'S USE ONLY

This paper consists of 12 printed pages. Candidates should check the question paper to ascertain that all pages are printed as indicated and that no pages are missing.

1. The diagram below shows a set up used by a student in an attempt to prepare collect oxygen gas



a) i) Identify and correct the mistakes in the set up to enable the preparation and collection of the gas.
(2mks)

ii) Identify solid w. (1mk)

b) A piece of phosphorous was burnt in excess air. And the product dissolved in hot water to make a solution.

i) Write an equation for the burning of phosphorous in excess air. (1mk)

ii) The solution obtained in (b) above was found to have a pH of 2.0. Give reasons for this observation. (1mks)

c) Explain why cooking pots made of aluminium do not corrode easily when exposed to air. (1mk)

d) The reaction between sulphure (IV) Oxide and oxygen to form Sulphur (VI) Oxide is an exothermic reaction, which can be represented by the equation below;

$2SO_{2(g)} + O_{2(g)} \leftrightarrows 2SO_{3(g)} \quad H = -ve \quad \Delta$

A factory manufacturing sulphuric (VI) acid by contact process produces 350kg of sulphur(VI)oxide per day (conditions for the reaction; catalyst, 2 atmospheres pressure and temperatures between 400 – 500 ^{o}C.)

i) What is meant by an exothermic reaction? (1mk)

ii) How would the yield per day of sulphur trioxide be affected if temperatures lower than 400^{o}C are used? Explain. (1mk)

iii) All the sulphur (VI) Oxide produced was absorbed in concentrated sulphuric acid to form oleum.

$SO_{3(g)} + H_2SO_{4(l)} \rightarrow H_2S_2O_{7(l)}$

Calculate the mass of oleum that was produced per day. (S = 32.0, O= 16: H = 1.0)(3mks)

2. Study the table below and answer the questions that follow:

Compounds	Melting point ^{0}C	Boiling points ^{0}C
$C_2H_4O_2$	16.6	118

C_3H_6	-185.0	-47.7
C_3H_8O	-127	97.2
C_5H_{12}	-130	36.3
C_6H_{14}	-95.3	68.7

(a) (i) Which of the compounds is a solid at 10°C. Explain (1mk)

(ii) Choose two compounds which are members of the same homologous series and explain the difference in their melting points (3mks)

(iii) The compound $C_3H_8O$is an alcohol. How does its solubility in water differ from the solubility of C_5H_{12} in water? Explain (2mks)

(b) Complete combustion of one mole of a hydrocarbon produces four moles of carbon (IV) oxide and four moles of water.

(i) Write the formula of the hydrocarbon (1mk)

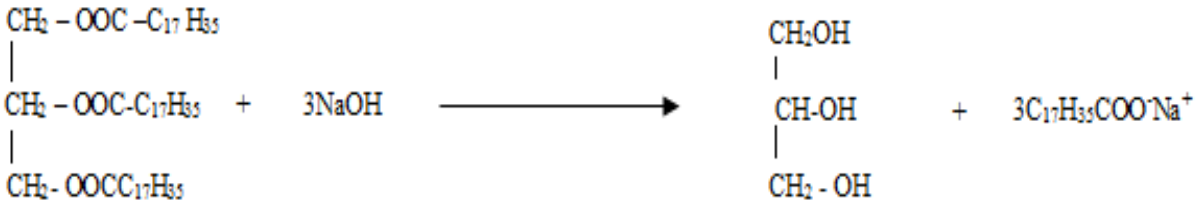
(ii) Write the equation for the complete combustion (1mk)

(c) (i) In a reaction, an alcohol "J" was converted to hex -1-ene. Give the structural formula of alcohol "J" (1mk)

(ii) Name the reagent and conditions necessary for the reaction in C (ii) above (1mk)

(d) Compound K reacts with sodium hydroxide as shown below

(i)



What type of reaction is represented by the equation above (1mk)

(ii) To what class of compound does "K" belong? (1mk)

(e)The following equations represent two different types of reactions

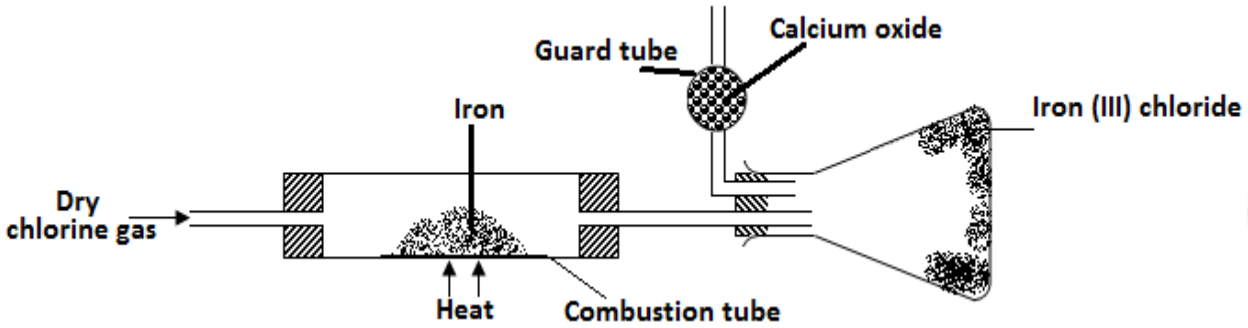
(i) $nC_4H_{8(g)} \rightarrow [C_4H_8]_{n(g)}$

(ii) $C_2H_{6(g)} + Cl_{2(g)} \rightarrow C_2H_5Cl_{(g)} + HCl_{(g)}$

State the type of reaction represented by (i) and (ii) (1mk)

3. (a) Give the name of one reagent which when reacted with concentrated hydrochloric acid produces chlorine gas (1mk)

(b) A student set out to prepare iron (lll) chloride using apparatus shown in the diagram below



(i) Explain why it is necessary to pass chlorine gas through the apparatus before heating begins? (1mk)

(ii) What property of iron (III) chloride makes it possible to be collected as shown in the diagram (1mk)

(iii) The total mass of iron (III) chloride formed was found to be 0.5g. Calculate the volume of chlorine gas that reacted with iron. (Fe = 56, Cl = 35.5 and molar gas volume at r.t.p is 24,000 cm^3)
(3mks)

(c) When hydrogen sulphide gas passed through a solution of iron (III) chloride the following observation was made;
The colour of the solution changed from reddish brown to green and yellow solid was deposited. Explain these observations (2mks)

(d) State and explain the observations that would be made if a moist blue-litmus paper was placed in a gas jar full of chlorine gas (2mks)

(e) Study the information to answer the questions that follow. The letters do not represent the actual symbols of the elements.

Elements	Atomic number	Melting point (^0C)
L	11	97.8
M	13	660
N	14	1410
C	17	-101
R	19	63.7

a) i) Write the electron arrangement for the ions formed by elements " M" and "C" (1mk)

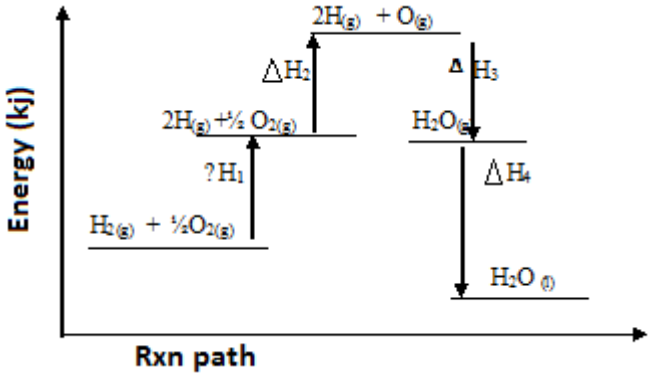
ii) State the type of the bond that will be formed when M and C react.
(1mk)

iii) In which group and period of the periodic table does element "R" belongs? (1mk)

iv) Element R loses its outermost electrons more readily than "L". Explain (1mk)

v) Using dots and crosses to represent electrons, show bonding in the compound formed between N and C. (2mks)

4. Study the energy level diagram below and answer the questions that follow.



(a) (i) Which ΔH values have a positive sign. (1mk)

……

(ii) Which ΔH values have a negative sign (1mk)

……...

(iii)What chemical changes is being represented by (2mks)

H_1 ….Δ……..

H_4 ….Δ……..

(b) The hydration energy of Al^{3+} and Cl^- are -4690 and -364kJmol^{-1} respectively. The heat of solution of aluminum chloride is -332kJ mol-^{1}.

(i) Calculate the lattice energy of aluminum chloride (2mks)

(ii) Draw an energy level diagram for dissolving of aluminum chloride (2mks)

(c) When one mole of butanol is burnt. 2676kJ are liberated

(i) Write a chemical reaction for combustion of butanol. (1mk)

……

(ii) Considering the following heats of combustion

$\Delta H^{\theta}C$ (Graphite) = -393kJ mol^{-1}

$\Delta H^{\theta}C$ $(H_2)_{(g)}$ = -286kJ mol^{-1}

$\Delta H^{\theta}C$ (Butanol) = -2676kJ mol^{-1}

Draw an energy cycle for the above energy changes (2mks)

(iii) Calculate the heat of formation of butanol (2mks)

5. (a) The equations below shows the standard reduction potential for four half cell. Study it and answer the questions that follow. Letters are not actual symbols of the element.

E^{θ} Volts

$F_{2(g)}$ + 2e- → $2F^-_{(aq)}$ + 0.54

$G^{2+}_{(aq)}$ + 2e- → $G_{(s)}$ -0.44

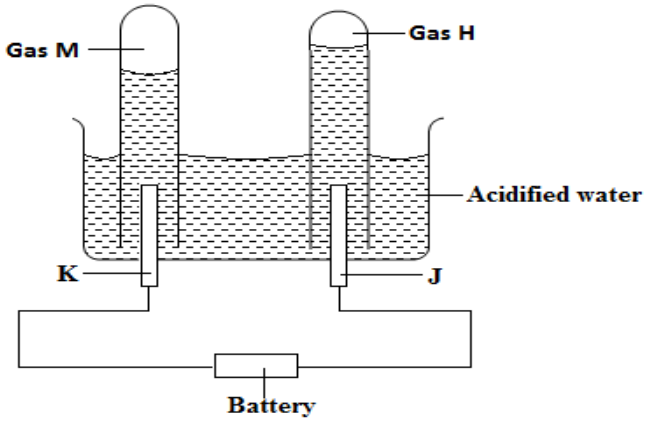
$H^{+2}_{(aq)}$ + 2 e- → $H_{(s)}$ + 0.34

$2J^{+}_{(aq)}$ + 2e- → $J_{2(g)}$ 0.00

i. Write the equation for the reaction which takes place when solid "G" is added to a solution containing H^{2+} (ions) (1mk)

ii. Calculate the E^{0} value for the reaction in (ii) above (1mk)

(b) The diagram below shows the apparatus used to electrolyze acidified water to obtain hydrogen and oxygen gases. Study it and answer the questions that follows?



i. Identify the electrodes marked K and J (1mk)

K ……

J …….

ii. Write the equation that led to the production of gas (1mk)

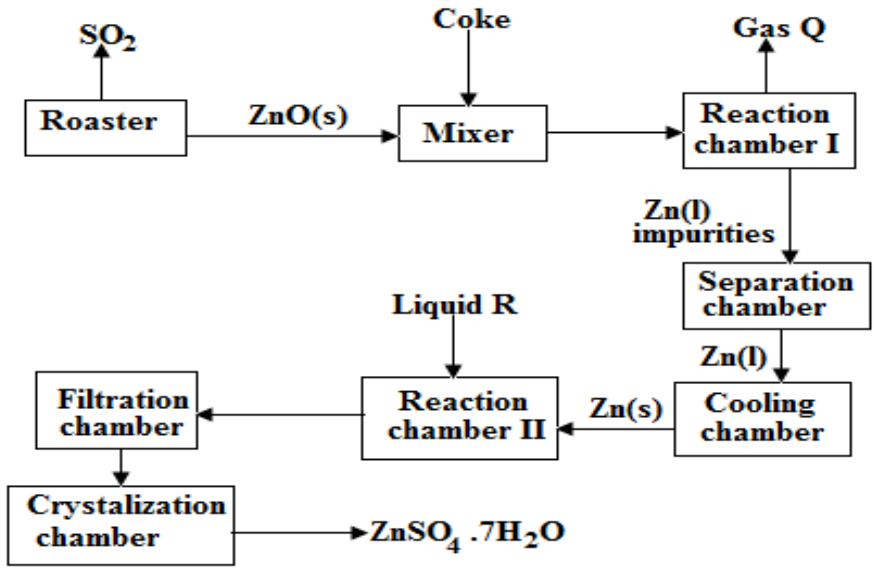
M ……

H ……

iii. Explain why hydrochloric acid is not used to acidify the water (1mk)

(c) During electrolysis of aqueous copper (II) sulphate 144750 columbus of electricity were used. Calculate the mass of copper metal that was obtained (Cu= 64, 1 Faraday = 96500 Columbus) (2mks)

6. The flow chart illustrates the extraction of zinc and preparation of Zinc (II) sulphate crystals. Study it and answer the questions that follow



(a)(i) Name

I. Gas Q ……. (1mk)

II. Liquid R …….. (1mk)

(ii) Write an equation for the reaction that takes place in

Chamber I …… (1mk)

The Roster ……(1mk)

Chamber II ……(1mk)

(iii) Given that the zinc sulphide ore contain 45% of Zinc sulphide by mass, calculate

I. The mass in grains of Zinc sulphide that would be obtained from 250 kg of the ore.(1mk)

II. The volume of sulphur (IV) oxide (So_2) that would be obtained from the above mass of zincsulphideat room temperature and pressure (S = 32.0, molar gas volume = 24 dm^3). (2m

III. The mass of zinc metalthat would be obtained in Iabove(Zn = 65.4) (1mk)

(b) In such an experiment sulphur (IV) Oxide may keep escaping to the atmosphere. Explain how this could affect the environment. (1mk)

(c) Suggest one other manufacturing plant that could be set up near Zinc extraction plant. (1mk)

7. (a) State the difference between chemical and nuclear reactions (1mks)

(b) Below is a radioactive decay series starting from $^{214}_{83}Bi$ and ending at $^{206}_{82}Pb$. Study it and answer the questionsthat follows

$$^{214}_{83}Bi \xrightarrow{\text{Step I}} {}^{219}_{84}Ti \xrightarrow{\text{Step II}} {}^{210}_{82}Pb \xrightarrow{\text{Step III}} {}^{210}_{83}Bi \xrightarrow{\text{Step IV}} {}^{210}_{84}Po \xrightarrow{\text{Step V}} {}^{206}_{82}Pb$$

(i) Identify the particle emitted in step I and III. (2mks)

I …….

II ……

(ii) Write the nuclear equation for the reaction which takes place in step V (1mk)

……

(c) The table below gives the percentage of radioactive isotope of Bismuth that remains after decaying at different times.

Time (mm)	0	6	12	22	38	62	100
Percentage of Bismuth	100	81	65	46	29	12	3

(i) On the grid provided below, plot a graph of the percentage of bismuth remaining (vertical axis) against time (3mks)

(ii) Use the graph, determine the

I. Half life of the Bismuth (1mk)

…….

II. Original mass of bismuth isotope given that the mass remained after 70 minutes was 0.16g (1mks)

……..

d. Give one use of radioactive isotope in medicine (1mk)

…….

NAME ……..…….. **DATE** ……

INDEX NO. …….…….……...…..… **SIGNATURE** ……..……..

233/1
CHEMISTRY
(THEORY)
PAPER 3
TIME: 2 HOURS.

MOI GIRLS' HIGH SCHOOL

POST MOCK EXAMINATIONS

FORM 4

2021

Kenya Certificate of Secondary Education

INSTRUCTIONS TO CANDIDATES

a) Write your **NAME** and **INDEX NUMBER** in the space provided above
b) Sign and write the date of examination in the spaces providedabove
c) Answer **ALL** the questions in the spaces provided
d) **ALL** working must be clearly shown where necessary.
e) Mathematical tables and silent electronic calculators may be used.

FOR EXAMINER'S USE ONLY

1. You are provided with;
    - Solid A magnesium ribbon
    - Solution B 2MHCL
    - Solution C, 0.3MNaOH
    - Distilled water

You are required to determine the:

i. Temperature change when magnesium reacts with excess hydrochloric acid
ii. Number of moles of hydrochloric acid that remains unreacted
iii. Number of moles of magnesium that reacted
iv. Molar heat of reaction between magnesium and hydrochloric acid

Procedure 1

Using a burette, measure 50cm of solution B and place it in 100ml beaker. Measure the temperature of solution B in 100ml beaker after every 10 seconds. At 30^{th} seconds add magnesium ribbon to solution B and continue recording the temperature. Stir the mixture continuous with a thermometer making sure that the magnesium ribbon remains in the solution as it reacts. Measure the temperature after ever 10 seconds and record values at the table below. Continue stirring and measure the temperature to complete table 1 below.

Keep the resulting solution for use in procedure 2.

Table 1

a)

Time (sec)	**0**	**10**	**20**	**30**	**40**	**50**	**60**	**70**	**80**	**90**	**100**	**110**	**120**	**130**
Temperature (^{0}C)				**X**										

i) Plot graph of temperature against time on the grid provided. (3mks)

ii) On the graph, show the maximum change in temperature ΔT and deter mine its value.

Procedure 2

Transfer all the solution obtained in procedure 1 into 250ml volumetric flask. Top up with distilled water to 250ml mark. Label it with solution D. Empty the burette and fill it with solution C. Pipette 25mlof solution D and place it in 250ml conical flask. Add drops of phenolphthelene indicator and titrate solution C against solution D. Record the results in table 2. Repeat the titration of solution C against solution D and complete table 2.

Table 2

b)

	I	II	III
Find burette reading			
Initial burette reading			
Volume of solution C (cm^3)			

(4mks)

i) Calculate average volume of solution C used. (1mk)

ii) Calculate the number of moles of:

I 0.3MNaOH (1mk)

II Hydrochloric acid in 25cm^3 of solution D. (1mk)

III Hydrochloric acid in 250cm^3 of solution D. (1mk)

IV Hydrochloric acid in 50cm^3 of solution B. (1mk)

V Hydrochloric acid that reacted with magnesium. (1mk)

VI Magnesium that reacted. (1mk)

c).Using your answer in iv above, determine molar heat of reaction between magnesium and hydrochloric acid. Assume the heat capacity of solution is 4.2$Jg^{-1}k^{-1}$ and density of solution 1g/$cm^{3.}$ (2mks)

2. You are provided with solid E. Carry out the experiments below. Write your observation and inferences in the space provided.

a) Place all solid E in a boiling tube. Add about 20cm^3 distilled water and shake until all the solid dissolves label this solution E. use solution E for experiments (i) and (ii)

i) To 2$cm^3$of solution E in a test tube in each of experiments I,II,III and IV add:

I Two drops of aqueous sodium sulphate;

Observations	Inferences

(1mk)	(1mk)

II Five drops of aqueous sodium chloride;

Observations	Inferences
(1mk)	(1mk)

III Two drops of barium Nitrate;

Observations	Inferences
(1mk)	(1mk)

IV Two drops of lead (ii) Nitrate

Observations	Inferences

(1mk)	(1mk)

ii) To 2cm^3 of solution E in a test tube add 5 drops of aques sodium hydroxide. Add a piece of Aluminium foil provided to the mixture and shake. Warm the mixture and test any gas produced with the and read litmas papers.

Observations	Inferences
(2mk)	(1mk)

3. You are provided with solid F. Carry out the following tests and record the observations and inference in the space provided.

a) Place about one third of the solid F on a clean metallic spatula and burn it in a Bunsen burner flame.

Observations	Inferences
(1mk)	(1mk)

b) Place the remaining amount of solid F in a boiling tube. Add about 10cm^{3}of distilled water and shake use the mixture for tests (i) to (ii)

Observations	Inferences

(½mk)	(½mk)

i) Using about 2cm^3 of the mixture in a test tube determine the PH Using universal indicator paper and chart.

PH	Inferences
(1mk)	(1mk)

ii) To about 2cm3 of the mixture in a test tube add three drops of acidified potassium manganese vii.

Observations	Inferences
(1mk)	(1mk)

iii) To about 2cm^3 of the mixture in a test tube add two or three drops of bromine water.

Observations	Inferences
(1mk)	(1mk)

MOKASA 11 JOINT MOCKS

233/1

CHEMISTRY

PAPER 1

TIME: 2 HOURS

2020-2021

1 a) What is meant by allotropy? (1mk)

b) Identify the two crystalline allotropes of carbon. (1mk)

c) Give one use of carbon black. (1mk)

2. When hydrated sample of iron (II) Sulphate $FeSO_4$. nH_2O was heated until there was no further change in mass, the following data was recorded.

Mass of evaporating dish = 78.94g
Mass of evaporating dish + hydrated salt = 84.14g
Mass of evaporating dish + residue = 81.78g
Determine the empirical formula of the hydrated salt
(Relative formula Mass of $FeSO_4$ = 152, H_2O =18) (3mks)

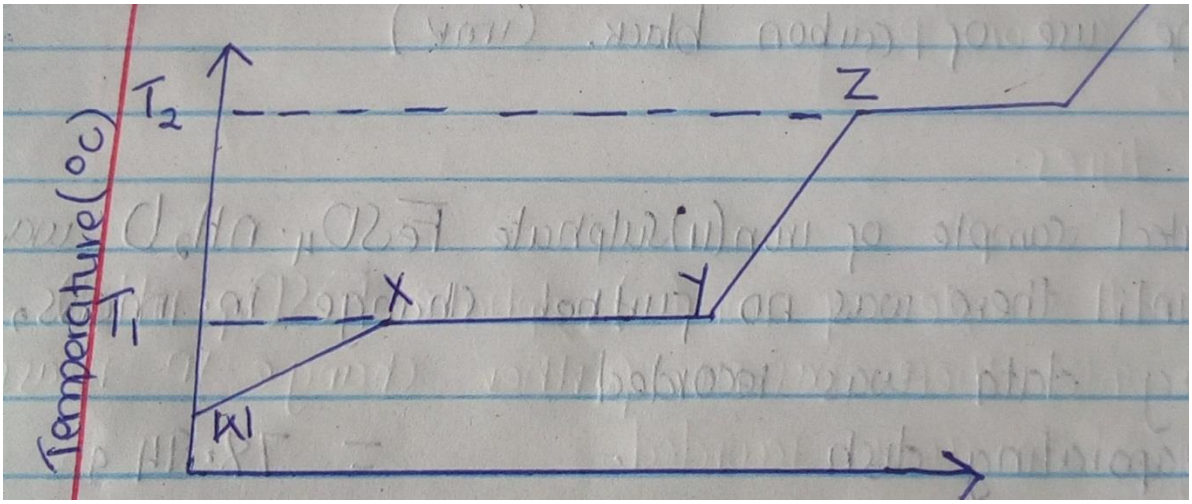
3. Equal volumes of 2M monobasic acids R and S were each reacted with excess magnesium ribbon. The table below shows the volume of the gas produced after one minutes

Acid	Volume of gas (cm^3)
R	80
S	30

c) Write the ionic equation for reaction which took place (1mk)

d) Explain the difference in the volumes of the gas produced (2mks)

4. The graph below shows the changes which takes place when a solid is heated.



d) What happened to the molecules between W and X? (1mk)

e) What is the significance of temperatures T_1 and T_2 (1mk)

f) Explain why the temperature does not rise between X and Y (1mk)

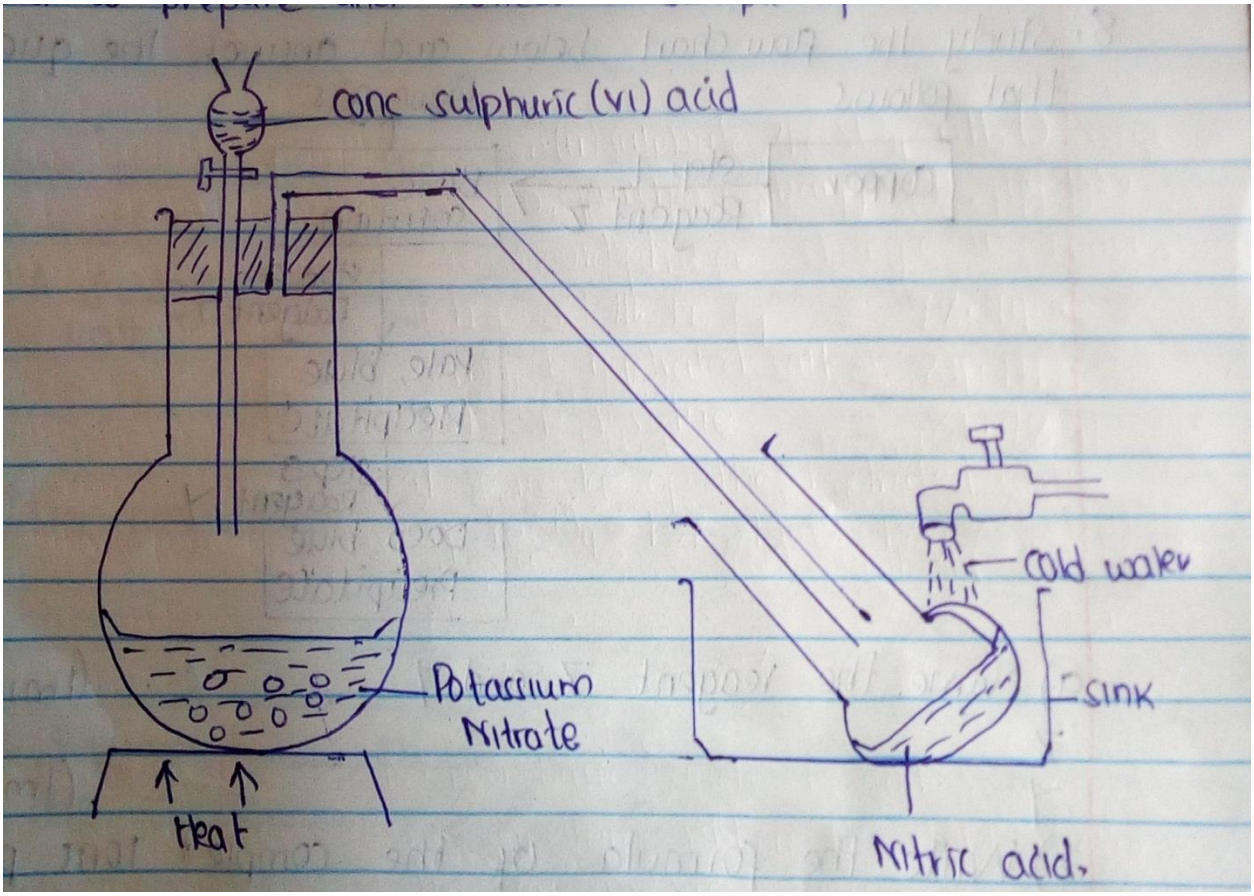
5. In an experiment to determine the solubility of potassium nitrate at 30^0c, a saturated solution was heated in an evaporating dish until there was no further change in mass. The following

data was obtained.

Mass of dish + solution = 128.9 g
Mass of dish + dry salt = 103.9 g
Mass of empty dish = 94.3 g

Determine the solubility of potassium nitrate at 30^0c. (3mks

6. The diagram below shows a set up that was used to prepare and collect a sample of nitric acid.

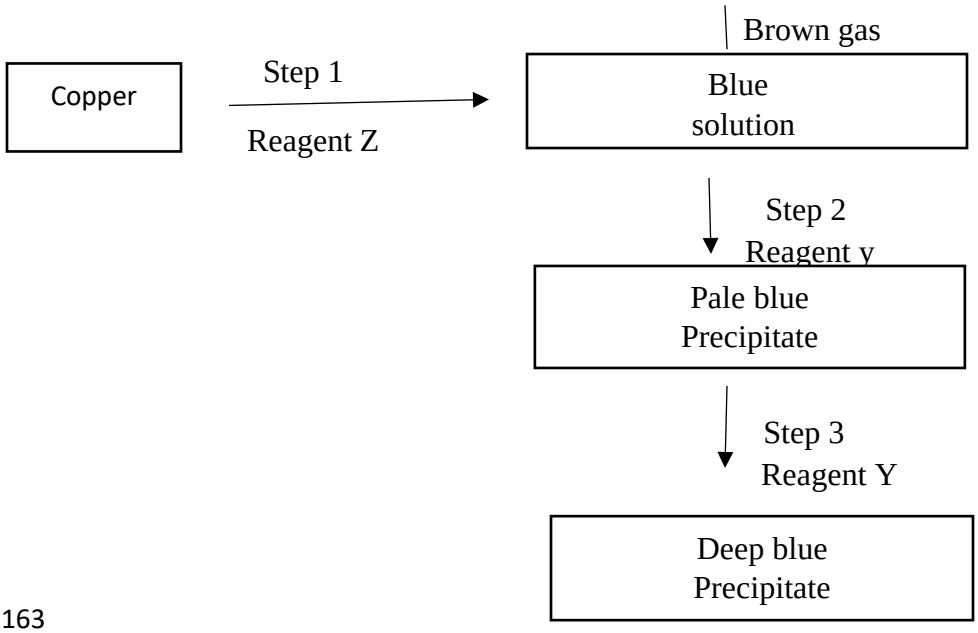


f) Give a reason why it is possible to separate nitric acid from Sulphuric acid in the set up. (1mk

g) Name another substance that can be used instead of potassium nitrate. (1mk)

7. Starting with lead oxide, nitric acid, sodium sulphate, water and all necessary apparatus, describe how you would prepare a dry sample of lead (II) sulphate (3mks)

8. Study the flow chart below and answer the questions that follows:



c) Name the reagent Z and Y

Z (1mk)

Y (1mk)

d) Write the formula of the complex ions presented in the deep blue solution (1mk)

9. The equations below shows the molar enthalpies of combustion of carbon, hydrogen and methane.

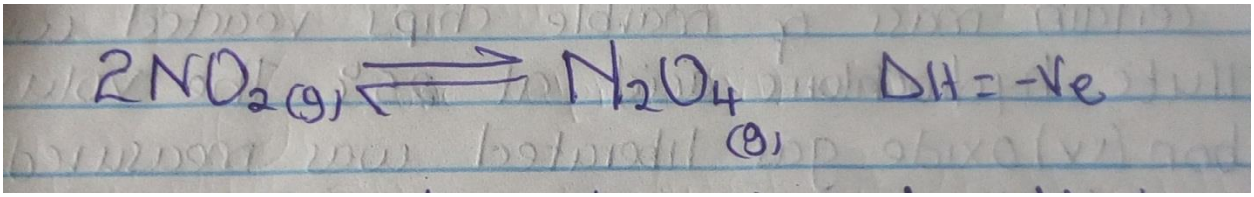
$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H_c = -393\ KJmol^{-1}$

$H_2(g) + \frac{1}{2} O_2(g) \longrightarrow H_2O(l)$ $\Delta H_c = -285\ KJmol^{-1}$

$CH_4(g) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H_c = -890 KJmol^{-1}$

Use the energy cycle diagram to calculate the heat of formation of methane (3mks)

10. NO_2 and N_2O_4 gases exist in equilibrium at 20^0c

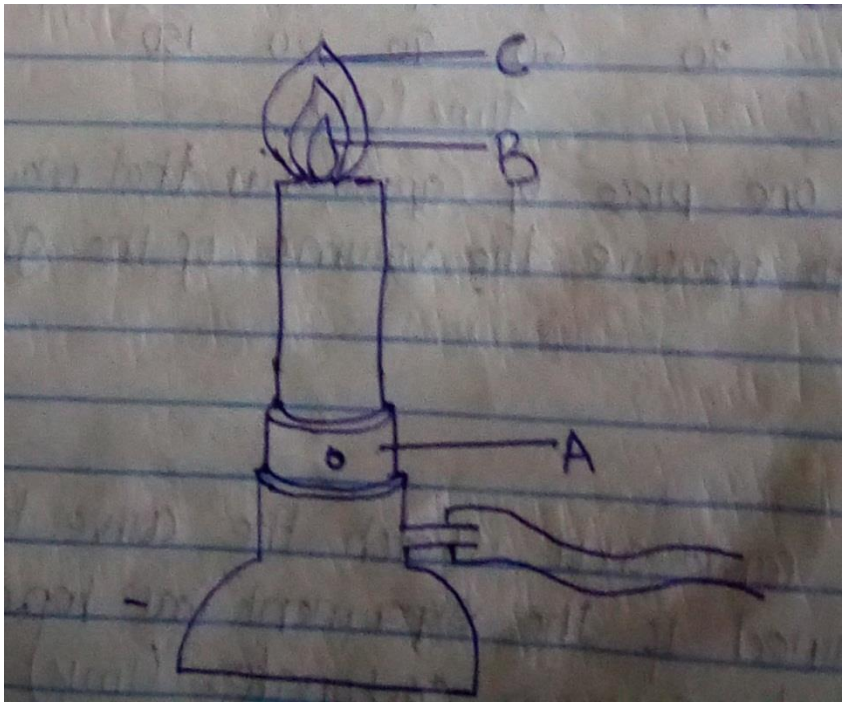


State and explain the observation that would be made when

a) A syringe containing the mixture 20^0c is heated to 40^0c (1mk)

b) The gaseous mixture in a syringe is compressed. (1mk

11. The diagram below shows a Bunsen burner when in use



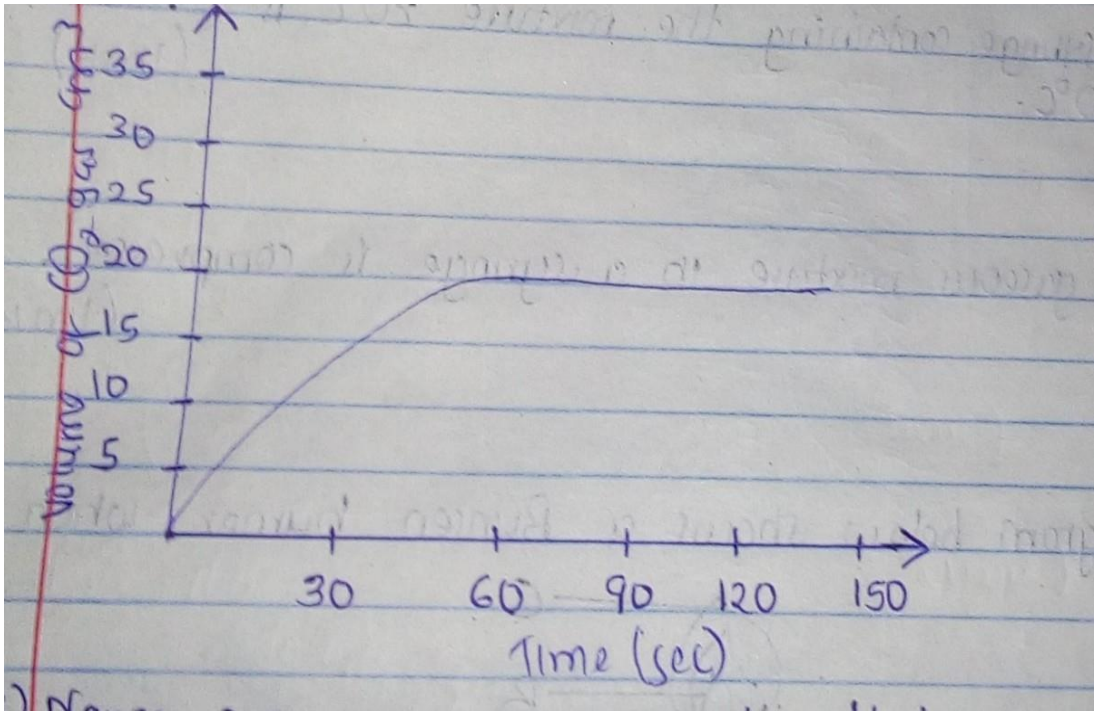
f) Name the regions labelled B and C (1mk)

B

C

g) What is the function of the part labelled A? (1mk)

12. A certain mass of marble chips reacted with excess dilute hydrochloric acid at 25^0c. The volume of carbon (iv) oxide gas liberated was measured after 30 seconds. The results were presented as shown in the graph below.



c) Name one piece of apparatus that may have been used to measure the volume of the gas liberated. (1mk)

d) On the same axis sketch the curve that would be obtained if the experiment was repeated using powdered calcium carbonate. (1mk)

13. When hydrogen Sulphide gas was bubbled into an aqueous solution of iron (iii) chloride, a yellow precipitate was deposited.

c) State another observation that would be made (1mk)

d) Write an equation of the reaction that took place. (1mk)

14. The table below shows the atomic number of elements M, P, Q and R.

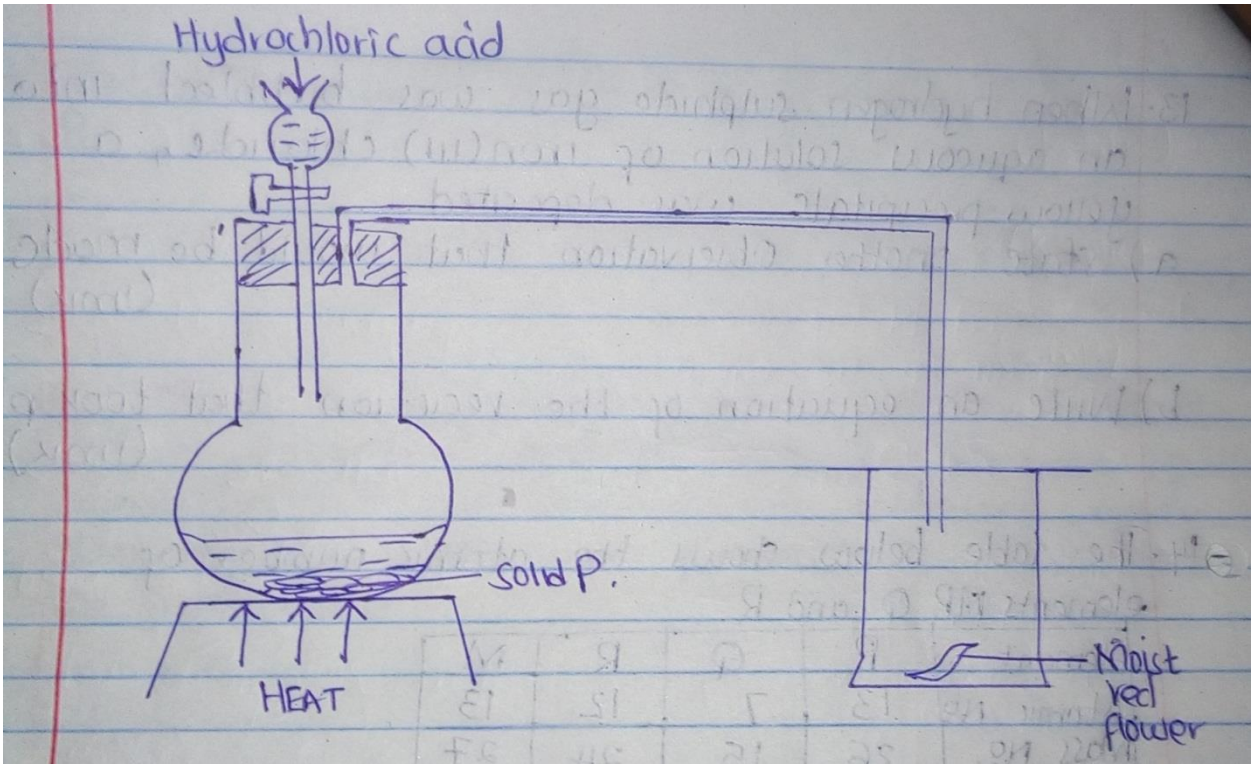
Element	P	Q	R	M
Atomic No	13	7	12	13
Mass No	26	15	24	27

c) Which two letters represent the same element? Give reasons (1mk)

d) Give the number of neutrons of an atom of element Q (1mk)

15. The diagram below show the set up that was used to prepare and collect

Sulphur (iv) oxide gas.



h) Identify the solid P (1mk)

i) i) Why is it possible to collect Sulphur (iv) oxide as shown? (1mk)

ii) What happened to the red flower? (1mk)

16 a) State Charles' law (1mk)

b) The volume o f a sample of nitrogen gas at temperature of 298k and 600mmHg pressure was 0.048m^3, calculate the temperature at which the volume of the gas would be 0.032m^3 if pressure remains the same. (2mks)

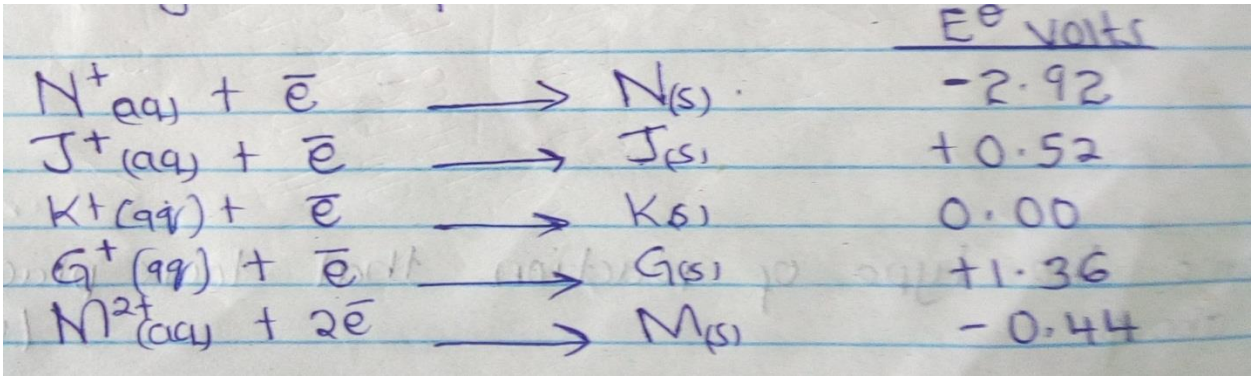
17. Element T consists of two isotopes ^{62}T and ^{64}T in the ratio 7:3 respectively. Calculate the Relative atomic mass of element T (3mks)

18. Name the process which takes place when

a) Solid carbon (iv) oxide changes directly into gas (1mk)

b) Butanol reacts with hexanoic acid in the presence of Sulphuric (iv) acid. (1mk)

19. Study the standard electrode potentials for the half-cells give below and answer the questions that follows (the letters do not represent the actual symbols of the elements)



g) Identify

vii) The strongest reducing agent (½ mks)

viii) The strongest oxidizing agent (½mks)

h) Calculate the e.m.f of the cell (2mks)

$N_{(s)}/N^{+}_{(aq)}$ // $G^{+}_{(aq)}$ / $G_{(s)}$

20. Study the table below and answer the questions that follow

Bond type	Bond energy KJ/mol
C - C	346
C = C	610
C - H	413
C - Br	280
Br - Br	193

i) Calculate the enthalpy of the following reaction. (2mks)

$C_2H_{4(g)} + Br_2(g) \longrightarrow C_2H_4Br_2(g)$

j) Name the type of reaction that took place in a) above (1mk)

21. Briefly explain how you would obtain pure sample of lead (ii) chloride from a mixture of lead (ii) chloride and silver chloride (3mks)

22. Explain the following observations: very little carbon (iv) oxide is evolved when lead carbonate reacts with dilute hydrochloric acid (2mks)

23. The table below gives some properties of compounds P, Q, R and S

Compound	B.P^{0}C	M.P^{0}C	Conductivity in water
P	77	-23	Does not conduct

Q	74	-19	Does not conduct
R	-161	-85	Conduct
S	2407	714	Conduct

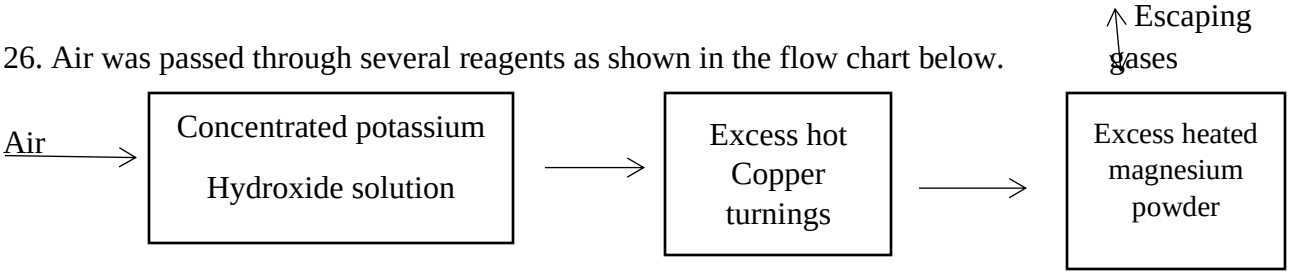
c) Which one of the compounds in the table is ionic?
Explain (1mk

d) Give the compound that is liquid at room temperature. (1mk)

24. When butan – 1 – 0L is oxidized by acidic potassium dichromate, a weak organic acid is formed. Draw and name the structure formula of the acid obtained from the above reaction. (2mks)

25. When a hydrocarbon fuel burns, one of the main products is acidic gas R
i) Identify gas R (1mk)
ii) What two effects does gas R have when its concentration in the atmosphere exceeds its acceptable level. (2mks)

26. Air was passed through several reagents as shown in the flow chart below.

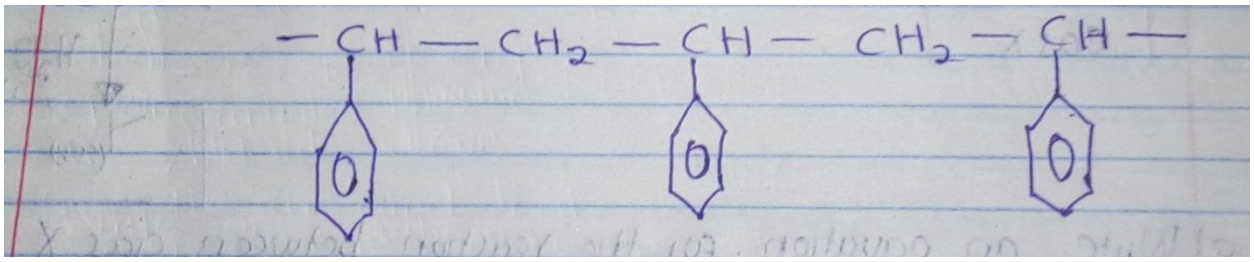


c) Write an equation for the reaction that took place in the chamber with the magnesium powder (1mk)
d) Name one gas that escapes from the chamber containing magnesium powder. Give a reason for your answer. (1mk)

27. When a current of 6.42 Amperes was passed through an electrolyte Y^{2+} for 10 minutes, 2.74g of Y were deposited. (1mk)
iii) Calculate the quantity of the electricity passed in the experiment.
iv) Determine the relative atomic mass of (1 faraday = 96,500 coulombs) (2mks)

28. Explain why aluminium metal is not extracted from aluminium chloride (2mks)

29. Part of the structure of a polymer is given below.



xii) Identify the polymer. (1mk)

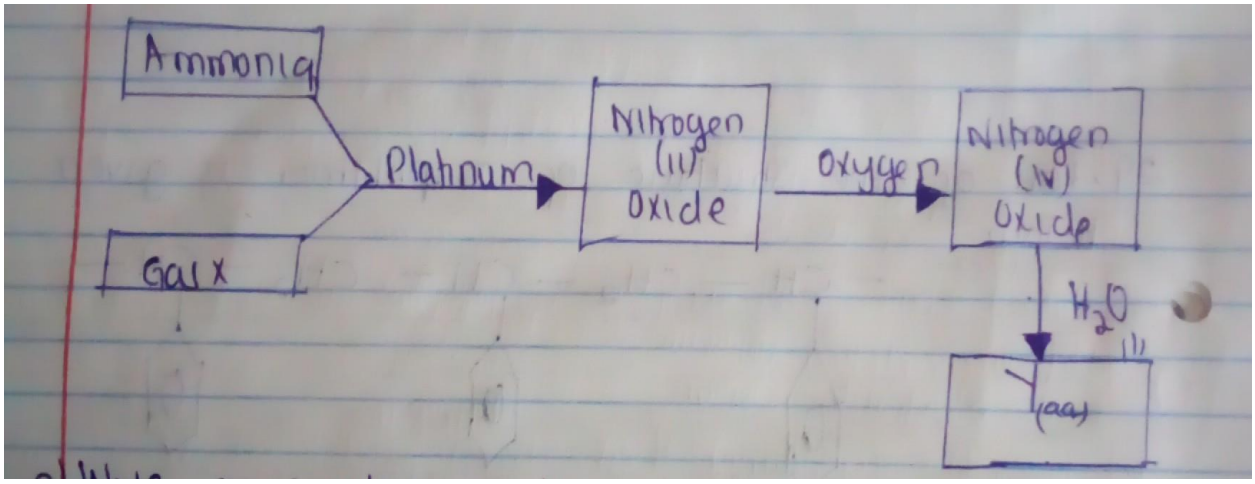
xiii) State one disadvantage of continued use of this polymer (1mk)

30. The table below gives the rate of decay for a radioactive element M

Number of days	Mass (g)
0	12.8
280	0.8

Determine the half – life of the radioactive element M (2mks)

31. Study the flow chart below and answer the questions that follows.



f) Write an equation for the reaction between gas X and ammonia (1mk)

g) Write the formulae of the substance present in the mixture Y(aq) (2mks)

32. When the air hole is fully opened, the Bunsen burner produces a non-luminous flame

Explain (1mk)

MOKASA II

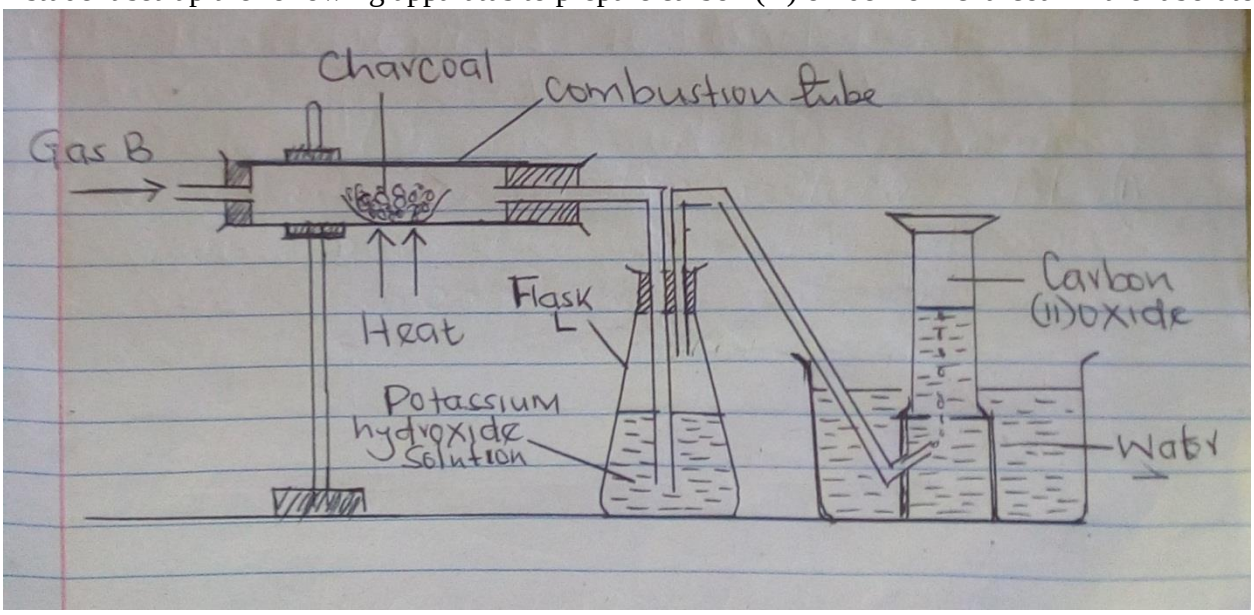
233/2

CHEMISTRY PAPER 2

2020-2021

TIME: 2 HOURS

j) A student set-up the following apparatus to prepare carbon (II) oxide from charcoal in the laboratory.



j) State the purpose of potassium hydroxide solution (1mk)

k) Identify gas B (1mk)

l) Name **two** substances that react together to produce gas B (2mks)

m) Write balanced equations for reactions in
   i) Combustion tube (1mk)
   j) Flask L (1mk)

n) Describe **two** simple test that you would use to distinguish between Carbon (IV) oxide and Carbon (II) oxide. (2mks)

o) In another experiment, the student reacted charcoal with excess hot concentrated nitric (v) acid.
   h) State one observation made (1mk)
   i) Write balanced equation for the reaction (1mk)

p) State two use of Carbon (II) oxide (1mk)

k) Use the information in the table below to answer the questions that follow. The letters are not the actual symbols of the elements.

Element	Atomic Number	M.P (^{0}c)
A	11	97.8
B	13	660
C	14	1410
D	17	-95
E	20	839

xiv) Write the electronic arrangement for the ions formed by elements D and A (2mks)

xv) Select an element which is :

ix) A poor conductor of electric current (1mk)

x) The strongest reducing agent (1mk)

xi) Has a giant covalent structure (1mk)

xii) In which state will element B exists at 661^{0}c Explain. (1mk)

xvi) Compare the electrical conductivity of element A and B. Give a reason (1mk)

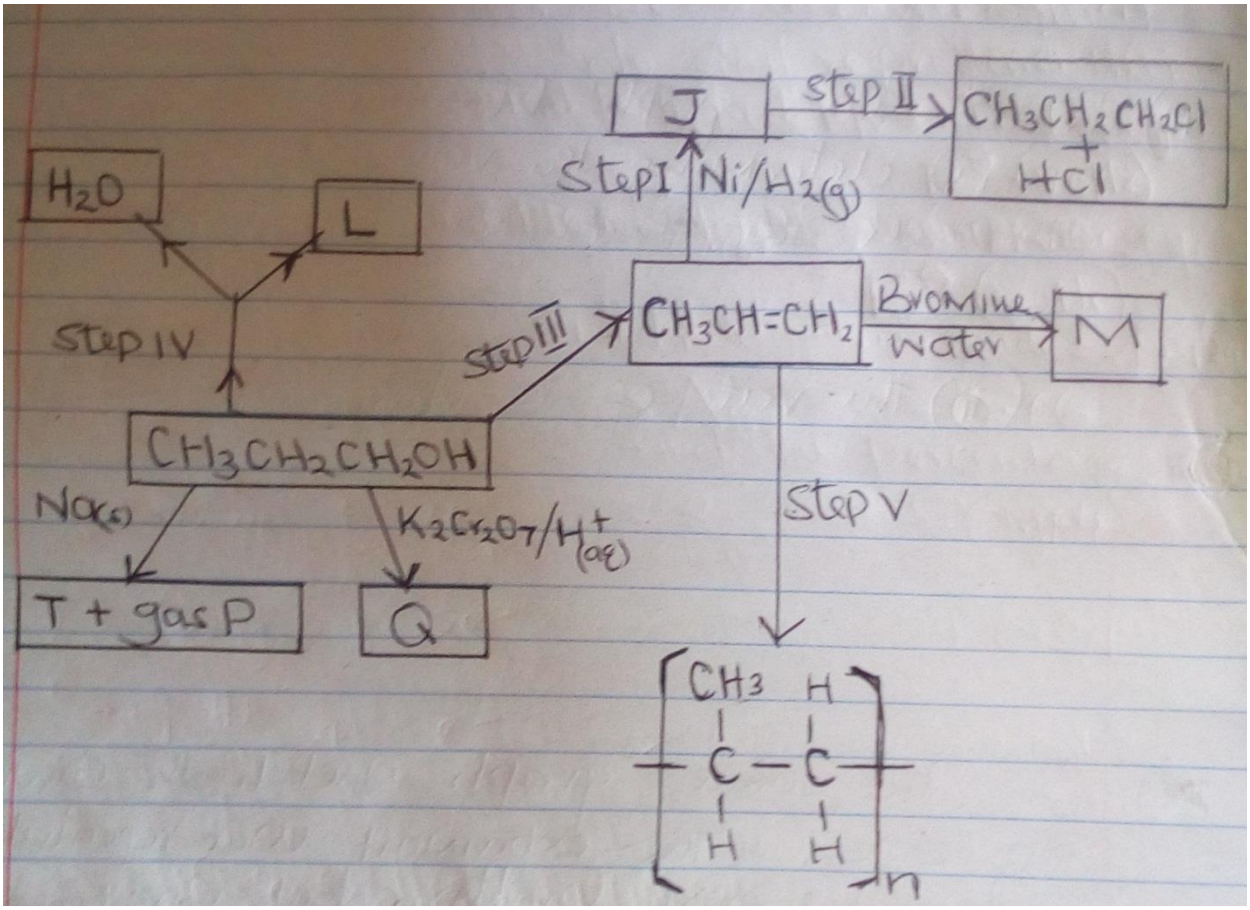
xvii) Using dots (.) and crosses (x) to represent the outermost electrons, show the bonding in the compound formed between elements C and D. (2mks)

xviii) Explain the difference in melting points in elements B and A (2mks)

xix) Write an equation for the reaction that takes place between element E and steam. (1mk

xx) Describe how a solid mixture of the Chloride of E and lead (II) Sulphate can be separated into solid sample. (2mks)

l) Study the flow chart below and answer the questions that follow.



h) Name substance J and draw its structural formula: (2mks)

Name

Structural formula

i) What reagents and conditions are necessary for:

k) Step (III) : Reagent (1mk)

Condition

l) Step II: Reagent (1mk)

Condition

c) Name the following

i) L (1mk)

ii) Gas P (1mk)

iii) Q (1mk)

iv) M (1mk)

d) Write the equation of the reaction that occur in step (IV) (1mk)

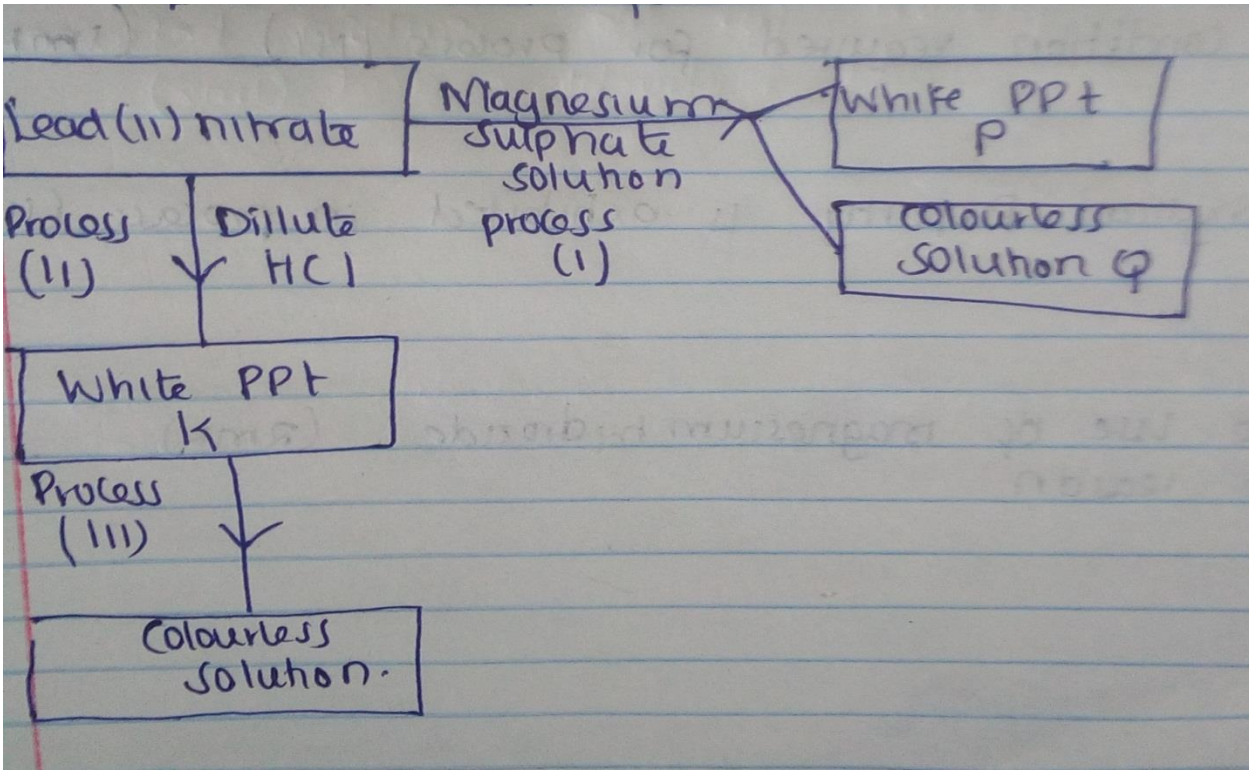
e) Give the name of process in step (V) (1mk)

f) If the relative Molecular Mass of R is 21,000, determine the value of n. (C = 12.0, H = 1.0) (2mks)

m) a) Define an electrolyte (1mk)

b) Explain why the following substances conduct an electric current (2mks)
i) Magnesium metal
ii) Molten magnesium Chloride

c) Study the reaction scheme below and answer the questions that follow.



i) Write the formula of P and Q (2mks)

ii) Write an ionic equation for the formation of P (1mk)

iii) Name process (i) (1mk)

iv) Write a balanced equation for the formation of white precipitate K (1mk)

v) State the condition required for process (III) (1mk)

vi) Which physical property is exhibited in process (III) (1mk)

vii) State one use of magnesium hydroxide (2mks)
Give one reason

5 a) At 25^0c, 50g of potassium nitrate were added to 100g of water to make a saturated solution. What is meant by a saturated solution? (1mk)

b) The table below gives the solubilities of potassium nitrate at different temperatures.

Temperature (^{0}c)	12	20	28	36	44	52

Solubility g/100g of water	22	31	42	55	70	90

i) Plot a graph of the solubility of potassium nitrate (vertical axis) against temperature (3mks)

ii) Using the graph

i) Determine the solubility of potassium nitrate at 15^0c. (1mk)

ii) Determine the mass of potassium nitrate that remained undissolved given that 80g of potassium nitrate were added to 100cm^3 of water and water to 40^0c. (2mks)

c) Determine the molar Concentration of potassium nitrate at 15^0c.
(Assume there is no change in density of water at this temperature)
(K = 39.0, N = 14.0, O = 16.0) (3mks)

6 a) Aluminium oxide reacts with both acids and bases

i) Write an equation for the reaction between aluminium oxide and hydrochloric acid (1mk)

ii) Using the equation in (a) above, calculate the number of moles of hydrochloric acid that would react completely with 153.0g of aluminium oxide (Al = 27.0, O = 16.0) (3mks)

b) Sodium hydroxide pellet were accidentally mixed with sodium chloride, 8.8g of the mixture were dissolved in water to make one litre of solution. 50cm^3 of the solution was neutralized by 20.0cm^3 of 0.25M Sulphuric (vi) acid.

i) Write the equation for the reaction that took place. (1mk)

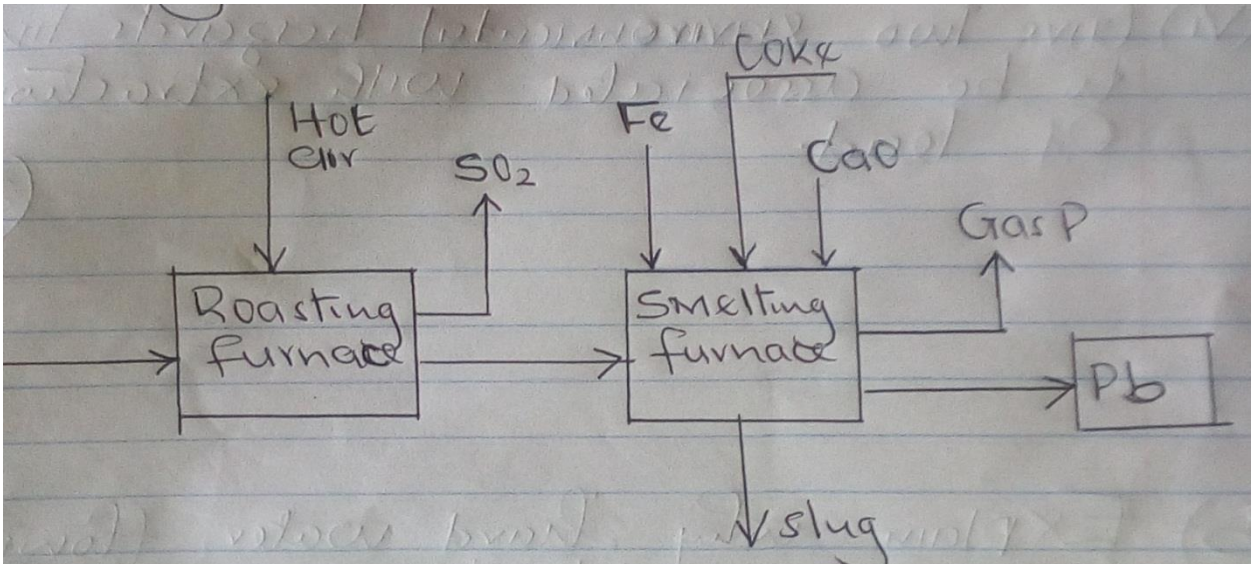
ii) Calculate the:

i) Number of moles of the substance that reacted with Sulphuric (vi) acid (2mks)

ii) Number of moles of the substance that would react with Sulphuric (vi) acid in the one litre solution. (1mk)

iii)The percentage of sodium chloride in the mixture. (2mks)

7. The flow chart below illustrates the industrial extraction of lead metal.
Study it and answer the questions that follow.



j) i) Name the ore that is commonly used in the process (1mk)

ii) Explain what takes place in the roasting furnace (1mk)

m) Identify gas P (1mk)

n) Write the equation for the main reaction that takes place in the smelting furnace. (1mk)

o) What is the purpose of adding iron in the smelting furnace? (1mk)

p) Give two environmental hazards likely to be associated with extraction of lead. (2mks)

k) Explain why hard water flowing in lead pipes may be safer for drinking than soft water flowing in the same. (2mks)

l) State one use of lead other than the making of lead pipes (1mk)

MOKASA II

233/3

CHEMISTY PAPER 3
PRACTICAL
FORM 4
MID TERM II 2020

a.)You are provided with:

xxi) Solution A, Dilute hydrochloric acid

xxii) Solution B, made by dissolving 0.5g of sodium hydroxide in water and made to 250cm^3 of solution

xxiii) Solid C, Magnesium ribbon

xxiv) Phenolphthalein in indicator

You are required to:

b.) Standardize solution A

c.) Determine the rate of reaction between solution A and magnesium

PROCEDURE

k) Measure exactly 10cm^3 of solution A using a burette and transfer into a 250ml volumetric flask. Top up to the mark using distilled water. Label this solution D.

l) Drain the remaining solution A in the burette, rinse the burette thoroughly and fill the burette with solution D.

m) Pipette 25cm^3 of solution B into a conical flask. Add three drops of phenolphthalein indicator

n) Titrate solution D with solution B. Record your results in the table below. Repeat procedure (i) to (iv) to complete the table. (3 marks)

	1	2	3
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution D used (cm^3)			

xiii) Calculate the average volume of solution D used (1 mark)

xiv) Calculate:

n) Number of moles of solution B used (1½ marks)

o) Number of moles of solution D in 250cm3 of solution (1½ marks

p) Morality of solution A (1 mark)

PROCEDURE II

h) Cut solid C into equal pieces, each 2cm long.

i) Using a burette, measure 12cm^3 of solution A, into a clean boiling tube.

j) Drop one piece of solid C into the boiling tube containing solution A and start stopwatch immediately. Stop the stopwatch when all solid C has just reacted. Record your results in the table below.

k) Repeat steps (ii) and (iii) above using 10cm3, 8cm3, 6cm3 and 4cm3 of solution A. Top up each with distilled water to make 12cm3 of solution and complete the table below. (4 marks)

Volume of solution A (cm^3)	Volume of distilled water (cm^3)	Concentration of solution a (moles/l	Time(s)	$\frac{I}{t}(s^{-1})$
12	0			
10	2			
8	4			
6	6			
4	8			

j) Plot a graph of $\frac{I}{t}(y-axis)$ against the concentration of solution A (3 marks)

k) From the graph, determine the time taken for the reaction to reach completion when 1.5 moles of solution A are used (2 marks)

l) Comment on the shape of the graph (1 mark)

j) You are provided with solid Q. Carry out the tests below and record your observations and inferences in the spaces provided.

q) Strongly heat a spatula-end full of solid Q in a dry test tube (1 mark)

Observation	Inference

r) (i) Place the remaining solid Q in a boiling tube. Add 10cm3 of distilled water. Divide the solution into five portions. (2 marks)

Observation	Inference

(ii) To the first portion, add aqueous lead (II) nitrate solution (1 mark)

Observation	Inference

d.) To the second portion add dilute nitric (V) acid, followed by barium nitrate solution (2marks)

Observation	inference

e.) To the third portion add a few drops of sodium hydroxide until excess observation (2marks)

Observation	Inference

f.) To the fourth portion, add a few drops of aqueous ammonia until is excess. (2 marks)

Observation	Inference

g.) To the fifth portion, add a few drops of hydrochloric acid (1½ marks)
Warm the contents.

Observation	Inference

k) You are provided with solid R. carry out the tests below and record your observations and inferences.

q) Place a spatula-end full of solid R in a dry boiling tube and add about $10cm^3$ of distilled water. Shake thoroughly and heat to boil. Divide the solution into five portions. (1½ marks)

Observation	inference

r) (i) Test the first portion with the universal indicator solution provided. (1½ marks)

Observation	Inference

(ii) To the second portion, add a few drops of acidified potassium manganite (VII) solution (2 marks)

Observation	Inference

(iii) To the third portion, add a few drops of bromine water (2 marks)

Observation	Inference

(iv) To the fourth portion, add half spatula of sodium hydrogen carbonate (1 mark)

Observation	Inference

l) To the fifth portion in a boiling tube, add 5cm3 of ethanol followed by a few drops of concentrated sulphuric (VI) acid. Warm the mixture. (1 ½ Marks)

Observation	Inference

MOMALICHE 2021

233/1

CHEMISTRY THEORY

PAPER 1

2020-2021

2 Hours

1. Study the information given below and use it to answer the questions that follow;
   Red dye is more soluble than green dye, green is more soluble than yellow whereas blue dye is the least soluble.

   i) Represent the three dyes on a round paper chromatography. **(2marks)**

   ii) Name one industrial application of chromatography. **(1mark)**

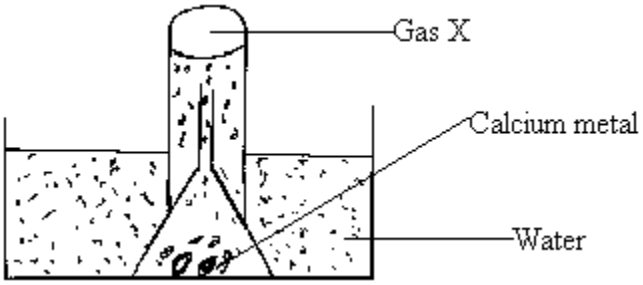
2. a) What is a fuel **(1mark)**

   b) Calculate the heat value of ethanol if its molar enthalpy of combustion is-1360kjmol^{-1}

   (C=12.0, O=16.0, H=1.0)

   (2marks)

3. Study the set up below and use it to answer the questions that follow.



   a) What physical property of calcium metal is demonstrated in the diagram above? **(1mark)**

   b) What would be observed if water was replaced with dilute Sulphuric (VI) acid? **(2marks)**

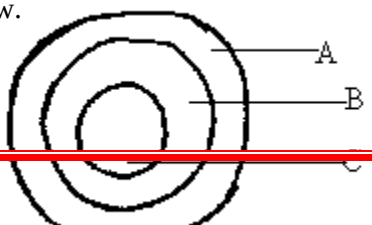
4. A hydrocarbon decolorizes chlorine gas in presence of ultra violet light but does not decolorize acidified potassium manganate (VII) solution.

   i) Name the homologous series to which the hydrocarbon belongs. **(1mark)**

   ii) Draw the structural formula and name the fourth member of the homologous series to which the hydrocarbon belongs? **(2marks)**

5. Explain why a solution of hydrogen chloride in water turns blue litmus paper red but a solution of hydrogen chloride in methylbenzene has no effect on litmus papers. **(2marks)**

6. The diagram below represents a cross section of the apparatus used to extract sulphur from its deposits. Study it and answer the questions that follow.



a) State the role of the substance that is passed through;

i) A ……..
(1mark)

ii) C……
(1mark)

b)Give one reason why the method shown in the diagram is suitable for extraction of sulphur. **(1mark)**

7. Explain how you would obtain magnesium carbonate from a mixture of magnesium carbonate and sodium carbonate. **(2mark**

8. 20g of potassium carbonate were dissolved in 50cm^3 of water in a conical flask. Lemon juice was then added drop wise while shaking until there was no further observable change.

a) Explain the observation that was made in the conical flask when the reaction was in progress**. (1mark)**

b) What observation would be made if lemon juice had been added to copper turnings in a conical flask?

Give a reason. **(2marks)**

9. Explain why a burning magnesium continues to burn in a gas jar full of carbon (IV) oxide while a burning candle would be extinguished. **(2marks)**

10. 8.4g of carbon (IV) oxide and 3.42g of water are formed when a hydrocarbon is burnt completely in oxygen.

Determine the empirical formula of the hydrocarbon.

(H=1.0; C=12.0; O=16.0)
(3marks)

11. The melting point of nitrogen is -196^{0}C while that of sodium is 98^{0}C, in terms of structure and bonding explain the differences in the melting points of nitrogen and sodium. **(2marks)**

12. a) What is an amphoteric substance?
(1mark)

b) Identify the reagent that acts as a base in the equation below. Give a reason for your answer.

$H_2O_{2(aq)} + \overset{H_2O_{(l)}}{\longrightarrow} H_3^+O_{(aq)} + HO_{2(aq)}$

(2marks)

13. In the industrial manufacture of ammonia gas by Harber process, Nitrogen and hydrogen gases are reacted together.

a) State any two conditions necessary for ammonia to be formed in the Harber process. **(1mark)**

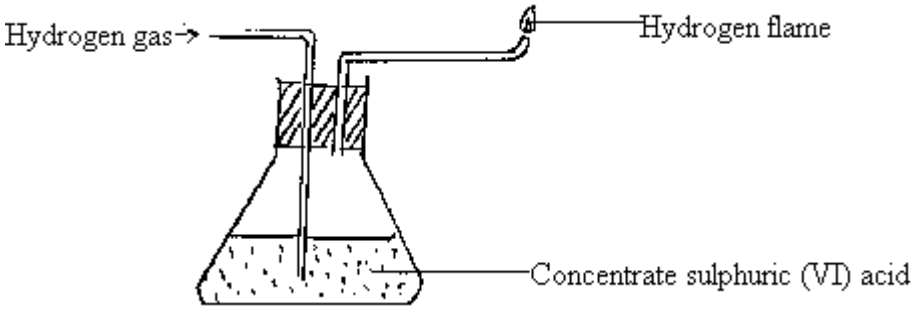
b) Nitrogen and hydrogen must be purified before they are reacted. Give a reason. **(1mark)**

c) Other than manufacture of fertilizers state one use of ammonia. **(1mark)**

14. Describe how you would prepare crystals of potassium sulphate starting with $100cm^3$ of 0.5M potassium hydroxide. **(3marks)**

15. Distinguish between atomic mass and relative atomic mass. **(2marks)**

6. Study the diagram below and answer the questions that follow:



a) Name one chemical and one physical property of hydrogen being demonstrated in the set-up above.

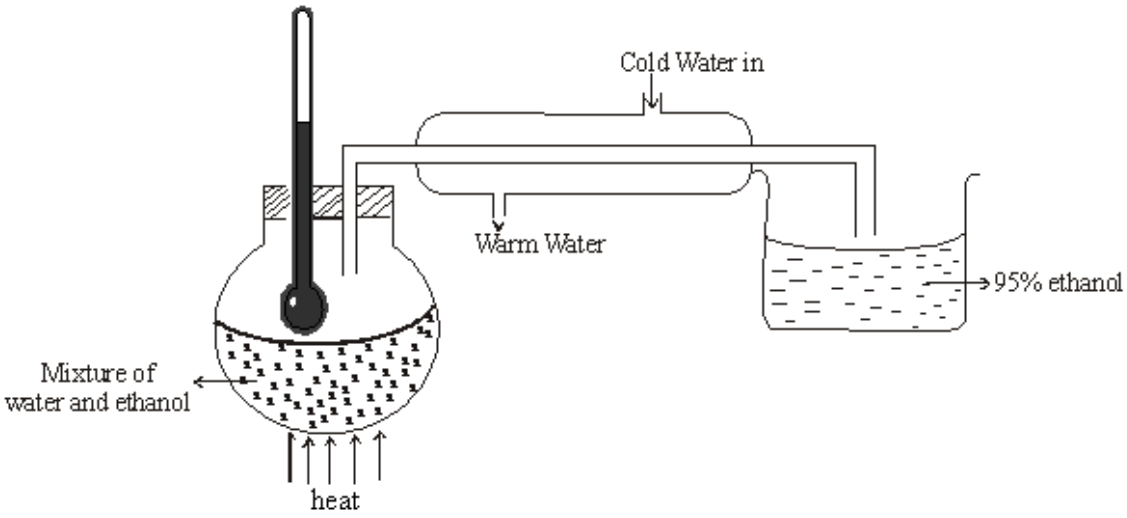
i) Chemical property. **(1mark)**

ii) Write a chemical equation for the reaction taking place. **(1mark)**

b) Name any other substance that can be used in place of concentrated sulphuric (VI) acid. **(1mark)**

c) Give a reason why it is necessary to burn the hydrogen gas as shown in the set-up. **(1mark)**

17. The diagram below shows a simple distillation to separate water and ethanol.



a) State one of the conditions for the above process to take place. **(1mark).**

b) Ethanol collected is 95% pure. Secondary distillation is carried out in which calcium metal is placed in ethanol to react with water. Give a reason why the following cannot be used. **(2marks)**

i. Sodium

ii. Copper

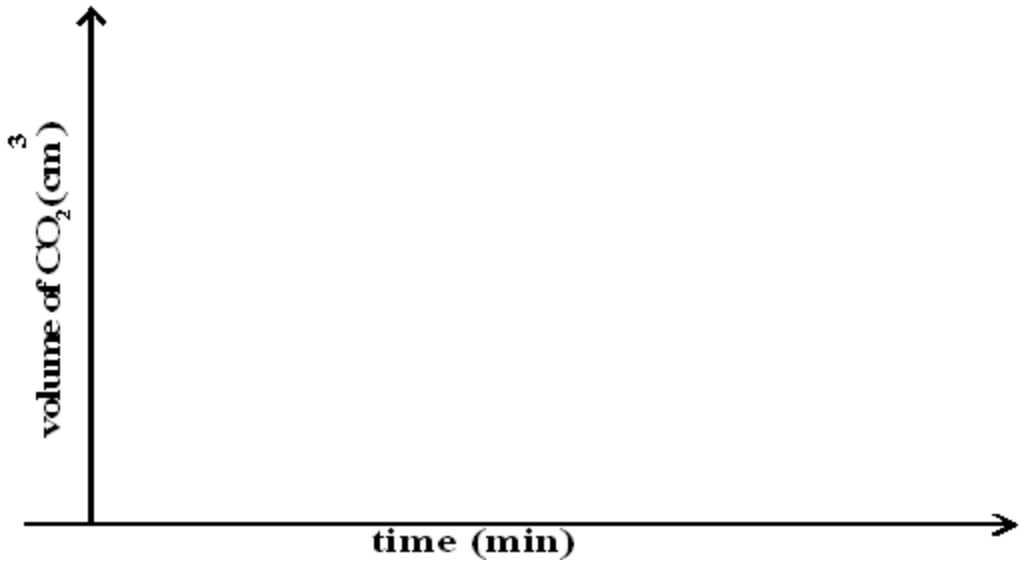
18. A solution of potassium chloride was added to a solution containing a lot of lead (II) nitrate. A precipitate that weighed 5.56g was formed. Find the amount of potassium chloride in the solution **(3marks)**

19. 1.9g of Magnesium chloride was dissolved in water. Silver nitrate solution was added till excess. Calculate the mass of silver nitrate that was added for complete reaction. **(3marks)**
($MgCl_2$= 95, N=14, O=16, Ag = 108)

20. In an experiment 40cm^3 of 0.5M nitric acid was reacted with excess Sodium Carbonate and the volume of Carbon (IV) Oxide produced recorded with time. In another experiment, the same volume and concentration of ethanoic acid was reacted with excess Sodium Carbonate and the volume of Carbon (IV) Oxide produced recorded with time.

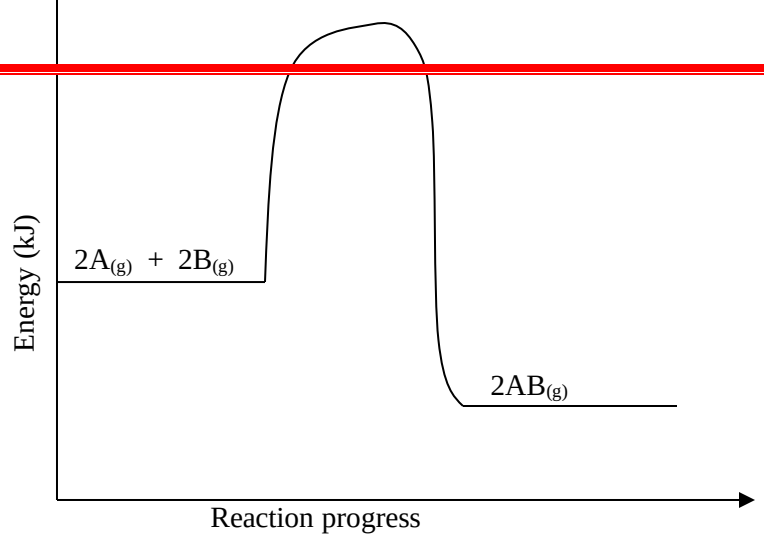
a) Why was Sodium Carbonate used in excess? **(1marks)**

b) On the graph below sketch and label the curves of the volumes of Carbon (IV) Oxide produced against time. **(2marks)**



21. The figure below is an energy level diagram for the reaction.

$2A_{(g)} + 2B_{(g)}$ ⇌ $2AB_{(g)}$



Explain how the following conditions would affect the yield of AB.

(i) Increase in pressure. **(2marks)**

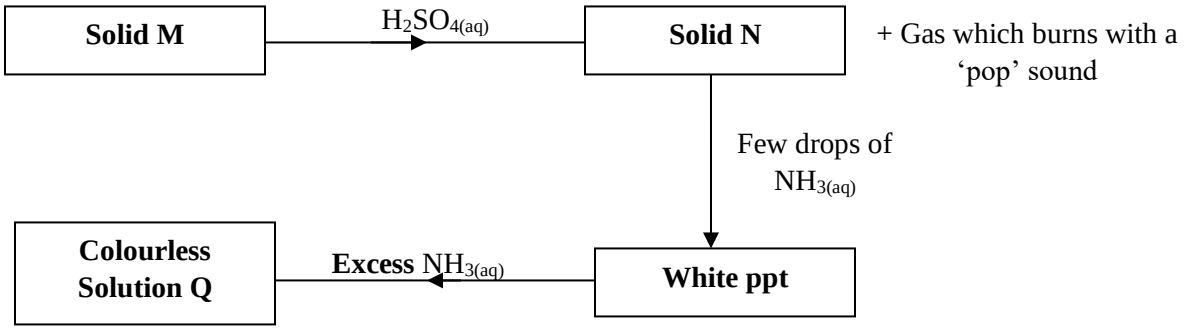
(ii) Decrease in temperature. **(2marks)**

22. A white solid K was heated. It produced a brown gas **A** and another gas **B** which relights a glowing splint. The residue left was yellow even after cooling.

a) Identify gases **A** and **B**. **(2marks)**

b) Write a balanced chemical equation for the decomposition of solid K. **(1mark)**

23. The scheme below shows some reaction sequence starting with solid M.



a) Name solid **M**. **(1mark)**

b) Write the formula of a complex ion present in solution **Q**. **(1mark)**

c).Write an ionic equation of the reaction between barium nitrate and solution **N**. **(1mark)**

24. (a) What is meant by a saturated solution? **(1mark)**

(b) In an experiment to determine the solubility of solid Y in water at 30^0C the following results were obtained.

Mass of evaporating dish	=	26.2g
Mass of evaporating + saturated solution	=	42.4g
Mass of evaporating dish + dry solid Y	=	30.4g

Using the information, determine the solubility of solid Y at 30^0C. **(2marks)**

25. Compare the electrical conductivity of dilute Sulphuric (VI) acid and concentrated Sulphuric (VI) acid. Explain your answer. **(2marks)**

26. Draw a well labelled diagram of a setup used to prepare and collect dry Sulphur IV oxide. **(3marks)**

7. The molar heat of formation of carbon (II) oxide is $-105kJmol^{-1}$, molar heat of combustion of carbon is $-393kJmol^{-1}$.
   By using an energy cycle diagram, determine the molar heat of combustion of carbon (II) oxide.
   (3marks)

28. In an experiment, a small amount of charcoal was added into a test tube and $5cm^3$ of concentrated nitric (V) acid added, then warmed.

(i) State the observation that was made. **(1mark)**

(ii) Explain the observation made in (i) above. **(1mark)**

(iii) Write an equation for the reaction that took place. **(1mark)**

MOMALICHE 2021
233/2
CHEMISTRY
PAPER2
2020-2021

1. (a) Define the following terms:

   i) Strong bases (1mk)

   ii) Amphoteric (1mk)

   iii) Solubility (1mk)

b) Using the equation below, identify the species that acts as the base in the forward reaction. Give a reason. (2mks)

$NH_{3(g)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

c) A solution of ammonia gas in water causes a greater deflection of the ammeter while a solution of ammonia gas in methylbenzene does not cause deflection. Explain this observation. (1mk)

d) Write a well-balanced chemical equation for the reaction between sodium hydroxide solution and zinc oxide. (1mk)

e) Explain how hard water is softened by ion exchange method. (2mks)

f) The table below gives the solubilities of sodium chloride and sodium sulphate at 0°C and 40 °C.

Substance	Solubility in g/100g of water	
	0 °C	40 °C
Sodium chloride	55	75
Sodium sulphate	10	12

When an aqueous mixture containing 60g of sodium chloride and 7g of sodium sulphate in 100g of water at 80 °C was cooled to 0 °C, some crystals were observed.

i) Identify the crystals and determine the mass of the crystals formed. (2mks)

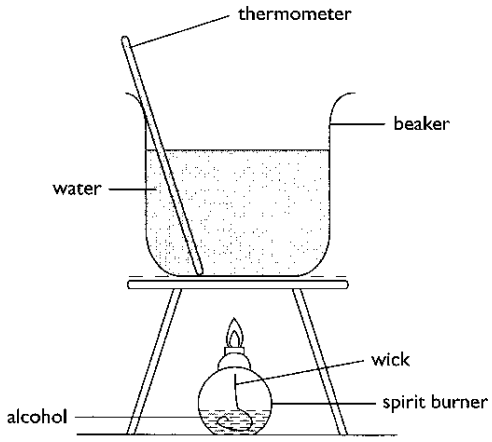
ii) Name the method used to obtain the crystals. (1mk)

2. a) Define

   i) Molar heat of combustion. (1mk)

   ii) Heating value of a fuel. (1mk)

b) In an experiment to determine the heat of combustion of ethanol. CH_3CH_2OH, a student set up apparatus as shown in the diagram below. Study the set up and the data and answer the questions that follow.



Volume of water	=	$100cm^3$
Final temperature of water	=	36.0^0c
Initial temperature of water	=	22.0^0c
Final mass of lamp an ethanol	=	84.75g
Initial mass of lamp and ethanol	=	85.10g
Density of water	=	1 g/cm^3

(Specific heat capacity of water = $4.2kJKg^{-1}K^{-1}$)

i) Calculate:
   I) Number of moles of ethanol used in this experiment. (C=12, O=16, H=1)(1 mk)
   II) The amount of heat given outin this experiment. (2mks)
   III) The heat of combustion per mole of ethanol. (1 mk)

ii) Write a thermochemical equation for the combustion of ethanol. (1 mk)

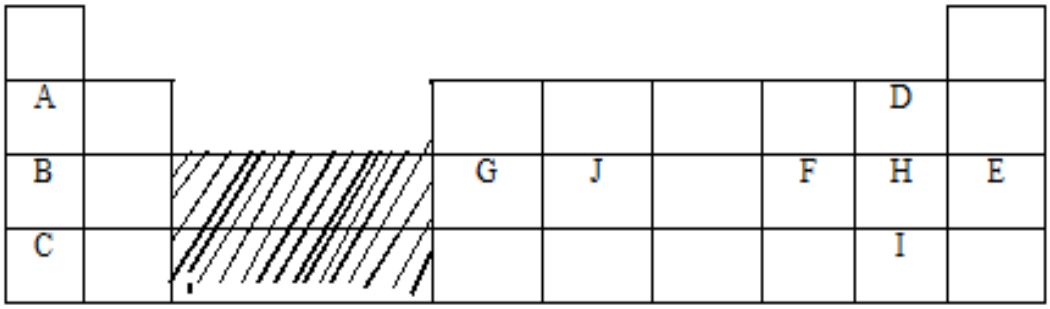
iii) Explain how the molar heat of combustion for ethanol obtained above differs with the theoretical value. (2mks)

iv) State one precaution that should be adhered to when carrying out this experiment. (1mk)

v) In this experiment an assumption that links ethanol and water is made. State the assumption. (1 mk

vi) Draw an energy level diagram for the combustion of ethanol. (2mks)

3. The figure below represents a section of the periodic table. Study it and answer the questions that follow. Note that the letters do not represent the actual symbols of the elements.



(a) Consider elements H and I.

(i) Explain why theatomic radius of element H is smaller than its ionic (1mk)

(ii) When element H was dissolved in water and blue litmus papers dipped, the colour of the litmus paper changed from blue to red to white. Explain. (2mks)

(iii) Explain what is likely to be observed when element H is bubbled through a solution containing the ions of element I. (2mks)

(b) Compare the atomic radius of elements G and J. Explain the difference. (2mk

(c) Use dot and cross diagram to show bonding in a compound of B and H. (1mk

(d) G chloride has an unexpected bond type and structure.State the type of bond and the structure.

Bond type (lmk)

Structure (lmk)

(e) A piece of blue litmus paper is placed in a solution of B chloride and a solution of G chloride. Explain what would be observed in each case.

(i) B chloride solution (lmk

(ii) G chloride solution (1mk)

4. In an experiment to study the rate of reaction, 2.5g of copper (II) sulphate crystals were added to a given mass of zinc granules and 100cm^3 dilute hydrochloric acid at 27^{o}C. The volume of hydrogen released was measured at 10 second intervals. The results obtained are tabulated below.

Time (seconds)	0	10	20	30	40	50	60	70	80	90
Volume (cm^3)	0	60	85	105	114	116	118	122	122	122

a) Why were the following not used in the reaction?

i) Nitric (V) acid (1mk

ii) Iron powder (1mk)

iii)

b) On the grid below plot a graph of volume of gas against time and label it X (3mks)

i) Use the graph to calculate the rate of reaction at t=25seconds (2mks)

ii) Explain why the volume of gas produced does not exceed 122cm^3 (1mk)

iii) Sketch graph Y on the same grid to show the results if the experiment is repeated at 20^{o}C. (1mk)

iv) How does the catalyst used (copper (II) sulphate) speed up the reaction? (1mk)

c) i) State Le'Chatelier's principle. (1mk)

ii) What is the effect on the position of equilibrium when dilute hydrochloric acid is added to the closed system of the reaction below (1mk)

$NH_{3\,(g)} + H_2O_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

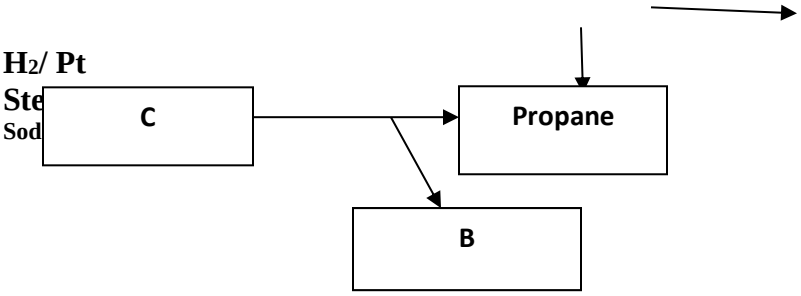
5. (a) Give the IUPAC names of the following organic compounds. (2 mks)

(i) $CH_3 - CH_2 - CH(CH(CH_3)_2) - CH_3$

(ii) $CH_3 - C \equiv C - CH_3$

(b) Study the flow chart below and answer the questions that follow:

$H_2SO_{4(aq)}$ **A** **D**



(i) Identify substances (2mks)

A

B

C

D

(ii) State how substance A and propanecould be distinguished chemically. (1 mk)

(iii) Give the components of soda lime in step I (2mks)

(iv) What is the industrial application of the process that converts substance A to propane? (1mk)

(c) In the laboratory propene can be prepared using propanol, broken porcelain and sodium hydroxide. State the use of broken porcelain and sodium hydroxide solution

Broken porcelain (1mk)

Sodium hydroxide solution (1mk)

6. a) Draw a fully labeled diagram of the apparatus you would use to electrolyse an electrolyte in the aqueous state. (3mks)

b) Explain why crystals of sodium chloride are non-conductorsof electricity butwhen melted they conducts electric current more readily. (2mk)

c) Answer the following questions in relation to the electrolysis of molten lead (II) iodide.

i) State what happens to molten lead (II) iodide when an electric current is passed through it. (1mk)

ii) At what electrode is a metal formed? Write an equation to show how the metal is formed. (2mks)

iii) Why is it necessary to carry out this experiment in a fume chamber? (1mk)

iv) What is a binary electrolyte? (1mk)

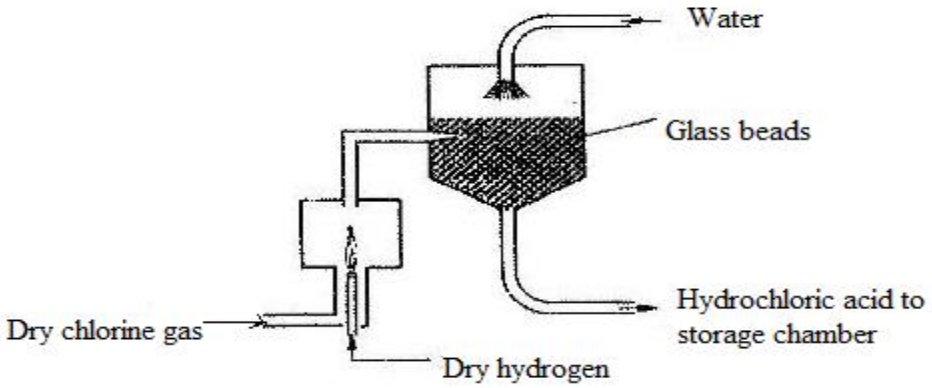
c) Give the application of electrolysis in

i) Chemical manufacturing industry (1mk)

ii) Metal extraction industries (1mk)

iii) Jewellery e.g. necklaces manufacturing industries (1mk)

7. The diagram below represents the industrial manufacture of hydrochloric acid. Study it and answer the questions that follow.



a) Name the main source of hydrogen in this process. (1mk)

b) The reaction between chlorine and hydrogen can be very explosive. How can this be avoided? (1mk)

c) What is the role of glass beads in the absorption chamber? (1mk)

d) Explain why the storage chamber for hydrochloric acid is made up of steel lined with rubber. (1mk)

e) The acid obtained is 35% pure. Calculate its molarity, given that at 25^{o}C, the density of the acid is 1.08g/cm^{3} (H=1, Cl=35.5) (3mks)

f) Explain why hydrochloric acid is not used to acidify potassium manganate (VII) solution.(1mk)