



TOP NATIONAL SCHOOLS TRIAL EXAMS 2022

CHEMISTY

A SOURCE YOU CAN TRUST

- MARANDA SCHOOL
- ASUMBI GIRLS
- PANGANI GIRLS
- KENYA HIGH
- NAIROBI SCHOOL
- MANG'U SCHOOL
- MOI GIRLS ELDORET
- FRIENDS SCHOOL
- MASENO
- BAHATI GIRLS
- STAREHE BOYS

COMPILED BY
GOLDEN ELITE EDUCATIONAL PUBLISHERS
NAIROBI
0724351706

FOR MARKING SCHEMES INBOX 0724351706

MOI GIRLS-ELDORET

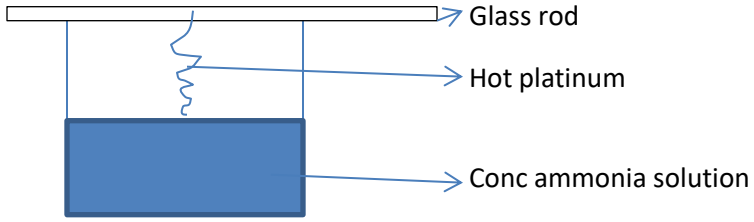
PAPER 1

TIME 2HRS

1. Element K has atomic number 20 while element M has atomic number 8.
   a) Write the electron configuration of K and M
      K _____ (1mk)
      M _____ (1mk)
   b) Write the symbol of the most stable ion of K and M
      K _____ (1/2 mk)
      M _____ (1/2mk)
2. Molten lead (ii) iodide is electrolyzed using inert electrodes. Write the half equation of the reactions that occur at the anode and cathode.
   i) Anode _____ (1mk)
   ii) Cathode _____ (1mk)

   b) Explain why the conductivity of metals decrease with increase in temperature

3. Some sodium chloride was found to be contaminated with copper (ii) oxide. Describe how a sample of dry sodium chloride can be obtained from the mixline
4. Hot platinum wire was lowered into a flask containing concentrated ammonia solution as shown below



State and explain the observations made (3mks)

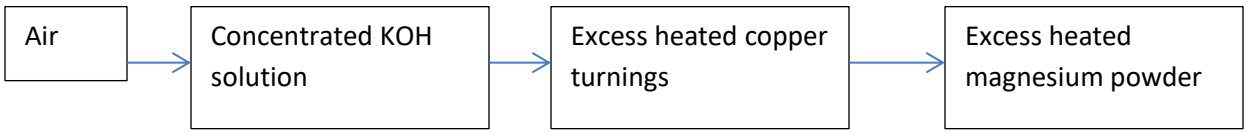
_____

5. a) What is a dative boud? (1mk)

_____

b) Draw a dot (.) and cross (x) diagram to show bouding in carbon (ii) oxide (2mks)

6. Air was passed through several reagents as shown in the flow chart diagram



a) What is the purpose of concentrated potassium hydroxide solution? (1mk)

_____

b) Write an equation for the reaction which takes place in the chamber with magnesium powder (1mk)

_____

c) Name one gas which escapes from the chamber containing magnesium powder (1mk)

_____

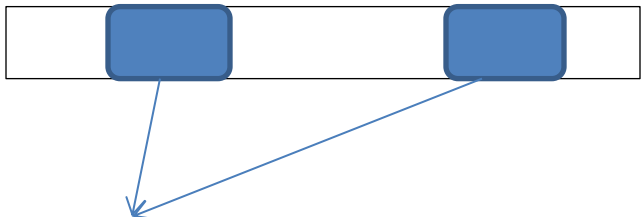
7. Name the following substances
   a) $CH_2CH\ CH_2CH_3$ _____ (1mk)
   b) $CH_3CHCHCH_2CH_3$ _____ (1mk)
   c) State the observation made when compound in (a) above was passed through acidified potassium (vii) manganite (1mk)

_____

_____

_____

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



i) Explain the observation made (2mks)

_____

_____

ii) Explain why non-luminous flame is preferred for heating than luminous flame (1mk)

_____

_____

9. Explain giving reasons why?
   a) Sulphuric(vi) acide is not used with marble in the preparation of carbon(iv) oxide (2mks)

_____

_____

_____

   b) Water cannot be used to extinguish oil fire

_____

_____

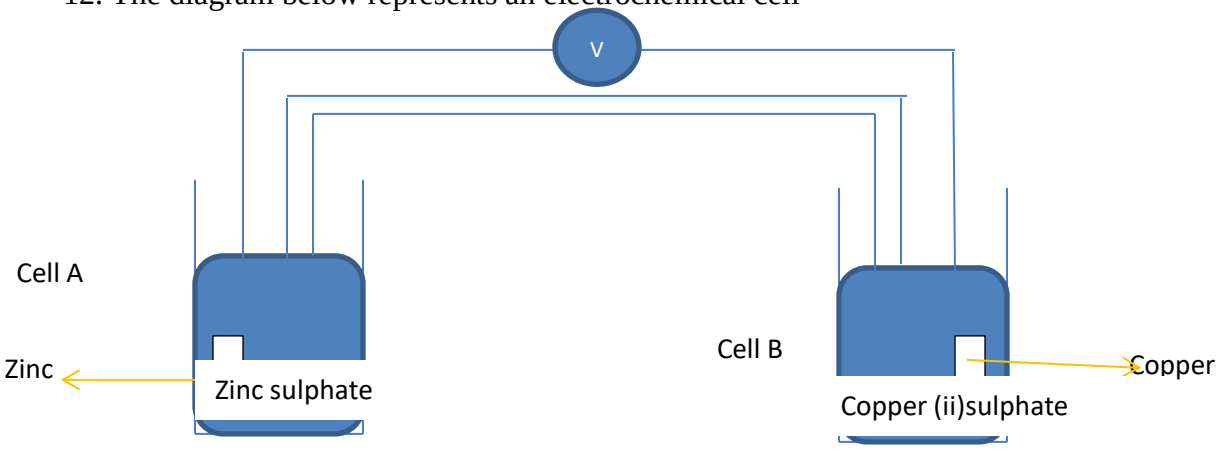
_____

10. 15cm^3 of a solution containg 2.88g/dm^3 of an alkali XOH completely reacts with 20.0cm^3 of 0.045m sulphuric(vi) acid. Calculate the molarity and relative atomic mass of x present in the alkali

11. An 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 (2mks)

    b) Name the homologous series to which Q belongs

12. The diagram below represents an electrochemical cell



    i) On the diagram label the salt bridge (1mk)

    ii) State two observations made in cell B (1mk)

    a) Write the overall ionic equation of the cell (1mk)

13. During the extraction of copper and zinc from their ores, some of the processes include
    i) Crushing
    ii) Mixing of the crushed ore with oil and water and bubbling air through it.
    (a) (i) Name the process (ii) above (1mk)

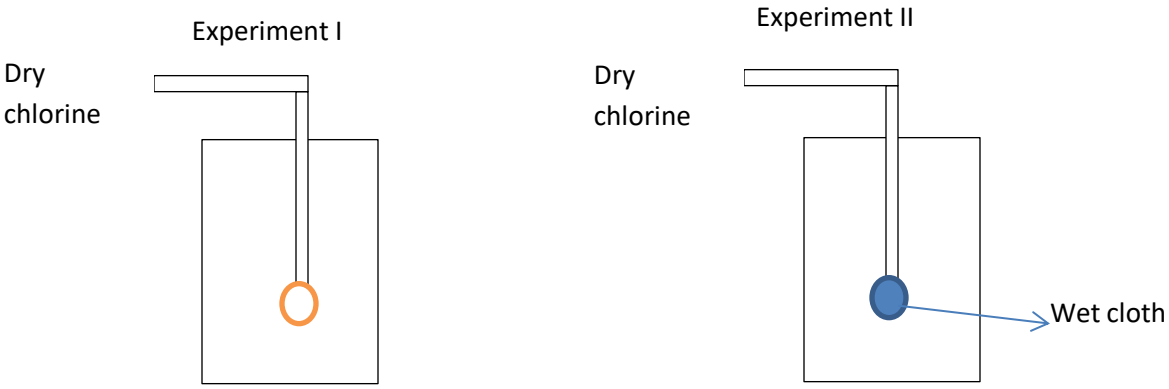
_____

(ii) What is the purpose of (ii) above

_____

_____

14. Dry chlorine gas was passed through two pieces of coloured cotton cloth as shown



a) State what is observed in each experiment (1mk)

Experiment I

_____

Experiment II

_____

b) Explain your observation using an equation (1mk)

_____

_____

15. a) what is meant by solubility? (1mk)

_____

_____

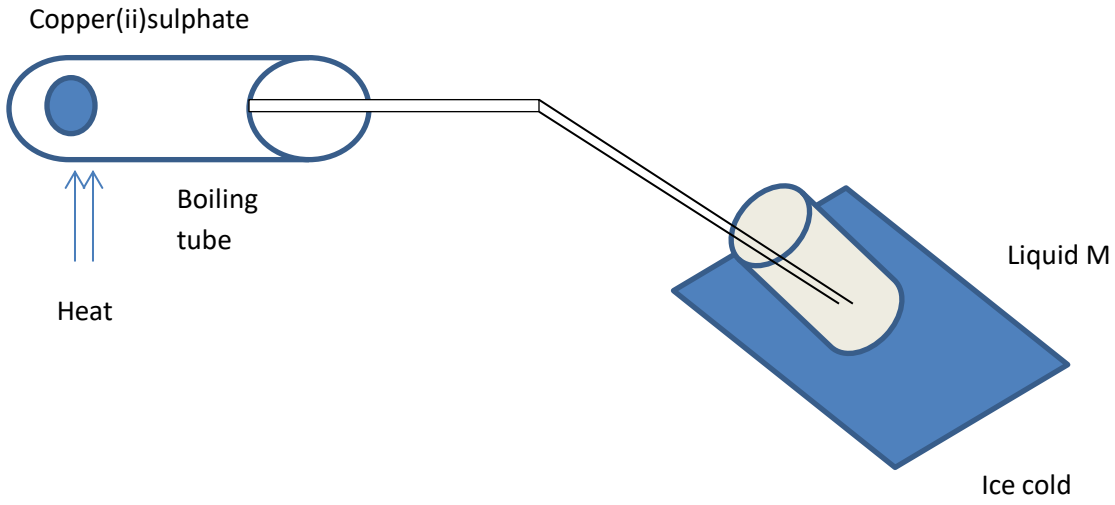
b) In an experiment to determine the solubility of solid Y in water at 30^{o}C the following results were obtained.
Mass of evaporating dish = 26.2g
Mass of evaporating dish + saturated solution = 42.4g
Mass of evaporating dish + dry solid y = 30.4g
Using the information, determine the solubility of solid Y at 30^{o}c in grams per 100g of water (2mks)

_____

_____

16. the molar heat of formation of carbon(ii) oxide is $^{-}105kjmol^{-1}$, molar heat of combustion of carbon is -393 $kjmol^{-1}$
    by using an energy cycle diagram, determine the molar heat of combustion of carbon(ii)oxide (3mks)

17. The diagram below was used to study the effect of heat on copper(ii)sulphate crystals



a) Name liquid M (1mk)

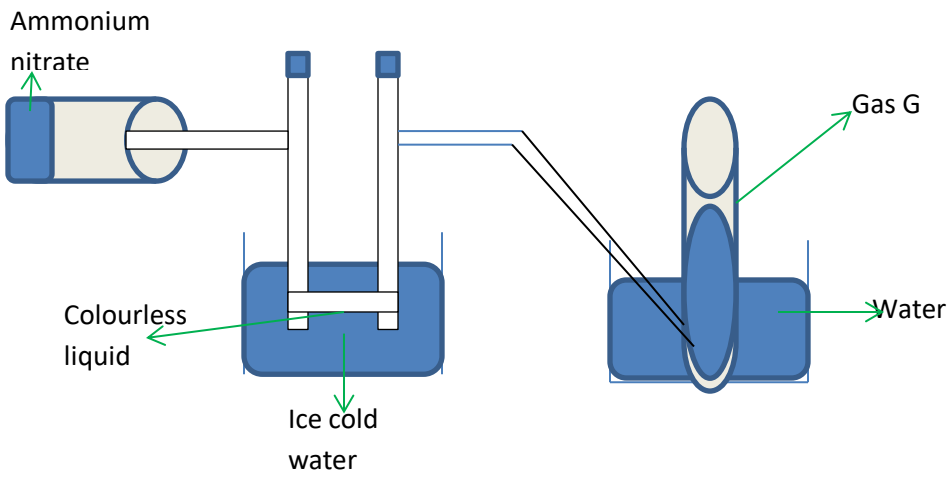
b) State and explain the precaution that should be made before stopping heating (2mks)

18. Deuterium $^{2}_{1}D$ and tritium $^{3}_{1}T$ are two isotopers of hydrogen. They react to form element Y and neutron particles according to the equation below.
    $^{2}_{1}D + {}^{3}_{1}T \longrightarrow {}^{a}_{b}Y + {}^{1}_{0}n$
    i) Find the value of a and b (2mks)

    ii) What name is given to the type of reaction undergone by the isotope of hydrogen (1mk)

19. A gas occupies $4dm^3$ at -23^0c and 152mmHg. At what pressure will its volume be halved, if the temperature then is 227^0c? (2mks)

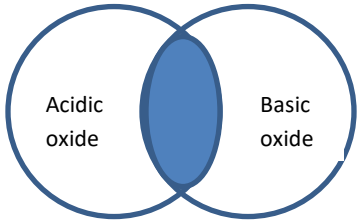
20. Ammonium nitrate was gently heated and the products collected as shown in the diagram



a) Identify
   i) Colourless liquid H (1mk)
   _____
   ii) Gas G (1mk)

b) Describe one chemical test that can be used to identify gas G
   _____
   _____

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



a) State the type of oxide that would be placed in the shaded area (1mk)
   _____

b) Name an oxide that would be placed in the shaded area (1mk)
   _____

22. A dynamic equilibrium between dichromate and chromate ions is established as shown in the equation below.

$Cr_2O_7^{2-}(aq) + ZOH^-(aq) \rightleftharpoons 2Cro^{2-}_4 + H_2O\ (l)$

Orange — Yellow

a) What is meant by dynamic equilibrium? (1mk)
   _____
   _____

b) State and explain the observation made if a dilute hydrochloric acid is added to the equilibrium mixture (2mks)
   _____
   _____

23. An experiment showed that the composition of a compound to be 5838% Barium, 13.72% Sulphur and 27.47% oxygen. Calculate the empirical formula of the compound (Ba = 137; S=32, O=16) (3mks)

24. In an experiment to study diffusion of gases, the following set up was used



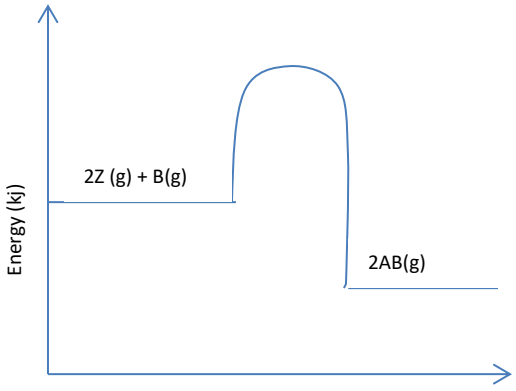
Cotton wool soaked in conc. $NH_3(aq)$

Cotton wool soaked in con. Hcl

i) vations made in the experiment (2mks)

ii) Write an equation for the reaction that occurs in the experiment (1mks)

25. The figure below is an energy level diagram for the reaction $2Z\ (g) + 2B(g) = 2AB(g)$



Explain the effect of yield AB by

i) Increase in pressure (1 ½ mk)

ii) Decrease in temperaline (1 ½ mk)

26. Study the following changes that took place when the following substances are exposed to air.

a) $NaOH(s) \xrightarrow{I} NaOH(aq)$

b) $N_2CO_3.IOH_2O(s) \xrightarrow{II} Na_2CO_3(s) + IOH_2O(l)$

c) $CuSO_4(s) + 5H_2O(l) \xrightarrow{\quad} III \quad CuSO_4.5H_2O(s)$

Name the process (3mks)

I _____

II _____

III _____

27. 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 when hot and white when cold.
    a) Identify gases A and B (2mks)
    A _____
    B _____
    b) Write an equation for the decomposition of solid K (1mk)
    _____
    _____

28. Bronze is an alloy of copper and another metal. Identify the other metal.

PAPER 2

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		
I	B		C		D		E	
F	G						H	

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

……
……
……

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

……

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

.....
.....
.....

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

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

i) F and G

……

ii) B and G

……
……

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

……
……
……

(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. a) Sulphur occurs naturally in two different forms called allotropes;

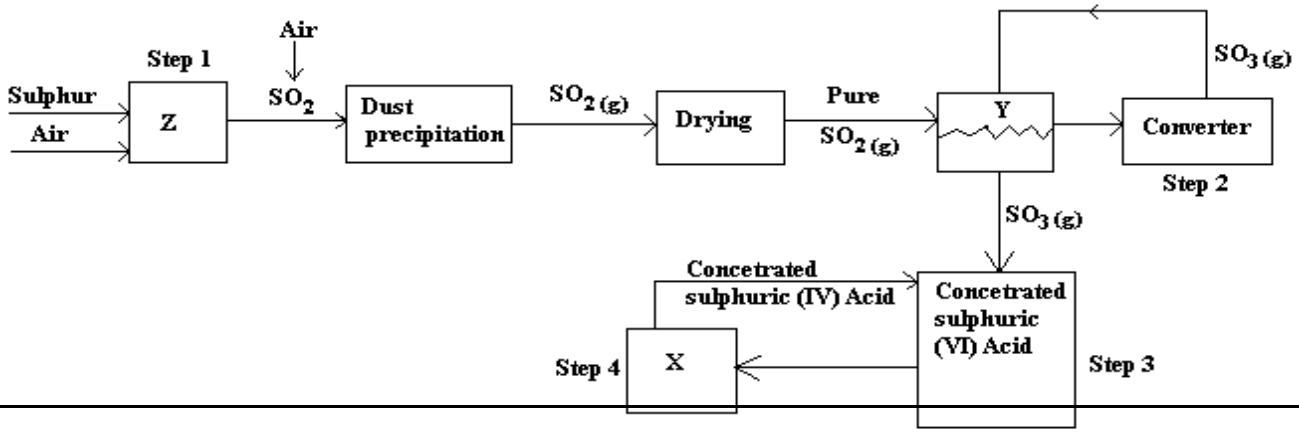
(i) What are allotropes? **1mark**

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

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

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.



(h)

(i) Give the name of chambers labeled **1 ½ mark**

X

Y

Z.

(j) State the three conditions in the converter. **1 ½ mark**

……
……
……

(k) Explain why gases are passed through ; **2marks**

I – The dust precipitator and drying power

……
……

(i) II- The chamber labeled Y Write the balanced equations for the reactions in; **3marks**

Step 2:

……

Step 3:

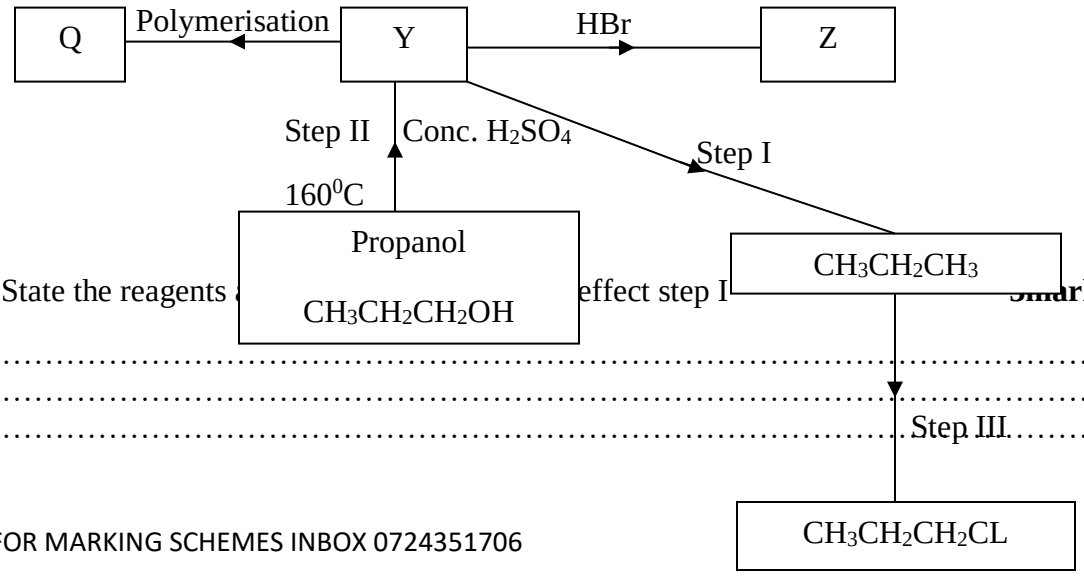
……

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**

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



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

……
……
……

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

……
……

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

……

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

……
……

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

Step II

……
……

Step III

……
……

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

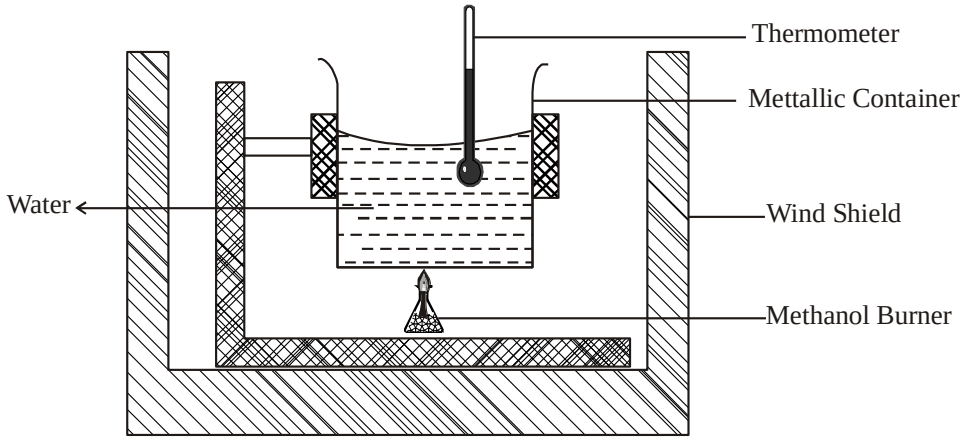
……
……

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

4.

a) What is the molar heat of combustion of a substance? (1mark)

The experiment below was set up to determine the molar heat of combustion of methanol.



The following data was obtained from the above experiment.

Mass of burner + methanol before burning = 62.74g

Mass of burner + methanol after burning = 62.36g Final temperature of water = 38.5^0C

Initial temperature of water = 23.5^0C

Volume of water used = $100cm^3$

i) From the above results work out the molar heat of combustion of methanol. (3marks)

(Density of water =$1g/cm^3$, C = 12, O=16, H= 1.0)

Specific heat capacity of solution 4.2Kj $K^{-1}{}_g$ K^{-1})

……
……
……

ii) Write a thermo chemical equation for this reaction. (1mark)

……
……

iii) Explain why the value obtained in (i) above may be lower than the actual value. (1mark)

……
……

b) Study the data given below

$C_3H_{8(g)} + 5O_{2(g)} \longrightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ $\Delta H = -2209$ KJmol^{-1}

$H_{2(g)} + \frac{1}{2} O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H = -286$KJmol^{-1}

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H = -406$KJmol^{-1}

Use this information to find the heat of formation of propane. (3marks)

……
……
……

c) What do you understand by the term heating value of a given fuel? (1mark)

……
……

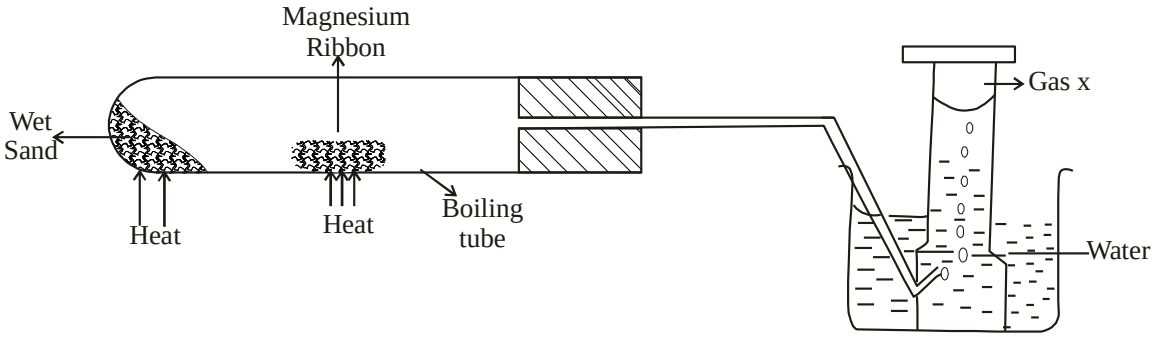
……

d) State two factors you consider when choosing a fuel. (1mark)

……

5.

a) Magnesium ribbon was reacted with steam as shown in the diagram below.



(i) State two observations in the boiling tube. (2marks)

……
……

(ii) Describe how you test for gas x (2marks)

……
……

(iii)State one industrial use of the product formed in the boiling tube at the end of the experiment.
(1mark)

……
……

b)

(i) Explain what is meant by the term neutralisation. (1mark)

……
……

(ii) Starting with $50cm^3$ of 2M nitric (v) acid, describe how you would prepare crystals of sodium nitrate.
(3marks)

……
……
……

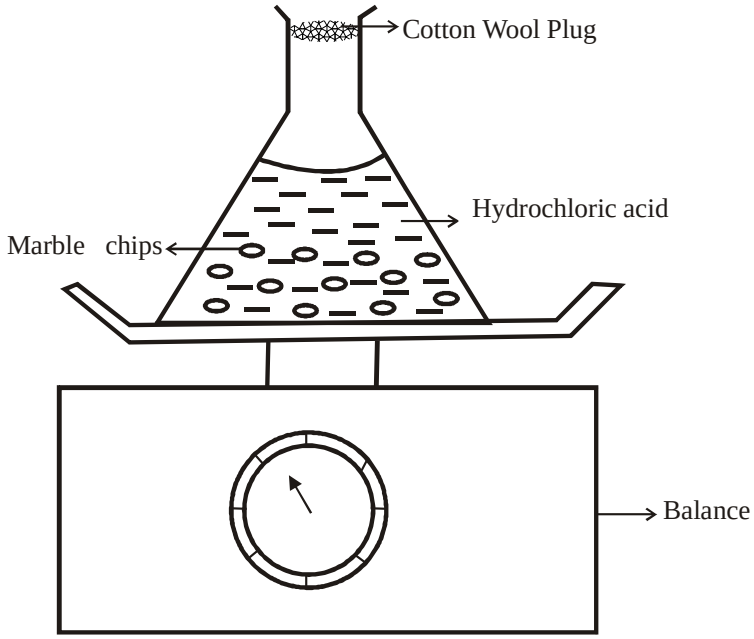
c) Complete the table below. (1mark)

Indicator	Colour in	
	Acidic solution	Alkaline solution
Phenolphthalein	_____	Pink
Methyl Orange	Pink	_____

d) When magnesium is burnt in air two reactions take place forming two different compounds. Write down the equations for the two reactions. (2marks)

……
……
……

6. The set up below is used to measure the change in mass during the course of the reaction between dilute hydrochloric acid (Excess) and marble chips at 22^0C.



Changes in mass were noted at one minute intervals and were as follows;

Time (Min)	1	2	3	4	5	6	7
Loss in mass (g)	0.26	0.46	0.60	0.69	0.73	0.73	0.73

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

……
……

b) Give a reason why the mass of the flask charged with time? (1mark)

……
……

c) What is the role of cotton wool at the mouth of the flask? (1mark)

.....
.....

d) Explain why it is not advisable to use dilute sulphuric (VI) acid with marble chips in this experiment (1mark)

.....
.....

e) Plot a graph of loss in mass (vertical axis) against time. Label the curve 22^0C (3marks)

f) On the same axis in (e) above sketch the graph you would expect to obtain if the experiment was repeated at 35^0C. Label the curve 35^0C. (1mark)

g) State what would happen if the marble chips were replaced with the same mass of marble powder. Explain your answer. (1mark)

.....
.....
.....

h) Determine the volume of carbon (IV) oxide produced if 0.12g of marble chips was reacted with excess dilute hydrochloric acid. (Experiment done at room temperature and pressure. Molar gas volume at r.t.p = $24dm^3$,Ca = 40.0,O = 16, C = 12.0) (2marks)

……
……
……

7. In an experiment ,0.71g of hydrated sodium carbonate ($Na_2CO_3.XH_2O$) was treated with dilute nitric v acid and the gas evolved was carbon iv oxide which was measured using a syringe at stp.The volume of carbon iv oxide obtained was $56cm^3$

a.Write the equation for the reaction between anhydrous sodium carbonate and dilute nitric v acid (1mk)

b. Calculate the number of moles of carbon iv oxide gas collected at s.t.p (molar gas volume at stp=22,400) (2mks)

c.Calculate the mass of anhydrous sodium carbonate reacted (3mks)

d.Calculate the mass of water in 0.715g of hydrated sodium carbonate (1mk)

e. Determine the R.F.M of hydrated sodium carbonate, hence the value of X (3mks)

PAPER 3

1. You are provided with:

- Solution **A**, a mixture of two bases sodium hydroxide and sodium carbonate solids dissolved in a 1 litre solution.
- Solution **B**, **0.2**M hydrochloric acid.
- Phenolphthalein and methyl orange indicators.
- Solution **C**, barium chloride solution.

You are required to determine the **concentration** of **each** of the reactants in the mixture.

Procedure 1

Pipette **25.0**cm^3 of solution **A** into a conical flask.

Add two drops of methyl orange indicator.

Titrate solution **A** with **B** until the yellow colour just changes to pink.

Record your results in the table below.

Repeat the procedure to obtain two more readings.

Table I (3 marks)

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

(a) Calculate the average volume ($\mathbf{V}_1$) of solution **B** used. (1 mark)

(b) Calculate the number of moles of hydrochloric acid that reacted. (1 ½ marks)

Procedure II

Pipette **25.0**cm^3 of solution **A** into a conical flask. Measure **15.0**cm^3 of barium chloride solution (solution **C**) with clean measuring cylinder.

Add it to the solution **A** in the conical flask. Shake it gently and add three drops of phenolphthalein indicator.

Titrate solution **B** into the conical flask until the pink colour just changes to colourless.

NB: The white precipitate should remain in the flask.

Repeat the procedure to obtain two more readings.

Table II (3 marks)

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

(c) Calculate the average volume ($\mathbf{V_2}$) of solution **B** used. (1 mark)

(d) The equation for the formation of white precipitate

$$\mathbf{Na_2CO_{3\,(aq)} + BaCl_{2\,(aq)} \longrightarrow BaCO_{3\,(s)} + 2NaCl_{\,(aq)}}$$

During titration **II** the white precipitate formed after adding barium chloride does not take part in the titration but all the hydroxide ions ($\mathbf{OH^-}$) in the solution are neutralized.

(i) Calculate the moles of the acid (solution **B**) reacting in titration **II**. (1 ½ marks)

(ii) Calculate moles of sodium hydroxide ($\mathbf{OH^-}$) reacting during the titration. (1 ½ marks)

(e) Calculate number of moles of acid that reacted with sodium carbonate in the mixture. (1 ½ marks)

(f) Calculate the concentration of solution **A** in terms of sodium hydroxide in moles per litre. (1 ½ marks)

(g) Write an ionic equation for the reaction of the acid with sodium carbonate. (1 mark)

(h) (i) Calculate the number of moles of sodium carbonate in the mixture. (1 mark)

(ii) Calculate concentration of solution **A** in terms of sodium carbonate in moles per litre. (1 ½ marks)

2. You are provided with solid **Z**. Carry out the tests below and write your observations and inferences.

(a) Using a clean metallic spatula, heat a half of solid **Z** in a Bunsen burner flame.

Observation	**Inferences**
(1 ½ marks)	(1 marks

(b) Dissolve the remaining portion of solid **Z** into **10**cm^3 of distilled water in a boiling tube. Divide the resulting solution into four portions.

Observation	**Inferences**
(1 mark)	(½ mark)

(c) To 1st portion, add **3** drops of acidified potassium manganate (VII)

Observation	**Inferences**

(½ mark)	(1 ½ marks)

(d) To the 2nd portion, add **3** drops of acidified potassium dichromate (VI) and warm.

Observation	Inferences
(½ mark)	(1 ½ marks)

(e) To the 3rd portion, add all the $NaHCO_3$ provided.

Observation	Inferences
(1 mark)	(½ mark)

(f) To the 4th portion, add **3** drops of universal indicator and determine the pH value.

Observation	Inferences
(1mark)	(½ mark)

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

(a) Place half of solid **Y** in a boiling tube and heat. Test any gas produced with litmus paper.

Observation	Inferences

(1 ½ marks)	(1 mark)

(b) Place the remaining solid **Y** into a boiling tube. Add about **10**cm^3 distilled water and shake. Divide the resulting solution into **5** portions.

Observation	Inferences
(½ mark)	(½ mark)

(c) To the 1st portion, add $NaOH_{(aq)}$ dropwise till in excess.

Observation	Inferences
(1mark)	(½ mark)

(d) To the 2nd portion, add $NH_{3\,(aq)}$ dropwise till in excess.

Observation	Inferences
(1 mark)	(½ mark)

(e) To the 3rd portion, add **1**cm^3 of acidified hydrogen peroxide followed by $NaOH_{(aq)}$ dropwise till in excess.

Observation	Inferences
(1 mark)	(½ mark)

(f) To the 4th portion, add **3** drops of lead (II) nitrate and then filter.

Observation	Inferences
(1 mark)	(1 mark)

(g) To the 5th portion, add **3** drops of acidified barium nitrate solution.

Observation	Inferences
(½ mark)	(½ mark)

KENYA HIGH SCHOOL

PAPER 1

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.

* Anode

…… **1mark**

* Cathode

…… **1mark**

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

.....

.....

.....

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**

.....

.....

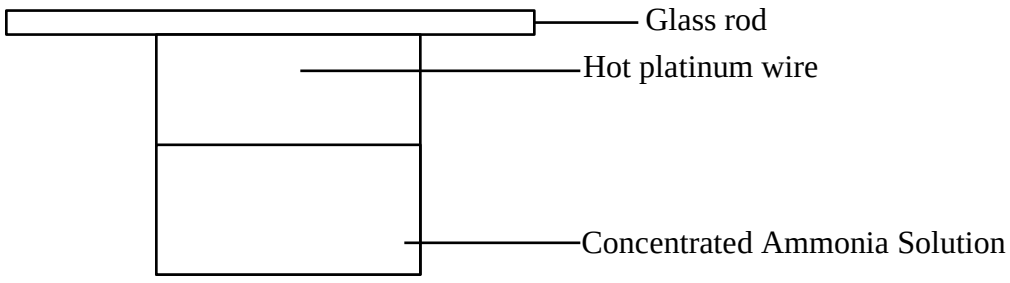
5) Some sodium chloride was found to be contaminated with copper (II) oxide. Describe how a sample of sodium chloride can be separated from the mixture. **2marks**

……

……

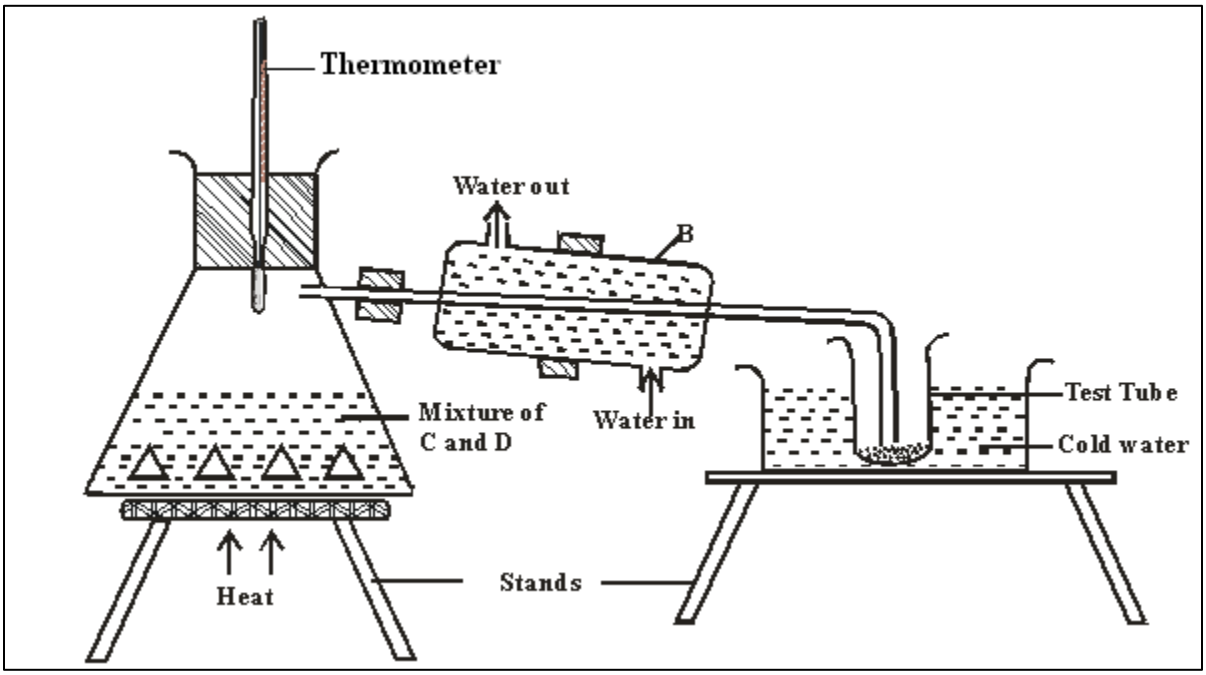
……

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



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

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**

……

……

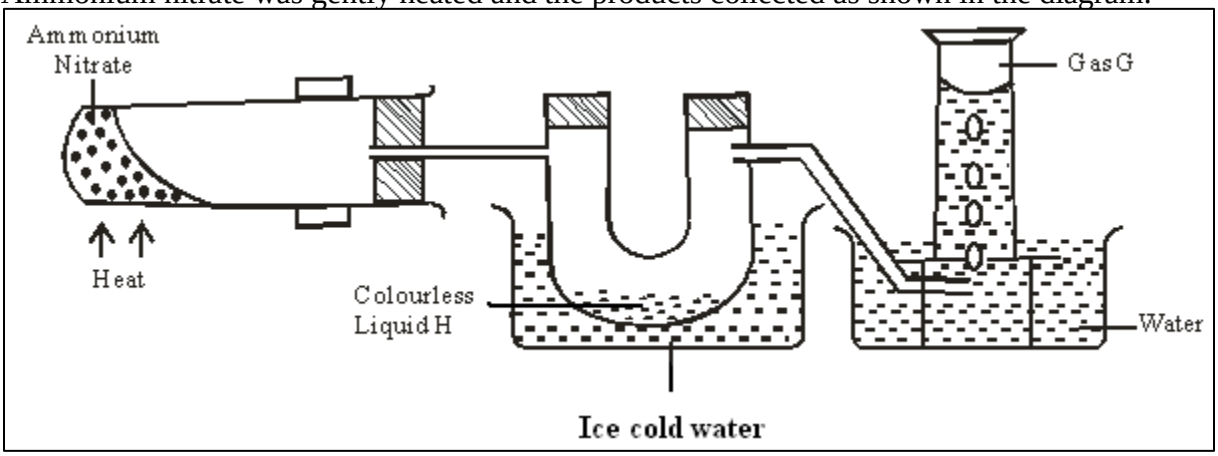
c) Which liquid was collected in the test tube? **1mark**

……

……

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.



i. Identify:

a. Colourless liquid H

…… **1mark**

b.Gas G

…… **1mark**

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

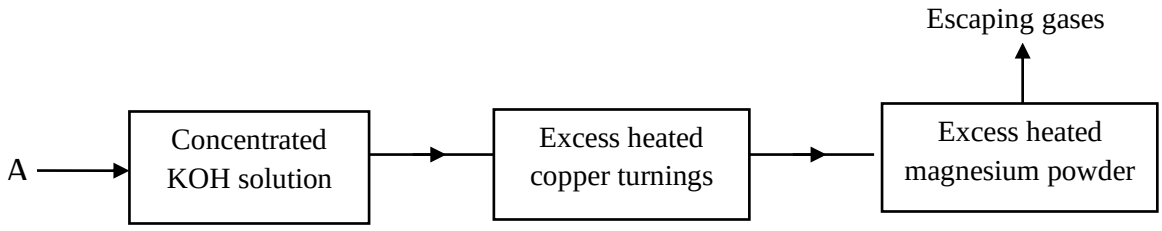
……

……

……

……

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**

……

……

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

……

……..

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

……..

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

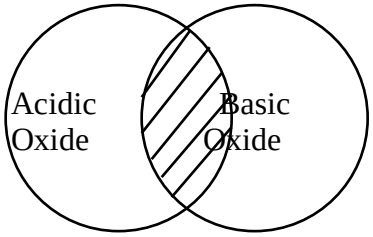
……

……

11) Name the following substances.

- $CH_2\,CH\,CH_2\,CH_3$ **1mark**
- $CH_3\,CH\,CH\,CH_2\,CH_3$ **1mark**

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**

……

……

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

……

……

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

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

……

……

……

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

……

……

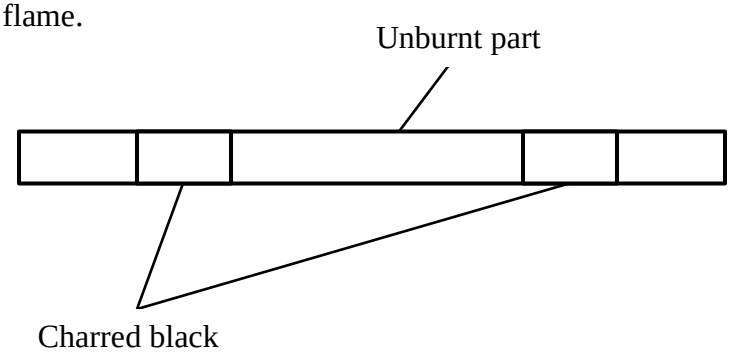
c) State a possible structure in substance C? **1mark**

……

……

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**

……

……

……

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

……

……

……

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**

……

……

……

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

……

……

18) Explain giving reasons why?

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

……

……

……..……..

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

……

……

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

……

……

……

……

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**

……

……

……

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

……

……

……

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**

……

……

……

……

……

……

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**

……

……

……

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

……

……

……

……

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.

(i) Write the structural formula of Q. **1mark**

……

……

.....

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

……

……

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**

……

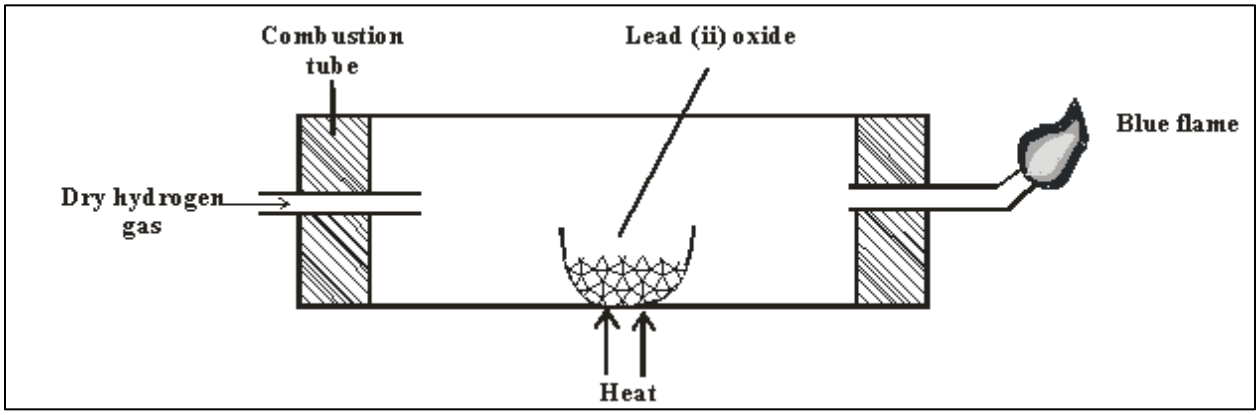
ii) Solution Y **1mark**

……

iii) Colourless gas Z **1mark**

……

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



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

……

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

……..

.....

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

……

……

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

……

……

……

28)

1. What is meant by the term allotrophy? **1mark**

……

……

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

PAPER 2

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		
I	B		C		D		E	
F	G						H	

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

……

……

……

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

……

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

.....

.....

.....

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

……

……

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

a) F and G

……

……

b) B and G

……

……

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

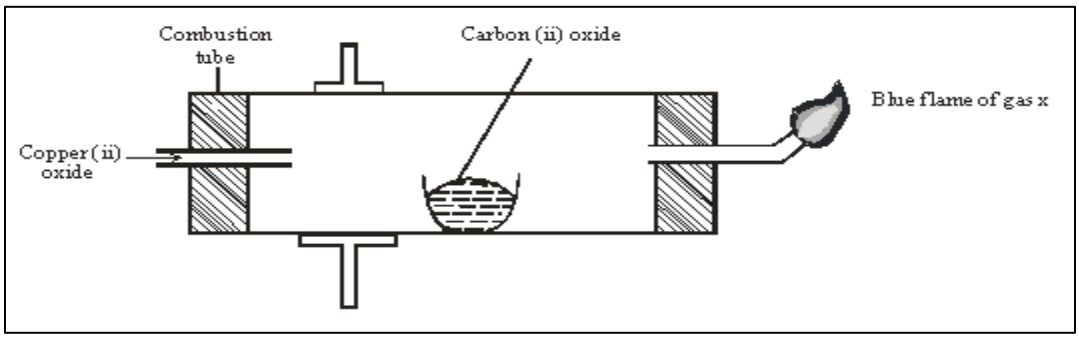
……

……

……

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.



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

……
……

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

……
……

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

……
……

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

……
……

v. Why is it necessary to burn gas x? **1mk**

……
……

vi. Name the reducing and oxidizing agent. **2marks**

a) Reducing agent

……

b) Oxidising agent

……

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

……
……

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

……
……
……

3) a) Sulphur occurs naturally in two different forms called allotropes;

- What are allotropes? **1mark**

……

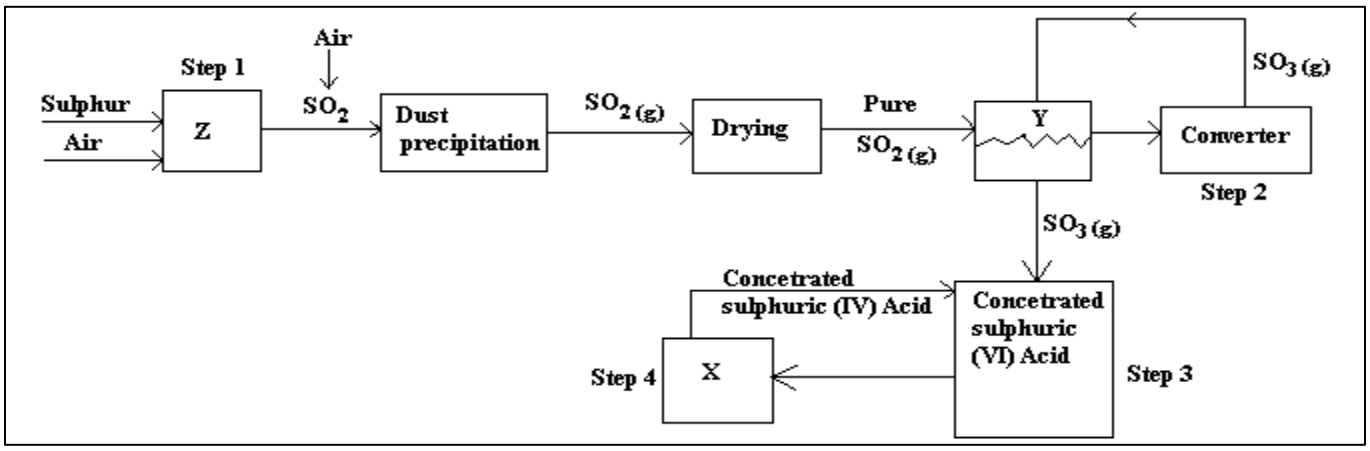
- The two allotropes of sulphur are stable at different temperatures, as shown in the equation below.

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

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.



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

X

……

Y

……

Z

…….

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

……

……

……

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

I – The dust precipitator and drying power

……

……

II- The chamber labeled Y

……

……

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

Step 2:

……

Step 3:

……

Step 4:

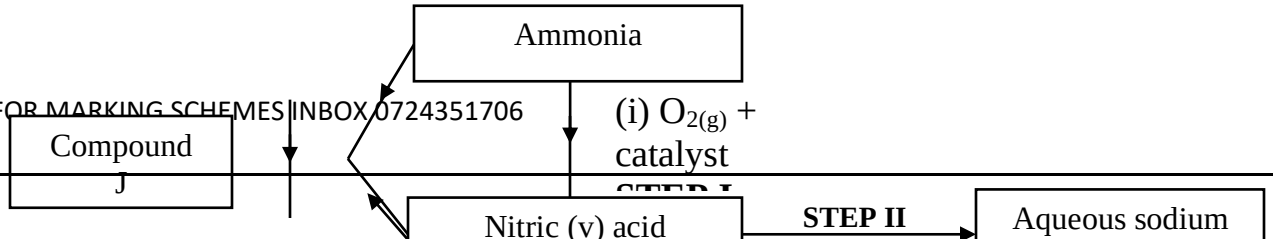
……

* 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**

……

……

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



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

……..

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

.....

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

.....

d) Identify the process is step II? **1mark**

……

e) 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)**

……

f)

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

……...

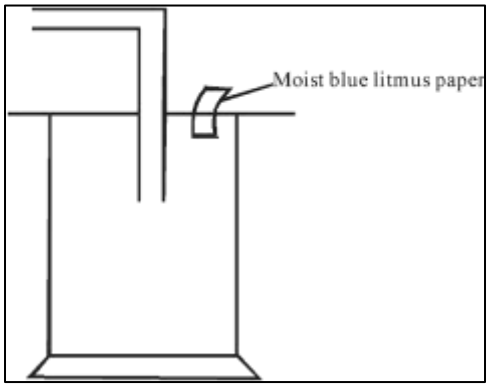
II. Calculate the mass of compound J that would contain 14g of nitrogen. (N=14, O=16, H= 1) **(2marks)**

b) Explain the advantage of using ammonium phosphate fertilizer over the other nitrogenous fertilizers. (**1mark)**

……

……

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



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

……

……

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**

……..

……

……

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

……
……
……

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

……
……
……

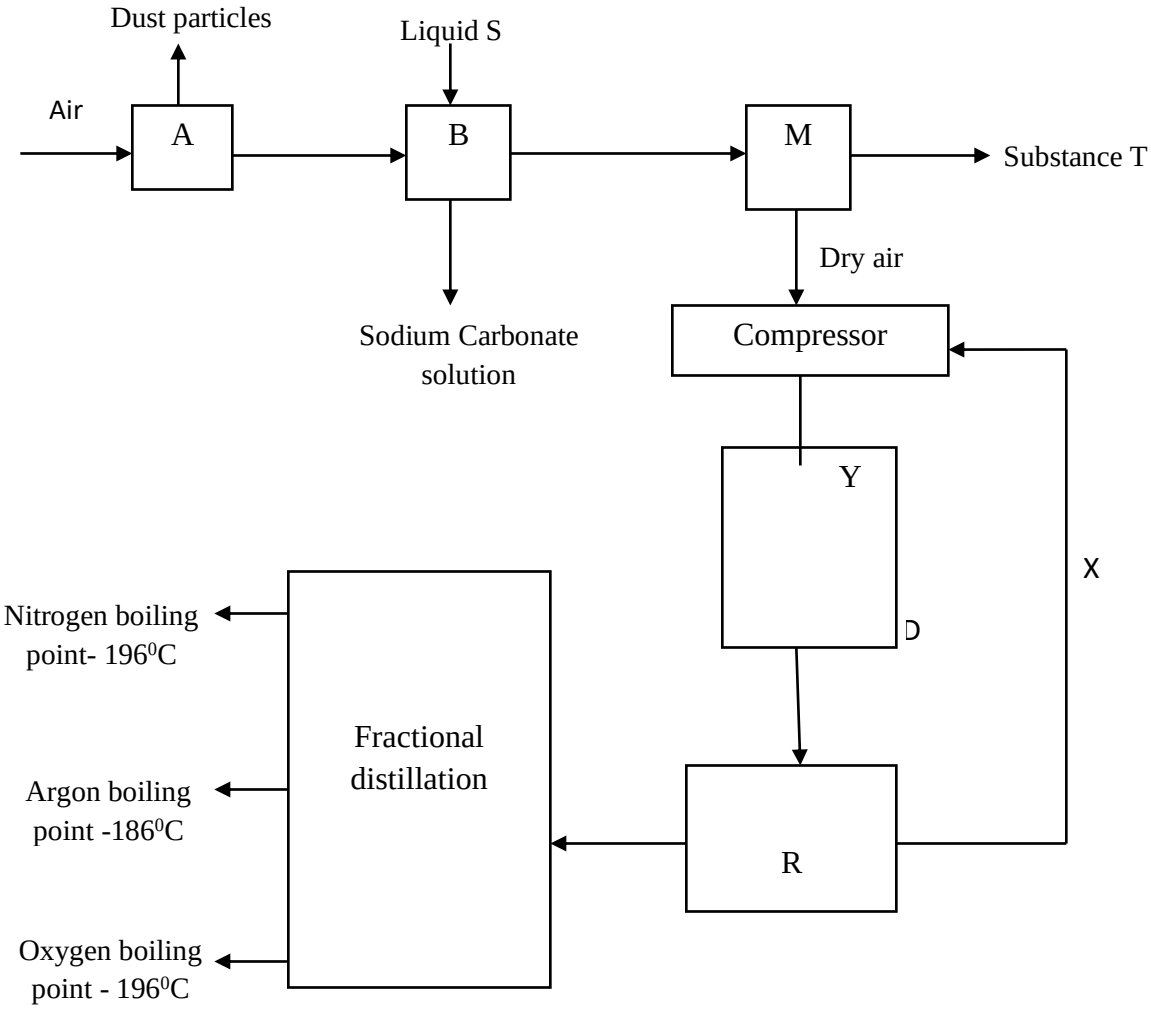
f) Chlorine gas is mixed with moist hydrogen sulphide gas, state and explain the observations **2marks**

……
……
……

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

……
……

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



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

ii. Name;

i) Liquid S

……

ii) Substance T

……

iii. Explain why part Y in chamber D is curved? **1mark**

……

……

iv. Give two industrial uses of oxygen gas? **2marks**

……

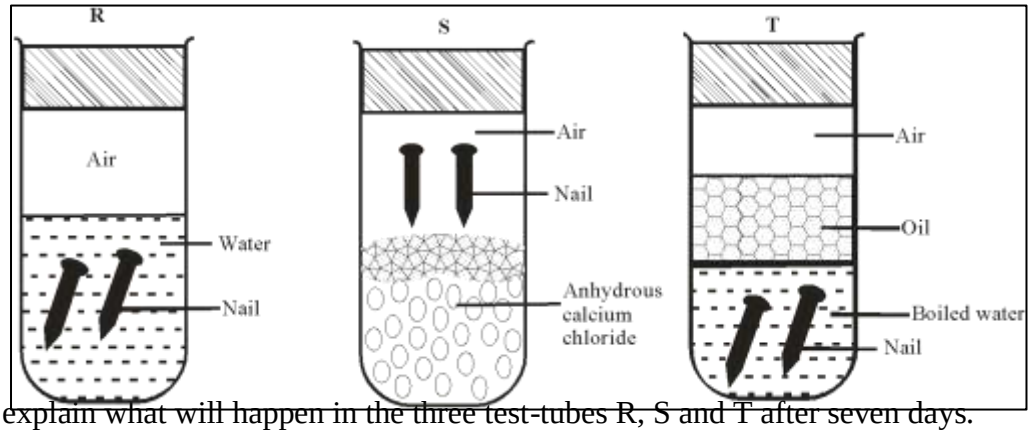
……

v. 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**

……

……

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



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

……

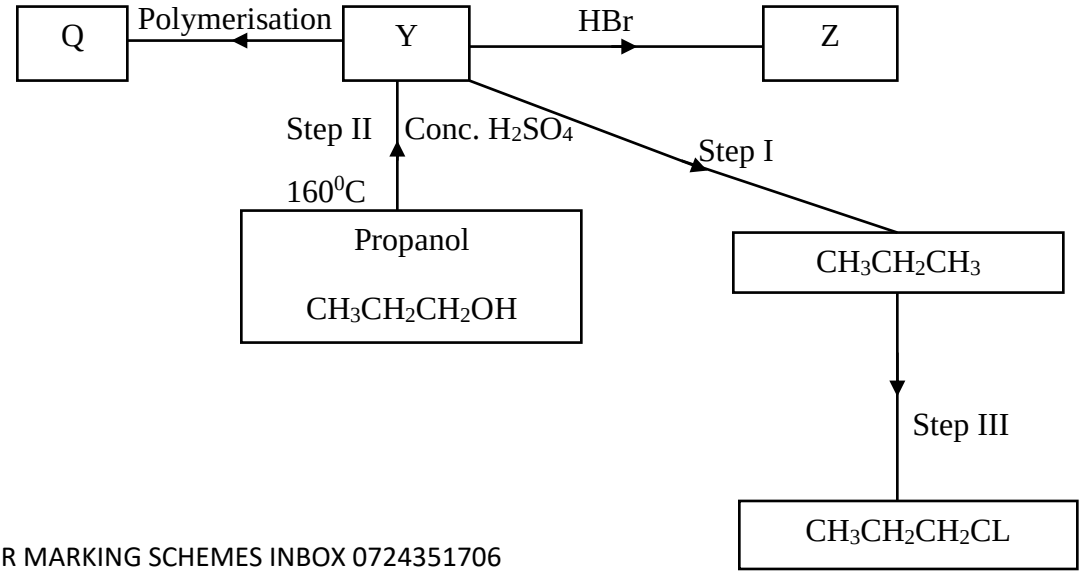
……

……

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

……

vii) 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**

……
……
……
……

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

……
……
……

c) Name product Q **1mark**

……

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

……
……
……..

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

Step II

……
……

Step III

……
……

f) (i) Define the term hydrocarbon 1mark

……
……

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

PAPER 3

c) 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.

-

Titration	**1**	**2**	**3**
Final burette reading (cm^3)			
Initial burette reading (cm^3)			

Volume of solution A used (cm^3)			

4marks

- Calculate the average volume of solution A used. **1mark**
- Calculate the moles of sodium hydroxide in the volume of solution B used. **2marks**
- 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**
- Calculate the moles of organic acid solution A used per litre of solution **2marks**
- Calculate the relative formula masses of the organic acid solution A **3marks**
- Calculate the value of n in $H_2C_2O_4.nH_2O$(H=1, C=12, O=16) **3marks**

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

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

Observation	Inferences

1mark **1mark**

i) 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**

j) 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**

e) 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.

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

Observation	Inferences

1mark **1mark**

d) (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**

e) 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**

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

Observation	Inferences

1mark **1mark**

g) 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.

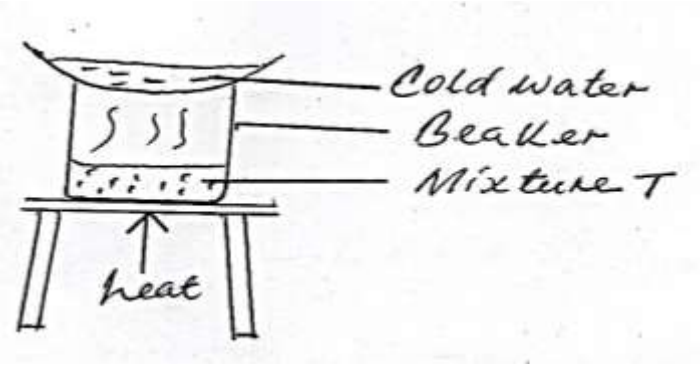
Observation	Inferences

1mark **1mark**

NAIROBI SCHOOL

PAPER 1

1. The set up below was used to separate a mixture of two substances.



One of the components in the mixture T was sodium chloride.

(i). Name the other component (1mk)

……
……

……
……

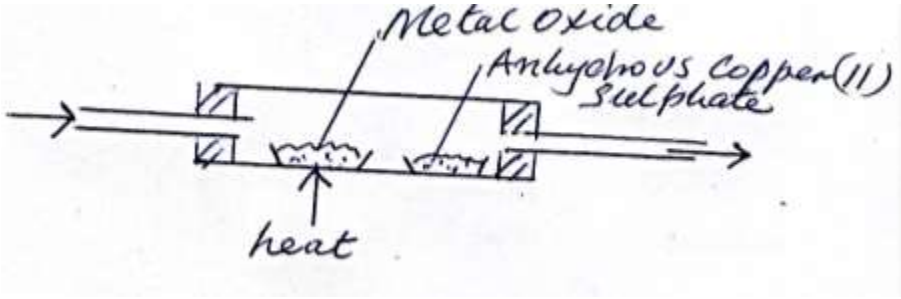
(ii). Name the method of separation (1mk)

……
……

……
……

2. Dry hydrogen gas was passed through a hot metal oxide as shown in the diagram below.

Dry Hydrogen



The metal oxide turned from black to brown.

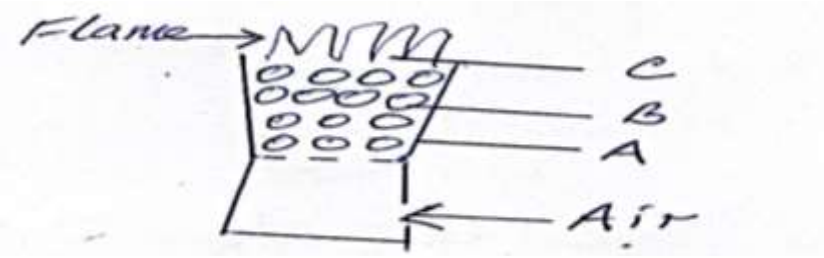
a). Identify the metal oxide (1mk)

b). State one other observation in the combustion tube. (1mk)

c). Write a chemical equation for one of the reaction taking place in the combustion tube. (1mk)

……
……

3.The diagram below shows regions of a burning charcoal stove.

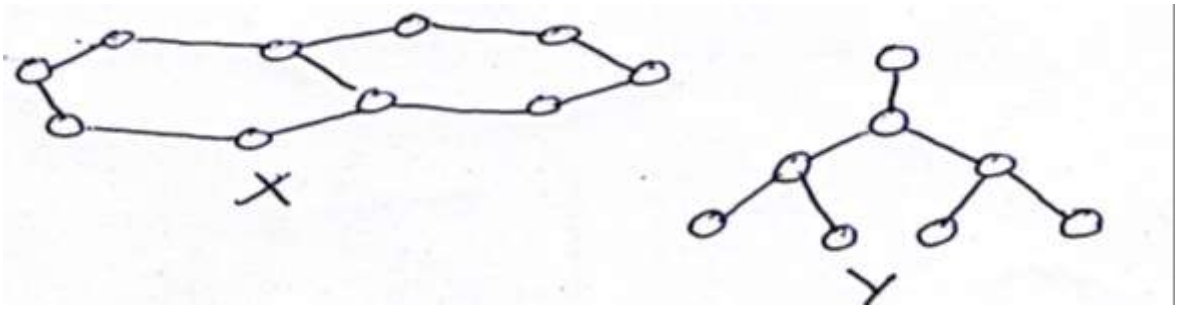


a). Write an equation for the reaction taking place at

(i). B (1mk)

(ii). C (1mk)

b. Name the allotropes of carbon represented by the diagram below (2mks)



4. Student are advised to use a non- luminous flame when heating during laboratory experiments.

a). Why is the non-luminous flame preferred. (1mk)

……
……

……
……

b). How does a Bunsen Burner produce a non-luminous flame. (1mk)

……
……

……
……

5a. State Boyles Law (1mk)

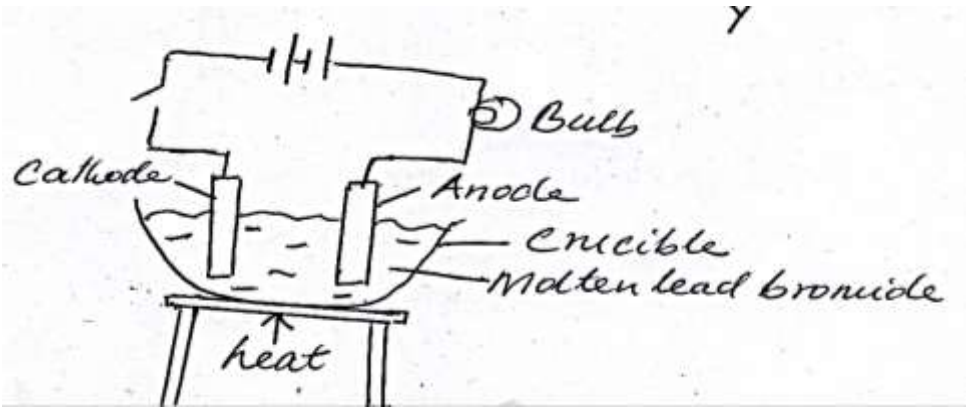
……
……

……
……

b). A balloon contains 250dm^3 of helium at 25˚c and 100kPa pressure. Calculate the temperature when its volume reaches 400dm^{3}and 80kpa pressure (2mks)

……
……

6. Below is a diagram of a set up of apparatus used to investigate the effect of electric current on a binary electrolyte, lead (II) bromide.



(i). What is a binary electrolyte. (1mk)

……
……

……
……

(ii). What is the importance of heating in the above experiment? (1mk)

……

……

……

(iii). Write the ionic equation for the reaction taking place at the anode (1mk)

……

……

……

7. Explain how the following factors affect the rate of a chemical reaction

(a). Temperature (2mks)

……

……

……

(b). Concentration (2mks)

……

……

……

8.Study the reaction below and answer the questions that follows

$2NO_2g \rightleftharpoons N_2O_4(g)$ ΔH = -ve

Brown Pale yellow

a). State the observation made when a mixture of NO_2 (g) and N_2O_4 (g) at equilibrium is subjected to

(i). High pressure (½mk)

……
……

……
……

(ii). High temperatures (½mk)

……
……

……
……

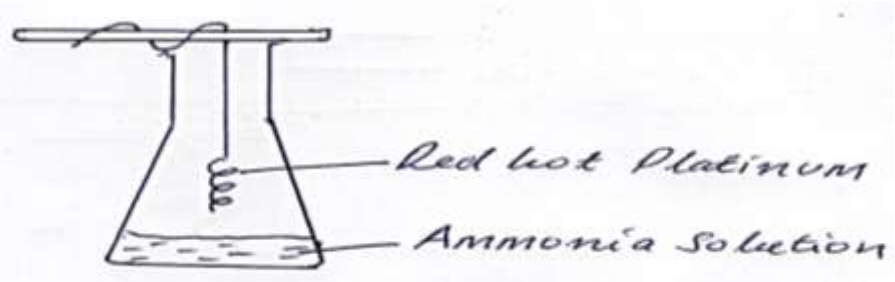
Explain the observations in a(i) and a(ii) (1mk)

……
……

……
……

……
……

9. The set up below shows the catalytic oxidation of ammonia in the laboratory.



One of the observations made in the flask is that the platinum wire glows even though it is no longer heated.

(a). Explain this observation (1mk)

……
……

(b). State another observation made in the conical flask (1mk)

……
……

c). Write an equation to explain the second observation (1mk)

……
……

10. Distinguish between a dative and covalent bond (2mks)

……
……

……
……

b). Draw a diagram to show bonding in hydroxonium ion (H_3O^+) (H=1, O = 8) (2mks)

11.The information below gives pH value of solution V, W, X, Y, Z

SOLUTION	**pH Values**
V	2
W	6.5
X	11
Y	14
Z	4.5

(a). Which solution is likely to be

--

(i). Calcium hydroxide? (1mk)

(ii). Rain Water (1mk)

b. Explain the pH value of rain water (1mk)

12. $20cm^3$ of a dibasic acid required $25cm^3$ of 0.1M sodium hydroxide for complete neutralisation.

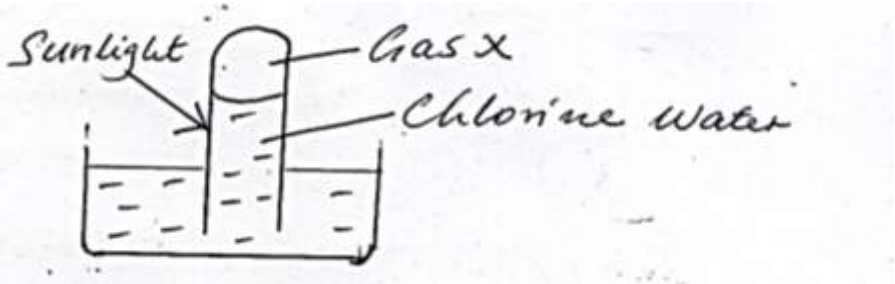
(a). How many moles of sodium hydroxide reacted with the dibasic acid ? (1mk)

……
……

b). Calculate the concentration of the dibasic acid in moles per litre (2mks)

……
……

13. Chloride water was exposed to sunlight as shown in the set up below x



a). Write an equation for the reaction that produce gas X. (1mk)

……
……

b). Explain the observation made if a red flower petal is immersed in chlorine water.
……
……

(1mk)

14. The table below shows the solubility of a substance at various temperatures. Study it and answer the questions that follows.

Temperature ˚c	Solubility in g/100g water
0	36
40	30
80	25
110	20

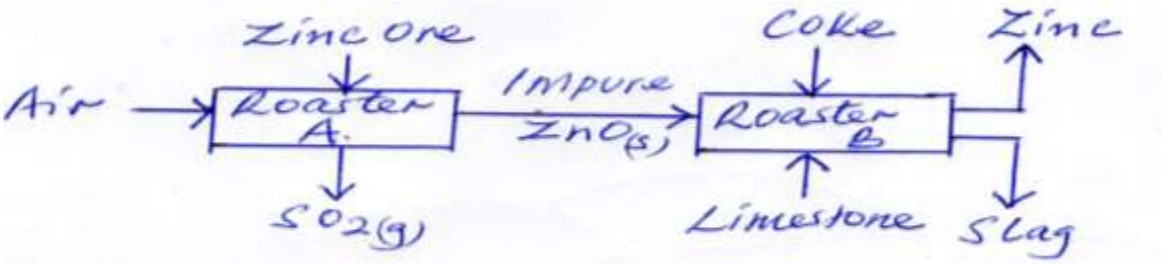
a). What is the meaning of solubility (1mk)

……
……

b. State and explain what would happen if a sample of a saturated solution of the substance at 40˚c was heated to 110˚c
(1mk)

……
……

15. The flow chart below shows the processes involved in extraction of Zinc metal. Study it and answer the questions that follow.



(a). Name the main ore used in the extraction of Zinc. (1mk)

……
……

b). What is the function of limestone in roaster B (1mk)

……
……

c). State one use of Zinc (1mk)

……
……

16. The products formed by action of heat on nitrates of elements P,Q,R are shown in the table below.

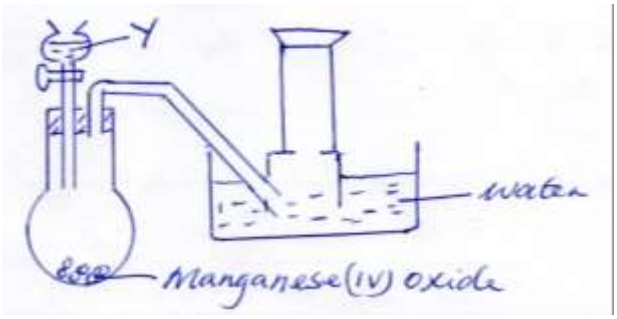
Nitrate of element	**Products formed**
P	Metal oxide + Nitrogen (iv) Oxide +Oxygen
Q	Metal + oxygen + nitrogen (iv)Oxide
R	Metal Nitrite + Oxygen

a). Arrange the metal elements in order of increasing reactivity (1mk)

b). Which element forms a soluble carbonate (1mk)

c). Give an example of element Q (1mk)

17. A student set up the apparatus shown below to prepare and collect oxygen gas.



He made a mistake in the set and could not collect the gas.

(i). What was the mistake (1mk)

……
……

(ii). Identify substances Y (1mk)

……
……

(iii). Write an equation for the reaction in the flask (1mk)

……
……

18a). A radioactive element weighed 384g. After 270days, its mass fell to 48g. Calculate the half -life of the element. (2mks)

……
……

……
……

b). State one application of radioisotopes in industry. (1mk)

……
……

19. Three portions of a solution of $B(NO_3)_2$ (B is not the actual symbol of the element) where tested as follows.

(i). When $2cm^3$ portions of dilute hydrochloric acid is added to the first portion, a white precipitate was formed which dissolve on warming.

(ii). When two drops of 2M sodium hydroxide solution were added to the second portion, a white precipitate is formed which dissolved in excess sodium hydroxide to form a colourless solution.

(iii). When a solution of potassium iodide was added to the third portion, a yellow precipitate was formed.

(a). Identify the

White precipitate formed in step 1 (1mk)

Element B (1mk)

b). Write an ionic equation for the reaction that occurs in step (iii) (1mk)

FOR MARKING SCHEMES INBOX 0724351706

20. The following table gives standard electrode potentials for a number of half cell reactions.

$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)}$ -0.70

$Fe^{2+}_{(aq)} + 2e^- \longrightarrow Fe_{(s)}$ -0.44

$I_2 + 2e^- \longrightarrow 2I^-_{(aq)}$ +0.54

(i).Which of the substances listed above is the strongest oxidising agent. Explain (2mks)

……

(ii). Write the cell representation that would give the highest e.m.f value (1mk)

……

21. 0.6g of element K (not actual symbol) were completely burnt in oxygen to heat 500$cm^3$of water. Given that the RAM of X is 12.06, determine the final temperature of the water heated if the initial temperature was 21˚c. Specific heat capacity of water = 4.2$Jk^{-1}g^{-1}$

Density of water = 1.0gcm^3

Molar heat of combustion of K is 380kJ mol (3mks)

……

22a. Name two reagent that can be used to prepare sulphur (iv) oxide gas in the laboratory. (2mks)

b). When a tube containing moist sulphur (iv) oxide gas is inverted over one containing hydrogen sulphide gas a yellow deposit forms on the sides of both tubes. Explain (2mks)

……

c). State one use of sulphur (iv) oxide gas (1mk)

……

23. A container in the lab has the label $CH_3CH_2COOCH_3$.

(i). Name the process of formation of the above substance (1mk)

(ii). Identify the two substances from which the substance is made (2mks)

(iii). Name the condition necessary for the formation of $CH_3CH_2COOCH_3$- (1mk)

24. In an electrolytic process a current of 200A was passed through molten oxide of a metal Q for 58 minutes and 64.8g of the metal deposited. Determine

(i). Charge on metal Q (R.M.M of Q =27) (1mk)

(ii). The volume of oxygen produced at standard temperature and pressure (IF= 96500c, Molar gas volume at StP = 22.4dm³) (2mks)

25. Describe how a student can distinguish between Calcium and Lead ions in solution using aqueous sodium chloride. (2mks)

26. The table below shows the 1st and 2nd ionization energies of three elements in the same family of the periodic table.

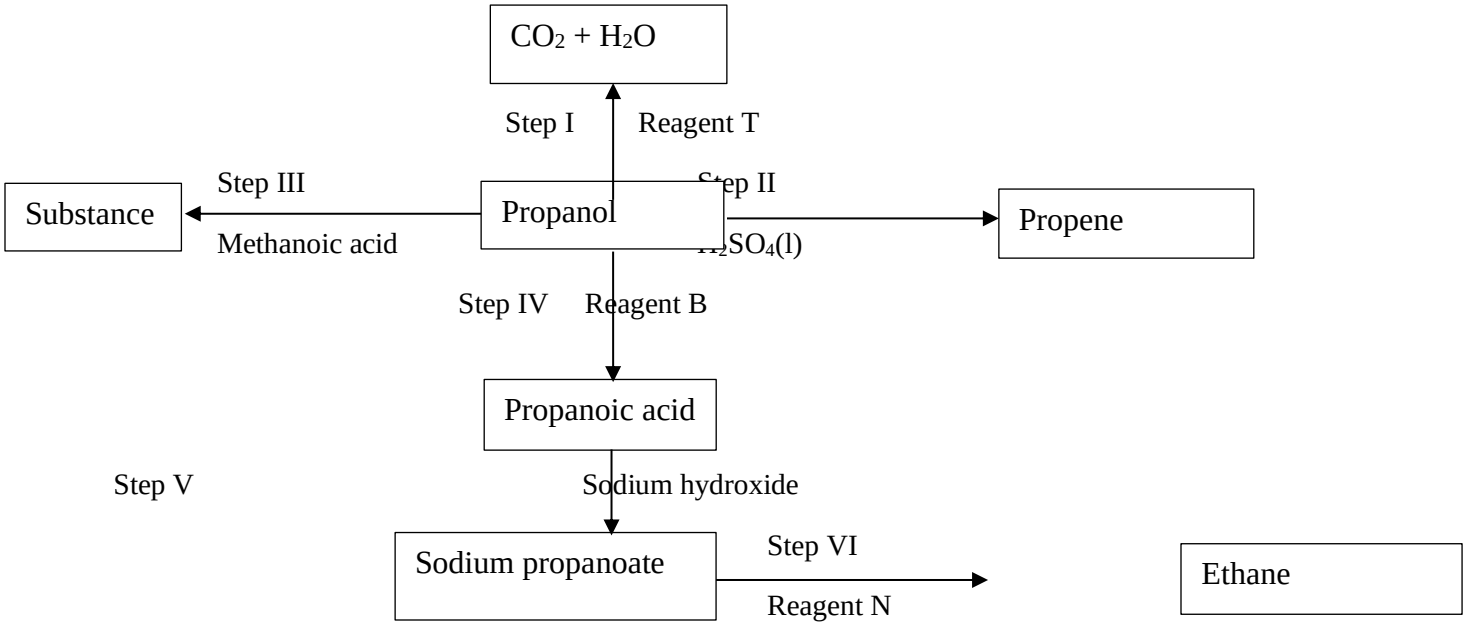
Element	1st ionisation energy kJ/mol	2nd Ionisation energy kJ/mol
K	900	1880
L	736	1450
M	590	1150

(a). Arrange the above element in order of decreasing reactivity (1mk)

b). Explain why the 1st ionization energy is higher than the second ionization energy (2mks)

27. Draw and name two isomers of C_4H_6 (3mks)

PAPER 2



a. Name the process in step; (3 marks)

I …….

III ……...

IV ……..

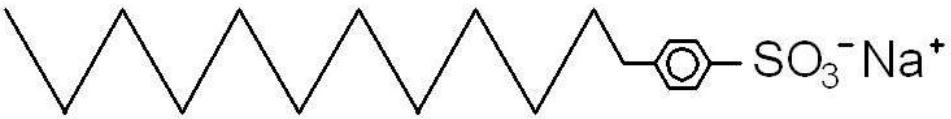
b. Write an equation for the reaction in step (2 marks)
I ……
V ……

c. Give the name and structural formula of substance M (2 marks)
Name ……
Structural formula
……
……

d. Name the reagent; (2 marks)
B ……
N ……

e. State the condition necessary for reaction in step II (1 mark)
……

f. The diagram below shows the structure of a detergent.



i. Identify the detergent (1 mark)
……

ii. A sample of water was found to contain magnesium ions. Explain why the detergent above is a suitable reagent to be used in the water. (1 mark)
……
……
……

1. a.The table below shows properties of four substances. Study it and use it to answer the questions that follow.

Substance	Melting point (^{0}C)	Electrical conductivity	
		Solid	Molten
A	– 33	Poor	Poor
B	801	Poor	Good
C	1083	Good	Good
D	1417	Poor	Poor

i. Identify the structure in the following: (2 marks)
A ……
C ……

ii. Explain the conductivity in substance B (2 marks)
……
……
……
……
……

iii. Give a reason why substance D has a h-igh melting point. (1 mark)
……
……
……

b.Draw dot and cross diagram showing bonding in the following; (2 marks)

i. Ammonia gas (N=7, H=1)

ii. Sodium sulphide (Na=11, S=16)

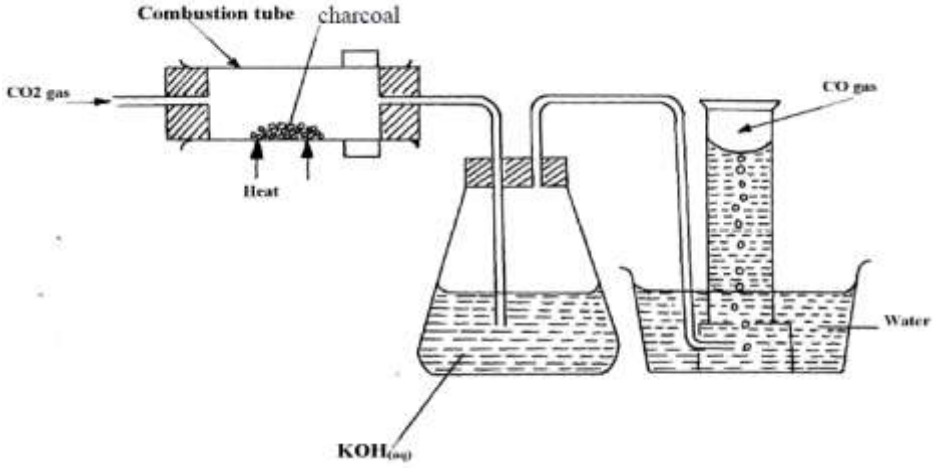
c. Explain the following; (3 marks)

i. Magnesium and sulphur are in the same period of the periodic table. However, magnesium oxide is a solid while sulphur (IV) oxide is a gas at room temperature (Mg = 12, S=16, O=8)
……
……
……
……

ii. Ethanol is molecular but it dissolves in water
……
……
……
……

iii. Solid copper metal is a better electrical conductor than molten copper
……
……
……
……

2. a.The diagram below shows the set-up used to test a property of carbon in the laboratory. Study it and use it to answer the questions that follow.



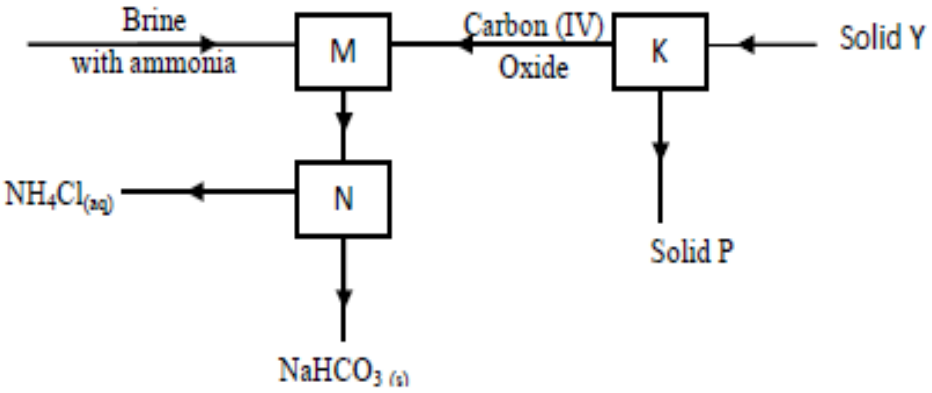
i. State the role of potassium hydroxide solution (1 mark)
……
……
……

ii. Write an equation for the reaction in the combustion tube (1 mark)
……
……
……

iii. State the property of carbon being investigated. (1 mark)

……
……
……

b.Sodium carbonate is prepared industrially using Solvay process. The flow diagram below shows some of the reactions in the process. Study it and use it to answer the questions that follow.



i. Identify; (2 marks)

Solid Y ……

Solid P …….

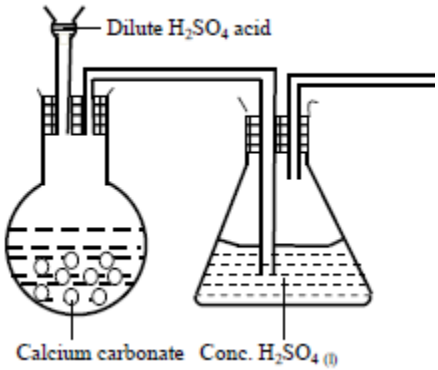
ii. Write an equation for the reaction taking place in chamber M (1 mark)
……
……
……

iii. Name the process taking place in chamber N. (1 mark)
……
……
……

iv. State two uses of sodium carbonate (2 marks)
……
……
……

……
……

c. The set-up below was used to prepare carbon (IV) oxide gas in the laboratory. Study it and answer the questions that follow.



i. Identify the mistake in the set-up and suggest a possible correction. (2 marks)

……
……
……
……

ii. Complete the diagram showing how the gas can be collected (1 mark)

3. The list below shows reduction potentials of element M, N, P and Q

	E^{θ}(volts)
$M^{2+}_{(aq)}+2e \rightarrow M_{(s)}$	; -0.76
$N^{2+}_{(aq)}+2e \rightarrow N_{(s)}$	;-2.37
$P^{+}_{(aq)}+2e \rightarrow P_{(s)}$	; +0.80
$Q^{2+}_{(aq)}+2e \rightarrow Q_{(s)}$	;-0.14

a. Identify the element that is strongest reducing agent (1 mark)

……
……

b. Which elements would form an electrochemical cell with the highest e.m.f. (1 mark)

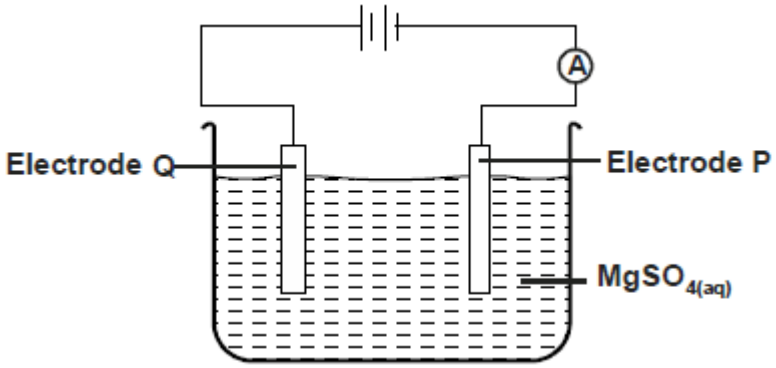
……
……

c. The half cells of M and P were combined to form an electrochemical cell.

i. Draw the electrochemical cell formed (3 marks)

ii. Calculate the e. m. f of the cell formed (1 mark)

d. The set-up below was used during the electrolysis of a solution of Magnesium sulphate using inert electrodes.



i. State the observation made in electrode Q. Explain (2 marks)

……
……
……

Write an equation for the reaction in electrode P (1mark)

……
……

ii. A current of 0.5 Amperes was passed through the cell for 16 minutes and 5 seconds. Calculate the volume of product at the anode at RTP (1M= 24l ,I F=96500C)

……(3 marks)
……
……

e. Give one application of electrolysis (1 mark)

……
……

4. a) Define molar heat of neutralization (1mark)

b) The table below shows temperature reached when equal volumes of an alkaline solution of 1.5M concentration was reacted with 0.95M sulphuric (VI) acid.

Total volume of Sulphuric VI acid added	0	5	10	15	20	25	30	35	40
Volume of alkaline solution	30	30	30	30	30	30	30	30	30
Highest temperature reached	23	24	25	26	27	28	28	27	26

Plot a graph of temperature against volume of acid used (3mks)

c. From the graph determine

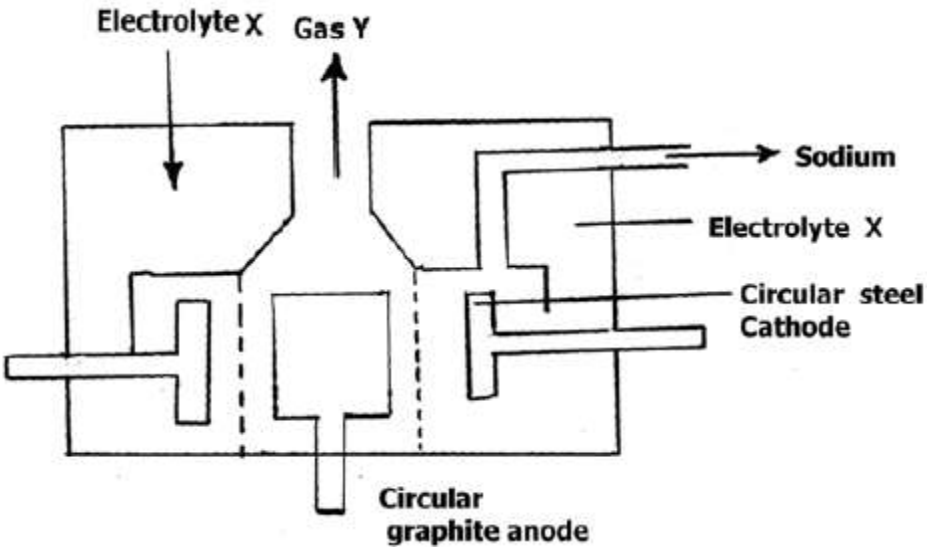
i. the volume of sulphuric VI acid needed to completely neutralize $30cm^3$ of the alkali solution (1mk)

the temperature change (1mk)

d. Calculate the heat change for the above reaction density of solution $1g/cm^3$, Specific Heat Capacity 4.2g/J/K (2mks)

e. Calculate the molar heat of neutralization for the reaction (2mks)

5. The diagram below shows the set-up used to extract sodium metal.



a. Identify; (2 marks)

i. Electrolyte X

……

……

ii. Gas Y

……

……

b. During extraction of sodium using the down's process, calcium chloride is added to the ore. Give a reason for the addition of calcium chloride. (1 mark)

……

……

c. State two uses of sodium (2 marks)

……

……

d. Give a reason why sodium is extracted using electrolysis (1 mark)

……

……

e. Why is the anode made of graphite and not steel? (1 mark)

……

……

f. On the diagram, label the steel diaphragm. (1 mark)

g. State the role of the steel diaphragm (1 mark)

……

……

h. State and explain two observations made when sodium metal is placed in a trough of cold water. (3 marks)

……

……

……

……

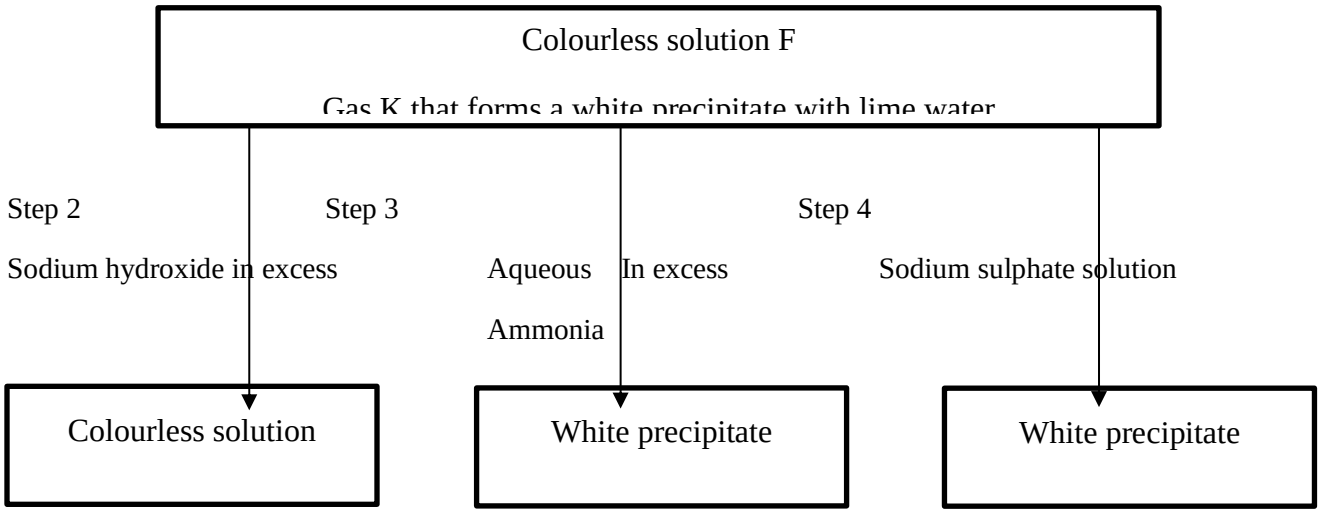
……

……

6. a. The figure below shows some properties and reactions starting with solid S. Study it and answer the questions that follow.

White solid S

Add dilute nitric (V) acid Step 1



……
……

Gas K

……
……

ii. Write an equation for the reaction in step 1 (1 mark)
……
……

iii. State the property of solution F that makes the reaction in step 2 possible. (1mark)
……
……

iv. Write an **ionic equation** for the reaction in step 2 (1 mark)
……
……

b. Starting with Zinc oxide, describe how a dray sample of zinc carbonate can be prepared in the laboratory (3 marks)

……
……
……

c. Name the process taking place when the following reactions take place (3 marks)

i. Calcium chloride placed on a watch glass overnight forms a solution
……
……

ii. Sodium hydroxide reacts with sulphuric (VI) acid to form a colourless solution
……
……

iii. Silver nitrate and potassium chloride react to form a white solid

PAPER 3

1. You are provided with :

- 2M hydrochloric acid, solution W
- 5 pieces of magnesium ribbon, each 2cm long
- 0.5M sodium carbonate, solution R

You are required to determine:

i) the rate of reaction between hydrochloric acid and magnesium

ii) the mass of 2cm of magnesium ribbon

Procedure 1

I. Using a clean measuring cylinder, measure 60cm^3 of 2M hydrochloric acid, solution W and place it into a clean conical flask. Take one piece of 2cm piece of magnesium ribbon provided and place it in the hydrochloric acid and immediately start the stopwatch.

II. Measure and record the time taken for the magnesium ribbon to react completely with hydrochloric acid in table 1 below.

Retain the contents of conical flask 1 for use in procedure II. Label this solution P

III. Repeat the procedure using 50cm^3, with 10 cm^3 of water , 40 cm^3 and 20cm3 of water ,, 30cm3 and 20cm3 of water , portions of 2M hydrochloric acid adding distilled water to make up to 60cm3 of solution and complete the table below.

NOTE: Do not retain the contents of the conical flask in experiments 2, 3, 4 and 5. Table 1

Experiment number	1	2	3	4	5
Volume of 2M hydrochloric acid(cm^3)	60	50	40	30	20
Volume of water added	0	10	20	30	40
Time taken for ribbon to disappear (s)					
1/time (sec $^{-1}$)					

(6mks)

a) Plot a graph 1/time (sec^{-1}) against volume of 2M hydrochloric acid (3mks)

b) From your graph, determine the time taken for the ribbon to disappear when $36cm^3$ of 2M hydrochloric acid were used. (1mks)

c)In terms of rate of reaction, explain the shape of your graph. (1 mks)

Procedure II

1) Using a clean measuring cylinder measure $40cm^3$ of distilled water and add it to the contents of the conical flask retained in procedure I labeled solution P

2) Fill a burette with solution P. Pipette $25.0cm^3$of solution R 0.5M sodium carbonate and place it into a clean flask. Add 2-3 drops of methyl orange indicator to solution R. Titrate with solution P and record your results in table II below. Repeat the titration two more times and complete the table.

Table II

	1	2	3
Final volume(cm^3)			
Initial volume (cm^3)			
Final- initial volume (cm^3)			

(4mks)

Calculate the :

vii. Average volume of solution P used. (1 mks)

ix. Number of moles of sodium carbonate solution R used. (1 mks)

viii. Number of moles of hydrochloric acid used. (1 mks)

ix. Number of moles of hydrochloric acid present in $100cm^3$ of solution P. (1 mks)

x. Number of moles of hydrochloric acid present in $60cm^3$ of solution W. (1 mks)

xi. Number of moles of hydrochloric acid that reacted with 2cm magnesium ribbon. (1 mks)

xii. Mass of magnesium present in 2cm ribbon. (Mg = 24.0) (1 mks)

2. You are provided with solid K. Carry out the following tests below. Write your observations and inferences in the spaces provided.

a) Place about one half of solid K in a dry test tube. Heat gently then strongly. Test any gases produced with blue and red litmus papers

observation	inference
(1mk)	(1mk)

b) Place the remaining amount of solid K in a boiling tube. Add about 10cm3 of distilled water and shake the mixture.

observation	inference
(1mk)	(1mk)

c) Divide solution K above into four portions of 2cm3 each in separate test tubes. Use the portions for tests (i) to (iv) below.

i) To the first portion add sodium hydroxide solution dropwise until in excess.

observation	inference
(1mk)	(1mk)

ii) To the second portion add about $1cm^3$ of sodium chloride solution

observation	inference
(1mk)	(1mk)

iii)To the second portion add aqueous ammonia drop wise till excess

observation	inference
(½mk)	(½mk)

iv)To the second portion add three drops of aqueous barium nitrate followed by five drops of nitric (v) acid .

observation	inference
(1mk)	(1mk)

3. You are provided with an organic substance S. Carry out the following tests and record your observations and inferences in the spaces provided.

a) Place about one third of substance S on a metallic spatula and ignite it with a bunsen burner flame.

observation	inference
(1mk)	(1mk)

Place the remaining amount of substance S in a boiling tube. Add about $10cm^3$ of distilled water and shake well. Use about $2cm^3$ portions of the mixture obtained for tests (i) to (iii) below.

i) To the first portion add solid sodium hydrogen carbonate.

observation	inference
(½mk)	(½mk)

ii) To the second portion add two drops of acidified potassium manganite (VI) solution.

observation	inference
(1mk)	(1mk)

iii) To the third portion add 3 drops of bromine water

observation	inference
(1mk)	(1mk)

SUNSHINE SCHOOL

PAPER 1

1. What name is given to the different forms of an element in the same physical state? (1mark)

2. Element **J** whose atomic number is 31 has two isotopes. The table below shows the mass numbers and the relative abundance for each isotope.

Mass	Relative abundance %
69	60.4
71	39.6

(a) Determine the number of neutrons in the isotope with mass number 69 (1mark)

(b) Calculate the relative atomic mass of element J (2marks)

3. When excess chlorine gas is bubbled through dilute sodium hydroxide solution the resulting solution act as a bleaching agent.

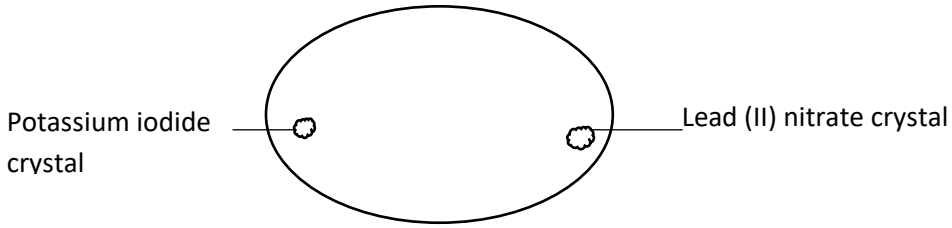
(a) Write an equation for the reaction between chlorine and sodium hydroxide solution. (1mark)

(b) Explain how the resulting solution act as a bleaching agent (1mark)

(c) Other than bleaching state one use of chlorine (1mark)

……
……

4. Crystals of lead (II) nitrate and potassium iodide were placed on opposite ends of a petri dish with water as shown below.



(i) State the observation that would be made after some time (1mark)

(ii) On the diagram above indicate with an **X** the likely position of the observation made in (i) above. (Pb = 207 , I = 127) (1mark)

(iii) Explain your observation in (ii) above. (1mark)

5. The table below gives some information about elements represented by letters B,C,D and E. Study the information and answer the questions that follow.

Element	Atomic radii(nm)	Melting point ^oC
B	0.152	180
C	0.186	98
D	0.231	64
E	0.244	39

(i) Would these elements form part of a group or a period? Explain. (1mark)
(ii) Explain the trend in the melting point of the elements. (1mark)

6. When an aqueous solution of barium chloride was added to an aqueous sodium salt **W**, a white precipitate was formed. On addition of dilute hydrochloric acid the white precipitate dissolved and a gas was evolved.

(i) Give **two** possible identities of **W** (1mark)

(ii) What type of reaction takes place when Sulphur is reacted with concentrated sulphuric(VI) acid. (1mark)

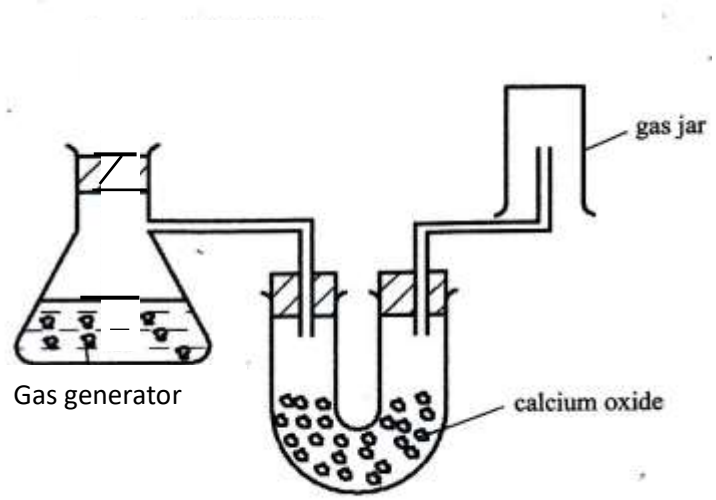
(iii) What property of concentrated sulphuric (VI) acid enables it to be used as used as a drying agent (1mark)

7. In an experiment 10.6g of a mixture of anhydrous sodium carbonate and sodium chloride were dissolved in water to make $100cm^3$ of solution.$25cm^3$ of this solution required $20.0cm^3$ of 0.1M hydrochloric acid for complete neutralization. Calculate the percentage of sodium chloride in the mixture.(R.A.M; Na = 23 , O = 16 , H = 1) (3marks)

8. Give the name of a suitable method that can be used to extract potassium from its ore. Explain your

answer (1mark)

9. The diagram below shows the apparatus used by a student to collect dry hydrogen chloride gas



i) Explain why even with the correct chemicals in the gas generator the student failed to collect hydrogen chloride gas. (1mark)
ii) Which gas could be dried and collected using this arrangement? (1mark)
iii) Write an equation for the reaction that produces hydrogen chloride gas in the laboratory (1mark)

10. An element **R** has a boiling point of 4830 ^oC and burns in air to form an acidic gas.

FOR MARKING SCHEMES INBOX 0724351706

Suggest a likely structure for element **R**. Explain your answer (2marks)

11. 3.79g of metal **M** were deposited when a molten salt of M was electrolysed by passing a current of 0.6A for 90 minutes.

(Relative atomic mass of M = 226, 1 Faraday = 96500 Coulombs)

(a) Calculate the amount of electricity in Coulombs;

(i) Used to deposit 3.79g of metal M (1mark)

(ii) Needed to deposit one mole of M (1mark)

(b) Deduce the charge on the ions of M (1mark)

12. Lead is extracted from an ore called galena

(a) What is the formula of galena? (1mark)
(b) State the role of the following in extraction of lead.
(i) Scrap iron (1mark)

(ii) Limestone (1mark)

13. The equations below represent two processes that take place without change in temperature

I $H_2O(s) \longrightarrow H_2O(l)$

II $CdCl_2(s) \longrightarrow Cd^{2+}(l) + 2Cl^-(l)$

(i) Explain why although heat is required for each of the processes to take place, the temperature remains constant in both cases (1mark)

(ii) Which of the two processes has a higher enthalpy change ΔH Give a reason? (3marks)

14. Describe how you can distinguish between dilute sulphuric (VI) acid and ethanoic acid. (2marks)

15. (i) An isotope **F** has a half- life of 2.5 hours. What percentage of a given mass of the isotope would be left after 10.0 hours? (2marks)

(ii) Radioactive Polonium 216 dacays as shown below.

$$^{216}_{84}Po \longrightarrow {}^{208}_{m}\!\!\;\;{}_{n}$$

Determine the values of **m** and **n** (2marks)

16. Alkanol is one of the homologous series of organic compounds

(a) Give the name and structural formula of the fourth member of this series

(i) name; …… (1mark)

(ii) structural formula (1mark)

(b) Write an equation for the complete combustion of the fourth member of this series (1mark)

17. (a)What is vulcanization of rubber (1mark)

(b)Sulphur(IV)oxide gas is oxidised catalytically to sulphur(VI) Oxide gas in the contact process as shown below

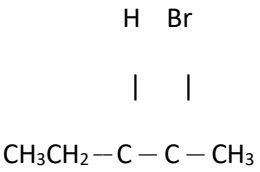
$2SO_2\,(g) + O_2\,(g) \quad 2SO_3\,(g) \qquad \Delta H = -197kJ$

Explain how the following conditions will affect the yield of Sulphur (VI) oxide

(i) Increase in temperature (1mark)

(ii) Increase in pressure (1mark)

18.(i) A compound **Y** reacts with bromine to form another compound whose formula is



Give the formula and name of compound Y (2marks)

(ii)Name the compound formed when ethanol is reacted with propanoic acid in presence of a few drops of concentrated sulphuric (VI) acid (1mark)

19. (i)When soap is added to hard water, lather does not form immediately but eventually forms on addition of more soap. Explain using an equation (1mark)

(ii) State **two** methods that can be used to remove both types of water hardness (1mark)

20. Methane in natural gas is used for preparing hydrogen for the Haber process. When methane is heated with steam, carbon II oxide and hydrogen are formed.

(i)Write an equation for this reaction (1mark)

Using the bond energies given below

Bond	Bond Energies $kJmol^{-1}$
H–H	436
H–O	463
C–H	412
C ═O	995

(ii) Calculate the enthalpy change for the reaction in (i) above (2marks)

21. Starting with **50 cm^3** of **2M** sodium hydroxide describe how crystals of sodium sulphate can be prepared in the laboratory. (3marks)

22. When carbon (IV) oxide is bubbled through lime water a white precipitate is formed. This precipitate dissolves when excess carbon (IV) oxide is bubbled.

(i) Name the white precipitate (1mark)

(ii) Write an equation for the reaction that occurs when the white precipitate dissolves (1mark)

(iii) State **one** use of carbon (IV) oxide and state the property of the gas which the use depends (1mark)

23. Hydrogen peroxide decomposes in presence of manganese (IV) oxide to give oxygen gas

(i)Draw a labelled diagram to show how the volume of oxygen gas can be measured. (1mark)

(ii) Explain how an increase in temperature affects the rate of a chemical reaction. (2marks)

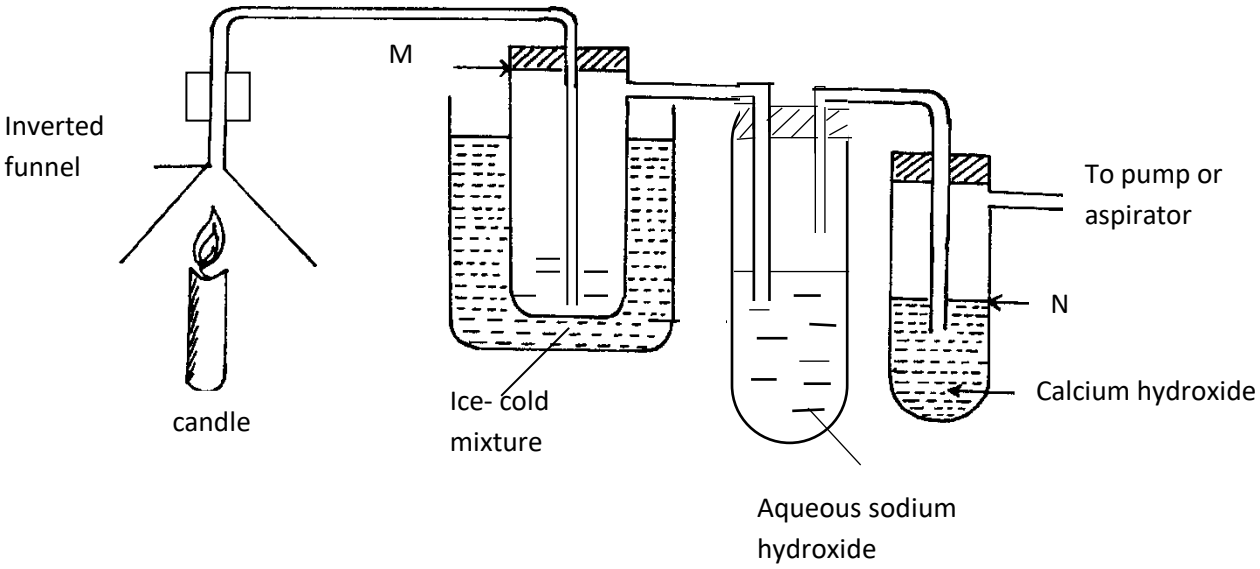
24.(a)Name the solvent that is used to extract oil from groundnuts (1mark)

(b) Study the information in the table below and answer the question that follow

Liquid	Boiling point ^oC
Water	100
Ethanoic acid	118

Suggest with an explanation the most suitable method of separating a mixture of ethanoic acid and water (1mark)

25. A candle was burnt in air as shown below by a form one student. She made some observations as the burning progresses.



(a) Identify the substance that form in tube **M** (1mark)

(b) What observation would be made in tube **N**. Explain your answer. (1mark)

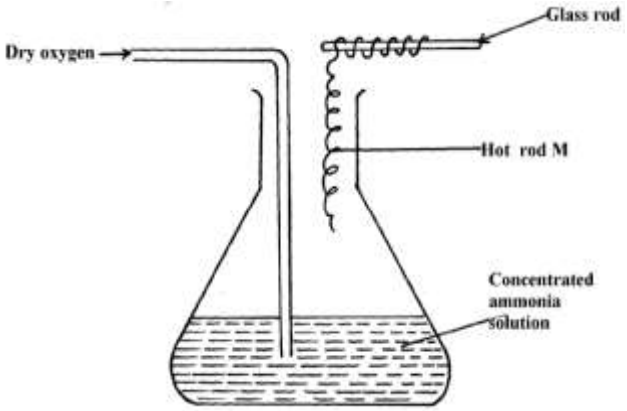
26. A piece of phosphorus was burnt in excess air and the product obtained was shaken with a small amount of hot water to make a solution.

(i)Write an equation for the burning of phosphorus in excess air. (1mark)

(ii)State the observation that would be made when both red and blue litmus papers are dipped into the

resulting solution (1mark)

27. The set- up below was used to study one of the chemical properties of ammonia. Study it and answer the questions that follow.



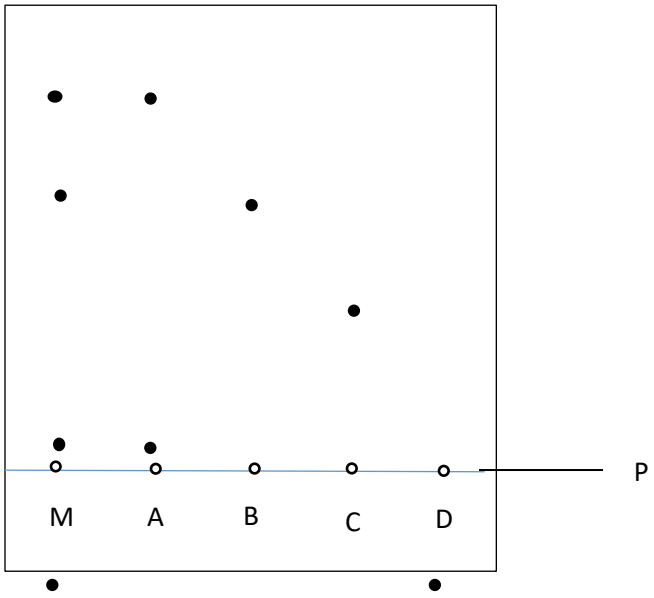
(i) Identify metal M (1mark)
(ii) State **two** observations that would be made during the experiment above (1mark)
(iii) Write an equation for the reaction that occurs. (1mark)

28. (a) What is an acid- base indicator. (1mark)

(b) Give one example of a commercial acid – base indicator and the colour of the indicator in a basic solution (1mark)

Indicator	Colour in basic solution

29. In a paper chromatography experiment to determine the presence of substances A B, C and D in a mixture M the results shown below were obtained



(a) Identify line P. …… (1mark)

(b)What substances are present in mixture M. (1mark)

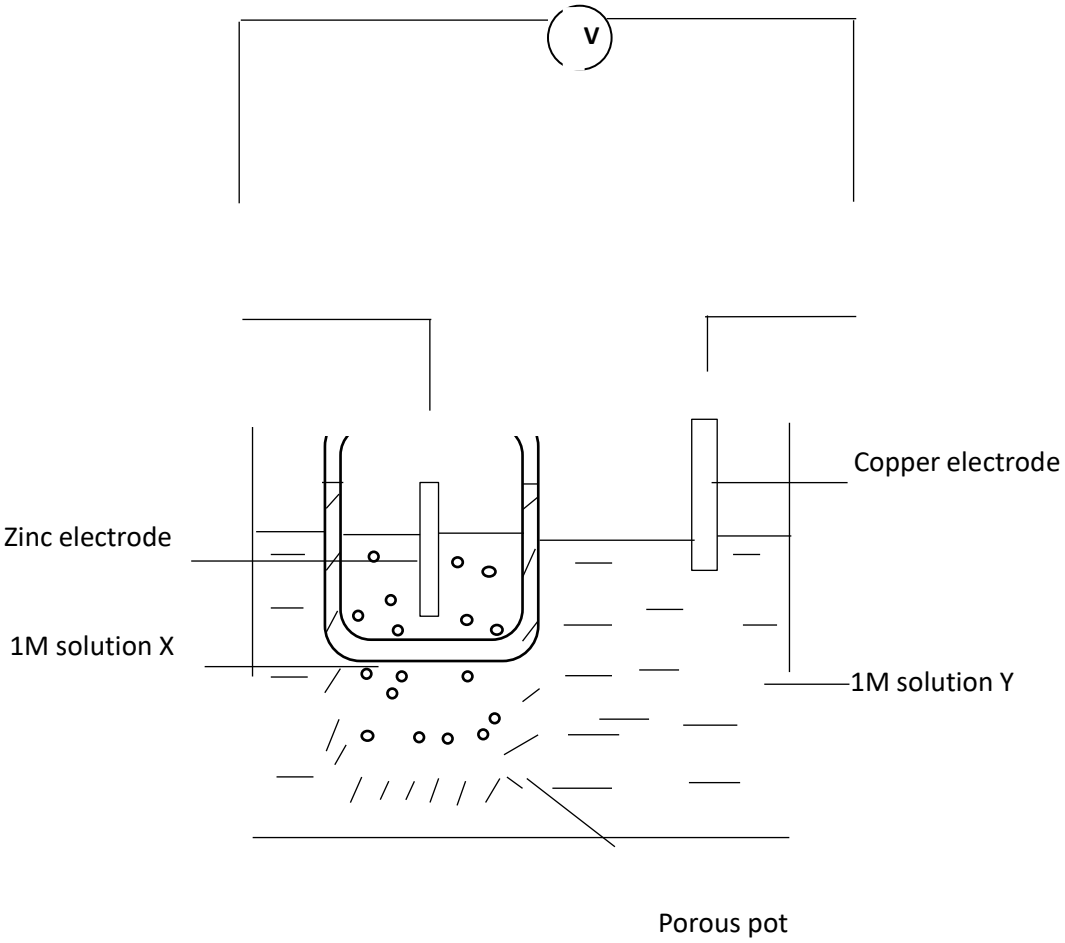
30. Use the standard electrode potential given below to answer the questions that follow

$Cu^{2+}_{(aq)} + 2e \longrightarrow Cu_{(s)}$ $E^{\ominus} = + 0.34$

$I_{2(aq)} + 2e \longrightarrow 2I^{-}_{(aq)}$ $E^{\ominus} = + 0.54$

Calculate the e.m.f of the cell made by combining the two half cells above (1mark)

31. Below is a diagram used by a student to investigate zinc / copper electrochemical cell



(i) What could solutions X and Y be (1mark)

(ii) On the diagram above show the direction of flow of electrons. (1mark)

(iii) Write an equation for the reaction that occurs at the anode. (1mark)

PAPER 2

1. (a) Use the information below to answer the questions that follow.

$Ca_{(S)} + \frac{1}{2}O_{2(g)} \rightarrow CaO_{(S)}$ $\Delta H = -635$ kJ mol^{-1}

$Ca_{(S)} + O_{2(g)} \rightarrow CaO_{2(g)}$ $\Delta H = -394$ kJ mol^{-1}

$Ca_{(S)} + e_{(S)} + \frac{3}{2}O_{2(g)} \rightarrow CaCO_{3(S)}$ $\Delta H = -1207$ kJ mol^{-1}

Calculate the enthalpy change for the reaction.

$$CaO_{(S)} + CO_{2(g)} \rightarrow CaCO_{3(S)}$$ **(3 marks)**

(b) State **one** factor that should be considered when choosing a fuel for cooking. **(1 mark)**

(c) The following data was obtained during an experiment to determine the molar heat of combustion of ethanol.

Volume of water used	= 500cm³
Initial temperature of water	= 25°C
Final temperature of water	= 44.5°C
Mass of ethanol + lamp before burning	= 121.5g
Mass of ethanol + lamp after burning	= 120.0g

Calculate the

(i) Heat evolved during the experiment (density of water = 1g/cm³, specific heat capacity of water = $4.2Jg^{-1-}K^{1}$). **(2 marks)**

(ii) Molar heat of combustion of ethanol (C = 12, O = 16, H = 1). **(2 marks)**

(d) Write the thermo equation for the complete combustion of ethanol. **(1 mark)**

(e) At 298K and one atmosphere pressure, graphite changes into diamond according to the equation.

$$C_{(graphite)} \rightarrow C_{(diamond)} \qquad \Delta H = +2.9 \text{ KJ/mol}$$

In the space provided, sketch a simple energy level diagram for the above change. **(2 marks)**

2. (a) At 25°C 50g of substance X were added to 100g of water to make a saturated solution.

What is meant a saturated solution? **(1 mark)**

(b) The table **below** gives the solubilities of substance X at different temperatures.

Temperature °C	14	24	33	40	46	52
Solubility g/100g H_2O	24	36	50	62	72	90

(i). Plot a graph of the solubility of substance X (vertical axis) against temperature. **(3 marks)**

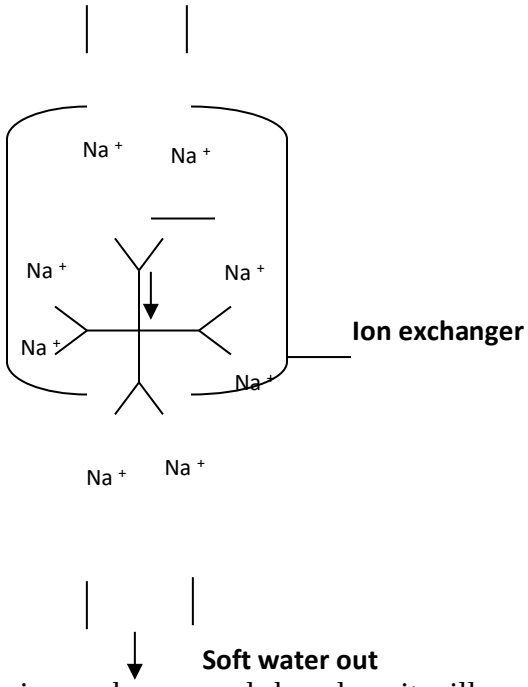
(ii) Using the graph.

d) Determine the solubility of substance X at 20°C. **(1 mark)**

e) Determine the mass of substance X that remained undissolved given that 90g of substance X were added to 100cm³ of water and warmed to 35°C. **(2 marks)**

f) Calculate the molarity of the solution at 30°C. (Relative formula mass of X = 122.5). **(3 marks)**

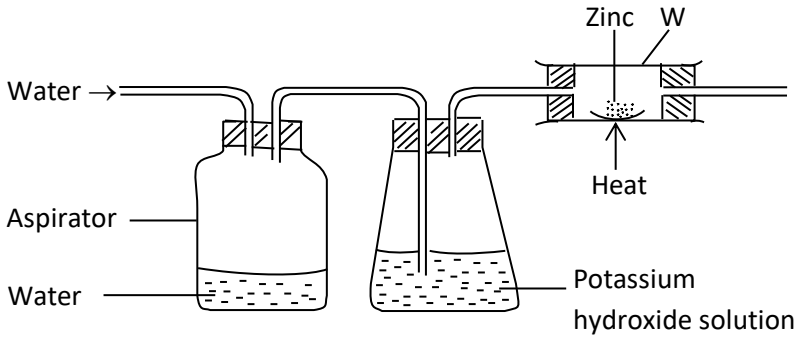
(c) The figure below shows an ion exchanger used to soften hard water



(i) Draw the ion exchanger and show how it will appear at the end of softening process. **(2 marks)**

(ii) How is the ion exchanger recharged after exhaustion **(1 mark**

3.(a) Below is an incomplete diagram of a set-up of the apparatus used to obtain nitrogen gas from the air.



IV. Complete the diagram to show how nitrogen gas is collected. **(1 mark)**

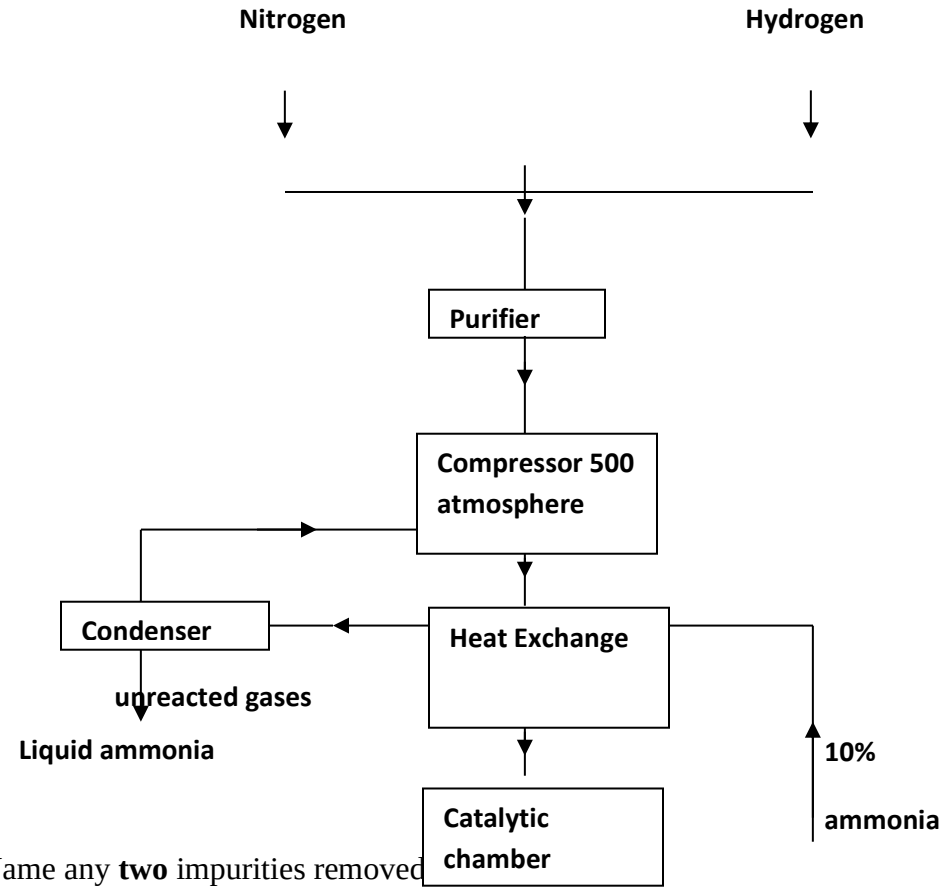
V. State the role of the following:

I Water entering the aspirator. **(1 mark)**

II Potassium hydroxide solution. **(1 mark)**

(iii).Write a chemical equation for the reaction that takes place in combustion tube. **(1 mark)**

(b).The diagram below represents the Haber's process for the manufacture of ammonia. Study it and answer the questions that follow.



(i) Name any **two** impurities removed **(2 marks)**

(ii) Name the catalyst used in the process **(1 mark)**

(iii) In the Haber's process the conversion of nitrogen and hydrogen into ammonia is only 10%.

The remaining unreacted gases are recycled. What is the advantage of recycling. **(1mark)**

iv) A part from the catalyst and pressure of 500 atmospheres, name any other condition required for this process.

(c) Give any **two** uses of ammonia **(2 marks)**

.....
.....
.....

d) In the manufacture of nitric (V) Acid from ammonia and air, ammonia is catalytically oxidized to nitrogen (II) oxide

(i) Name the catalyst used in the reaction. **(1mark)**

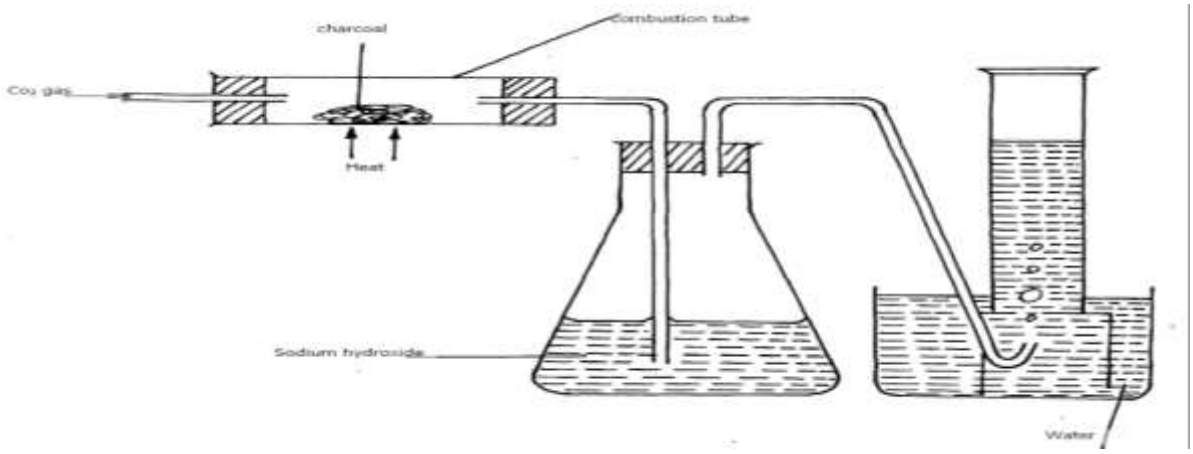
.....

(ii) Write a balanced chemical equation for the reaction between ammonia and air. **(1mark)**

(iii) State **one** environmental problem likely to be faced in an area where nitric (v) acid manufacturing plant is located. **(1 mark)**

.....

4. In an experiment, carbon (IV) Oxide gas was passed over heated charcoal and the gas produced collected as shown in the diagram below.



(i) Write an equation for the reaction that took place in the combustion tube . **(1 mark)**

(ii) Name another chemical substance that can be instead of sodium hydroxide . **(1 mark)**

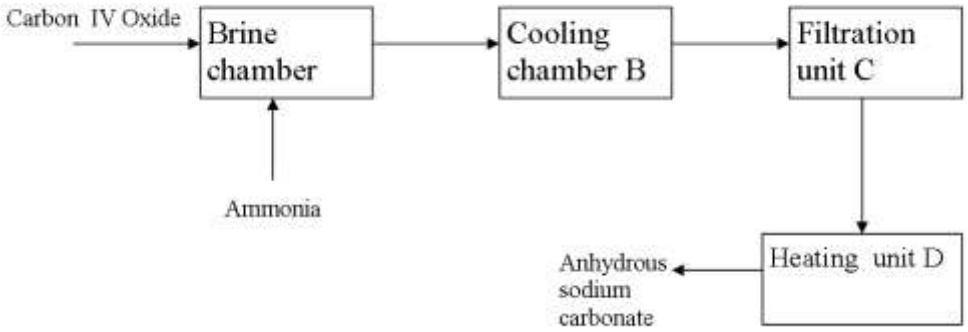
(iii) Describe a simple chemical test to distinguish between carbon (II) Oxide and carbon (IV) Oxide **(2 marks)**

(**iv)** What is the purpose of sodium hydroxide in the above set-up **(1 mark)**

(v) What property of the gas makes it possible to be collected as shown above? **(1 mark)**

(vi) State one use of carbon (II) oxide **(1 mark)**

(b) In order to prepare sodium carbonate in the laboratory, students passed carbon (IV) oxide and ammonia gas into brine as shown in the flow diagram below. Use it to answer the questions that follow:

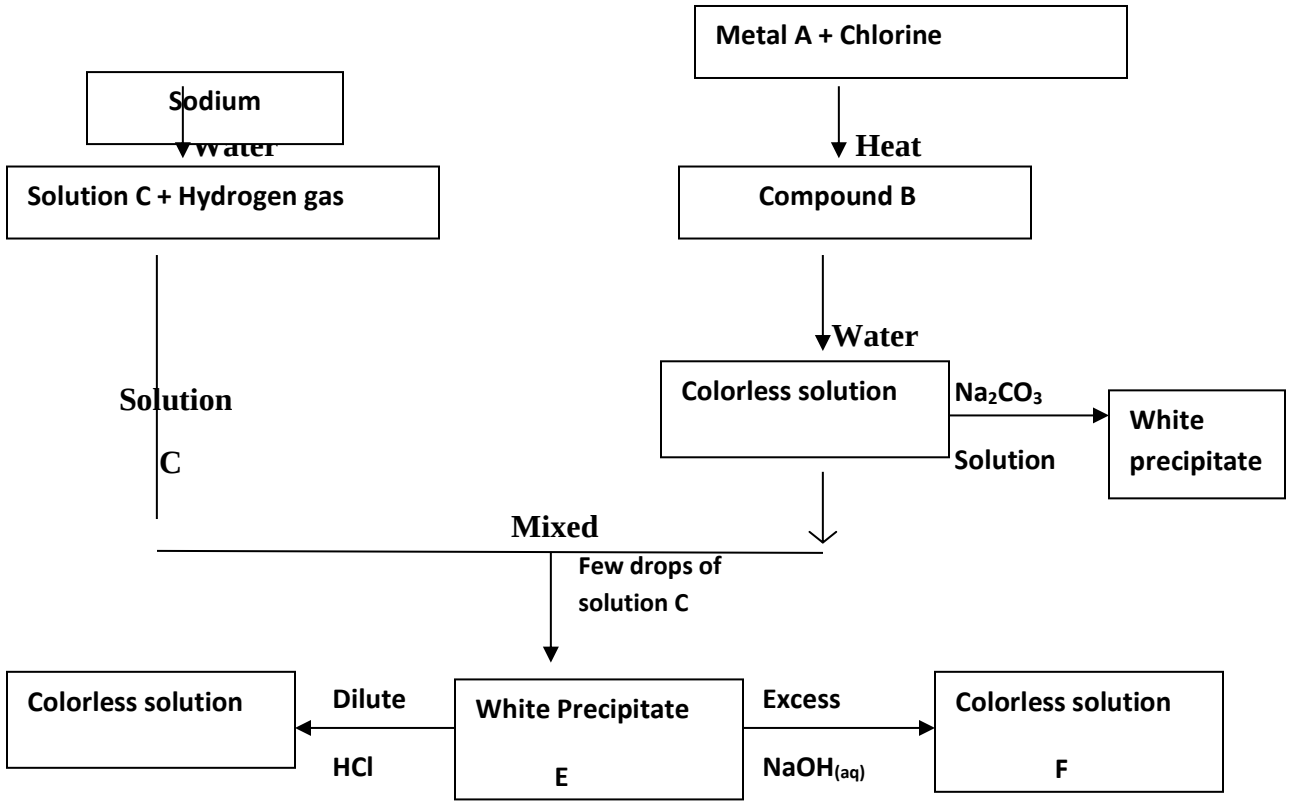


(i) Why is the mixture obtained in chamber A cooled down in chamber B? **(1 mark)**

(ii) Write an equation for the reaction that recurs in the heating chamber D **(1 mark)**

(iii) Give a reason why it is difficult to prepare potassium carbonate by the same method. **(1 mark)**

5. Study the flow diagram below and use it to answer the questions that follow.



(a) Give the name and formula of the following.

(i) White precipitate **E**

Name

(1 mark)

Formula

(1 mark)

(ii) Colourless solution F

Name

(1 mark)

Formula

(1 mark)

(b) What property is exhibited by white precipitate E when it reacts with Sodium hydroxide and HCl acid.
(1 mark)

(c) Write an ionic equation for the reaction between white precipitate E and excess sodium hydroxide solution.
(1 mark)

(d) You are provided with.

i) Potassium carbonate solid

ii) Zinc hydroxide

iii) Nitric (v) acid

iv) Distilled water

State briefly how you would prepare solid zinc carbonate using the reagents given**.** **(3 marks)**

(e) Distinguish between a weak acid and a strong acid giving an example of each. **(2 marks)**

(f). Identify an acid in the forward reaction given by the equation below:

$$HSO^-_{4(aq)} + H_2O_{(l)} \leftrightharpoons H_2SO_{4(aq)} + OH^-_{(aq)}$$ **(1 mark)**

6. The grid below shows part of the periodic table. Use it to answer the questions that follow. The letters do not represent actual symbols.

						S	U	V
P	R					T	X	W
Q								

x. Which of the elements has the largest atomic radius? Explain. **(2 marks)**

xi. Identify the most reactive non-metal. Explain. **(2 marks)**

xii. Compare the atomic radius of P and R. **(1 mark)**

xiii. Give the formula of one stable ion with an electron arrangement of 2.8 which is:

3. Negativity charged divalent ion. **(2 marks)**

4. Positively charged monovalent.

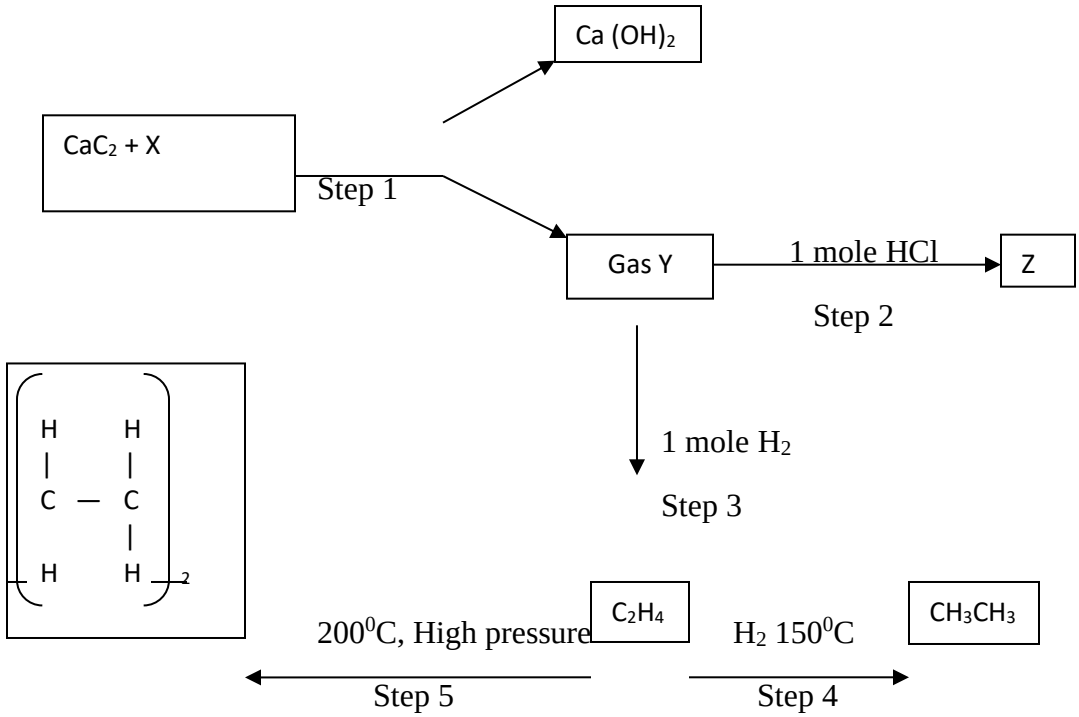
xiv. Given that the mass number of W is 40. Write down the composition of its nucleus. **(1 mark)**

xv. Write the formula of the compounds formed between.

(iii) Element R and X. **(1 mark)**

(iv) Give **one** property of the structure formed when R and X bond. **(1 mark)**

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

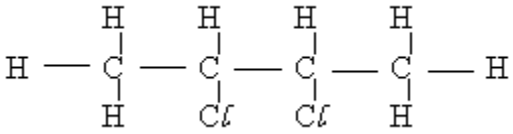


(i) Identify reagent X. **(1 mark)**

(ii) Draw the structural formula of gas Y. **(1 mark)**

(iii) What name is given to the process that takes place in step 5? **(1 mark)**

(b) An organic compound T reacts with chlorine gas in the presence of u.v light to form compound U. The structural formula of compound U is shown below.



Name the organic compound T and draw its structural formula. **(2marks)**

(c).The structure below represents two cleansing agents, L_1 and L_2.

$L_1 \rightarrow R - CH - CH_3$

$OSO_3^- Na^+$

$L_2 \rightarrow R - COO^- Na^+$

(i) Identify each of the two cleansing agents, L_1 and L_2.

L_1 (½mark)

L_2 (½mark)

(ii). State a disadvantage of each of the above cleansing agents.

L_1 (½mark)

L_2 (½mark)

(d) In an experiment an organic compound was reacted with absolute ethanol in the presence of concentrated sulphuric (VI) acid to form a compound whose formula is $CH_3 CH_2 CH_2 COOCH_2 CH_3$. Name

I. The type of reaction that took place. **(1 mark)**

II. The name of the organic compound to which the compound belonged. **(1 mark)**

(e) Write the structural formula and give the systematic name of the acid used in the above experiment. **(2 marks)**

PAPER 3

(PRACTICAL)

Q1.You are provided with:

i) Magnesium ribbon, solid FA1.
ii) 0.7 M hydrochloric acid, solution FA2.
iii) 0.05 M sodium hydroxide solution, solution FA3.
iv) Distilled water.
v) Phenolphthalein indicator solution.

You are required to determine the:

i) Number of moles of hydrochloric acid that remain unreacted.
ii) Number of moles of magnesium that reacted.

PROCEDURE I

a) Using a burette, measure 50.0cm^3 of solution FA2 and place it in a 100ml plastic beaker.
b) Put the magnesium ribbon, solid FA1 in the 50.0cm^3 of solution FA2 in the 100ml beaker and allow the reaction to proceed until effervescence stops.

PROCEDURE II

c) Transfer ALL the solution obtained in Procedure I into a 250ml volumetric flask.
d) Top up the solution in the volumetric flask to calibration mark using distilled water. label this as solution FA4.
e) Empty the burette and fill it with solution FA3.

f) Pipette 25.0cm^3 of solution FA4 and place it into an empty 250ml conical flask. Add 3 drops of the phenolphthalein indicator solution and titrate against solution FA3 from the burette. Record the results in Table 1.

g) Repeat the titration of solution FA4 against FA3 two more times in order to complete Table 1.

Table 1.

Titration	1st	2nd	3rd
Final burette reading, cm^3			
Initial burette reading, cm^3			
Volume of solution FA3 used, cm^3			

(4mks)

Average volume of solution FA3 used = _____ cm^3 (1mk)

Calculate the number of moles of:

i) Sodium hydroxide in the average titre volume used. (1mk)
ii) Hydrochloric acid in 25.0 cm^3 of solution FA4. (2mks)
iii) Hydrochloric acid in 250.0 cm^3 of solution FA4. (2mks)
iv) Hydrochloric acid in 50.0 cm^3 of solution FA2. (1mk)
v) Hydrochloric acid that reacted with the magnesium. (2mks)
vi) Magnesium that reacted. (2mks)

2. You are provided with:

i). 2.20g of solid **BA11**,
ii). Thermometer.
iii). Distilled water.
iv). 100 ml Glass beaker
v). Boiling tube.

You are required to determine the solubility of compound **BA11** at various temperatures.

Procedure I:

a) Place the whole amount of solid **BA11** supplied to you into a clean, dry boiling tube.
b) Using a burette, add 2.00cm^3 of distilled water into the boiling tube with solid **BA11**.
c) Insert a thermometer into the boiling tube and heat the mixture in the hot water-bath (use the 100ml beaker), while stirring continuously with the thermometer, until the temperature of the mixture is about 80^{0}C when **ALL** the crystals **JUST** dissolve
d) Remove the boiling tube from the hot water bath and allow the contents to cool slowly while stirring with the thermometer. Note the temperature at which the crystals FIRST form/reappear and record this crystallization temperature, T_c in Table 2
e) Using the same mixture from (d) above, add 1.00cm^3 of distilled water from the burette into the boiling tube containing the mixture and repeat steps (c) and (d) above. Continue in this way until a total volume of water added to the boiling tube is 7.00cm^3. Complete Table 2 by calculating the solubility of compound **BA11** in water at the different temperatures.

Table 2: (4mks)

Total volume of water added (cm^3)	Crystallization Temperature ,T_C(^{o}C)	Solubility of compound **BA11** in water (g/100g of water)
2.00		
3.00		

4.00		
5.00		
6.00		
7.00		

f) On the grid provided plot a graph of solubility of compound BA11 (vertical axis) against temperature. (3mks)

g) Using the graph determine:

I. the temperature at which 100.0g compound **BA11** would dissolve in 100g of water. (1mk)

……

II. solubility of compound **BA11** at 30.0^0C. (1mk)

……

h) A solution containing 100g of **BA11** per 100g of water was cooled to 30.0^0C. Determine the mass of crystals formed. (2mks)

3. You are provided with solids FA5, FA6 and FA7. Carry out the following tests and write your observations and interferences in the spaces provided.

a) Place all of solid FA5 in the boiling tube. Add about 10 cm^3 of distilled water and shake until all the solid dissolves. Label this as Solution FA5.

i). To about 2 cm^3 of Solution FA5 in a test tube, add 2M sodium hydroxide solution drop wise until in excess.

OBSERVATION	INFERENCES
(1mk)	(1mk)

ii). To about 2 cm^3 of Solution FA5 in a test tube, add 2M ammonium hydroxide solution drop wise until in excess.

OBSERVATION	INFERENCES
(1mk)	1mk)

iii) To about 2 cm^3 of Solution FA5 in the test tube, add 4 drops of 2M sulphuric (VI) acid.

OBSERVATION	INFERENCES
(1mk)	(1mk)

iv) To about 2 cm^3 of solution FA5 in a test tube, add 2 drops of potassium iodide solution.

OBSERVATION	INFERENCES
(1mk)	(1mk)

b). Place solid FA7 into boiling tube. Add about 10cm^3 of distilled water and shake well. Label this as solution FA7 .Use this solution for the following tests.

i) Place about 2cm^3 of solution FA7 in a test tube and place the universal indicator paper provided into the solution hence determine its pH.

OBSERVATION	INFERENCES
(1mk)	(1mk)

ii). To about 2cm^3 of solution FA7 made in (ii) above, add 3 drops of acidified potassium manganate (vii) solution.

OBSERVATION	INFERENCES
(1mk)	(1mk)

iii). To the remaining solution FA7 in the boiling tube, add the other half of solid FA6.

OBSERVATION	INFERENCES
(1mk)	(1mk)

BAHATI GIRLS

PAPER 1.

1. A certain element Y has atomic number 15 and mass number of 31.

   a) How many electrons are in this element? (1mk)

……

……

   b) Write the electron arrangement of the ion formed by element Y. (1mk)

……

   c) How would the atomic size of the above element compare with another atom X whose atomic number is 11 and mass number 23? Explain. (2mks)

……

……

2. Explain why the pH of 1.0 M hydrochloric acid is 2.0 while that of 1.0M ethanoic acid is 5.0. (2mks)

……

……

3. Ethanedioic acid $(COOH)_2$ is used instead of methanoic acid (HCOOH) to prepare carbon (II) oxide in the laboratory. It gives equal volume of carbon (II) oxide and carbon (IV) oxide.

   a) If water is one of the products write an equation for the dehydration of elthanedioic acid. (1mk)

……

……

   b) How can pure carbon (II) oxide be obtained from the mixture of the two gases? (2mks)

……

……

4. State the Charles' law. (1mk)

b. A volume of $120cm^3$ of nitrogen gas diffused through a membrane in 40 seconds, how long will $180cm^3$ of carbon (IV) oxide take to diffuse through the same membrane? (2mks)

5. A solution of chlorine in tetrachloromethane turns colourless when propene gas is bubbled through it.

   a) What type of reaction takes place? (1mk)

……

   b) Write an equation for the above reaction. (1mk)

……

……

   c) State one use of ethane gas. (1mk)

……

……

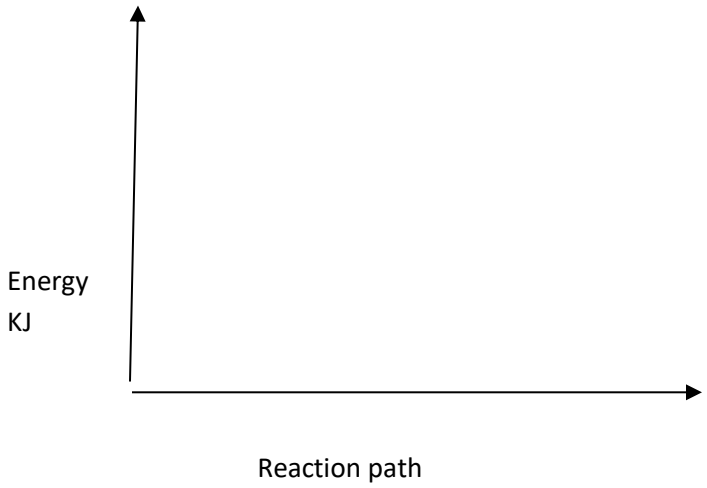
6. Study the information in the table below then answer the question that follow.

Bond	***Bond energy ($KJmol^{-1}$)***
H – H	435
Cl –Cl	243
H – Cl	431

   a) Calculate the enthalpy change for the following reaction. (2mks)

   $H_2(g) + Cl_2(g) \longrightarrow 2\ HCl\ (g)$

   b) On the axis given below draw an energy level diagram for the reaction above. (1mk)



7. 22.2cm^3 of sodium hydroxide solution, containing 4.0 g per litre of sodium hydroxide were required for complete neutralization of 0.1g of a dibasic acid. Calculate the relative formula mass of the dibasic acid. (Na = 23.0, O= 16.0, H= 1.0) (3mks)

8. The melting and boiling point of molecular substances increase with increase in relative molecular mass. Explain why water with a lower relative molecular mass of 18 has a higher boiling point of 100^{o}C than hydrogen sulphide with relative molecular mass of 34 and a boiling point of -61^{o}C. (2mks)

9. In an experiment to determine the solubility of solid Y in water at 30^{O}C the following results were obtained:

   Mass of evaporating dish = 26.2.

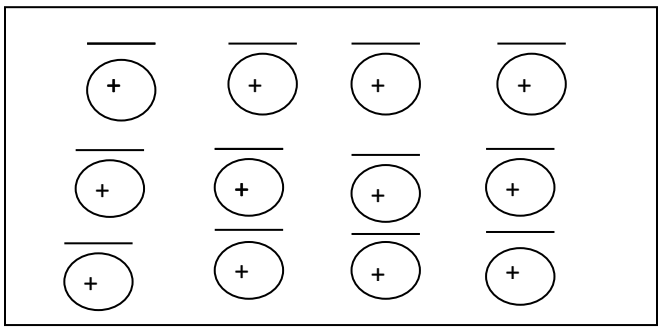
   Mass of evaporating dish + saturated solution = 42.4g

   Mass of evaporating dish + dry solid Y = 30.4g

   Using the information, determine the solubility of solid Y at 30^{O}C in grams per 100g. (2mks)

10. A, B, C and D are dyes present in a mixture. C is more soluble than B. A is more soluble than C while D is the least soluble in a given solvent. Draw a round paper chromatogram showing how they would appear when separated using the solvent. (2mks)

11. The diagram below shows a section of a model of the structure of element T.



Key



Charged nucleus

An electron

(-)

a. State the bonding type that exists in element T. (1mk)

……

b. In which group of the periodic table does element T belong? Give a reason. (1mk)

……

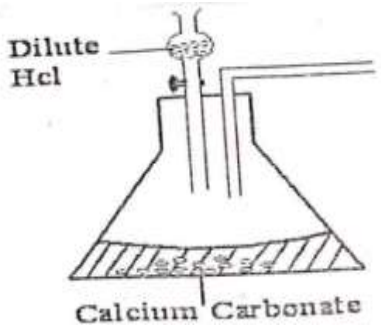
12. Determine the values of the scalars X and Y in the nuclear equation shown below.

$$^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{141}_{56}Ba + {}^{x}_{y}Kr + 3{}^{1}_{0}n$$

b. State one application of this type of reaction. (1mk)

c. State one danger associated with exposure of human beings to radioactive substances. (1mk)

13. The diagram below shows an incomplete set up of the laboratory preparation of dry carbon (IV) oxide. Complete it. (2mks)



14. Write down the property of concentrated sulphuric (VI) acid shown in the following reaction. (2mks)

a. $CuSO_4.5H_2O(s) \xrightarrow{H_2SO_4(i)} CuSO_4(s) + 5H_2O(i)$

Blue White

……

b. $C(s) + 2H_2SO_4(I) \longrightarrow CO_2(g) + 2H_2O(I) + 2SO_2(g)$

……

15. When excess chlorine gas is bubbled through dilute sodium hydroxide solution, the resulting solution acts as a bleaching agent.

a) Write an equation for the reaction between chlorine gas and sodium hydroxide solution. (1mk)

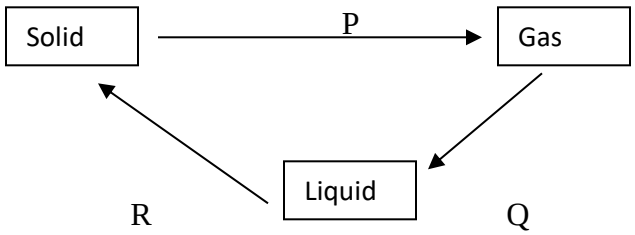
……

……

b) Explain how the resulting solution acts as a bleaching agent. (2mks)

16. An element P has a relative atomic mass of 88. When a current of 0.5 ampheres was passed through the fused chloride for 32.16 minutes, 0.44g of P were deposited at the cathode. Determine the charge on an ion of P. (1 F = 96500 coulombs) (3mks)

17. Matter exists in three states which can be related as shown in the diagram below.



a) Name processes P and R. (2mks)

P……

R……

b) Explain whether process Q is exothermic or endothermic. (1½ mks)

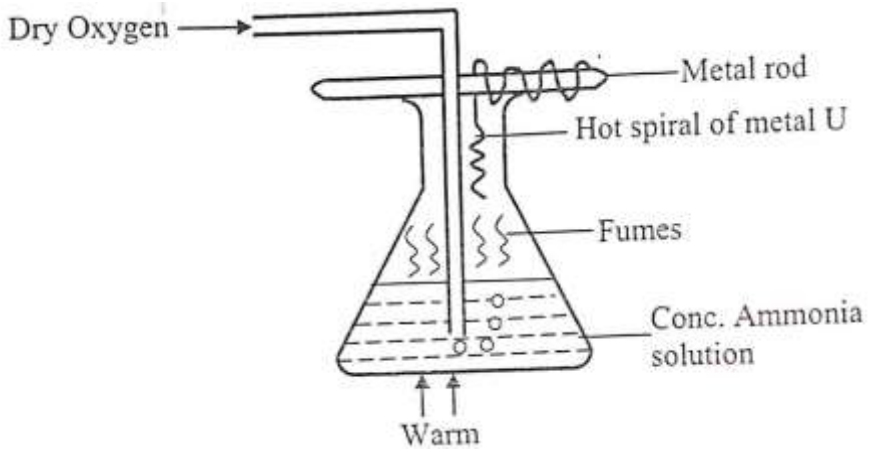
……

……

……

……

18. Study the diagram below.



a) Give the most likely identity of metal U. (1mk)

……

b) State two observations made in the conical flask. (2mks)

……

……

……

……

c) Write an equation for the reaction which took place between ammonia and oxygen inside the flask. (1mk)

……

……

19. In an experiment, soap solution was added to three separate samples of water. The table below shows the volumes of soap solution added in order to form lather with 1000cm^3 of each samples before and after boiling.

	Sample I	**Sample II**	**Sample III**
Volume of soap added to unboiled sample (cm^3)	27.0	3.0	10.6
Volume of soap added after boiling the sample (cm^3)	27.0	3.0	3.0

a) Identify the sample that was likely to be soft water. Explain. (1mk)

……

……

b) Explain the change in the volume of soap solution in sample III. (1mk)

……

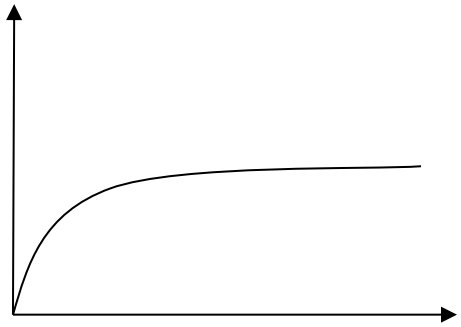
……

c) Give one disadvantage of hard water. (1mk)

……

……

20. In an experiment to monitor the rate of reaction of magnesium and hydrochloric acid a student recorded the volume of hydrogen produced at regular time intervals and obtained the graph shown below.



a) On the same set of axes sketch the curve expected if the experiment is repeated with a few crystals of copper (II) sulphate added to the reactants.
(1mk)

b) Explain the shape of your curve. (1mk)

……

……

……

……

c) State the factor that can increase the rate of a reaction. (1mk)

……

……

21. The grid below is a section of the periodic table. Study it and answer the questions that follow.



	A						D	
B			C				F	
E								

a) State the name given to the family of B and E. (1mk)

……

b) Identify the most reactive metal. (1mk)

……

c) Which type of bond exists in the compound formed by A and F. Explain.
(1 ½ mks)

……

……

……

22. Write the formula of the chief ore (bauxite) from which aluminum is extracted.
(1mk)

……

……

b. Explain the role of molten cryolite in aluminum smelting. (1mk)

……

……

……

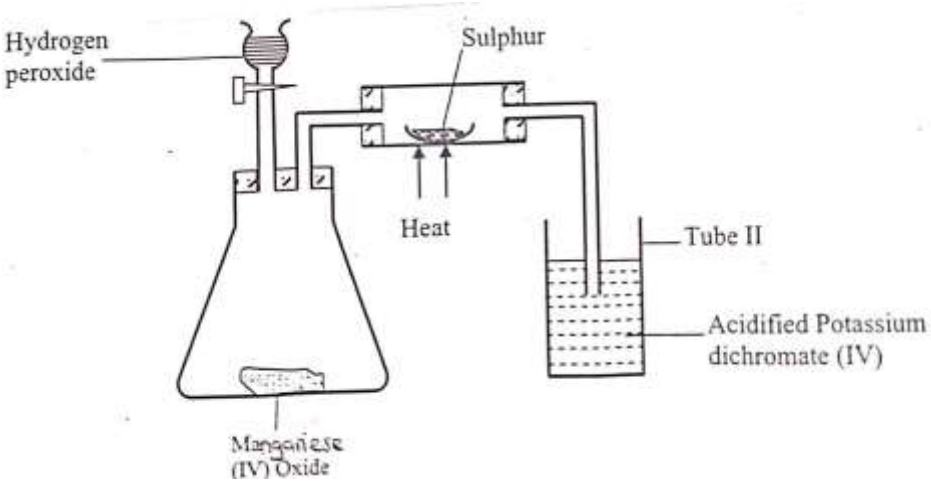
……

23. Aluminum does not apparently react with dilute nitric (V) acid to liberate hydrogen gas. Explain. (1mk)

……

……

24. Study the diagram below.



a) State the role of manganese (IV) oxide in the set up shown above. (1mk)

……

b) State and explain the observation made in tube II. (2mks)

……

……

……

25. Two manila papers were placed at different levels of a non- luminous flame. Paper A was placed at the lowest part of the flame, while B was placed at the top.

a) Indicate the observations made on each manila paper. (1mk)

……

……

b) Explain the observation made on paper A. (1mk)

……

……

26. Starting with $50cm^3$ of 2.8M sodium hydroxide, describe how a sample of pure sodium sulphate crystals can be prepared. (3mks)

27. In an experiment to determine the percentage of magnesium hydroxide in an anti-acid a solution containing 0.5g of the anti-acid was neutralized by $23.0cm^3$ of 0.10M hydrochloric acid. Given the relative formula mass of magnesium hydroxide is 58. Calculate the:

a) Mass of magnesium hydroxide in the anti-acid. (2mks)

……

……

……

……

b) Percentage of magnesium hydroxide in the anti-acid. (1mk)

……

……

28. Study the standard electrode potentials in the table below and answer the questions that follow.

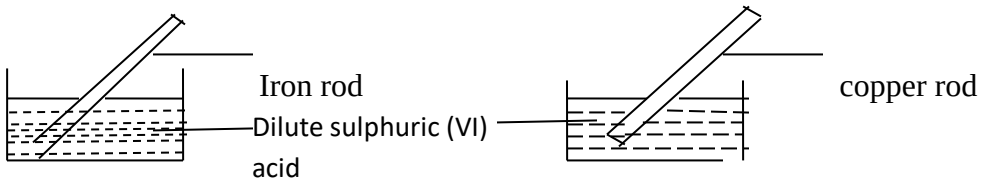
	EΘvolts
$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$	+ 0.34
$Mg^{2+}(aq) + 2e^- \longrightarrow Mg(s)$	- 2.38
$Ag^+(aq) + e^- \longrightarrow Ag(s)$	+0.80
$Ca^{2+}(aq) + 2e^- Ca(s) \longrightarrow$	- 2.87

a) Which of the metals is the strongest reducing agent? (1mk)

……

b) What observations will be made if a silver coin is dropped into an aqueous solution of copper (II) sulphate? Explain. (2mks)

29. A student used the figure below to investigate the action of dilute sulphuric (VI) acid on some metals. Beaker I and II contained equal volumes of dilute sulphuric (VI) acid. To beaker I, a clean iron rod was dipped and to beaker II, a clean copper rod was dipped.



I II

a) Describe the observations made in each beaker.

Beaker I (1mk)

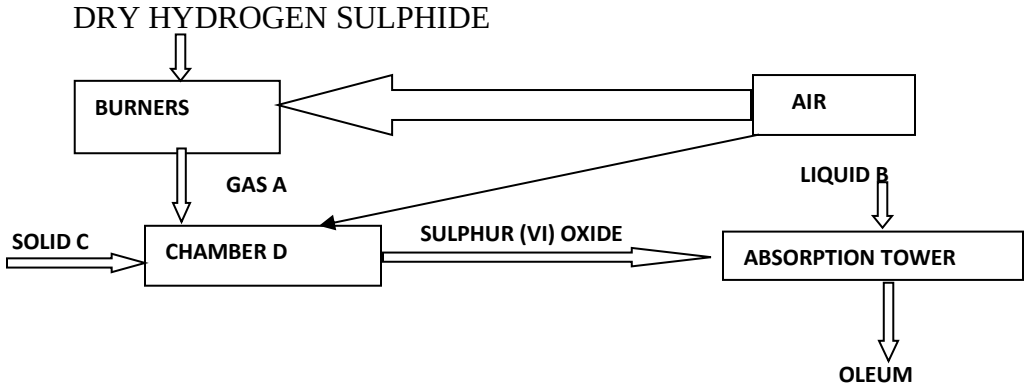
Beaker II (1mk)

b) Explain observations in (a) above. (1mk)

PAPER 2

1. Sulphuric (VI) acid can be prepared using hydrogen sulphide as shown in flow chart below.

Study it and answer the questions that follow.



(a) Identify:

(i) Gas **A**: (1 mark)

……

(ii) Liquid **B**: (1 mark)

……

(b) (i) What function does solid C play in the chamber **D**? (1mark)

……

……

(ii) Write an equation for the reaction in chamber **D**. (1 mark)

……

……

(c) Explain the observations made if hydrogen sulphide gas is bubbled through copper (II) nitrate solution? (2 marks)

……

……

……

……

(d)Write an ionic equation for the confirmatory test for hydrogen sulphide gas.1 mark)

……

……

……

(e)Write a chemical equation to show the formation of concentrated Sulphuric (VI) acid from the oleum. (1 mark)

……

……

……

(f)Explain why in contact process SO_3 gas is **not** directly dissolved in water to make concentrated sulphuric (VI) acid. (2 marks)

……

……

……

(g)Name the main pollutant from the process above and how it is controlled. (2 marks)

……

(d) State two factors that increases the yield of sulphur (VI) oxide using the equation below. (1 marks)

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad -ve$$

……

……

2.a) During an experiment a student added soap solution to separate samples of water until lather was formed. Below is a table showing the volumes of soap solution that was required to form lather with **$100cm^3$** of each sample of water before and after boiling the samples.

	Volume (cm^3) of soap required by water sample		
	X	**Y**	**Z**
Before boiling	4.5	19.5	22.5
After boiling	4.5	19.5	4.5

i) (a)State the most likely source of water sample **X**. ($^1/_2$ mark)

……

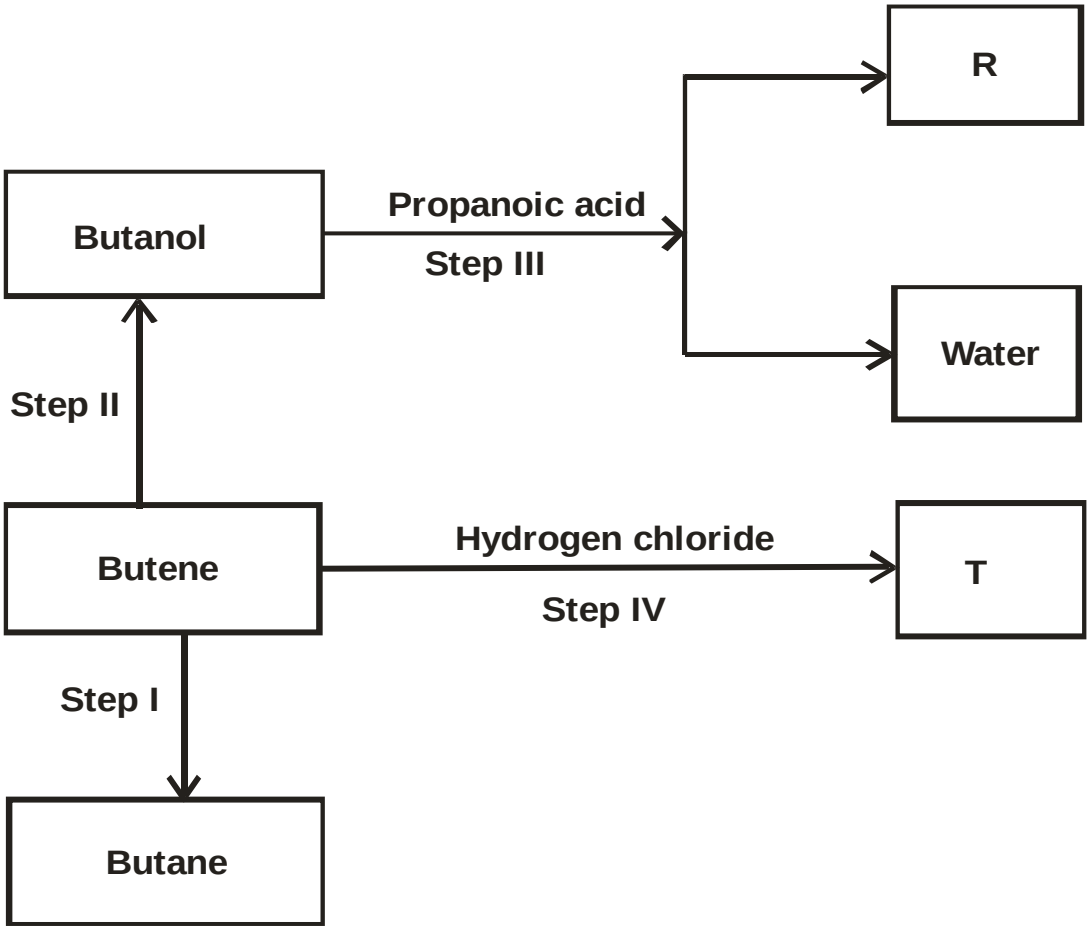
(b) Identify a salt most likely to be present in water sample **Y.** ($^1/_2$ mark)

……

ii) Write an equation for the reaction that may have occurred in water sample **Z** when it was being boiled. (1 mark)

……

b) Study the flowchart below and answer the questions that follow.



i) Name the types of reaction that occurs in steps **I** and **II**

Step I : …….. ($^1/_2$ mark)

Step II : **……** ($^1/_2$ mark)

ii) What conditions are necessary for the reaction you have named in (i) above? ($1^1/_2$ mark)

……

……

iii) Write a chemical equation for the reaction that takes place in step **IV** (1 mark)

……

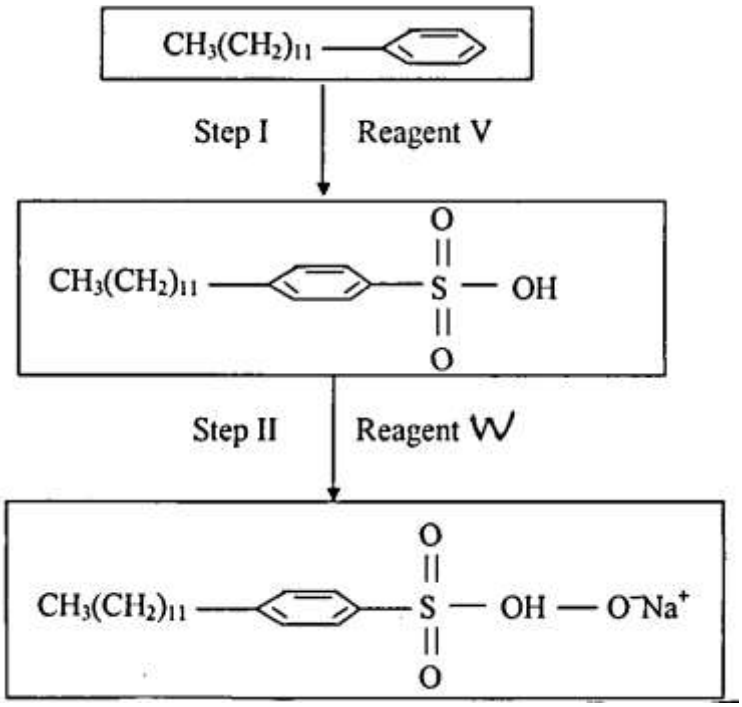
……

……

iv) Why is substance **R** used in some soaps? ($^1/_2$ mark)

……

c) The flow diagram below shows some of the steps followed during the industrial manufacture of a detergent.



i) What is a detergent? (1 mark)

……

……

……

ii) Identify reagents **V** and **W** (2 marks)

I) Reagent **V** ……..

II) Reagent **W** ……

iii) Write an equation for the reaction that may occur when the detergent is added to water containing magnesium ions. (1 mark)

……

……

iv) State **one** advantage of using the above detergent. (1 mark)

……

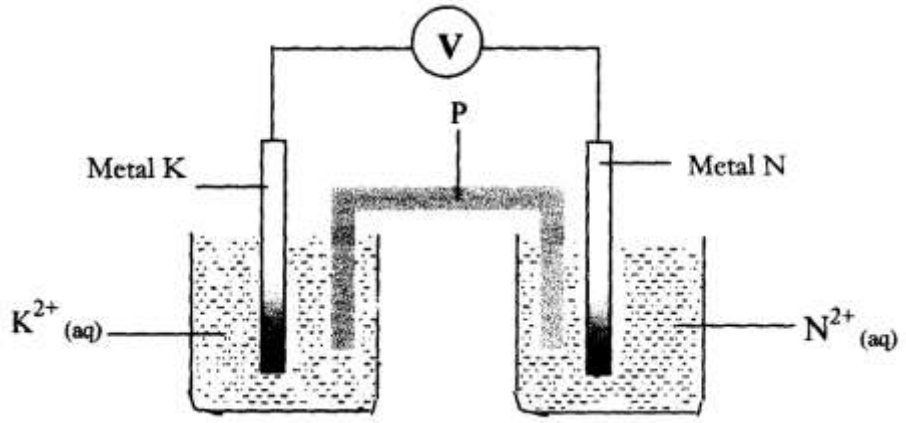
……

3. Metals **K** and **N** were connected to form a cell as shown in the diagram below. Their reduction potentials are as shown below:

$K^{+}_{(aq)} / K_{(s)} \equiv - 0.17V$

$N^{+}_{(aq)} / N_{(s)} = + 1.1\ 6V$

I.



Metal **K** electrode (1mark)

……

Metal **N** electrode (1mark)

……

II) Identify **P** and state **two** roles in the above setup

(i). Identity of **P** (1 mark)

……

(iii) **Two** Roles of **P** in the setup. (1 mark)

……

III. On the diagram, show the flow of :-

I. Electrons ($^1/_2$ mark)

……

……

II. Current. ($^1/_2$ mark)

……

……

IV Calculate cell potential (E) for the cell represented in the setup above (1 mark)

……

……

(b) The table gives the standard redox potentials for a number of half reactions. Use it to answer the questions that follow:-

	(E^{θ}/Volts)
$Zn^{2+}_{(aq)} + 2e^- \rightleftharpoons Zn_{(s)}$	-0.76
$Fe^{2+}_{(aq)} + 2e^- \rightleftharpoons Fe_{(s)}$	-0.44
$I^{2+}_{(l)} + 2e^- \rightleftharpoons 2I^-_{(aq)}$	+0.54
$Fe^{3+}_{(aq)} + e^- \rightleftharpoons Fe^{2+}_{(aq)}$	+0.77
$Ag^+ + e^- \rightleftharpoons Ag_{(s)}$	+0.88

(e) Relative to which half-cell reaction are the above electrode potentials expressed? ($^1/_2$ mark)

……

……

(ii) Calculate the e.m.f of the cell made up by combining the $\mathbf{I_{2(l)}/2I^-_{(aq)}}$ electrode and

$\mathbf{Zn^{2+}_{(aq)}/Zn_{(s)}}$ electrode (1marks)

……

……

(ii) Which of the substances listed in the above table is :- (1marks)

I. The strongest oxidising agent

……

……

II. The strongest reducing agent

……

……

(iv) Which substances could be used to convert iodide ions to iodine? Write balanced equations for any possible conversions (1mark)

……

(v) Draw a cell diagram formed between zinc and lead. (2marks)

c) A steady current of **2.5A** was passed for **15** minutes through a cell containing divalent ions $\mathbf{M^{2+}}$. During this process **0.74g** of metal M was deposited (IF = **96500C**)

Calculate the quantity of electricity passed in this cell (1mark)

……

……

ii) Determine the relative atomic mass of **M** (2marks)

……

……

……

4. In an experiment, a student measured the amount of gas produced with time when excess **1.0 M** hydrochloric acid was reacted with **0.42** g of a carbonate, $\mathbf{XCO_3}$ and obtained the following results. (Note: The reaction was carried out at room temperature)

Time (minutes)	**Volume of carbon (IV) oxide, cm^3**
0.0	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
18.0	120

a) On the graph paper provided, draw a graph of volume of carbon (IV) oxide against time. {3 mks}

b) From the graph,

i) Determine the time at which half the original mass of marble chips will have reacted.

(1 mark)

……

i) Determine the reaction rate between the **5th** and **6th** minutes. (2 marks)

……

……

c) i)Write the equation for the reaction that takes place. (1 mark)

……

……

……

……

ii) Calculate the total number of moles of carbon (IV) oxide produced in this reaction.

(Molar gas volume at **r.t.p = 24 dm^3**) (2 marks)

……

……

……

……

iii) Determine the relative molecular mass of **XCO_3**. (2 marks)

……

……

……

……

iv) Determine the relative atomic mass of **X.** (1 mark)

……

……

……

d) On the same graph paper, draw a sketch of the curve that would be obtained if **0.5 M** hydrochloric acid was used. Label the curve A. (1 mark)

……

……

5. Sodium metal tarnishes when exposed to air to form a white powder on its surface. A small piece of sodium metal was dropped into **30 g** of propanol and **2400cm^3** of hydrogen gas produced at room temperature and pressure .The unreacted propanol was evaporated and white solid remained .(molar Gas Volume at room temperature and pressure =**24dm^3 Na=23** , **C=12** , **O= 16**)

a) (i)Give the name of the white powder formed on the original piece of sodium metal. (1mark)

……

……

(ii)Explain how the white solid was formed. (2marks)

……

……

……

b) (i)White down the chemical equation for the reaction between propanol and sodium metal. (1mark)

……

……

(ii)Determine the mass of sodium that reacted with propanol. (2marks)

……

……

……

(iii) What mass of propanol was evaporated? (2 marks)

……

……

……

(iv) The propanol was evaporated at **97^{0}c** and the white solid remained unaffected at this temperature .what is the difference in structure of propanol and white solid. (1 mark)

……

……

……

c) (i)Name the inorganic liquid which liberates hydrogen gas with sodium metal. (1 mark)

……

……

……

(ii)State two differences you would observe if similar pieces of sodium metal were dropped separately into beakers containing equal amount of propanol and liquid named in (i) above respectively. (2marks)

……

……

……

……

6. The figure below is a section of periodic table. Study and answer the questions that follow. The letters do not represent the actual symbol of elements.

A								
					D		**I**	E
F	**G**		**H**					
J								

(i) Select the elements which belongs to the same chemical family. ($^1/_2$ mark)

……

(ii)Identify the strongest reducing element. ($^1/_2$ mark)

……

b) (i) The chloride of **H** vaporizes easily while the oxide of **H** has a high melting point. Explain the observation in terms of structure and bonding. (2marks)

……

……

……

……

(ii)Blue and red litmus papers were dropped into solution of chloride of H, state and explain the observations made. (1mark)

……

……

……

c) **K^-** has ionic configuration of **2:8:8**

(i) Give the chemical family name to which element **K** belong. (1mark)

……

……

(ii) Place element K on the above periodic table. (1mark)

……

……

d) The first and second ionization energies of element **G** at random are **665**kjmol$^-$ and **560** kjmol$^-$

(i) Define the term the ionization energy. (1mark)

……

……

(ii) Write equations for the first and second ionization energies for element **G indicating their energies**. (1 mark)

……

……

(iii) Explain your answer in (ii) above. (1mark)

……

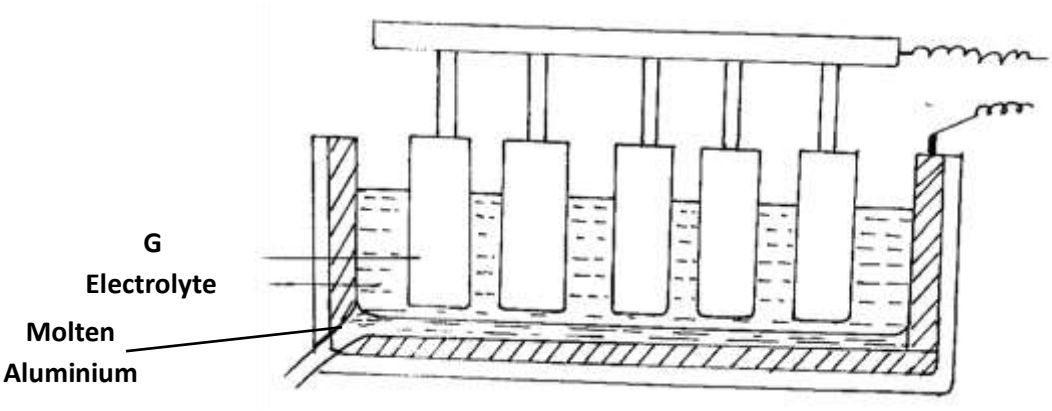
……

e) Explain the difference in the atomic radii of **D** and **I.** (1mark)

……

……

7. The diagram below illustrates the Hall's cell for the extraction of Aluminium. Study it and answer the questions that follow.



(a) (i) Name the electrode labeled **G** (1 mark)

……

(b) Electrolysis is carried at **800 – 900^{0}C** and newly formed Aluminium is tapped off as a liquid. What does this indicate about the melting point of Aluminium? (1 mark)

……

(c) (i) Give the ionic equations for the reaction that takes place at the cathode. (1 mark)

……

……

(ii) The anode has to be replaced frequently. Explain. (1 mark)

……

……

d) Cryolite is used in the extraction of aluminium from bauxite. State its function. (1mark)

……

……

d) A piece of unpolished aluminium foil is not attacked by water steam and dilute hydrochloric acid. Explain. (1mark)

……

……

e) (i) The basic raw material for extraction of aluminium is bauxite. Name two major impurities in bauxite. (1 mark)

……

……

(ii) State one property of duralium that make it more suitable than pure aluminium in aeroplane construction.
(1 mark)

PAPER 3

1. You are provided with

- 2.0M NaoH solution labelled B
- Sulphuric(VI) acid solution labelled A `

You are to:

[a] Prepare a dilute solution of NaoH solution.

[b] Determine the concentration of in moles per litre.

PROCEDURE 1

i. Using a pipette 25.0cm^3 of solution B and place it into 250cm^3 volumetric flask.
ii. Add about 200cm^3 of distilled water and share well.
iii. Add more water to make up to 250cm^3mark. Label this solution C

[a] Calculate the concentration of the dilute solution C in moles per litres. [2mks]

……
……
……

PROCEDURE 2

i. Fill the burette with solution A and record the readings in the table below.
ii. Pipette 25cm^3 of dilute solution C and place it into 250ml conical flask.
iii. Add 2-3 drops of phenolphthalein indicator.
iv. Titrate with solution A.
v. Record your results in the table below.
vi. Repeat the titration two or more times and complete the table.

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

[4mks]

[a] Determine average volume of the acid (solution A) used. [1mk]

……
……

[b] Determine moles of dilute solution C in the volume used. [2mks]

[c] Write an equation for the reaction taking place. [1mk]

……..

[d] Determine the number of moles of A used. [2mks]

[e] Determine the concentration of A in moles per litre. [2mks]

2. You are provided with the following

- 2M sodium hydroxide solution, solution B
- 2M hydrochloric acid, solution D

You are required to determine the molar enthalpy of neutralization of the acid using sodium hydroxide.

PROCEDURE

[i] Measure out $20cm^3$ of acid into a clean plastic beaker.

[ii] Record the temperature of this solution in the table below

[iii] Measure $5cm^3$ of sodium hydroxide and add it to the hydrochloric acid.

[iv] Stir with the thermometer and record the maximum temperature reached.

[v] Repeat the above procedure adding $5cm^3$ portions of sodium hydroxide until the total volume of the solution is $50cm^3$.

Volume of acid(cm3)	20	20	20	20	20	20	20
Volume of NaoH added cm^3	0	5	10	15	20	25	30
Temperature($°C$)of solution							

[3mks]

You are required to:

[a]. Plot a graph of temperature rise against sodium hydroxide added. [3mks]

[b]From your graph determine:

[i] maximum temperature change. [1mk]

[ii] the volume of NaOH that is required for complete neutralization [1mk]

[iii] Calculate the molar enthalpy of neutralization for this reaction. (C=4.2J/g/K) assume density of solution is $1gcm^{-3}$) [2mks]

[iii] The theoretical molar heat of neutralization is -57.2kj/mol-1.Compare your value in [ii] above with the theoretical value. Give the reasons for any differences noted between these two values. [2mks]

3. You are provided with solid N carry out the tests below and record your observations and inferences.

[a] Place a spatula of N in a test tube and add $5cm^3$ of water and shake well divide the solution in to three portions.

OBSERVATION (1mk)	**INFERENCE (1mk)**

[b] Add sodium hydroxide to the first portion drop wise while observing till in excess

OBSERVATION (1mk)	**INFERENCE (2mks)**

[c] Add ammonia solution to the second portion drop wise until in excess.

OBSERVATION (1mk)	**INFERENCE (1mk)**

[d] Add four drops of potassium iodide solution to the third portion.

OBSERVATION (1mk)	**INFERENCE (1mk)**

[e] Add three drops of acid barium nitrate to the fourth followed by 5 drops of nitric acid.

OBSERVATION (2mks)	**INFERENCE (1mk)**

ASUMBI GIRLS HIGH SCHOOL

PAPER 1

1 [a] State Boyle's law [1mk]

……

……

[b] At 400^0C, 850cm^3 of a gas exert a pressure of 560mmHg. What volume of the same gas would exert a pressure of 640mmHg at the same temperature? [3mks]

……

……

……

……

2. When burning magnesium is lowered into a gas jar containing nitrogen (I) oxide, it continues to burn forming a white solid

[a] Name the white solid 1mk]

……

……

[b] Write a chemical equation of the reaction that occurred [1mk]

……

……

3. Carbon {IV} oxide is one of the gases used in fire extinguishers

[a] State any other possible use of carbon {IV} oxide [1mk]

……

……

[b] Name any two reagents that can be reacted together ti generate carbon {IV} oxide [2mks]

……

……

4. Rusting is a process that causes massive destruction of iron structures

[a] State one condition that accelerates rusting [1mk]

……

……

[b] State one advantage of rusting [1mk]

……

……

5. At 60^0C, 38 grams of lead{II} nitrate saturate 56cm^3 of water. Determine the solubility of lead {II} nitrate at this temperature [2mks]

……

……

……

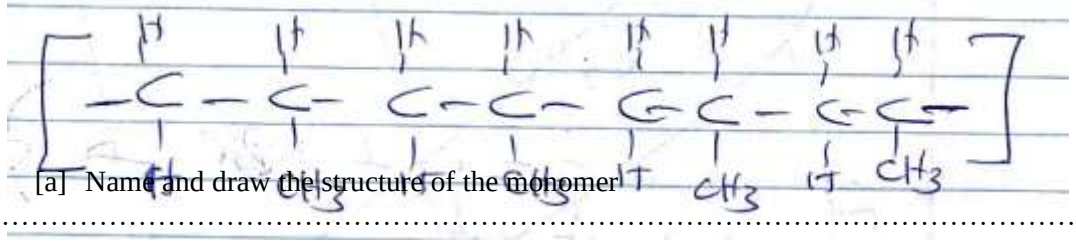
6. Explain why molten sodium chloride conducts electricity, but solid sodium chloride does not [2mks]

……

……

……

7. A polymer can be represented as



[a] Name and draw the structure of the monomer [2mks]

……

……
……
……
……

[b] What type of polymerization occurs in the above case? [1mk]

……
……

[c] Given that the molecular mass of the polymer is 25620, how many units of the monomer make the polymer [2mks]

……
……
……
……

8. A reaction can be represented as;

$C_2H_{4[g]} + HBr_{[g]} \longrightarrow C_2H_5Br_{[g]}$

Given the bond energies of C-H, C=C, C-C, C-Br, and H –Br as 20kJ/mol, 580Kj/mole, 446Kj/mole, 438KJ/mole and 396kJ/mole respectively. Determine the heat of formation of C_2H_5Br [3mks]

……
……
……
……
……

9 [a] Define the term, dynamic equilibrium [1mks]

……
……

[b] A reaction at equilibrium can be represented as

$2CrO^{2-}_{4[aq]} + 2H^{+}[aq] \rightleftharpoons Cr_2O7\ ^{2-}_{[aq]} + H_2O_{\{l\}}$

Yellow orange

State and explain the observation made when;

[i] NaOH is added to the equilibrium mixture [2mks]

……
……
……

[ii] HCl is added to the equilibrium mixture [2mks]

……
……
……

10. During the electrolysis of dilute copper {II} chloride using carbon electrodes, a current of 1.5A was passed through the solution for 2 hours and 30 minutes

[a] Write the ionic equation of the reaction that occurred at the cathode [1mk]

……
……
……

[b] Given R.A.M of copper = 64 and 1F = 96500C, calculate the change in mass of the cathode [3mks]

……
……

11. [a] Define the term half-life [1mk]

……
……

[b] Name two particles likely to be emitted when a radioactive nuclide undergoes radioactivity [2mks]

……

……

[c] The half-life of a radioactive nuclide is 3 hours. Given that its initial mass is 288g, determine the remaining mass after 12 hours. [2mks]

……

……

……

……

12. The reduction potentials of elements M and N are;

$M^{2+}_{[aq]} + 2e^- \rightleftharpoons M_{[s]}, E^{\theta} = +0.44V$

$N^{+}_{[aq]}\ e^- \rightleftharpoons N_{[s]},\ E^{\theta} = -1.64V$

Using the above reduction potentials, predict whether a reaction would occur between $N^{+}_{[aq]}$ and $M_{[[s]}$ [3mks]

……

……

……

13. An hydrocarbon can be represented as: $C_2\ H_2$

[a] Name the hydrocarbon [1mk]

……

……

[b] State two reagents that can be reacted together to generate the hydrocarbon [2mks]

……

……

[c] Identify the group of hydrocarbons into which C_2H_2 belongs to [1mk]

……

……

14. [a] Name two allotropes of sulphur [2mks]

[b] In an experiment to investigate a certain property of sulphur, Maina added few drops of conc HNO_3 to sulphur in a test tube and warmed the mixture

[i]State one observation made [1mk]

……

……

[ii]Write a chemical equation of the reaction that occurred [1mk]

……

……

15. Chlorine is commonly used in the manufacture of $Ca(OCl)_2$

[i] State one use of the above compound of chlorine [1mk]

……

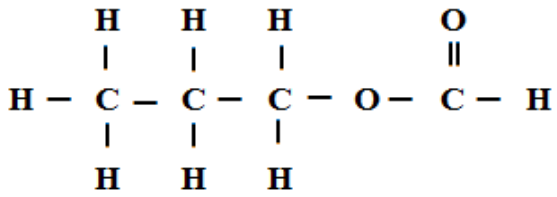
……

[ii] Write a chemical equation leading to the production of $Ca(OCl)_2$ [1mk]

……

……

16. A compound can be represented as



[a] What name is given to the above class of compounds [1mk]

……

……

[b] Name two reagents that can be reacted together to generate the above compound [2mks]

……

……

……

[c] State two conditions necessary for the reaction leading to formation of the above compound to occur [2mks]

……

……

……

17. Using dots and crosses, show bonding in carbon{II} oxide [2mks]

18. When 20g of a compound containing carbon, hydrogen and oxygen was burnt in the air, 29.3g of carbon{IV} oxide and 11.7g of water were produced. Determine its empirical formulae. {C=12, H=1 , O=16} [3mks]

……

……

……

19. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

{a} State one observation made [1mk]

……

……

{b} Write an ionic equation of the reaction that occurred in the test tube [1mk]

……

……

20. In the industrial manufacture of Ammonia one of the raw materials is nitrogen gas

{a} Name one other raw material [1mk]

……

……

{b} Name two possible sources of the raw material you have named in {a} above [2mks]

……

{c} Name two substances that can be used as catalyst in this process [2mks]

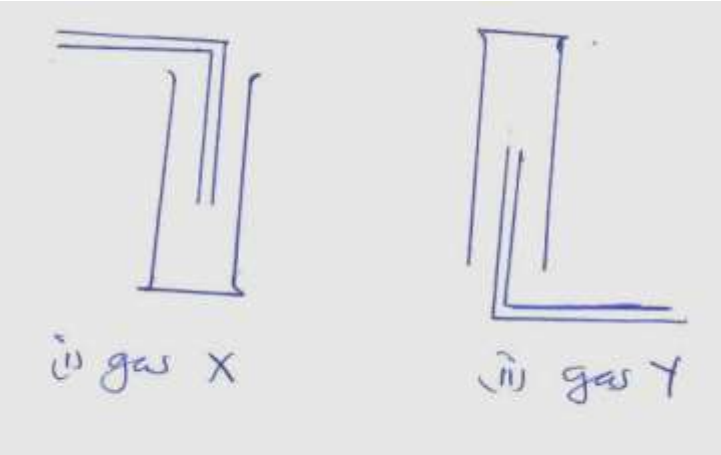
……

{d} State one use of ammonia [1mk]

……

……

21. Gas X and Y can be collected as shown below



[a] Name the method used to collect gas Y [1mk]

……

……

[b] How do densities of gas X and gas Y compare? [1mk]

……

……

[a] Give an example of a gas that can be collected using the same method as gas Y [1mk]

……

22. Element W has two isotopes W – 36 and W-40 which occur in the ratio x:4. Given that R.A.M of W is 37.25, find the value of x [2mks]

……

……

……

……

23. Describe an experiment that can be used to determine whether a given sample of a liquid is pure [2mks]

24. A given mass of gas T diffuses through a porous plug in 48 seconds while a similar mass of gas R diffuse in 70 seconds. Given that the density of gas T is 0.6g/cm3, find the density of gas R [2mks]

……

……

……

25. The electron configuration of elements A, B, C, D and E are as given below

Element	Electron configuration
A	2, 8, 1
B	2, 8
C	2, 7
D	2, 8, 6
E	2, 8, 3

{a} Which element has the highest electrical conductivity [1mk]

……

{b} Which letter represents the most reactive metal [1mk]

……

{c} Which letter represents the most reactive non-metal [1mk]

……

PAPER 2

1. The grid below shows a section of the periodic table, the letters are not the actual chemical symbol.

K	L				M		N	P	
	Q		R	S		T	V		
W									

a) Name the family into which element P belongs to (1mk)

……
……

b) Which two elements forms the most soluble carbonates (2mks)

……
……

c) With a reason, identify elements in period 3 with the largest atomic radius (2mks)

……
……

d) Write the formula of the compound formed between Q and M (1mk)

……
……

e) State two uses of element R and for each use , state property of element R that makes lts possible for the use

(i) Use (1mk)

……
……

Property (1mk)

……
……

(ii) Use (1mk)

……
……

Property (1mk)

……
……

f) Using dots and cross ,show bonding in the compound formed between R and oxygen (2mks)

g) In terms of structure and bonding explain why the oxides of element Thas relatively low boiling points (2mks)

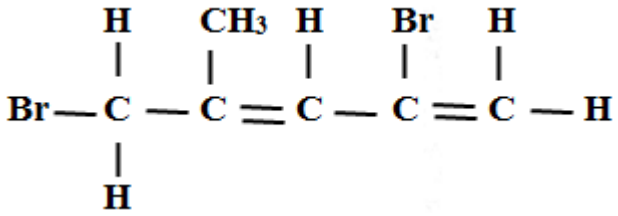
……
……
……
……

2. (a) name the following compounds (3mks)

(i) **$CH_3CH_2CH_2COOH$**

……

(ii)



……

(iii)**$CH_3CH_2OOCCH_2CH_3$**

……

b) Two types of detergents P and Q can be represented as

P: R −COONa

Q : R —  — OSO_3Na

(i) Identify each type of the detergent (2mks)

……

……

(ii) Which of the two detergents is the best to use with hard water? Give a reason (2mks)

……

……

(iii) State one advantage of detergent P (1mk)

……

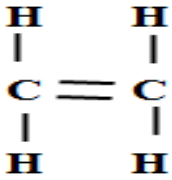
……

(iv) State one disadvantage of detergent Q (1mk)

……

……

(c) An hydrocarbon can be represented as follows



(i) Identify the hydrocarbon (1mk)

……

……

(ii) Name two reagents that can reacted together to generate the hydrocarbon (2mks)

……

……

3. (a) Name two apparatuses that can be used for determining mass in a laboratory (2mks)

……

……

……

(b) One of the flames produced by Bunsen burner is the luminous flame

i) Explain why this flame is very bright (1mk)

……

……

ii) State two disadvantages of the luminous flame (2mks)

……

……

(c) Air is usually one of the substances that is considered as a mixture

(i) Identify the two most abundant component of air (2mks)

……

……

(ii) Give two reasons why the air is considered as a mixture (2mks)

……

……

(iii) One of the components of air is carbon (iv) oxide. Describe an experiment that can be used to prove the presence of carbon (iv) oxide in the air (2mks)

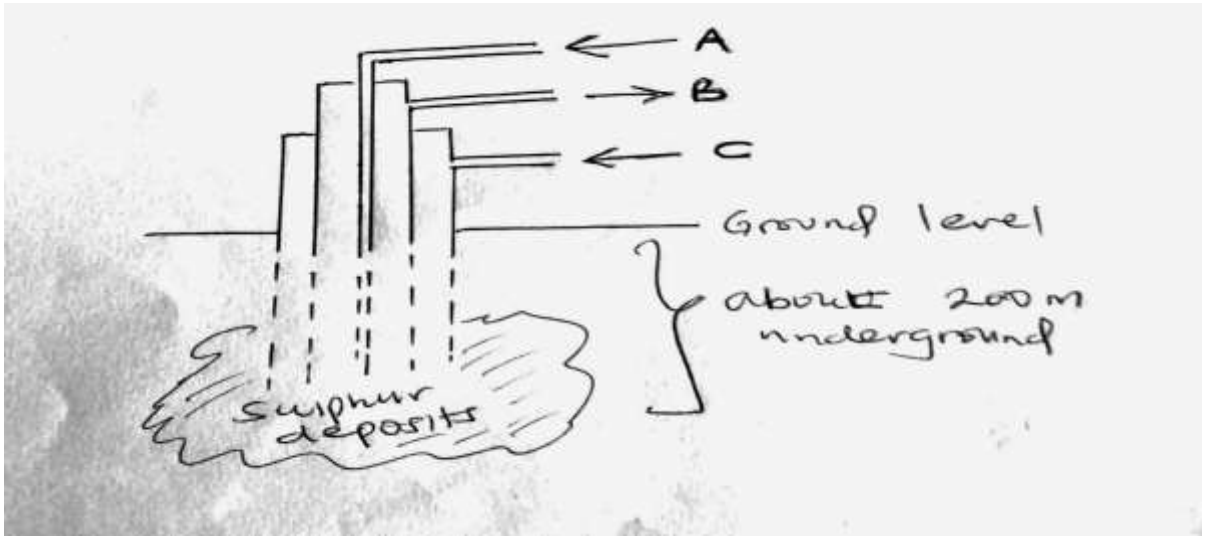
……

……

……

……
……

4. (a) The diagram below shows the process used to obtain Sulphur from underground deposits



i) Name the above process used to obtain sulphur from the underground deposits (1mk)

……
……

ii) Name the substance passed through pipe

A (1mk)

……

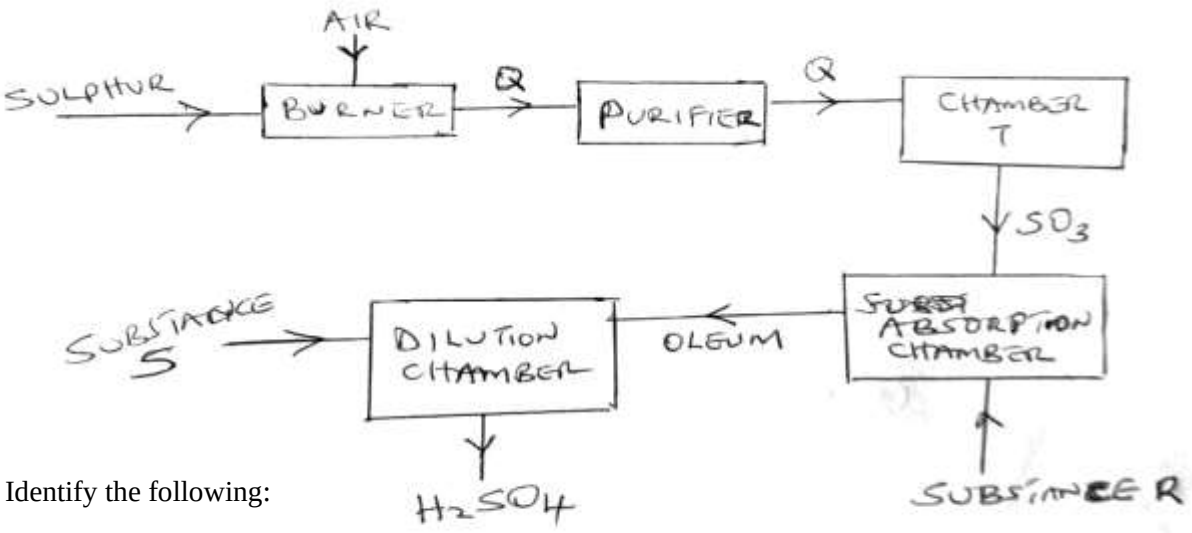
B (1mk)

……

iii) State two properties of Sulphur that makes it possible to extract using the above process (2mks)

……
……
……

b) The diagram below shows the contact process used in the manufacture of concentrated sulphuric(vi) acid



i) Identify the following:

a) Substance Q formed in the burner (1mk)

……

b) Chamber T (1mk)

……

c) Substance R (1mk)

……

d) Substance S (1mk)

……

ii) Write the chemical equation occurring in the dilution chamber (1mk)

……

……

iii) Why is it necessary to pass substance Q though a purifier (1mk)

……

……

iv) State one use of sulphuric (VI) acid (1mk)

……

5. (a) Calamine is one of the ores from which zinc can be extracted from

(i) Name any other ore from which zinc can be extracted from (1mk)

……

……

(ii) The calamine is usually decomposed by heating to obtain substance M as shown below

$ZnCO_3 \longrightarrow M + CO_2$

Identify substance M (1mk)

……

……

(iii) Identify two methods that can be used to obtain zinc from substance M (2mks)

……

……

……

(b) During the extraction of zinc, name two gases likely to emitted into the air and that are likely to cause pollution (2mk)

……

……

……

(c) State one likely pollution effects of each of the gases you have mentioned in (a) above (2mks)

……

……

(d) State one possible use of zinc metal (1mk)

……

……

6. (a) define the term electrolysis (1mk)

……

……

(b) State two functions of a salt bridge during electrolysis (2mks)

……

……

……

(c) The reduction potential of elements K, L, M, and P are as given below.

$K^+_{(aq)} + e^- \rightleftharpoons K_{(S)}$, E = -1.46v

$L^{2+} + 2e^- \rightleftharpoons L_{(S)}$, E = +0.49V

$M^{2+} \rightleftharpoons M_{(S)}$, E = -2.69V

$N^{+}_{(aq)} + e^- \rightleftharpoons N_{(s)}$, E = +0.52 V

$P^{+}_{(aq)} \rightleftharpoons P_{(s)}$, E= - 0.86V

(i) Which letter represents the, strongest reducing agent? give a reason (2mks)

……

……

(ii) Which two letters represent elements whose half cells would form an electrochemical cell with the largest e.m.f? (1mk)

……

……

(iii) Calculate the e.m.f of the cell formed in (ii) above (2mks)

……

……

……

……

(d) During the electrolysis of a molten chloride of metal Q, a current of 0.25A was passed though the molten chloride for 2 hours and 10minutes. Given that 0.9grams of metal Q were deposited at the cathode.

(i) Calculate the quantity of electricity passed (1mk)

……

……

……

(ii) Charge carried by the ions of metal Q given that R.A.M of metal Q is 84 (3mks)

……

……

……

……

……

……

7 (a) starting with magnesium oxide, describe how you can obtain a dry sample of magnesium Carbonate (3mks)

……

……

……

……

(b) (i) Give one example of an acid salt (1mk)

……

……

(ii) When sodium nitrate was heated a solid A and gas B were produced identify solid A and gas B (2mks)

……

……

……

(iii) State two uses of gas B produced in (ii) above (2mks)

……

……

……

(c) State two factors that should be considered when choosing a fuel (2mks)

PAPER 3

QUESTION 1

- You are provided with solution **K** and **L**
- **S**olution **K** is 1M H_2SO_4
- Solution **L** contains 8.7g of the hydroxide of metal **M** {with formulae MOH] in 600cm^3 of the solution
- You are required to carry out the experiment to determine;
  - i. Concentration of solution L
  - ii. R.A.M of metal **M**

Procedure

1. Measure 75cm3 of solution K and put into a clean 250cm3 volumetric flask and add distilled water up to the mark -label this solution **W**
2. Fill a clean burette with solution W
3. Pipette 25cm3 of solution L into a clean conical flask and add 2 drops of phenolphthalein indicator
4. Titrate the solution **W** in the burette against solution **L** in the conical flask and record the results in the table below
5. Repeat {3} and {4} above as you fill the table below.

TABLE 1

	I	II	III
Final burette reading {cm^3}			
Initial burette reading {cm^3}			
Volume of solution W used {cm^3}			

[4mks]

{a} Calculate the;

{i} Average volume of solution W used [1mk]

……

……

……

{ii} Concentration of solution W [1mk]

……

……

……

……

{iii} Number of moles of solution W that reacted with each 25cm3 portion of solution L {2mks]

……

……

……

{b} Calculate the;

{i} Number of moles of the metal hydroxide {MOH} in solution L that reacted with each portion of solution W [2mks]

{ii} Concentration of solution L [1mk]

{iii} Number of moles of the metal hydroxide [MOH]in 600cm3 of solution L [2mks]

{iv} R.A.M of metal M [2mks]
[0=16, H=1]

QUESTION 2

You are provided with solution N and P

- Solution N is 2M HCl
- Solution P is 0.16M sodium thiosulphate
- You are required to carry out the experiment below to determine how concentration affects the rate of reaction between HCl and sodium thiosulphate solutions

PROCEDURE

1. Fill a clean burette with solution P.
   Measure 25cm^3 of the solution P from the burette into a clean 100cm^3 glass beaker and place on a white piece of paper with a cross[x] marked on it
2. Add 10cm^3 of solution N into it and immediately start a stop watch and note the time taken for the cross beneath the mixture to become invisible
3. Clean the 100cm^3 beaker and measure into it 20cm^3 of solution P form the burette, and add 5cm^3 of distilled water into the solution solution
4. Repeat step [2] above and note the time taken for the cross to become invisible
5. Repeat the experiment using volumes indicated on the table below and as you record the results

TABLE 2

Expt	1	2	3	4	5
Volume of solution p(cm^3)	25	20	15	10	5
Volume of water added to solution p{cm3}	0	5	10	15	20
Volume of solution N	10	10	10	10	10
Time taken for the cross to become invisible [in seconds]					
$\frac{1}{t}$ S^{-1}					

(4mks**)**

[a] plot a graph of $\frac{1}{t}$ against volume of solution P on the grid provided [3mk]

{b} From the graph

{i} Determine the time taken for the cross to become invisible when 12.5cm^3 of solution P is used [2mks]

{ii} Explain the effect of concentration on the rate of reaction between HCl and sodium thiosulphate solution [2mks]

QUESTION 3

- You are provided with solids Q and R
- You are required to carry out the tests below as you record your observations and inferences

(i) SOLID Q

-Add about 5cm^3 of distilled water to solid Q, shake the mixture thoroughly for a while and then filter it
NOTE: Retain both the filtrate and the residue for the tests below

	TEST	**OBSERVATIONS**	**INFERENCES**

(a){i}	Divide the filtrate into 4 portion -To the first portion, add 4 drops of NaOH	$\left(\frac{1}{2}mark\right)$	$(1mark)$
{ii}	Scoop the 2nd portion on a metallic spatula and ignite on a non-luminous flame	$\left(\frac{1}{2}mark\right)$	$\left(\frac{1}{2}mark\right)$
{iii}	To the 3rd portion, add 2 drops of $Pb\{NO_3\}_{[aq]}$	$\left(\frac{1}{2}mark\right)$	$(1mark)$
{iv}	To the 4th portion ,add acidified $KmnO_4$	$\left(\frac{1}{2}mark\right)$	$\left(\frac{1}{2}mark\right)$
b{i}	Put the residue in a test tube and add about $2cm^3$ of HNO_3	$\left(\frac{1}{2}mark\right)$	$(1mark)$
{ii}	To the mixture in b{i} above, add 2 drops of KI solution	$\left(\frac{1}{2}mark\right)$	$\left(\frac{1}{2}mark\right)$

{**ii}SOLID R**

	TEST	**OBSERVATIONS**	**INFERENCES**

(a)	Scoop a portion of solid R on a Metallic spatula and burn on a Non-luminous flame	$(1mark)$	$(1mark)$
(b){i]	Put the remaining portion of solid R into a clean test tube and add about $3cm^3$of distilled water, shake and divide into 2 portions	$(1mark)$	$\left(\frac{1}{2}mark\right)$
{ii}	To the 1st portion, add 2 drops of acidified $KMnO_4$ and warm	$\left(\frac{1}{2}mark\right)$	$(1mark)$
{iii}	To the 2nd portion add $NaCO_3$	$\left(\frac{1}{2}mark\right)$	$(1mark)$

MARANDA SCHOOL

PAPER 1

1. a) A hydrocarbon consists of 92.3% carbon. Its molecular mass is 26. Calculate it's Molecular formula. (2 marks)

……

……

……..

b) Draw the structure of the hydrocarbon. (1 mark)

2. a) Explain why melting point of chlorine gas is greater than that of Argon. (l mark)

……

……

……..

b) Using dot(•) and cross (×) to represent electrons draw a diagram to show bonding in carbon (iv) oxide. (l mark)

c) In terms of structure and bonding. Explain why Graphite is used as a lubricant. (1 mark)

3. a) What is observed when a few drops of phenolphthalein indicator is added to a solution whose pH value is 3.0? (l mark)

……..

b) Write an equation for the reaction between Lead (ii) oxide and dilute Nitric acid. (l mark)

……

4. State and explain the observation that would be made when zinc powder is heated with copper (II) oxide. (2 marks)

……

……

……

5. Why is it dangerous to run a motor car engine in a closed garage? (2 marks)

6. 2 grams of sodium hydroxide is added to 30 cm3 of IM sulphuric (VI) acid. What volume of 0. 1M potassium hydroxide solution will be needed to neutralize the excess acid.

(Na23,016,H1) (3 marks)

7. An aqueous solution of hydrogen chloride gas reacts with manganese (IV) oxide to form chlorine gas while a solution of hydrogen chloride gas in methylbenzene does not react with manganese (iv) oxide. Explain (2 marks)

……
……
……..

8. A small piece of potassium Manganate (VII) was placed in a glass of water and was left standing for 6 hrs without shaking. State and explain the observations made. (2 marks)

……..……
……..

9. Magnessium reacts with both dilute and concentrated sulphuric (VI) acid. Write a balanced equation for the two reactions. (2 marks)

…….

10. 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

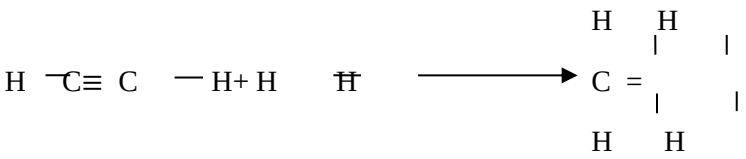
a) Name the type of bonding that exists in the compound formed when **X** and **Z** reacts.

(1 mark)

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

……

11. Ethyne reacts with hydrogen as shown below



Use the bond energies below to calculate the enthalpy changes for the above reaction.

(3 marks)

BOND	ENERGY
H-H	435
C-H	413
C ≡ C	835
C=C	611

……
……
……
……
……

12. a) Explain the role of common salt in defrosting ice on roads in ice cold countries.

(1 mark)

……
……
……

b) Explain why the long term effects of use of common salt is costly to motorists.
(1 mark)

13. Given the equation below

$NH_{3(aq)} + H_2O_{(l)} \longrightarrow NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$

Identify the species that acts as;

i) A base. Explain (1 mark)

……
……
…….

ii) An acid. (½ mark)

……
……...……
……..

14. a) State Grahams law of diffusion. (1mark)

……
……
……..

b) The rate of diffusion of sulphur(IV)oxide gas through a porous material is 40cm3s $^{-1}$.

Calculate the rate of diffusion of carbon(IV)oxide gas through the same porous material *(S=32,O=16,C=12)* (2 marks)

……
……
……
……
……

15. Describe how a solid sample of lead(II) chloride can be prepared using the following

reagents : dilute nitric acid, dilute hydrochloric acid and lead carbonate (3 marks)

……..
……..

……..
……..

16. The production of ammonia is given by the equation

$$3H2\,(g) + N_2(g) \rightleftharpoons 2NH_3\,(g);\ \Delta H\text{=-ve}$$

(i) State and explain the effect of addition of dilute hydrochloride acid on equilibrium.

(2 marks)

……
……

……...

(ii) Explain the effect of increase in temperature on the yield of ammonia. (2 marks)

……..
……..

……..
……..

17. $Cr_2O_7^{2-} + 14\ H^+\,(aq) + 6Fe^{2+} \longrightarrow Cr_2^{3+} + 7H_2O(l) + 6Fe^{3+}$.

The above equation show a redox reaction

(a) Calculate the oxidation state of chromium in $Cr_2O_7^{2-}$ (2 marks)

……
……

……
……

(b) What is the role of H^+ in the above reaction. (1 mark)

……
……

18. a) Define the standard heat of formation. (1 mark)

……
……

b) Draw energy cycle diagram to show how the standard heat of formation of ethanol

(C_2H_5OH) can be determined from standard heats of combustion of its elements. (2 marks)

c) Given that $\Delta H_C(C) = -393 kJmole^{-1}$, $\Delta H_C(H_2) = -286 kJmole^{-1}$ and $\Delta H_C(C_2H_5OH) = -1368 kJmole^{-1}$. Calculate the enthalpy of formation of C_2H_5OH. (2 marks)

……
……
……
……
……

19. 3.78g of a hydrated salt of iron (II) sulphate, $FeSO_4$, in H_2O were heated until all the water of crystallization was driven off. The anhydrous salt left had a mass of 1.52g. Determine the formula of the hydrated salt. (Fe = 56, S = 32, H = 1, O = 16) (3 marks)

.....
.....

20. A steady current of 0.2 Amperes was passed through molten silver bromide for 80 minutes.

a) Calculate the quantity of electricity that passed through the set up. (1 mark)

.....
.....
.....

b) Calculate the mass of product deposited at the cathode. (1F = 96500C; Ag = 108,

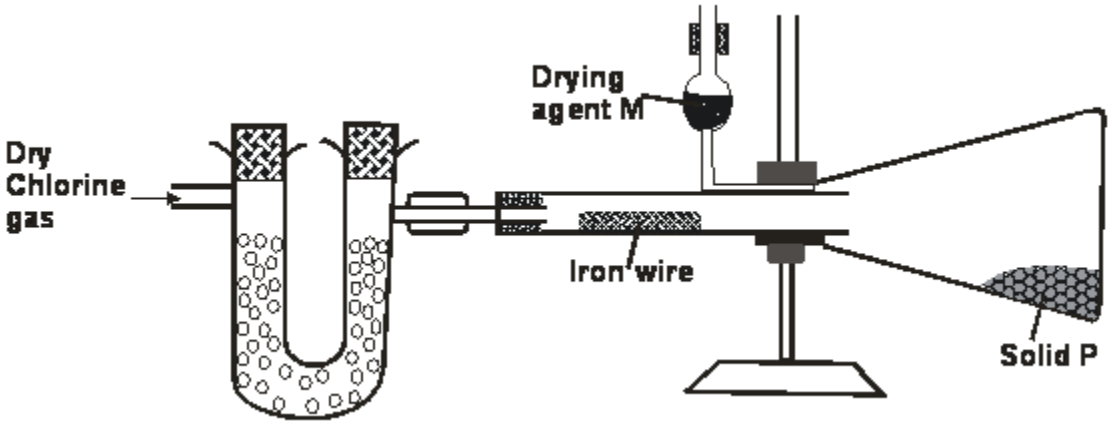
Br = 80) (2 marks)

……
……
……
……

c) If a sample of cobalt has an activity of 1000 counts per minute, determine the time it would take for its activity to decrease to 62.50 if the half-life of the element is 30 minutes. (2 marks)

……
……
……
……
…….

21. The apparatus set up below was used to prepare an anhydrous solid P



a) Write an equation for formation of solid P (1 mark)

.....

.....

.....

b) Suppose the gas used in the set up was dry hydrogen chloride gas; what would be the product obtained after the reaction? Give a reason for your answer. (1 mark)

……

……

…….

22. 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.

a) Give the common name of the ore from where aluminium is extracted from. (½ mark)

……

……

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

……

……

……

c) The refined ore has to be dissolved in cryolite first before electrolysis. Why is this necessary? (1 mark)

……

……

……

d) Why are the carbon anodes replaced every now and then in the cell for electrolysing aluminium oxide? (1 mark)

……
……
……

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

$V(s) / V^{3+}(aq) // Fe^{2+}(aq) / Fe(s)$

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

……
……

ii. If the E.M.F of the cell is 0.30 volts and the E^{θ} value for $V^{3+}aq / V(s)$ is -0.74V, calculate

the E^{θ} of $Fe^{2+}(aq) / Fe(s)$ (2 marks)

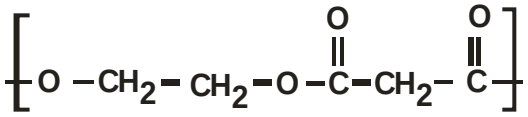
24. When $50cm^3$ 1M potassium hydroxide was reacted with $50cm^3$ of 1M hydrochloric acid, the temperature rose by 8^0C. When the same volume of Potassium hydroxide was reacted with $50cm^3$ of 1M Pentanoic acid, the temperature rose by 3^0C.

i) Give reasons for the above difference in temperature. (2 marks)

……
……

Write an equation to show dissociation of pentanoic acid? (1 mark)

25. The following is structural formula of polyester.



a) Draw the structural formula and name the alkanoic acid and alkanol that react to form the polymer. (2 marks)

b) Give **one** use of polyester. (1 mark)

26. A heavy metal P was dissolved in dilute nitric acid to form a solution of compound $P(NO_3)_2$. Portions of the resulting solution were treated as follows:

a) To the first portion a solution of dilute hydrochloric acid is added, where a white precipitate (S) is formed, which dissolves on warming.

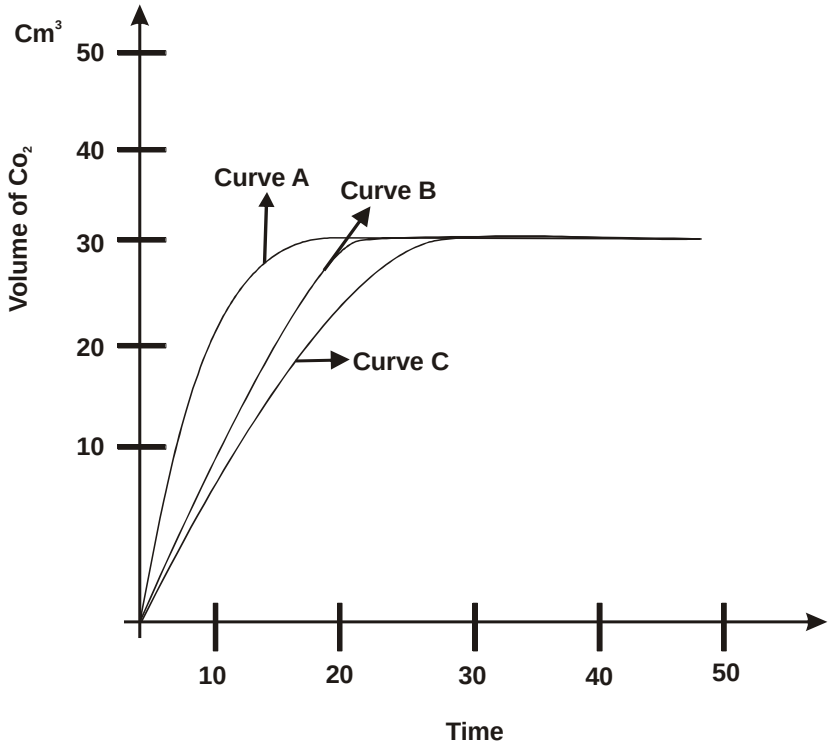
b) The second portion is treated with two drops of 2M Sodium hydroxide solution where a white precipitate T is formed. The white precipitate dissolved in excess sodium hydroxide to form a colourless solution.

c) A solution of potassium iodide is added to the third portion where a yellow precipitate (U) is formed.

d) When the resulting solution is evaporated to dryness and heated strongly a yellow solid (V) is formed and a brown gas (W) and a colourless gas (X) are formed.

i. Identify the substances P, S, T, U, V, W. (3 marks)

27. The graphs below were drawn when 15g of marble chips in different physical states were reacted with $50cm^3$ of 2M Hydrochloric acid. They are drawn by measuring the volume of carbon (iv) oxide produced with time.



a) Which curves corresponds to the reactions involving powdered calcium carbonate and large sized marble chips with the dilute acid?

(i) Powdered calcium carbonate (½ mark)

…….

(ii) Large sized calcium carbonate (½ mark)

.....

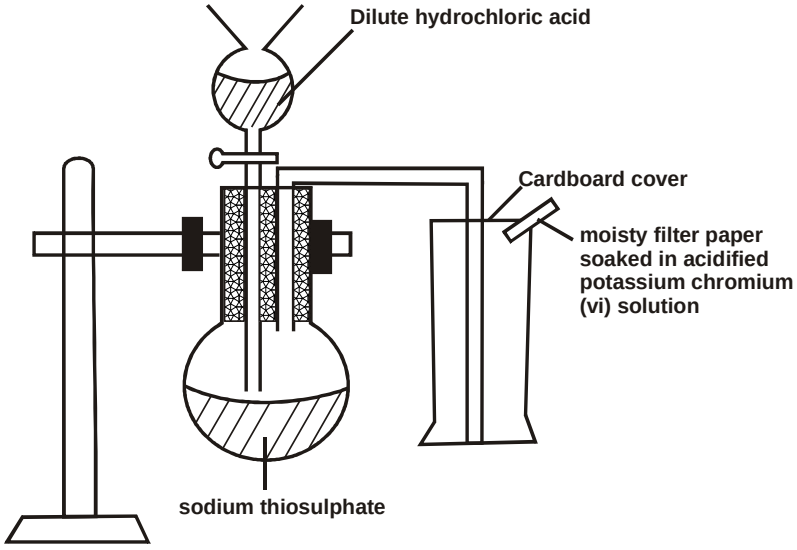
b) All the graphs eventually flatten out at the same level but at different time. Why do the graphs flatten out at the same level? (1 mark)

……
……
……..

c) Why is curve A very steep at any given point compared to the other curves. (1 mark)

……
……
……

28. Sodium thiosulphate was reacted with dilute hydrochloric acid in a round bottomed flask as shown below. The gas evolved was collected by downward delivery in a gas jar.



a) Write an equation to show the reaction going on in the reaction in vessel. (1 mark)

b) State the observation noted on the filter paper. Give a reason for your answer.

(1 mark)

c) Give a reason why the filter paper soaked in the acidified potassium chromium (VI) is used at the top of the flask (1 mark)

PAPER 2

1. The grid given below represents part of the periodic table. Study it and answer the questions that follow. The le are not the actual symbols of the elements.

								A
B				G		H	E	
	J		I	L				C
D							M	
Y								

(i) What name is given to the family of elements to which A and C belong? (1 mark)

(ii) Write the chemical formula of the sulphate of element D. (1 mark)

(iii) Which letter represents the most reactive (2 marks)

(a) Metal

(b) Non-metal

(iv) Name the bond formed when B and H react. Explain your answer. (2 marks)

(v) Select one element that belong to period 4. (1 mark)

(vi) Ionic radius of element E is bigger than the atomic radius. Explain.

(2 marks)

(vii) The electron configuration of a divalent anion of element N is 2.8.8. Induce the Position of element N on the periodic table drawn above. (1 mark)

(viii) The oxide of G has a lower melting point than the oxide of L. Explain.
(1 mark)

(ix) How do the atomic radii of I and C compare. Explain. (2 marks)

(x)Explain the trend in the 1st ionization energies of the elements J, I and L.(1mark)

2 a) define the following terms

i) Saturated solution(1mk)

ii) Fractional crystallization(1mk)

b) Solubility of salt X and Y were determined at different temperatures as shown in the following data.

Temperature (ºC)		0	20	40	60	80	100
Solubility of 100g of water	X	12	30	75	125	185	250
	Y	15	20	35	45	65	80

i. On the grid provided, plot a graph of solubility (vertical axis) against temperature.
(4mks)

ii. From the graph determine the solubility of each at 50ºC.

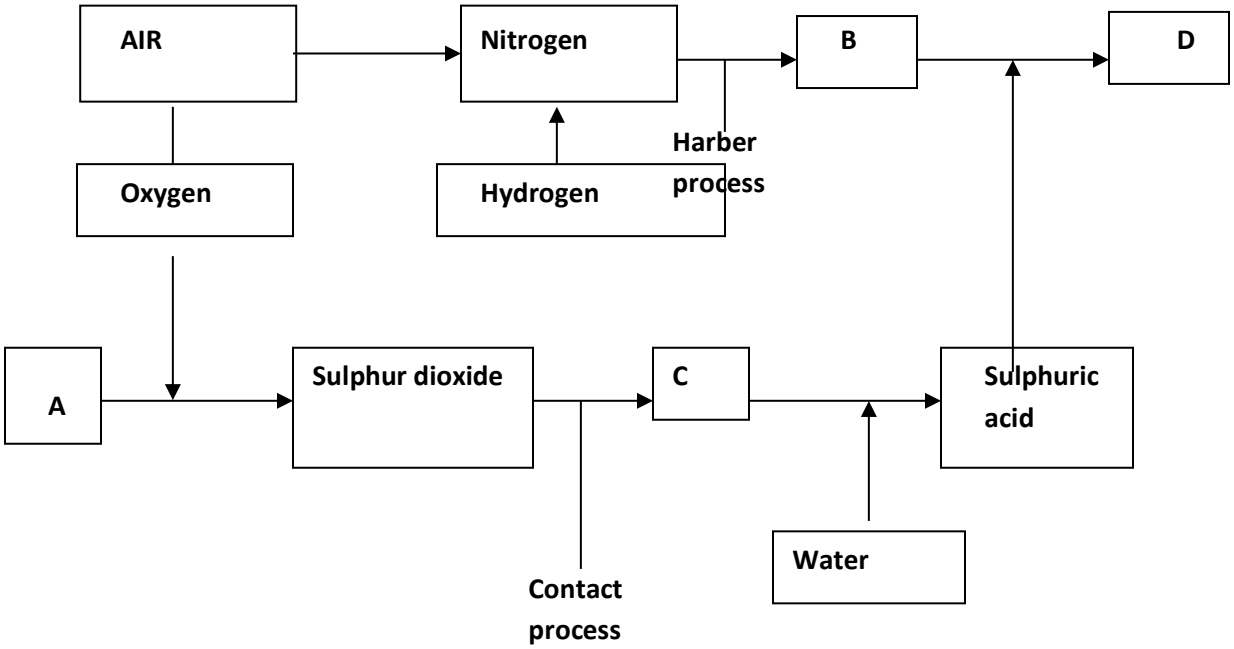
X …….. (1mk)

Y …… (1mk)

iii. At what temperature was the solubility of both salts equal. (1mk)

b)i. What is permanent hardness of water? (1mk)

3. The flow chart below illustrates two industrial processes. Haber and contact processes each with air as one of the starting materials and other chemical reactions.



a) (i) Give the name of the process by which air is separated into oxygen and nitrogen. (1 mk)

……

(ii) Apart from oxygen and nitrogen gas produced from process a(i) name any other gas produced in the process above. (1 mk)

……

b) Name the substances which are represented by the letter. (4 mks)

A……..

B……..

C …….

D……

c) Name the catalyst used in;

(i) The Haber process (1 mk)

……

(ii) The contact process (1 mk)

……

(iii) Explain the role of the catalyst in both the Haber and contact process. (2 mks)

……

d) (i) Write a balanced equation for formation of compound D. (1 mk)

……

(ii) Calculate the percentage by mass of nitrogen present in compound D

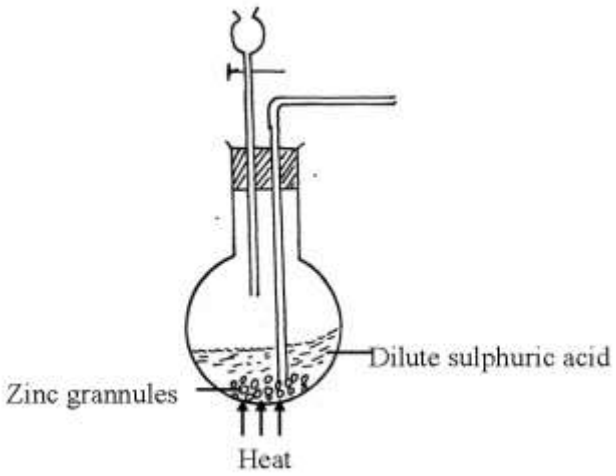
(N = 14.0, H = 1.0, S = 32.0, O = 16.0) (2 mks)

……

(iii) Give one use of compound D. (1 mk)

……

4. A student set-up the arrangement below to prepare and collect dry hydrogen gas



(a) Identify two errors from the section of the arrangement shown above (2mks)

I: ……

II:……

(b) Complete the diagram to show how dry hydrogen gas can be collected. (2mks)

(c) (i) Explain why hydrogen was collected by the method shown above (1mk)

……
……

(ii) Write a balanced chemical equation for the reaction that takes place when hydrogen gas is burnt in air. (1mk)

……
……

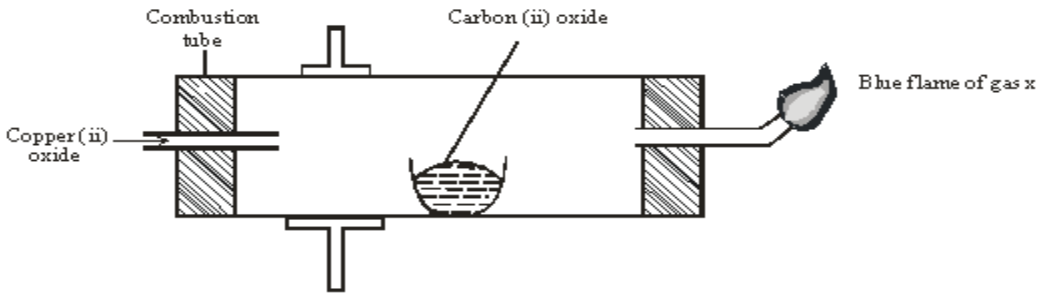
(e) Determine the relative atomic mass of zinc, given that when 6.54g of zinc was used, 2.4litres of hydrogen gas was produced. (Molar gas volume = 24 litres) (3mks)

……

……

(c) State any **two non**-industrial uses of hydrogen gas (2mks)

5. 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

……
……

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

……
……

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

……
……

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

……
……

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

……
……

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

(i) Reducing agent
……
(ii) Oxidising agent
……

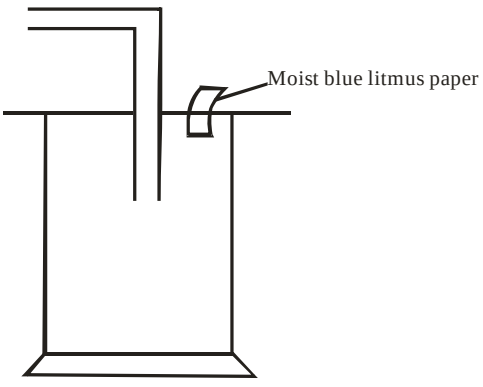
g) Identify any other substance that would have the same effect on copper (ii) oxide as carbon (ii) oxide.
1mark

……
……

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

……
……
……

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



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

……

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

……

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

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

……
……

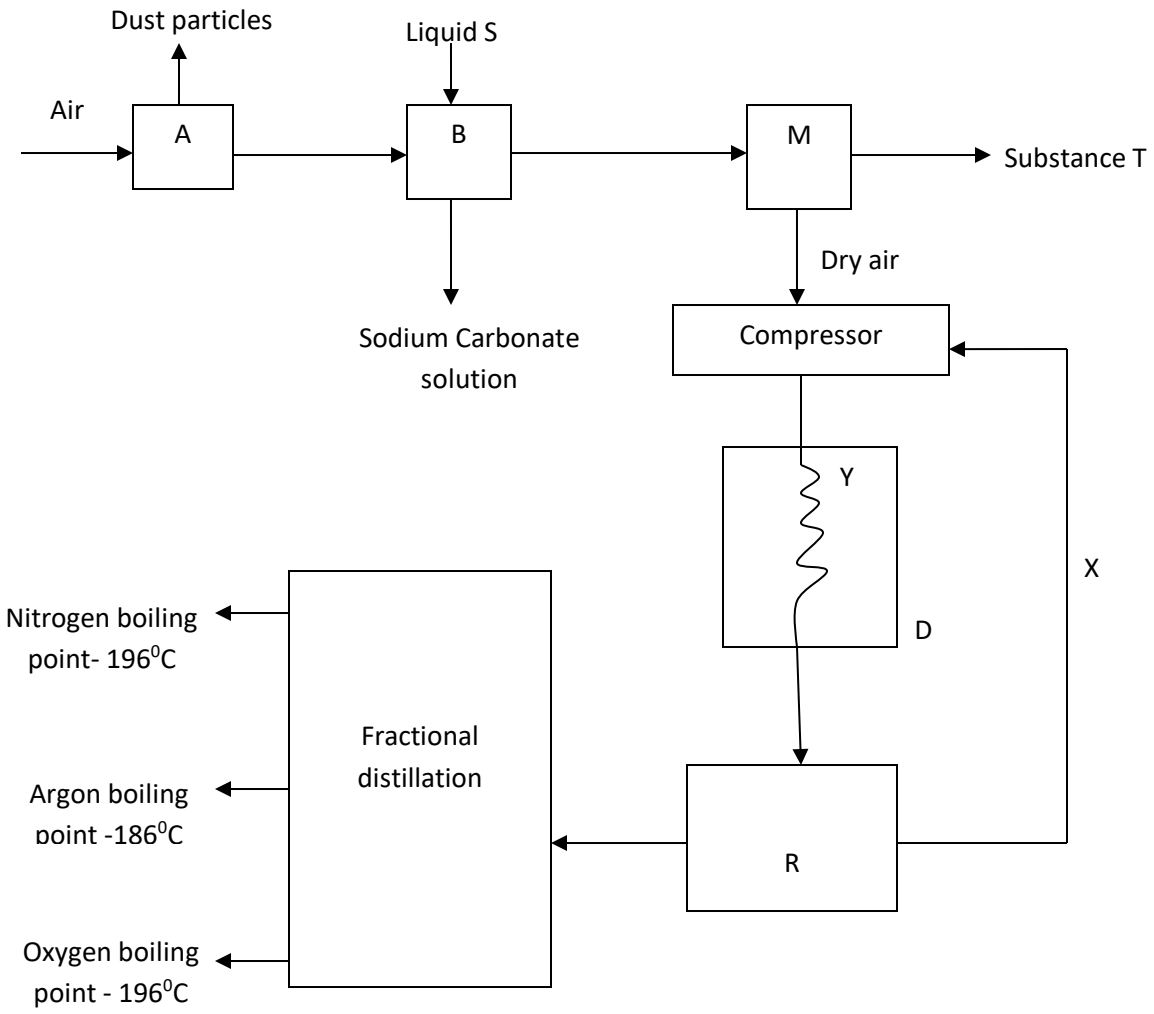
e) Write the formula of the compounds formed when chlorine gas reacts with warm dry phosphorous. (**2marks)**

……
……

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

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

7. 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**

b) Name;

(i) Liquid S(1mk)

……..……..…

(ii) Substance T(1mk)

……..……

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

……
……

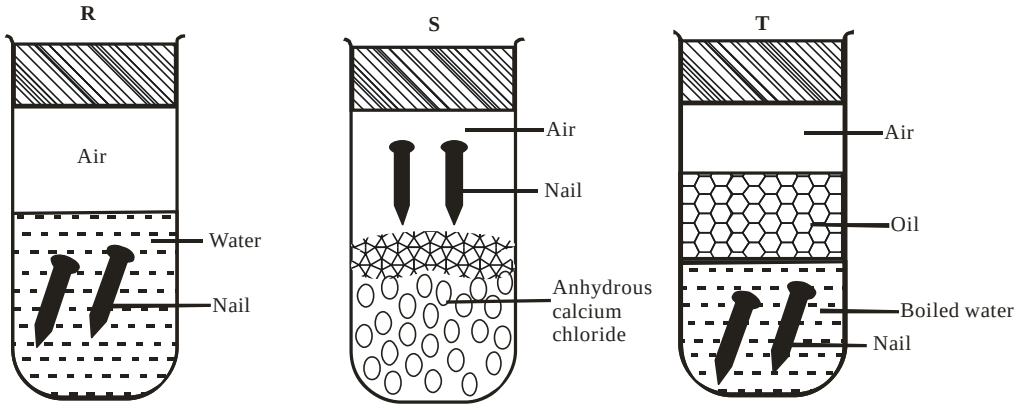
d) Give two industrial uses of oxygen gas? (**2marks)**

……
……

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**

……
……

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. **2marks**

……
……

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

……

PAPER 3

1. You are provided with
   - 4.5g of **Solid T** in a boiling tube
   - **Solution N**, 0.6M acidified potassium manganate (VII)

You are required to determine:

- Solubility of **Solid T** at different temperatures
- The rate of reaction of **Solution T** at different temperatures

PROCEDURE A

a) Using a burette, add 4cm^3 of distilled water to **Solid T** in the boiling tube. Heat the mixture while stirring with a thermometer to about 85^{o}C for the solid to dissolve; allow the solution to cool while stirring. Note the temperature at which crystals of **Solid T** first appear. Record the temperature in *Table 1*.
b) Using a burette, add 2cm^3 of distilled water to the content 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 T** first appears.
c) Repeat **step b)** two more times and record the temperature in *Table 1*. Retain the contents of the boiling tube for use in **Procedure B**.
d) Complete *Table 1* by calculating the solubility of **T** at different temperatures

Table 1

Total volume of water in the boiling tube (cm^3)	4	6	8	10
Temperature at which crystals of T appear (^{o}C)				
Solubility of Solid T (g/100g of water)				

(5 marks)

i) On the grid provided, draw a graph of Solubility T (*y-axis*) versus temperature in ^{o}C. (3 marks)

ii) Use your graph to find the temperature at which the first crystal will appear if 100g of **Solid T** is dissolved in 100cm^3 of distilled water at 85^{o}C then the solution is allowed to cool. (2 marks)

……..

PROCEDURE B

a) Transfer all the content of the boiling tube into a 100ml beaker. Accurately measure 10cm^3 of distilled water and add to **mixture T** in the beaker.
b) Accurately measure 4cm^3 of the mixture in the beaker and transfer into a clean boiling tube. Heat the mixture to 80^{o}C and add 4cm^3 of **Solution N** (acidified potassium manganate (VII)) and immediately start the stopwatch.
c) Note the time taken for the mixture to change to colourless. Discard the content of the boiling tube and accurately measure another 4cm^3 of the mixture in the beaker (**Solution T**) and transfer into the boiling tube.
d) Heat the mixture to 70^{o}C and add 4cm^3 of **Solution N** and immediately start the stopwatch. Note the time taken for the mixture to turn to pink.
e) Repeat the procedure two more times and complete *Table 2* using temperature in the table.

Table 2

Temperature (^oC)	80	70	60	50
Time, *t* (sec)				
$^1/_{time}$ (sec^{-1})				

(5 marks)

i) On the grid below, draw a graph of $^1/_{time}$ (sec^{-1}) (*y-axis*) versus temperature. (3 marks)

ii) State and explain the shape of your graph (2 marks)

……..

……..

iii) What does the reciprocal of time represent on your graph? (1 mark)

……..

iv) From your graph, determine the time the mixture will decolorize if the experiment is carried out at 65^oC (1 mark)

……..

……..

2. You are provided with **Solid D**. Carry out the tests below. Record your observation and inferences in the spaces provided.

a) Put a spatula end full of **Solid D** in a boiling tube. Add about $1.0cm^3$ of distilled water. Shake well.

Observation	**Inference**
(1 Mark)	(1 Mark)

b) Divide the above mixture into four portions each, of $2cm^3$.

Observation	**Inference**

(1 Mark)	(1 Mark)

c) To the 1st portion, add 2M NaOH solution dropwise until in excess.

Observation	Inference
(1 Mark)	(1 Mark)

d) To the 2nd portion, add 3 drops of barium chloride solution

Observation	Inference
(1 Mark)	(1 Mark)

e) To the 4th portion, add 3 drops of lead (II) nitrate solution

Observation	Inference
(1 Mark)	(1 Mark)

f) Dip a clean glass rod in the remaining solution and place on a non-luminous flame of a Bunsen burner

Observation	Inference
(1 Mark)	(1 Mark)

g) To the 3rd portion, add 2cm^3 of bromine water

Observation	Inference
(1 Mark)	(1 Mark)

ou are provided with **Solid J**. Carry out the tests below and record your observations and inferences in the spaces provided.

a) Burn half of **Solid J** on a non-luminous flame of a Bunsen burner.

Observation	Inference
(1 Mark)	(1 Mark)

b) Put the remaining amount of **Solid J** in a boiling tube. Add about 10cm^3 of distilled water and shake thoroughly. Divide the mixture into 2 portions. To the 1st portion, add 3 drops of $NaHCO_3$ solution.

Observation	Inference
(1 Mark)	(1 Mark)

c) To the 2nd portion, add 3 drops of acidified potassium manganate (VII) solution.

Observation	Inference
(1 Mark)	(1 Mark)

MANG'U SCHOOL

PAPER 1

Answer all the questions on spaces provided

1. (a) What name is given to a compound that contains Carbon and Hydrogen only (1mk)

   (b) Octane is a compound containing Carbon and Hydrogen

   (i) What method is used to obtained Octane from Crude Oil (1mk)

   (C) State one use of Butane (1mk)

2. Starting with Potassium Chloride, describe how a pure sample of Lead(II) Chloride can be prepared in the laboratory. (3mks)

3. When Magnesium burns in air, it forms a few solid and a grey-green solid. When a few drops of water are added to the mixture a gas that turns red litmus paper blue is evolved. Identify the:
   (i) White solid (1mk)

   (ii) Gas evolved and state its use

   Name of the gas ……. (1mk)

   Uses of the gas …… (1mk)

4. Iron is extracted from its ore by the blast furnace process.
   a. Name one ore from which iron is extracted. (1mk)

   b. One of the impurities in iron is removed in the form of calcium silicate. Write an equation the reaction in which calcium silicate is produced. (1mk)

   c. Give one use of iron (1mk)

5. During the electrolysis of Aqueous Lead (II) Chloride using Lead electrolysis, a current of 0.5 amperes was passed through the cell for 5 hours.
   (a) Write an ionic equation for the reaction that took place at the anode. (1mk)

   (b) Determine the change in mass of the anode which occurred as a result of the electrolysis process (Pb = 207, 1 Faraday = 96,500 Coulombs.) (2mk)

6. (a) Distinguish between nuclear fission and nuclear fussion. (2mk)

   (b) Radio-active emits three different particles. Give the symbol of the particle with the highest mass (1mk)

7. An element Q has two Isotopes Q – 36 and Q – 40 which occur in the ratio Y:4. Given that Relative Atomic Mass of Q is 37.25. Find the value of Y. (3mks)

8. The grid below represents part of the periodic table. Study the information and answer the questions that follow. The letters do not represent the actual symbol of the elements.

C								
H				**T**		**R**	**Y**	**F**
	E	**W**	**S**				**Z**	
M	**I**							

   (i) How does the atomic radius of T compare with that of Y. (1mk)

   (ii) Write an equation for the reaction that would occur between E and Z. (1mk)

   (iii) Which element would form a trivalent cation? (1mk)

9. (a) State Graham's law of diffusion (1mk)

(b) A volume of 120cm^3 of Nitrogen gas diffused through a Membrane in 40seconds, how long will 240cm^3 of Carbon (iv) Oxide diffuse through the same Membrane. (N = 14, C = 12, O = 16) (2mks)

10. Use the information below on solubility to answer questions that follow

Salt	Solubility in g/100g of H_2O	
	80ºC	20ºC
Na_2Co_3	80	31
$KClO_3$	55	12

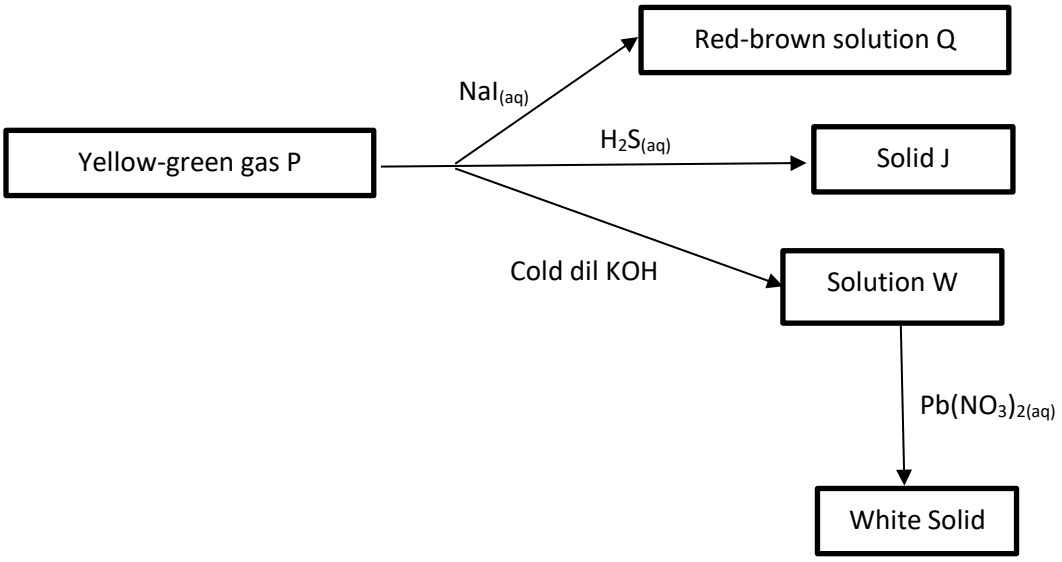
A mixture containing 30g of Potassium Chlorate and 30g of Sodium Carbonate in 100g of water at 80ºC was cooled to 20ºC. Some Crystals are formed.

(i) Which of the two salts crystallized out and by how much? (2mks)

(ii) Name the method used to obtain crystals in the above salts. (1mk)

(iii) Name the salt that will be unsaturated at 20ºC (1mk)

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



Identify

(i) Solid J (1mk)

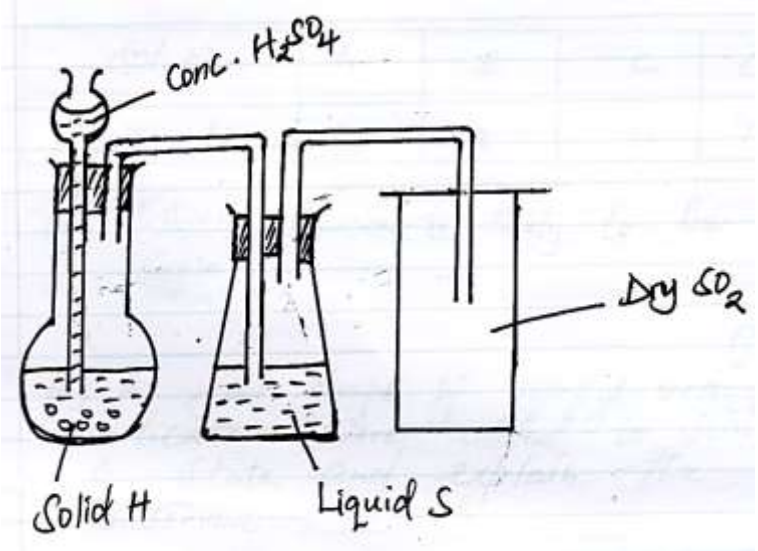
(ii) Solution Q (1mk)

12. (a) Half-life of a radio-active element is 30 days. Define the term half-life. (1mk)

(b) Calculate the time required for its mass to reduce to 37.5 %(2mks)

13. A compound was analysed and found to contain 24.27% Carbon, 4.08% Hydrogen and the rest is Oxygen. If the molar mass of the compound is 99. Determine the molecular formula of the compound. (C = 12, H = 1, O = 16) (3mks)

14. The diagram was used to prepare and collect Sulphur (iv) Oxide gas



(a) Identify Solid H (1mk)

(b) State two properties of SO_2 that makes possible to be collected in method shown. (1mk)

(c) What are the Optimum conditions of conversion of SO_2 to SO_3 (1mk)

15. The table below shows pH values of solutions A, B, C and D.

Solution	A	B	C	D
pH Value	14	2	11	7

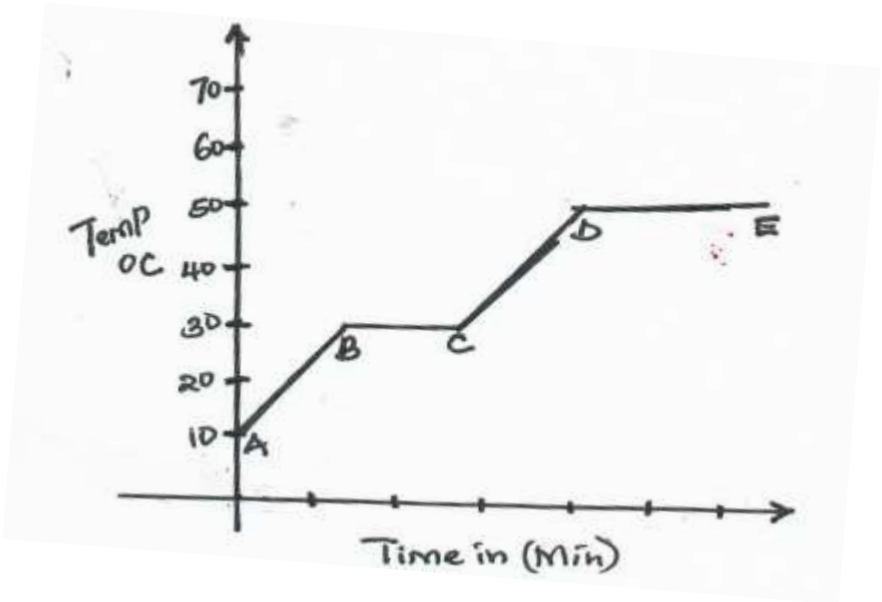
(a) Which solution is likely to be sugar solution (1mk)

(b) A few drops of Methyl-Orange indicator were added to solution A. State and explain the observations made. (2mks)

16. (a) Explain why the metals Magnesium and Aluminium are good conductors of electricity. (1mk)

(b) Other than cost, give two reasons why aluminium is used for making electric cables while Magnesium does not. (2mks)

17. The below graph shows a heating curve for substance W. Study and answer the questions that follow



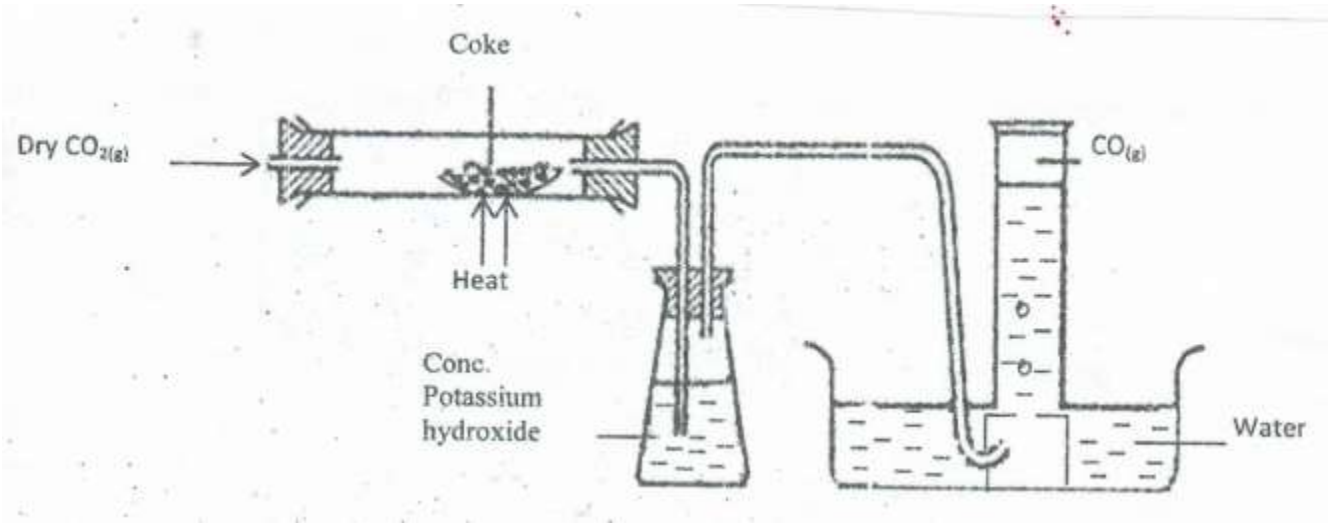
i) What is the melting point of substance W.? (1mk)

ii) In terms of kinetic theory of matter, explain what happened to the particles in region CD (2mks)

18. i) Name the catalyst used for the catalytic oxidation of ammonia during Ostwald process. (1mk)

iii) State and explain the observations made when aqueous ammonia is added to copper (ii) sulphate solution drop wise till in excess. Use equations if necessary. (2mks)

19) In an experiment, Carbon(iv) Oxide gas was passed over heated coke and the gas produced collected as shown in the diagram below;



i) Write an equation for the reaction that took place in the combustion tube. (2mk)

ii) Name another substance that can be used instead of potassium hydroxide. (1Mk)

20) Hydrogen can be prepared by reacting Zinc with dilute hydrochloric acid.

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

ii) Name an appropriate dry agent for hydrogen gas. (1mk)

iii) Explain why copper metal cannot be used to prepare hydrogen gas. (2mks)

21) 25.0 cm^3 of a solution of Potassium Carbonate neutralized 26.8cm^3 of 0.1M hydrochloric acid. Calculate the Molarity of the carbonate. (3mks)

22. At 20^0 C and 760mmHg pressure, NO_2 and N_2O exists in equilibrium as shown in the equation below.

$2NO_{2(g)} \rightleftharpoons N_20_4(g)$ ΔH= -Ve

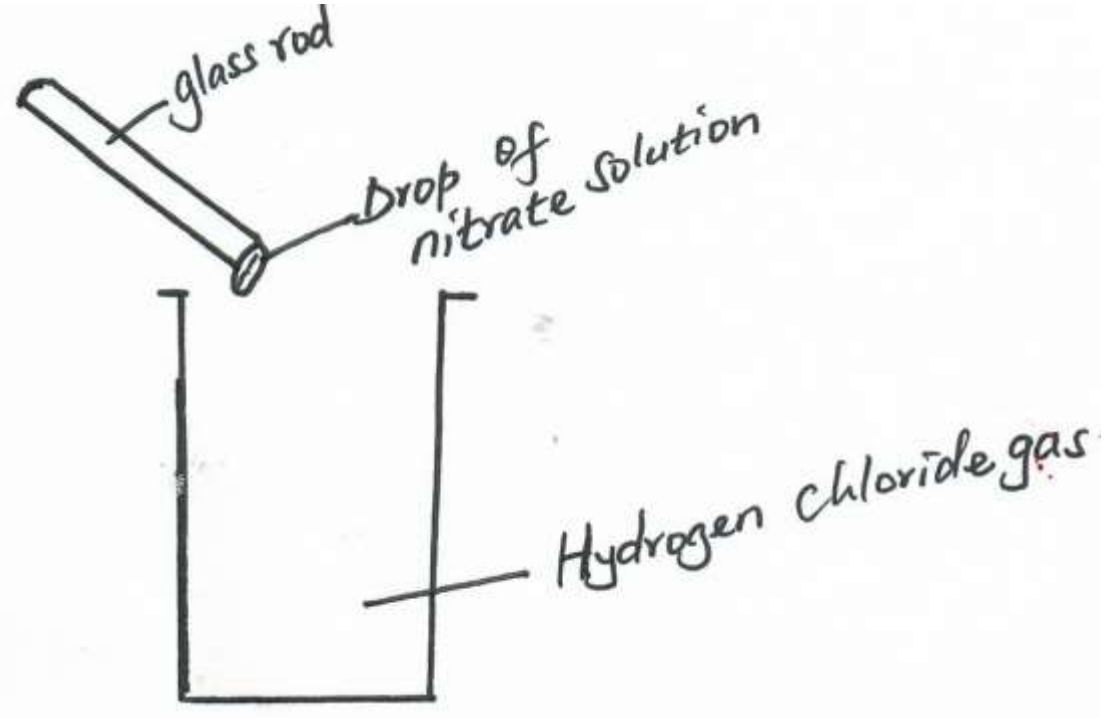
Brown pale yellow-

State and explain the observations that would be made when;

i) A syringe containing the gaseous mixture is immersed in ice-cold water.(2mks)

ii) The volume of the gaseous mixture in a syringe is reduced. (1mk)

23) A drop of silver nitrate solution on a glass rod was brought to the mouth of a gas jar containing hydrogen chloride as shown below;



i) State and explain the observations made. (2mks)

ii) Write an ionic equation to represent the reaction above. (1mk)

24) a) Give the systematic name of the following compound, (1mk)

i) $CH_3COOCH_2CH_2CH_3$

b) Alkanoic acid can be prepared through oxidation of alcohols by strong oxidizing agent. Name two oxidizing agents.

i)…… ($^1/_2$mk)

ii) …… ($^1/_2$mk)

c) The structure below represents a pleasant-smelling compound;

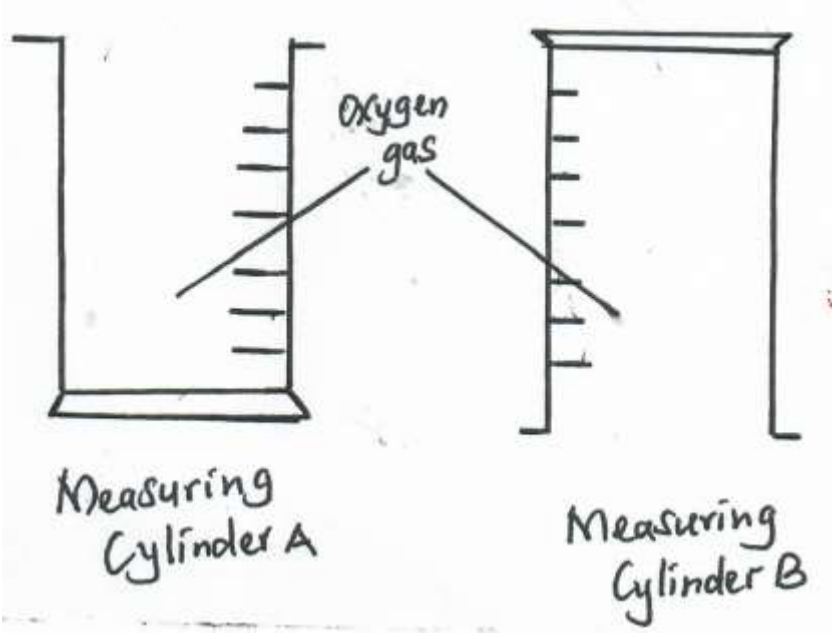
CH_3-CH_2-CH_2-COO-CH_2CH_3

Give the names of the two organic compounds that can be used in its preparation;

i)…… ($^1/_2$mk)

ii) …… ($^1/_2$mk)

25) Two measuring cylinders were each filled with oxygen and placed in position shown below. After 5 minutes, a glowing splint was then introduced into the mouth of each measuring cylinders. State and explain what was observed in each gas jar (3mks)



26) Use bond energy value given below to answer questions that follow;

Bonds	Bond energy KJM/mol
H-H	432
C=C	610
C-C	346
C-H	413

i) Determine the enthalpy change for conversion of butene to butane by hydrogenation. (2mks)

ii) Sketch an energy level diagram for above enthalpy change. (1mk)

27) Study the information in the table below and answer the question that follow. (**The letters do not represent the actual symbols of the elements).**

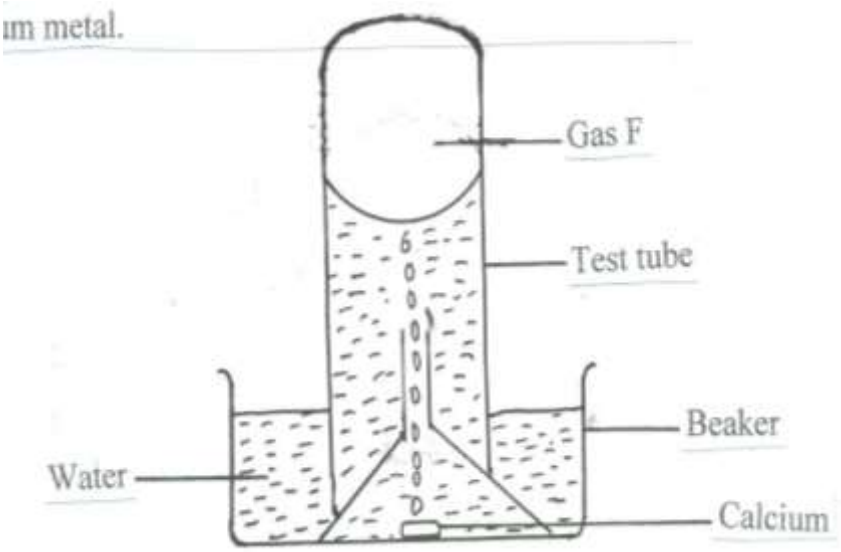
Element	Electron configuration	Ionization energy KJ/mol
X	2,8,8,1	418
Y	2,8,1	494
Z	2,1	519

a) Give the general name to which the elements belong. Explain (1mk)

b) Explain why element Z has the highest ionization energy. (1mk)

PAPER 2

1. (a) The set up below was used to collect gas F, produced by the reaction between water and calcium metal.



(i) Name gas F (1 mark)

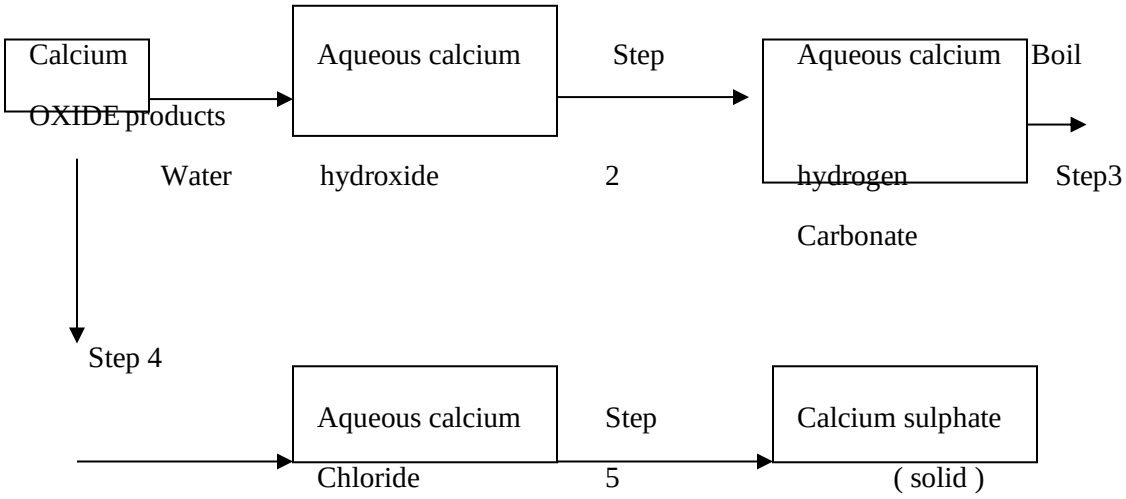
(ii) At the end of the experiment, the solution in the beaker was found to be a weak base.

Explain. (2 marks)

(iii) Give one laboratory use of the solution formed in the beaker. (1 mark)

(b) The scheme below shows some reactions starting with calcium oxide.

Study it and answer the questions that follow.



(i) Name the reagents used in steps 2 and 4.

Step 2 _____ (1 mark)

Step 4 _____ (1 mark)

(ii) Write an equation for the reaction in step 3. (1 mark)

(ii) Describe how a pure solid sample of anhydrous calcium sulphate is obtained in step 5. (3 marks)

2.The diagram below shows part of the periodic table. The letters used in it do not represent the actual symbols of the elements. Study it and answer the questions that follow.

	A	----------						
	B	---------- -	C		D		E	

(a) Compare the:

(i) Reactivity of elements A and B. (2 marks)

(ii) Atomic radii of elements C and D. (2 marks)

(b) What name is given to the elements in the same group as element E. (1 mark)

(c) Write down the formula of the compound formed when D reacts with excess oxygen.(1 mark)

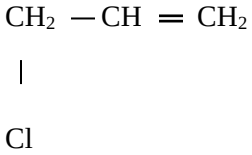
(d) An element F is found just above element D in the periodic table. Write down the electronic configuration of element F. (1 mark)

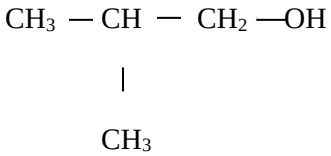
(e) A sample of the chloride of C was dissolved in distilled water. Both red and blue litmus papers were dipped into this solution. State and explain what was observed. (2 marks)

(f) 2g of element B react with 0.6 dm^3 of oxygen at r.t.p. From these results, calculate the relative atomic mass of B. (Molar gas volume = 24.0dm^3 at r.t.p) (3 marks)

(g) Helium is used in filling weather study balloon. Name another gas which is used for this purpose and explain which of the two is better suited for use for this purpose. (2 marks)

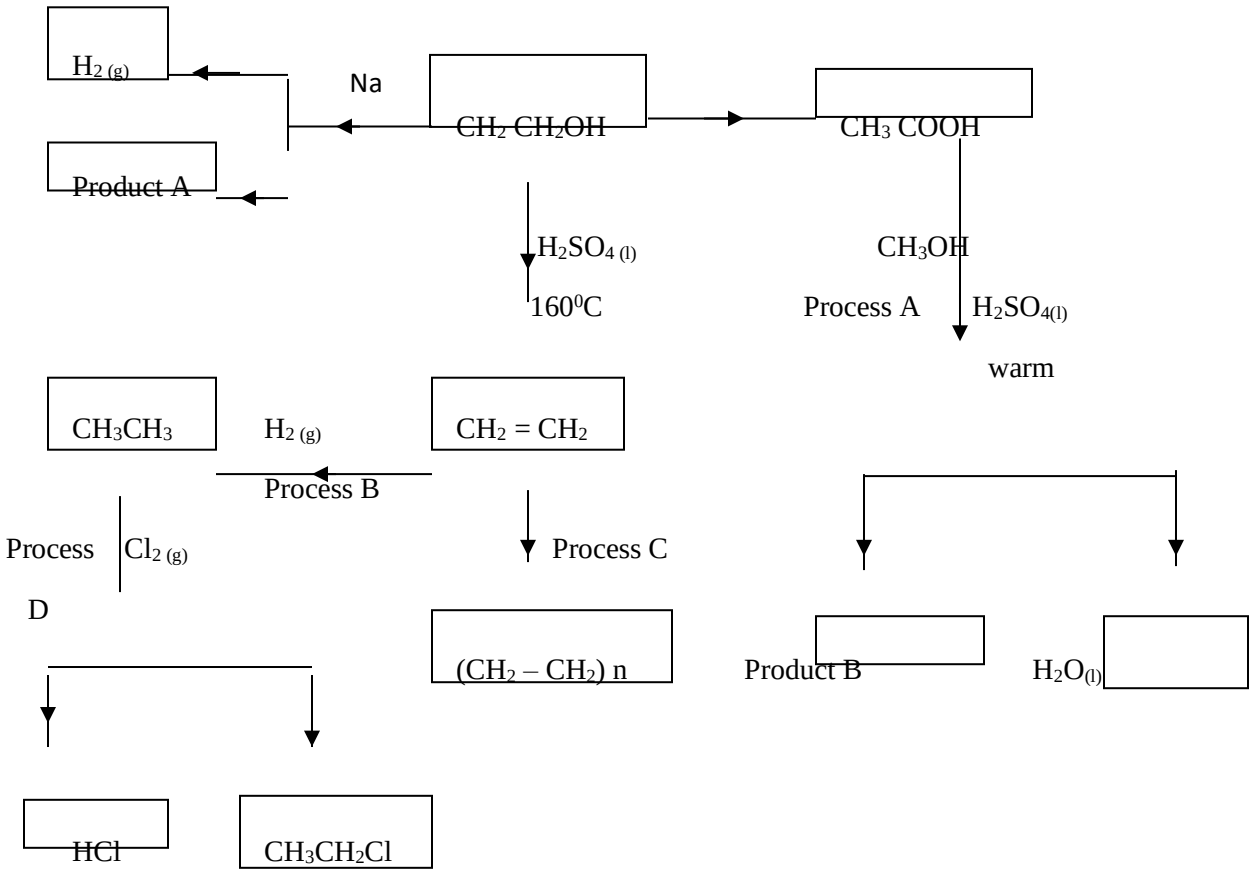
3. (a) Give the systematic names of the compounds with the structures below. (2 marks)

(i)


(ii)


(b) Describe a chemical test that can be used to distinguish between ethanol and ethanoic acid.
(2 marks)

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



(i) Name product A _____ (1 mark)

(ii) State the industrial application of process B. (1 mark)

(iii) Write down the equation for the reaction that takes place in process A. (1 mark)

(iv) Explain why high pressure is necessary when carrying out process C. (1 mark)

(v) Give the condition necessary for process D to take place. (1 mark)

(d) When a hydrocarbon is burnt in excess oxygen 3.3g of carbon (IV) oxide and 1.8g of Water are produced. Find the empirical formula of the hydrocarbon. (3 marks)

4. Use the standard electrode potentials for the elements RST and U given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.

	E^{θ} volts
$R^{+}_{(aq)} + 2e \longrightarrow {}_{(s)}$	-0.76
$S^{2+}_{(aq)} + 2e \longrightarrow S_{(s)}$	-0.44
$T^{2}_{(g)} + 2e \longrightarrow 2T^{-}_{(aq)}$	+ 0.54
$U^{4+}_{(aq)} + e \longrightarrow {}^{3+}_{(aq)}$	+1.61

(a) Which element is the strongest reducing agent? Explain. (1mark)

(b)(i) Draw a labelled diagram of the electrochemical cell that would be formed when half cells of elements R and S are combined. On the diagram show the direction of flow of electrons.
(3 marks)

(ii) Calculate the e.m.f of the cell formed in b (i) above. (2 mark)

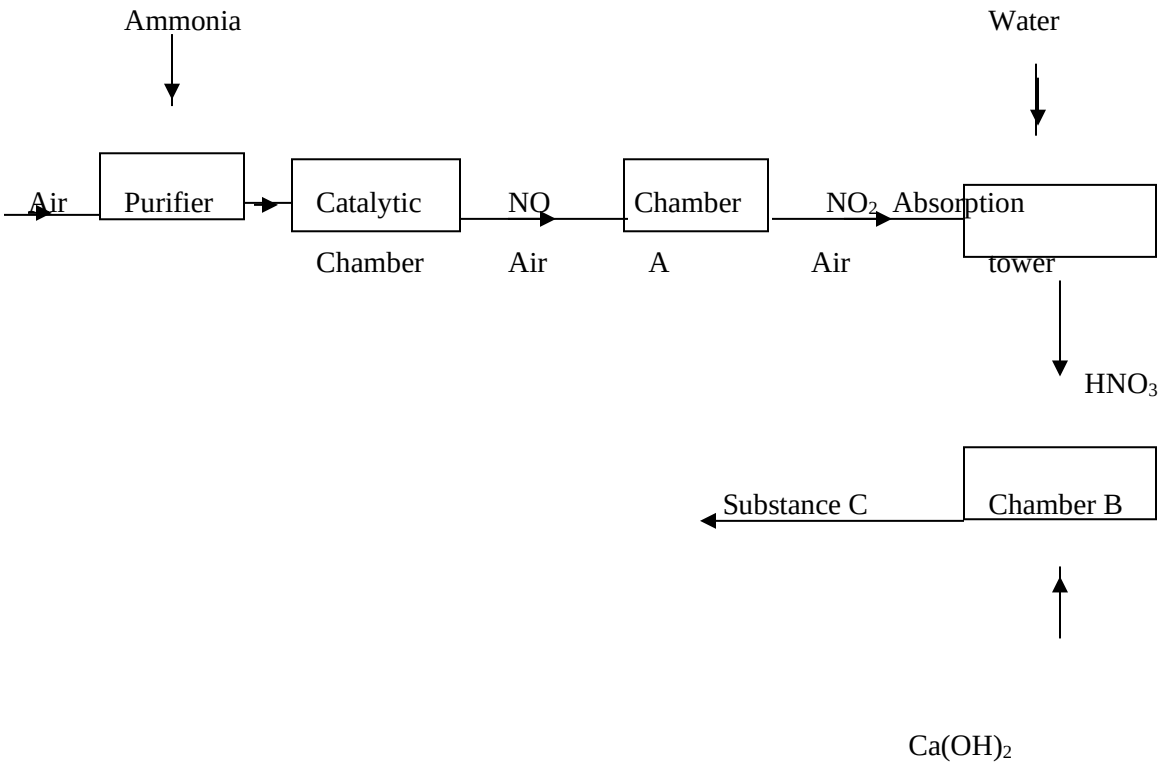
(c) In an experiment to electroplate iron with silver, a current of 0.5 amperes was passed through a solution of silver nitrate for one hour.

(i) Give two reasons why it is necessary to electroplate iron with silver. (2 marks)

(ii) Calculate the mass of silver that can be deposited on iron (Ag = 108, I faraday = 96500C) (3 marks)

5. (a)Briefly explain how nitrogen gas is obtained industrially from air. (3 marks)

(b) Study the flow diagram below and answer the questions that follows.



(i) Name the catalytic used in the catalytic chamber. (1 mark)

(ii) Name the process that takes place in chamber A. (1 mark)

(iii) Write down the overall equation of the reaction that takes place in the absorption tower.(1 mark)

(iv) State one use of substance C. (1 mark)

(c) Write down the equation for the reaction that takes place when silver nitrate is heated.

(1 mark)

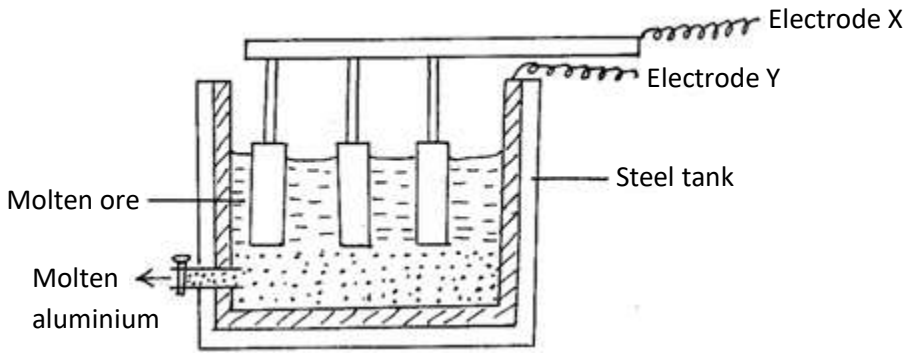
(d) Urea (NH_2 $CONH_2$) is commonly applied to the soil as a fertilizer. Calculate the

Percentage of nitrogen by mass in urea. (2 marks)

(N = 14, H = 1, C = 12, O = 16)

(e) Name the process through which substance C is formed. (1 mark)

6. Aluminium is extracted using the electrolytic cell represented by the diagram **below**.



(a)Why is aluminium extracted by electrolytic method? (1mk)

(b) Name the electrodes labeled.

X (1mk)

Y (1mk)

(c) The chief ore from which aluminium is extracted is bauxite.

(i)Name **two** main impurities present in bauxite. (2mks)

(ii) Aluminium oxide is the main component in bauxite with a melting point of 201 but electrolysis of molten aluminium oxide is carried out at 800°C. Explain how this is achieved.(2mks)

(d) Write the equations for the reaction taking place at the anode. (1mk)

(e) One of the electrodes is replaced periodically. Which one and why? (2mks)

(f) Duralumin (an alloy of copper, aluminium and magnesium) is preferred to pure aluminium

in the construction of aeroplane bodies. Give **one** property of duralumin that is considered.(1mk)

7. (a)In an experiment to study the rate of reaction a 10cm length of magnesium ribbon was reacted with 50cm^3 of 1M hydrochloric acid. The table below gives the data that was collected.

Time(sec)	0	10	20	30	40	50	60	70	80	90
Volume of hydrogen (cm^3)	0	60	90	105	112	116	118	120	120	120

(i) Plot a graph of volume of hydrogen against time. (3 marks)

(ii) From the graph find:

I) the volume of hydrogen that had been produced when time was 35 seconds. (1 mark)

II) The rate of reaction when time is 45 seconds. (2 marks)

(ii) Sketch on the diagram the curve you would obtain if the reaction is repeated Using 0.5M HCl. Label this curve 0.5M HCl. (1 mark)

(b) Study the equilibrium equation below and answer the questions below it.

$$A_{2\,(g)} + B_{2\,(g)} \rightleftharpoons 2AB_{(g)} \qquad \Delta H = +7\ kJmpol^{-1}$$

(i) Explain the effect of changing pressure on the equilibrium above. (2 marks)

(ii) What is the effect of raising the temperature of the equilibrium mixture? (1 mark)

PAPER 3

You are provided with

- Magnesium powder

-1M Hydrochloric acid solution R

-0.2M sodium hydroxide solution S

You are required to determine the;

a) Mass of Magnesium that reacted

b) Molar enthalpy of reaction between magnesium and Hydrochloric acid

Procedure I

Using a measuring cylinder, transfer 100.0cm^3 of the acid into a 200ml plastic beaker. Stir the acid with the thermometer. Take its initial temperature and record it in the table below at time =0 seconds. Add all the magnesium at once and start your stop watch immediately. Stir well and take the temperature after every thirty seconds up to the 5th minute.

Table 1

Time (seconds)	0	30	60	90	120	150	180	210	240	270	300
temperature											

(4mk)

a) On the grid provided, plot a graph of temperature (Y-axis) against time (3mk)

b) On your graph show the highest temperature change ΔT (1mk)

c) Calculate the heat change for the reaction (1mk)

Procedure 2

Transfer the content of the plastic beaker into a 250 ml volumetric flask. Rinse the beaker and place the rinsing water into the volumetric flask. Top up the solution to the 250ml mark using distilled water and label it solution D.

Fill the burette with sodium hydroxide solution S

Using a pipette, transfer 25.0cm^3 of solution D into a conical flask. Add 2 drops of phenolphthalein indicator and carry out titration .Record your results in the table 2 below. Repeat the procedure two more times and complete table 2 below.

Table 2

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

.(4mks)

b) Determine

I average titre volume of sodium hydroxide solution S used (1mk)

II moles of NaOH in the average titre volume (1mk)

III moles of hydrochloric acid in solution D that reacted with NaOH (1mk)

IV moles of HCl in 250cm^3 of solution D (1mk)

V moles of HCl in 100cm^3 of solution R (1mk)

VI moles of HCl that reacted with Mg (1mk)

VII moles of Mg that reacted (1mk)

VIII) Molar enthalpy of reaction between Magnesium and HCl (2mk)

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

a) Place all solid Z in a boiling tube. Add 10cm^3 of distilled water and shake. Filter the mixture. Divide the filtrate into two and preserve the residue.

observations	inferences
1mk	1mk

b) To the first portion of filtrate add dilute sodium hydroxide and warm gently. Test the gas produced if any using moist blue and red litmus papers

observations	inferences
1mk	1mk

c) To the second portion add 2 drops of lead (II) nitrate and warm

observations	inferences
1mk	1mk

d) Place the residue in a test tube. Add dilute nitric (V) acid until reaction is complete and test the gas produced using a glass rod dipped in lime water. Divide the solution formed into two

observations	inferences
1mk	1mk

e) To the first portion add sodium hydroxide drop wise till in excess

observations	inferences
1mk	2mk

f) To the second portion add ammonia solution drop wise till in excess

observations	inferences
1mk	1mk

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

a) Place 2 drops of liquid L on a watch glass and ignite using a wooden splint

observations	inferences
1mk	1mk

b) To $2cm^3$ of liquid L in a test tube add 2 drops of acidified KMnO4

observations	inferences
1mk	1mk

c) To $2cm^3$ of liquid L in a test tube add 2drops of acidified potassium dichromate (VI) and warm

observations	inferences
1mk	1mk

d) Use the remaining liquid L to determine the pH of the liquid using universal indicator paper provided. Use the guide provided

procedure	observation	inferences
1^1/2mk	1/2mk	1mk

PANGANI GIRLS

PAPER 1

1. Molten sodium chloride and graphite both conduct electricity. State their difference in electrical conductivity. (2mks)

……
……

……
……

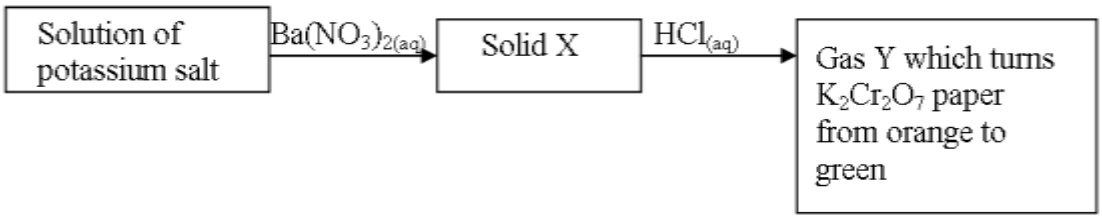
2. Element R has atomic number 8 and a mass number 16.

(i) Draw the atomic structure of element R. (1mk)

(ii) Explain why R forms a hydride with a low boiling point. (1mk)

……
……

3. Study the diagram below and answer the questions that follow.



(a) Name (i) Solid X (1mk)

……
……

(ii) Gas Y (1mk)

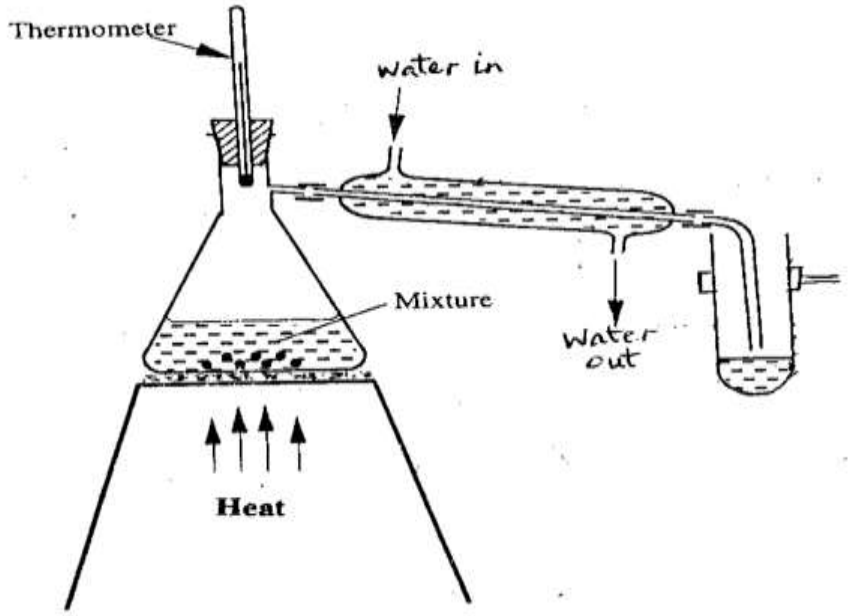
……
……

4. Compare the second ionization energy of magnesium with its first ionization energy. Explain your answer. (2mks)

……
……

……
……

5. The set-up represented below can be used to separate ethanol from its mixture with water.



(a) Identify an error in the set-up. (1 mk)

……

(b) Name this method of separation. (1 mk)

……

(c) What properties make it possible to separate ethanol from water by this method? (1 mk)

……

……

6. Element K has two isotopes $^{20}\mathbf{K}$ and $^{22}\mathbf{K}$ with relative abundance of 90% and 10% respectively.

a) What are isotopes? (1 mk)

……

……

b) Determine the relative atomic mass of element K. (2 mks)

……
……
……

7. Xg of Potassium hydroxide were dissolved in water to make 100cm^3 of solution.50cm^3 of solution required 50cm3 of 2M Nitric acid for complete neutralization. **Calculate** the mass X of Potassium hydroxide. (3mks)

……
……

……
……

8. Sulphur burns in air to form a gaseous product.

i) What is the colour of the flame of burning sulphur? (1 mk)

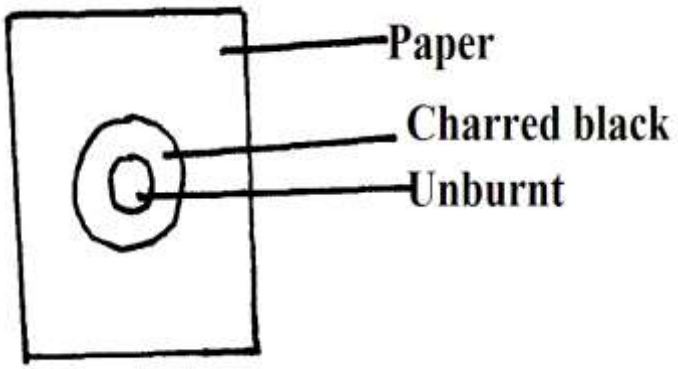
……..…

ii) Give an equation for the reaction that takes place when the gaseous product is bubbled through water. (1 mk)

……..……

iii) State one importance of the product formed in (ii) above. (1 mk)
……..……

9. The figure below shows a paper that was placed horizontally across the middle of a non-luminous flame and quickly withdrawn.



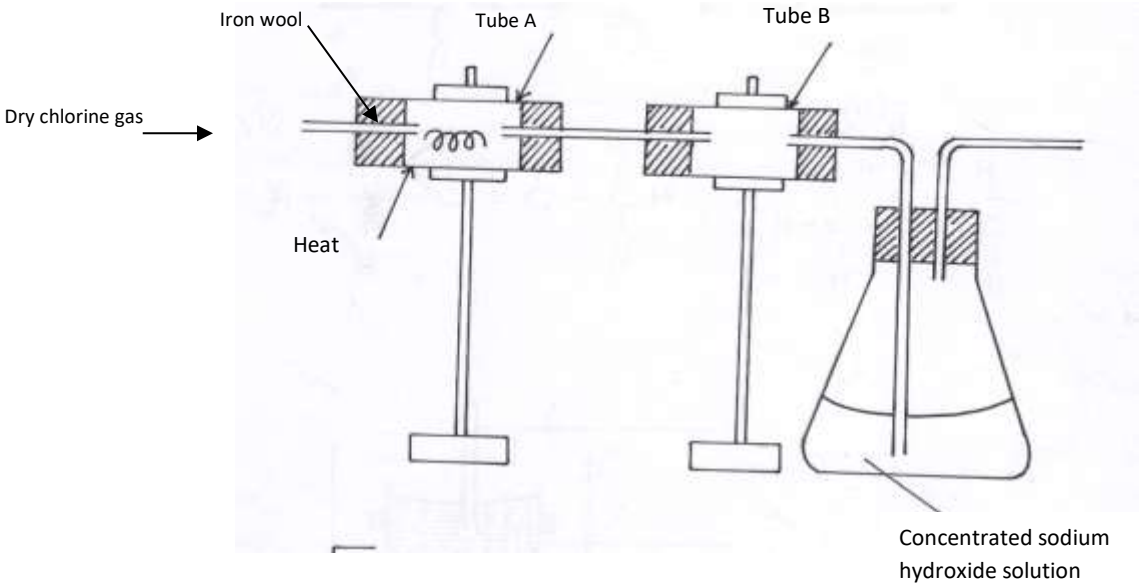
(a) Explain the observations. (1mk)

……
……

(b) Why is luminous flame not used for heating in the laboratory? (1mk)

……
……

10. Study the diagram below and answer the questions that follow.



(i) What is observed when the hot iron wool reacts with chlorine gas? (1mk)

……
……

(ii) What is the purpose of:

a) Tube B (1mk)

……

b) Concentrated Sodium hydroxide solution. (1mk)

……

11. The table below shows results obtained from experiment carried out on a suspect salt solution M.

Experiment	**Results**
I. A few drops of Barium nitrate added to solution M	No ppt/ colourless solution

II.	A few drops of lead (II) nitrate added to solution M.	White ppt
III.	Ammonia solution added dropwise until in excess	White precipitate Colourless solution

(a) Identify the cation and anion present in solution M. (1mk)

Cation (½ mk)

…….

Anion (½ mk)

……....

b) Write an ionic equation for the formation of white precipitate in experiment II (1mk)

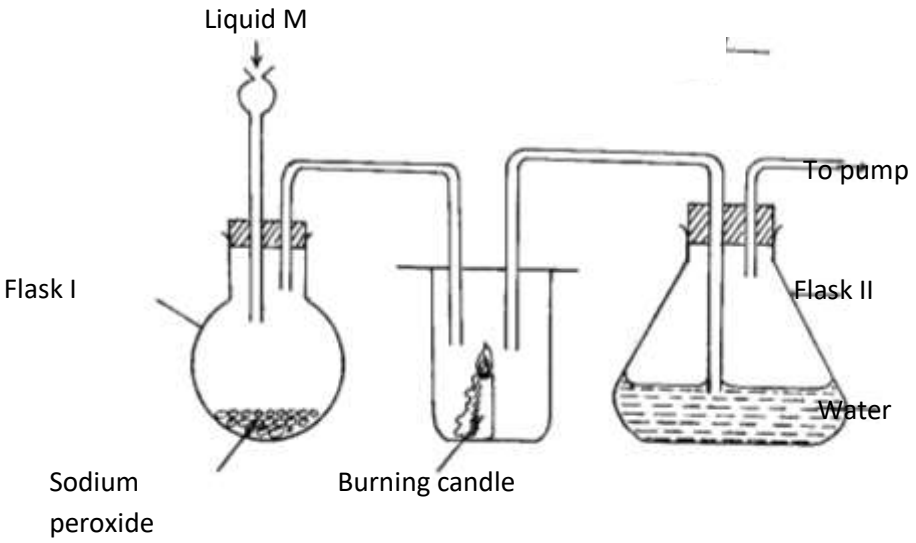
……
……..…

c) Write the formula of the Ion responsible for formation of colourless solution in experiment III

(1mrk)

……
……

12. 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. (1mk)

……
……

(ii) The pH of the solution in flask II was found to be less than 7. Explain. (2mks)

……
……
…….

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

……
…….

13. Briefly explain the following

(i) Alkaline earth metals are generally less reactive than alkali metals. (1mk)

……
…….

(ii) Melting point of alkali metals decrease down the group while melting point of halogens increases down the group. (2mks)

……
…….

……
…….

(iii) Group VIII elements are gases at room temperature. (1mk)

……
…….

14. How would you obtain a sample of pure iodine from a mixture of iodine and lead (II) sulphate. (2mks)

……
…….

……
…….

15. The table below indicates the PH values of solutions labelled A, B, C, D and E

Solution	A	B	C	D	E
pH value	5	13	2	10	7

Identify the solution:

(i) Containing highest concentration of hydrogen ions. (½ mk)

……
…….

(ii) That is likely to be ethanoic acid. Give a reason. (1mk)

……
…….

(iii) That is likely to be common salt solution. (½ mk)

……
…….

16.The table below shows physical properties of some substances. Use the information to answer the questions that follow.

Substance	Density (gm^{-3})	M-P (^{O}c)	B.P (^{O}c)	Electrical conductivity	
				Solid	Liquid
M	3.5	801	1413	POOR	GOOD
O	0.8	-114	-84.9	POOR	POOR
P	3.8	3550	4827	POOR	POOR
Q	21.4	-39	357	GOOD	GOOD
R	1.53	660	2470	GOOD	GOOD

(i) Which of the elements is a liquid at room temperature. Explain (1mk)

……

(ii) Identify the type of structure in

P……

R…… (1mk)

(iii) Which element would be the most suitable for use in over-head electric wire transmission? (2 mks)

……
……

17. An element Y has relative atomic mass 6.939 and atomic number 3. it has two isotopes with atomic mass 6.015 and 7.016. Calculate the relative abudance of the isotopes. (3mks)

18. (a) Give the name of the organic compound formed when methanol and ethanoic acid reacts in the presence of concentrated sulphuric (VI) acid. (1mk)

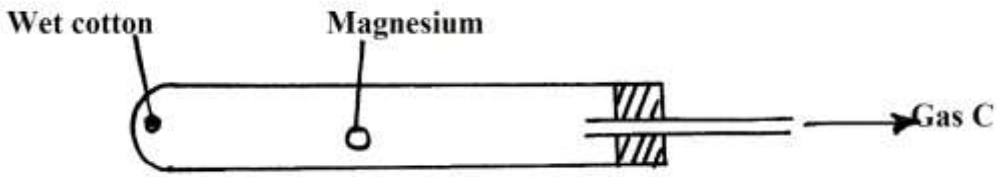
……
……

(b) Write the structural formula of

2 – methylpropane (1mk)

……
……

19. The diagram below shows how magnesium reacts with steam.



(i) Gas C would not be produced as in the set-up but when certain condition is introduced gas C is produced. On the diagram indicate the condition that was omitted. (1mk)

(ii) Describe how gas C is produced after the mistake was corrected in the set-up. (1mk)

……
……

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

Element	Atomic number	Electronic arrangement
X	16	
Y	19	

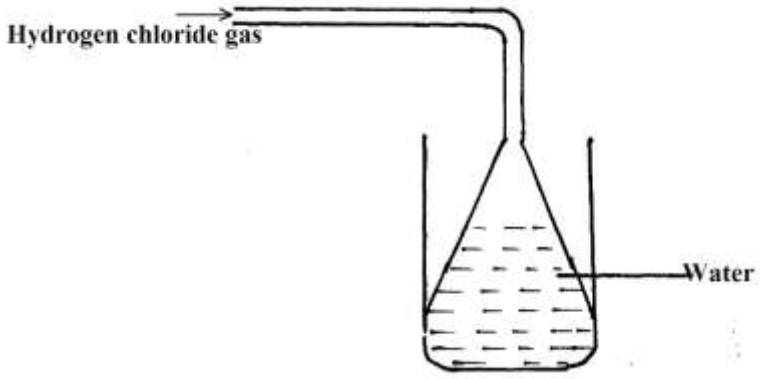
(a) Complete the table by writing the electronic arrangement of the elements (1mk)

(b) Which type of bond is formed between X and Y. Explain (2mks)

……
……

……
……

21. Hydrogen chloride gas was passed into water as shown below.



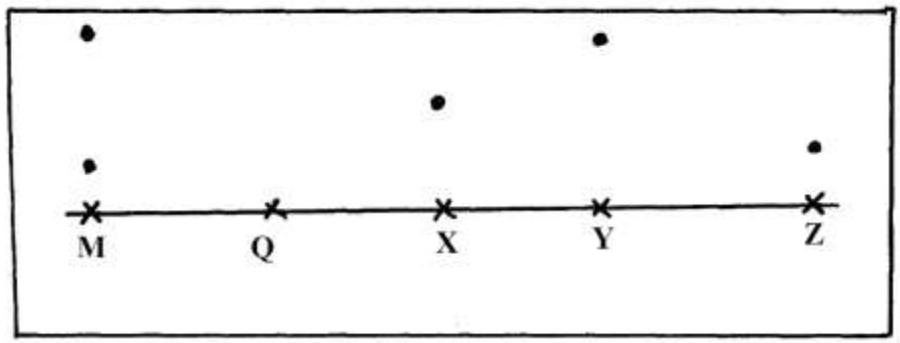
(a) When a blue litimus paper was dropped into the resulting solution, it turned red. Give a reason for the observation. (1mk)

……
……

(b) What is the function of the funnel? (1mk)

……
……

22. The paper chromatogram below shows the identification of unknown metal ions in mixture M. The reference ions X, Y and Z are also shown. The experiment was done in an ascending method.



X – Vanadium (IV) ion (V^{4+})
Y – Chromium (III) ion (Cr^{3+}) Z – Copper(II) ion (Cu^{2+})

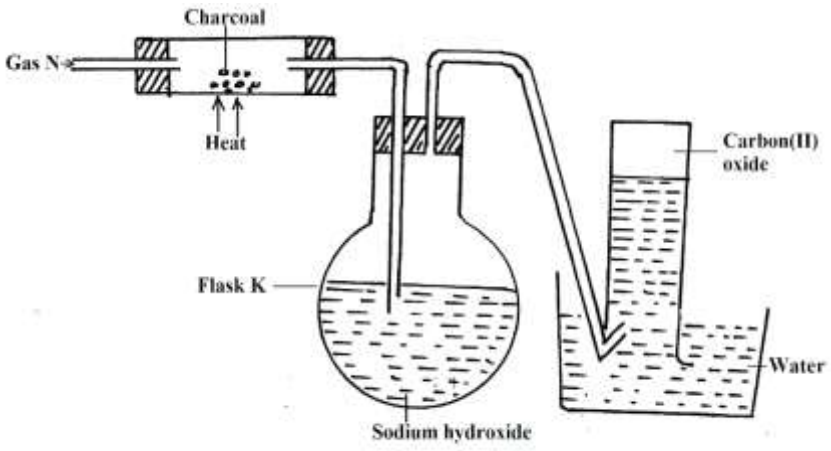
(a) Name the ions present in the mixture M. (1mk)

……
……

(b) Indicate the solvent front on the diagram. (1mk)

(c) Mixture Q contains all the three ions. Show the chromatography of Q. (1 ½ mks)

23. The set-up below shows the preparation of carbon (II) oxide.



(a) Name gas N (1mk)

……
……

(b) What is the purpose of sodium hydroxide in flask K? (1mk)

……
……

(c) Why is it necessary to carry out this experiment in a fume cupboard? (1mk)

……
……

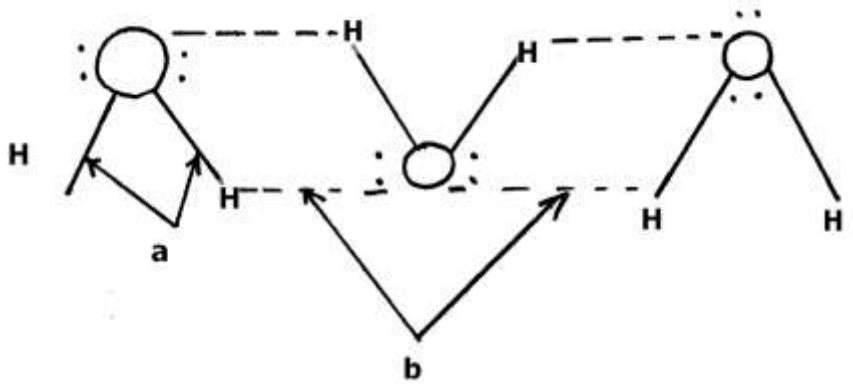
24. Determine the oxidation states of the underlined elements (2mks)

i) $\underline{Fe}\ (CN)_6^{3-}$ ii) $K\ [\underline{Cr}\ (CN)_6]^{4+}$

Oxidation state of Fe Oxidation state of Cr

……
……

25. The diagram below shows a structure (i) of water molecules



i) Name the bonds labelled (1 mk)

a) ……..

……..……

b……..

……

ii) Using dots (.) and cross(x) diagram show the bonding in the compound phosphonium ion

PH_4^+ (H = 1, P = 15) (1mks)

26. When dry hydrogen gas was passed over a heated lead (II) oxide sample in a combustion tube and the gaseous product cooled, a colourless liquid was obtained.

(a) (i) Name the colourless liquid. (½ mk)

……
…….

(ii) Describe a chemical test you would use to confirm the colourless liquid in a (i) above. (2mks)

……
…….

……
…….

(b) What observation can be made in the combustion tube at the end of the experiment? (½ mk)

……
…….

(c) Write a chemical equation for the reaction between hydrogen and heated lead (II) oxide. (1mk)

……
…….

27. State one use of:

a) Calcium nitrate (1 mrk)

……..

b) Magnesium hydroxide (1 mrk)

…….

28. Coloured flower placed in a gas jar containing gas X immediately turned colourless. A solution of gas X in water formed a white precipitate with silver nitrate solution. The precipitate was insoluble in nitric (V) acid but dissolved in excess aqueous ammonia.

(a) What is the identity of gas X? (1mk)

……
…….

(b) Write down the balanced chemical equation of the reaction that took place when:

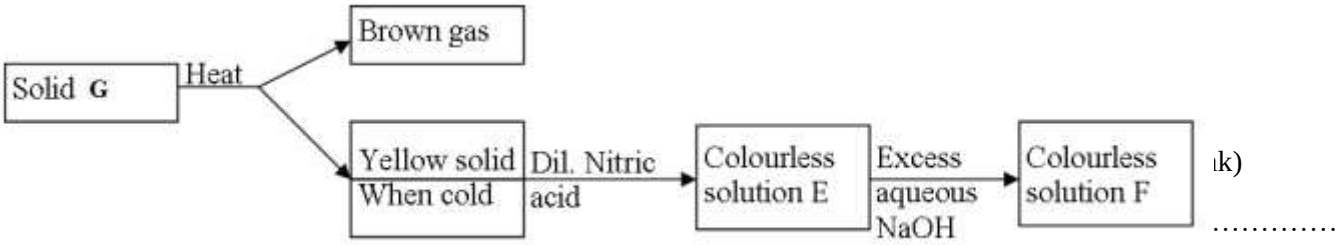
(i) Solution of gas X in water reacted with silver Nitrate solution. (1mk)

……
…….

(ii) Aqueous ammonia was added to the resulting mixture in b(i) above. (1mk)

……
…….

29. Study the flow chart below and answer the questions that follow.



lk)

……

(b) Write the formula of the complex ion in solution F (Imk)

30. Describe how you would obtain solid sample of sodium carbonate from a mixture of lead carbonate and sodium carbonate powders. (2mks)

PAPER 2

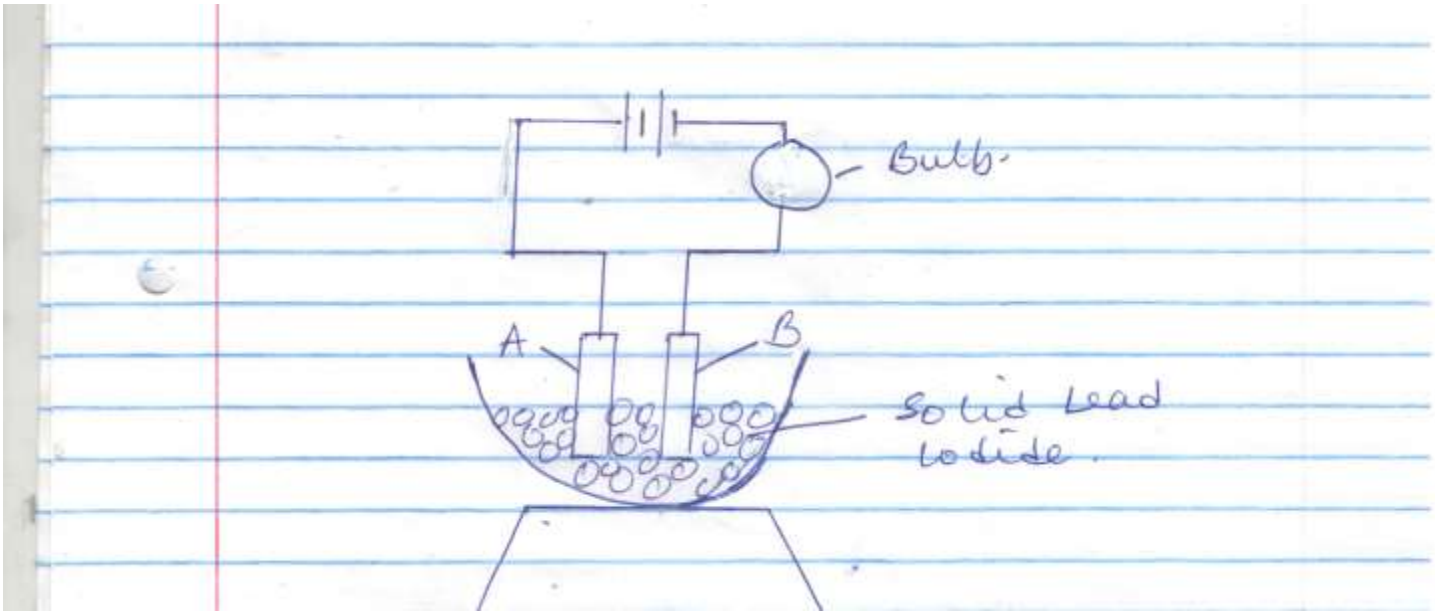
1. a What is an electrolyte (1mk)

bi. State how the following substance conduct electricity

i. Molten calcium chloride (½ mk)

ii. Graphite (½ mk)

c. The diagram below shows a set up that was used to electrolyze molten lead (II) iodide



i. Name electrodes A and B on the diagram 2mks

ii. What is omitted in the above set-up for the electrolysis process to take place? (1mk)

iii. Explain why the bulb lights when the omission is corrected (2mks)

iv. State the observation made at B(1mk)

v. Write the ionic equation for the reaction taking place;2mks

A:

B:

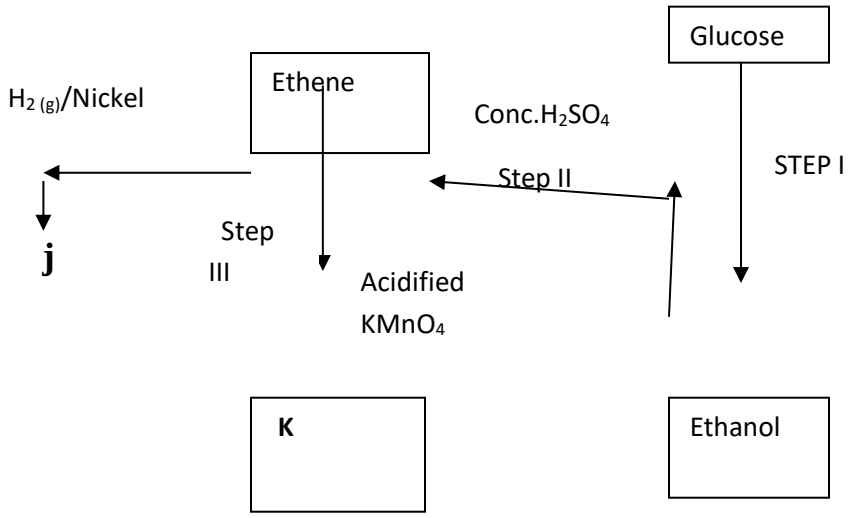
2. a) Draw the structural formula of . **(3 marks)**

(i) 2,3-dimethylpentane

(ii) Pent-2-yne

(iii) 2,3-dimethylbutane

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



(i)Name the process in step I **(1 mark)**

(ii)Give the two conditions necessary in step II **(2 marks)**

(iii)State the observation made in step III. **(1 mark)**

(iv)Name compound J. **(1 mark)**

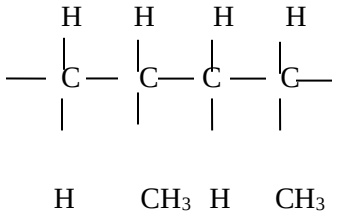
(v)Draw the structural formula of compound K. **(1 mark)**

(c) Water is added dropwise to calcium carbide in a conical flask.

(i)Identify the gas produced. **(1 mark)**

(ii)Write a chemical equation for the reaction that occurs. **(1 mark)**

(d)Part of a polymer is required below.



(i) Draw the structural formula of the monomer of this polymer. **(1 mark)**

(ii) State one use of this polymer. **(1 mark)**

3. The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters are not the actual symbols of the elements.

Y	R						Q	**X**	
	V		**W**						U

(a)Select an element whose oxide is amphoteric.**(1 mark)**

(b)On the grid indicate with letter J the position of element J which is in period 3 and forms a stable ion J^{2-}**.** **(1 mark)**

(c)Draw a dot-cross diagram to show bonding in the compound consisting of elements V and X only. **(2 marks)**

(d)Write an equation to show the formation of an ion of R. **(1 mark)**

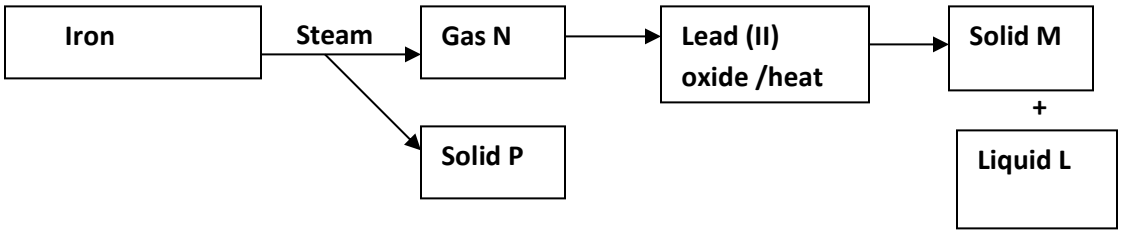
(e)Which is the least reactive element? Give a reason for your answer. **(2 marks)**

(f)Write an equation for the reaction that occurs when element Y is placed in water. **(1 mark)**

(g)How does the atomic radius of W compare with that of V? Explain. **(2 marks)**

(h)Name the chemical family to which elements R and V belong. **(1 mark)**

4. a) Use the chart below to answer the questions that follow.



Identify:

Gas **N** ……. **(½ mark)**

Solid **P** …….. **(½ mark)**

Solid M……. **(½ mark)**

Liquid **L**…….. **(½ mark)**

b) Name the method that can be used to extract oil from castor oil seeds. **(1 mark)**

c) i) In the method named above, state the property of oil that enables the extraction to take place. **(1 mark**)

ii) Describe an experimental procedure that can be used to extract oil from the seeds. **(3 marks)**

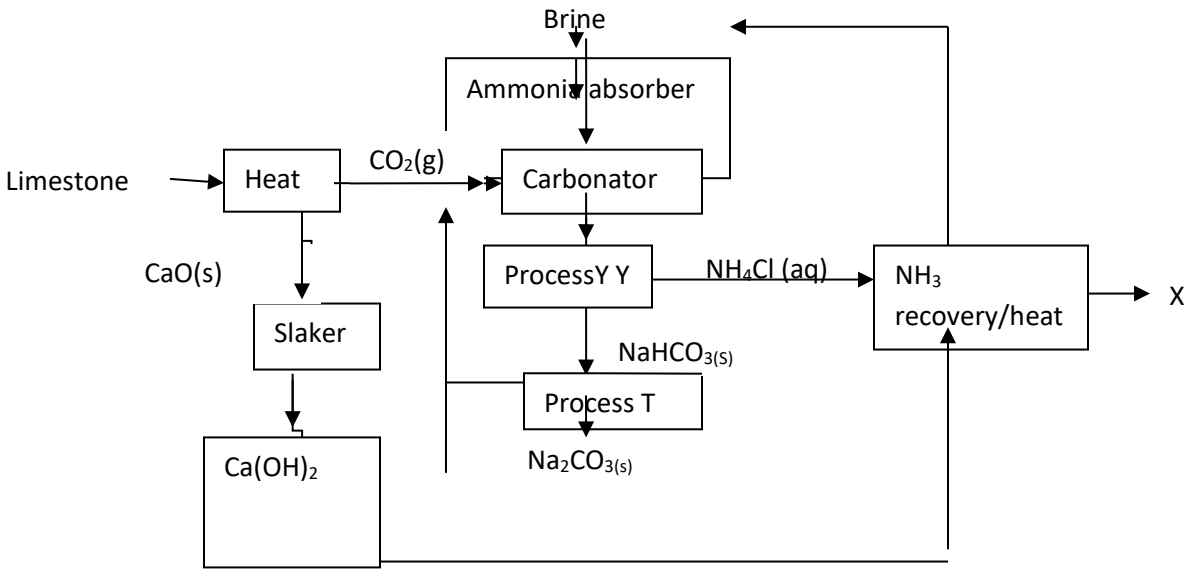
d) How is phosphorus stored in the laboratory? Explain your answer. **(1 mark)**

e) i) In the fractional distillation of liquid air water is removed, name two other substances that are removed. **(1 mark)**

ii) Why must water be removed? **(1 mark)**

iii) State the processes involved in fractional distillation of liquid air. **(2 marks)**

5. Study the flow chart below showing the Solvay process and use it to answer the questions that follow.



a) Write the equation for the reaction producing substance X.**(1 mark)**

b) Name processes Y and T. **(1 mark)**

c) In the carbonator, two reactions take place. Write the two equations for the reactions. **(2 marks)**

d) Explain why the Solvay process is said to be one of the most efficient industrial process. (1 marks)

e) 16.8g of sodium hydrogen carbonate are completely decomposed by heating. Calculate;

i) the mass of the resulting solid produced. **(3 marks)**

ii) the volume in litres of the gas produced at s.t.p **(2 marks)** (Molar Gas Volume at s.t.p =22400 cm^3, Na=23.0, C=12.0, H= 1.0, O=16.0)

f) Give two industrial uses of sodium carbonate. **(1 mark)**

6. a) Dissolving of potassium nitrate in water is an endothermic process. Explain the effect of increase in temperature on the solubility of potassium nitrate (2mks)

b. The table below shows the solubility of potassium sulphate and potassium chlorate (V) at different temperatures

Temperature ^oc	0	20	40	60	80	100
Solubility of K_2SO_4 g/100g of water	8.0	10.0	14.0	17.5	20.0	22.0
Solubility of $KClO_3$ g/100g of H_2O	3.0	5.0	15.5	24.0	38.0	53.0

i. On the grid provided (graph paper) draw the solubility curves for both salts on the same axis. (Temperature on the X-axis) (3mks)

ii. A solution of potassium sulphate contains 20g of the salt dissolved in 100g of water at 100^oc. This solution is allowed to cool to 25^oc.

i. At what temperature will crystals first appear (1mk)

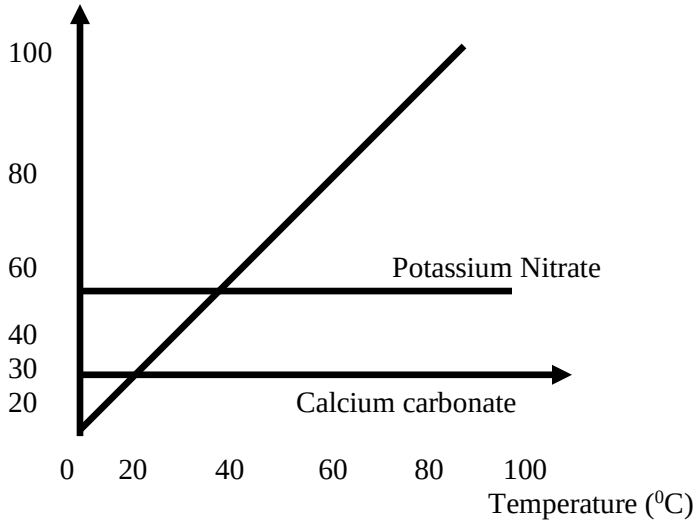
ii. What mass of crystals will be present at 25^oc (1mk)

iii. Which of the two salts is more soluble at 30^oc (1mk)

iv. Determine the concentration of potassium sulphate in moles per litre when the solubility of the two salts are the same (K=39.0, O=16.0 S = 32.0) (3mks)

v. 100g of water at 100^oc contains 19g of potassium sulphate and 19g of potassium chlorate (V). Describe how a solid sample of potassium sulphate at 60^oc can be obtained (1mk)

vi) Study the solubility curves below and answer the questions that follow.



(i) At what temperature would equal amounts of potassium nitrate and calcium ethanoate dissolve in 100g of water?
(1 Mark)

.....

(ii) Explain how you would prepare a saturated solution containing 80g of potassium nitrate in distilled water.
(1 Mark)

7.a) State two reasons why wood charcoal is not a suitable fuel for cooking. **(1 mark**)

b) In the equation below, identify the reagent that acts as a base. Give a reason

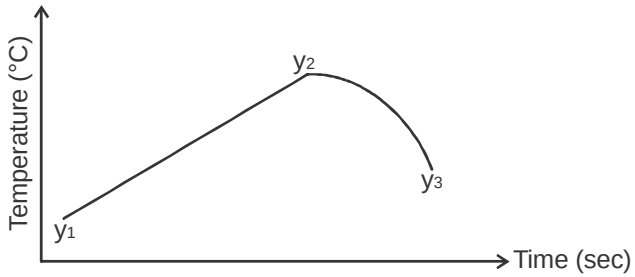
(2 marks)

$H_2O_{2\,(aq)} + H_2O_{(l)} \longrightarrow H_3O^+_{(aq)} + H2O_{(aq)}$

(II) Distinguish between a strong and weak acid. Give an example of each (2 Marks)

c) In order to determine the molar enthalpy of neutralization of sodium hydroxide, $50cm^3$ of 2M sodium hydroxide and $50cm^3$of 2M hydrochloric acid both at the same initial temperature were mixed and stirred continuously with a thermometer. The temperature of the resulting solution was recorded after every 15 seconds until the highest temperature of the solution was attained. Thereafter the temperature of the solution was recorded for a further two minutes.

The sketch below was obtained when the temperature of the mixture were plotted against time. Study and answer the questions that follow.



i)What is the significance of point y_2 **(1mark)**

ii) Explain why there is a temperature change between points y_1 and $\mathbf{y_2}$ **(1 mark)**

iii) Explain how the value of temperature rise obtained in this experiment would compare with the one that would be obtained if the experiment was repeated using $50cm^3$ of 2M methanoic acid instead of hydrochloric acid. **(2 marks)**

PAPER 3

1 **You are provided with;**

- Solution K, hydrochloric acid
- Solution L, containing 2g per litre of sodium hydroxide.
- 0.5 g of an impure calcium carbonate, solid **N.**
- You are required to determine the :

(a)Concentration of solution K in moles per litre.

(b) Percentage purity of calcium carbonate, solid **N**

Procedure I

Fill the burette with hydrochloric acid, solution K. pipette 25cm^3 of sodium hydroxide, solution L into a conical flask. Add 2-3 drops of phenolphthalein indicator and titrate. Record the results in the table. Repeat the procedure two more times.

Table 1

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

4mks

(a) What is the average volume of solution **K** used (1mk)

(b) Determine the concentration of solution L in moles per litre. (1mk(Na= 23,O = 16, H = 1)

c) Determine the number of moles of solution L that reacted with solution K(1mk)

d) Write the equation of the reaction that took place(1mk)

e) Calculate the number of moles of solution K that reacted(1mk)

(f) Calculate the concentration of solution K in moles per litre. (1mk)

Procedure II

Using a measuring cylinder, measure out 100cm^3 of solid K into a 250ml beaker. Add all of solid N into the beaker containing solution K. Swirl the mixture and allow the reaction to proceed until offervescence stops. Label this as solution P. Fill the burette with solution P. pipette 25cm^3 of solution L into a conical flask. Add 2-3 drops of phenolhthalein indicator and titrate. Record your results in table II below repeat the titration two more times and complete the table

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

4mks

(a) Determine the average volume of solution **P** used. 1mk

(b) Calculate the number of moles of hydrochloric acid in solution P used. (1mk)

c) Determine the number of moles of hydrochloric acid in 100cm^3 of solution P. (1mk)

d) Calculate the:

(i) Moles of hydrochloric acid in 100cm^3 of the original hydrochloric acid solution K (1mk)

(ii) Moles of the hydrochloric acid that were used up in the reaction with solid N. (1mk

(iii) Moles of calcium carbonate that reacted with hydrochloric acid.(1mk)

e) Given that the relative formula mass of calcium carbonate is 100,calculate the:

(i) Mass of the calcium carbonate that reacted. (1mk)

(ii) Percentage purity of the calcium carbonate, solid N. (1mk)

2You are provided with solid T. Carry out the following tests and write your observations and inferences in the spaces provided.

Place all solid T in a boiling tube. Add about $6cm^3$ of distilled water to the solid T and shake the mixture well. Retain the mixture for use in the following tests.

a) Dip a clean glass rod in the mixture obtained above and burn it on a Bunsen burner flame.

Observation	Inference
(1 mark)	(1 mark)

b) Divide the mixture in the boiling tube into 3 portions.

(i) To the 1^{st} portion, add about $1cm^3$ of barium chloride solution. Retain the resulting mixture for use in (iii) below.

Observation	Inference
(1 mark)	(1 mark)

(ii) To the mixture in (ii) above, add about $4cm^3$ of dilute hydrochloric acid.

Observation	Inference
(1 mark)	(1 mark)

(iii) To the 3rd portion, add about 3 drops of acidified potassium manganate (VII) solution.

Observation	Inference
(1 mark)	(1 mark)

3.You are provided with solid J. Carry out the test below to identify the compound.

(a) Place ½ spatula of solid J in a hard test tube and heat strongly until no further change. Test the gas produced with litmus paper.

Observation	Inference
(1/2 mark)	(1/2 mark)

(b) Place the remaining solid J into a clean boiling tube. Half fill it with distilled water and shake well. Divide the solution into four portions.

(i) To the first portion add dilute sodium hydroxide solution dropwise till in excess.

Observation	Inference
(1 mark)	(1 mark)

(ii) To the second portion add ammonia solution dropwise till in excess.

Observation	Inference
(1 mark)	(1 mark)

(iii)To the third portion add drops of dilute barium nitrate.

Observation	Inference
(1 mark)	(1 mark)

(iv)To the fourth portion add a few drops of dilute nitric acid followed by lead (II) nitrate solution and warm.

Observation	Inference
(1 mark)	(1 mark)

Identify Compound J……..… (1 mark)

MASENO SCHOOL

1. Element Y has atomic number 8 while X has 16 .
   i. Write electronic arrangement of X and Y (1mk)
   X-

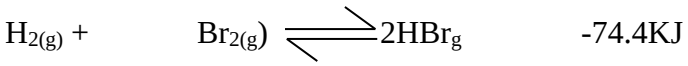
   Y-

   ii. Name the type of bond and structure formed when X and Y react. (2mks)
   Bond-

   Structure-

2. Explain why it is not advisable to leave a jiko with a burning charcoal in a closed room where one is sleeping. (2mks)

3. The following equation shows a reversible reaction



   Red Brown Colourless

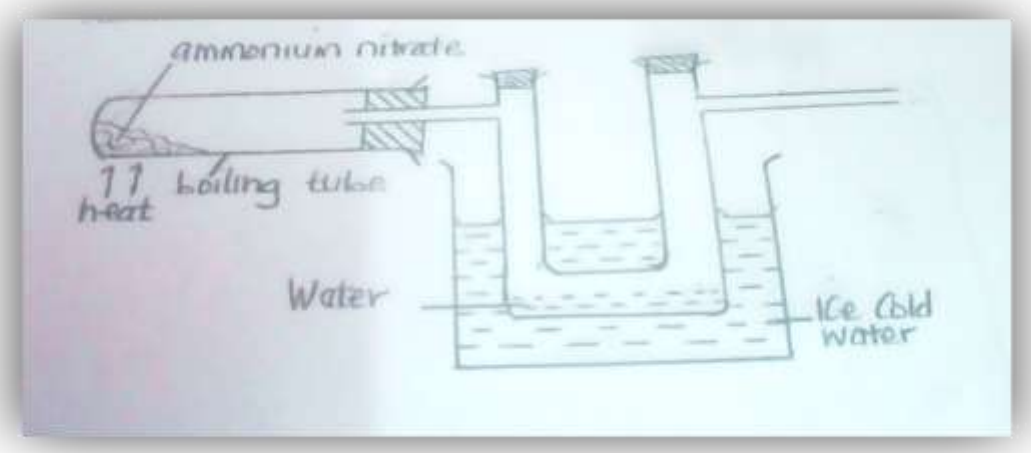
   State and explain the observation that can be made when

   i. Temperature is increased. (1 ½ mks)

   ii. Pressure is reduced. (1 ½ mks)

4. A mixture contains zinc oxide, iron (iii) chloride and potassium chloride. Describe how each of the substances can be obtained from the mixture. (3mks)

5. Using a dot (.) and cross (x) diagram, draw the structure for silicon (IV) chloride. (2mks)
   (Atomic numbers Si= 14, Cl=17)
6. Ammonium nitratewas gently heated as shown above.
   a) Complete the diagram to show how the gas is collected. (1mk)



b) Write the equation for the reaction occurring in the boiling. (1mk)

c) State one chemical test that can be used to identify the gas collected in the above set up. (1mk)

7. (a) What is a saturated solution? (1mk)

   (b) 115g of a saturated solution at $65^{o}c$ is found to contain 65g of potassium nitrate. Calculate the solubility of potassium nitrate at $65^{o}c$. (2mks)

8. What do you understand by the term prescription in relation to drugs? (1mk)

9. Starting with sodium solid, describe how a sample of sodium hydrogen carbonate crystals may be prepared. (3mks)

10. State boyles law. (1mk)

    b. a gas occupies $500cm^3$ at $27^{o}c$ and 100,000 pa. What will be its volume at $0^{o}c$ and 101325 pa. (3mks)

11. Write equations to show the effect of heat on each of the following:

a) Sodium hydrogen carbonate (1mk)

b) Silver nitrate (1mk)

d) Anhydrous iron (ii) sulphate (1mk)

12.A student electroplated a spoon with copper metal. Write an equation for the process that took place at the cathode. (1mk)

b) Calculate the time in minutes required to deposit 1.184g of copper if a current of 2 amperes was used. (1 faraday = 96500 coulombs, cu= 63.5). (2mks)

13. In the extraction of Sulphur by the frasch process, hot compressed air at 15 atmospheres is forced down the innermost pipe.

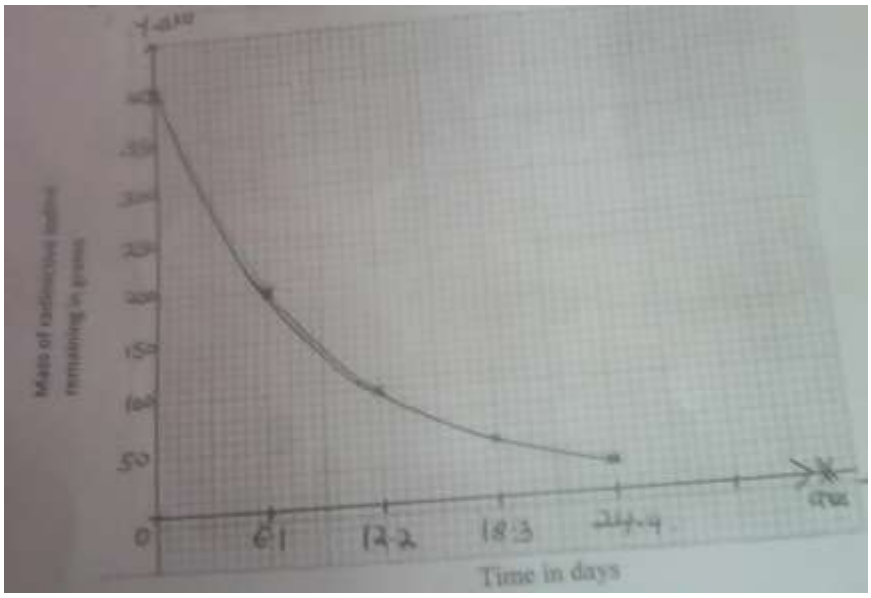
(a)What is the role of the hot compressed air? (1mk)

(b)Which allotrope of sulphur;

i. Is stable below the transition temperature at 96^0c. (1mk)

ii. has prismatic crystals (1mk)

14. The graph below shows the radioactive decay for a sample 400g of iodine -131.



a. Define half life. (1mk)

b. From the graph determine the half life of iodine -131. (1mk)

c. Determine the mass of the isotope present after 36.6 days. (1mk)

15. A certain salt was found to form a solution when exposed to air. Name the process undergone by the salt. (1mk)

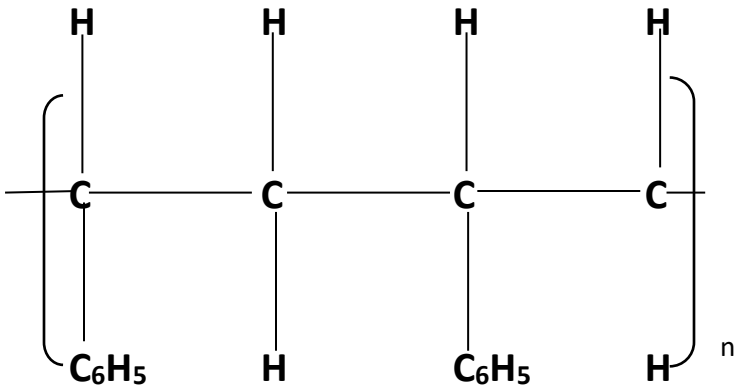
b. give one example of such a salt. (1mk)

16. State and explain two observations made when a spatula of sodium carbonate solid is added to aluminum chloride solution in a boiling tube. (2mks)

Observation

Explanation

17. The structure below shows a portion of a polymer



i. Draw a repeat unit of the polymer. (1mk)

ii. Name the polymer. (1mk)

18. Give one use and difference between the apparatus below. (3mks)

	Use	difference
		
		

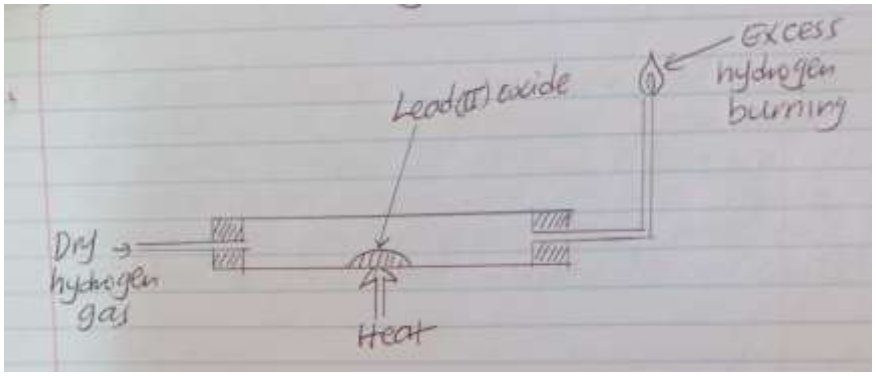
19. Element R has two isotopes with mass numbers 29.46 and 31. If the relative atomic mass of element R is 30, determine the percentage abundances of each isotope. (3mks)

20. When chlorine is bubbled through water, the resulting solution acts as a bleaching agent.

a)Write an equation for the reaction between chlorine gas and water. (1mk)

b)Using an equation, explain how the resulting solution acts as a bleaching agent(1 mk)

21. In an experiment, dry hydrogen gas was passed over heated lead (ii) oxide as shown in the diagram below.



State and explain the observations made in the combustion tube. (3mks)

22. State gay-lussacs law. (1mk)

b) A given volume of ammonia gas burned completely in air enriched with oxygen to form 300cm^{3}of steam and nitrogen gas. Assuming all volumes were measured at the same temperature and pressure, what was the volume of ammonia burned. (2mks)

23. The diagram below shows the apparatus for preparation of hydrogen sulphide gas.



a. Complete the diagram to show how hydrogen sulphide gas is collected. (2mks

b. Write an equation for the reaction that takes place in the conical flask. (1mk)

c. This experiment should only be carried out in fume cupboard. Explain (1mk)

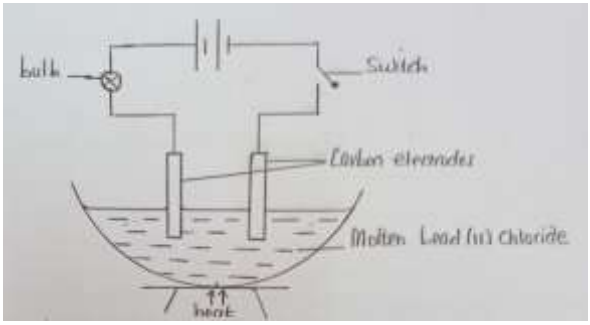
24. The table below gives some properties of three elements in group vii of the periodic table. Study it and answer the questions that follow.

Element	Atomic no	Melting point(^oC)	Boiling Point (^oC)
Chlorine	17	-101	-34.7
Bromine	35	-7	58.8
iodine	53	114	184

a. Which element is in liquid form at room temperature? Give a reason (1mk)

b. Explain why the boiling point of iodine is much higher than that of chlorine. (2mks)

25. Study the set up below and use it to answer the questions that follow.



(a) State and explain an observation that would be make at the anode when the circuit is completed. (2 mks)
(b) Write an equation for the reaction at the cathode. (1 mk)

26. In preparation of amnonia gas 30cm3 of nitrogen gas and 30cm3 of hydrogen gas were exploded in a vacuum

(i) Write an equation for this reaction. (1 mk)

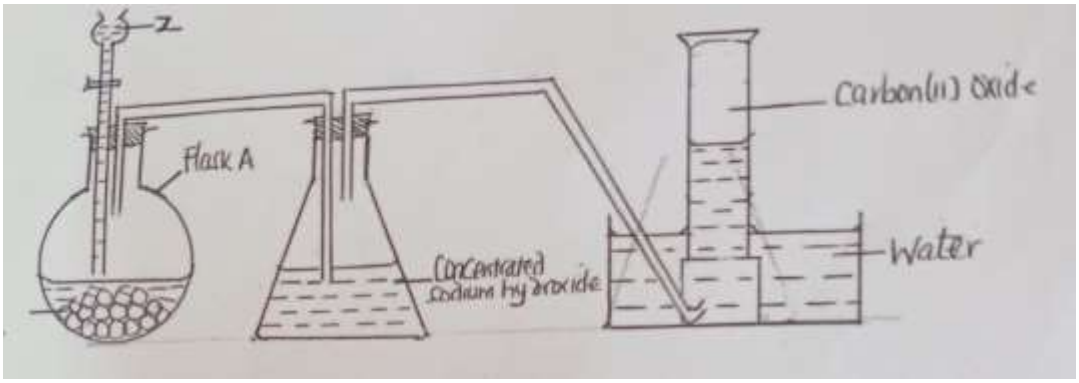
(ii) Calculate the volume of the residual gases. (2 mk)

27. juice extracted from a nettle plant were added drop wise into a boiling tube containing 5cm3 potassium hydrogen carbonate solution until there was no further change.

(a) Explain the observation made in the boiling tube when the reaction was going on. (2 mks)

(c) What observation would have been made if the nettle juice were added to silver metal in a boiling tube? Explain (1 mk)

28. The set up below was used to prepare and collect carbon (ii) oxide in the laboratory.



(i) Identify Z and give its role in the reaction. (1 mk)

(ii) Write an equation for the reaction in the flask a. (1 mk)

(iii) Give one use of carbon (II) oxide. (1 mk)

29. When 94.5g of hydrated barium hydroxide Ba(OH)2.nH2O was heated toa constant mass, 51.3g of anhydrous barium hydroxide was obtained. Determine the empirical formula of the hydrated barium hydroxide (Ba = 137, O=16, H=1) (3 mks)

PAPER 2

1. (a) The table below gives information about elements Q, R, S and T. The letters are not the actual symbols of the elements.

Element	Atomic number	Atomic radius (nm)	Ionic radius (nm)
Q	3	0.134	0.074
R	5	0.090	0.012
S	13	0.143	0.050
T	17	0.099	0.181

(i) In which period of the periodic table is element R? Give a reason. (2 mks)

(ii) Explain why the atomic radius of R is smaller than that of Q. (2 mks)

(iii) Explain why the ionic radius of T is larger than its atomic radius. (2 mks)

(iv) Using dots (.) and crosses (x) to represent the outermost electrons, draw a diagram to show the bonding in the compound formed when Q reacts with T. (2 mks)

(b) The table below shows some properties of substances E, F and G. Study it and answer the questions that follow.

Substance	**Melting point (oc)**	**Solubility in water**	**Electrical conductivity**	
			Solid state	**Molten state**
E	-39	Insoluble	Good	Good
F	1610	Insoluble	Poor	Poor
G	801	soluble	Poor	Poor

(i) Select a substance with:
Giant atomic structure _____ (1mk)

Giant ionic structure _____ (1mk)

(ii) Which substance is likely to have metallic bonding? Give a reason (2 mks)

2. (a) Define the term molar heat of combustion. (1 mk)

(b) The following results were obtained when an experiment was carried out to determine the heat of combustion of ethanol. The experiment involved heating a known volume of water with a flame from ethanol burner. The burner was weighed initially and after the experiment.

Results

Volume of water in glass beaker	= 200cm^3
Mass of ethanol burner at the start	= 86.66g
Mass of ethanol burner after experiment	=86.20g
Initial temperature of water	=24.0^{O}c
Density of water	=1g/cm^3
Specific heat capacity of water	=4.2kj/kg/k

Calculate the:

(i) Mass of ethanol burned (1 mk)

(ii) Amount of heat produced in this experiment (2)

(iii) Moles of ethanol burned (C=12, H=1, 0=16) (2 mks)
(iv) Molar heat of combustion of ethanol (2 mks)

(c) write a thermochemical equation for the combustion of ethanol (1 mk)

(d) Draw an energy level diagram for the combustion of ethanol. (3 mks)

3. Name the following compounds

(i) $CH_3CH_2CH_2C$(=O)OH (1mk)

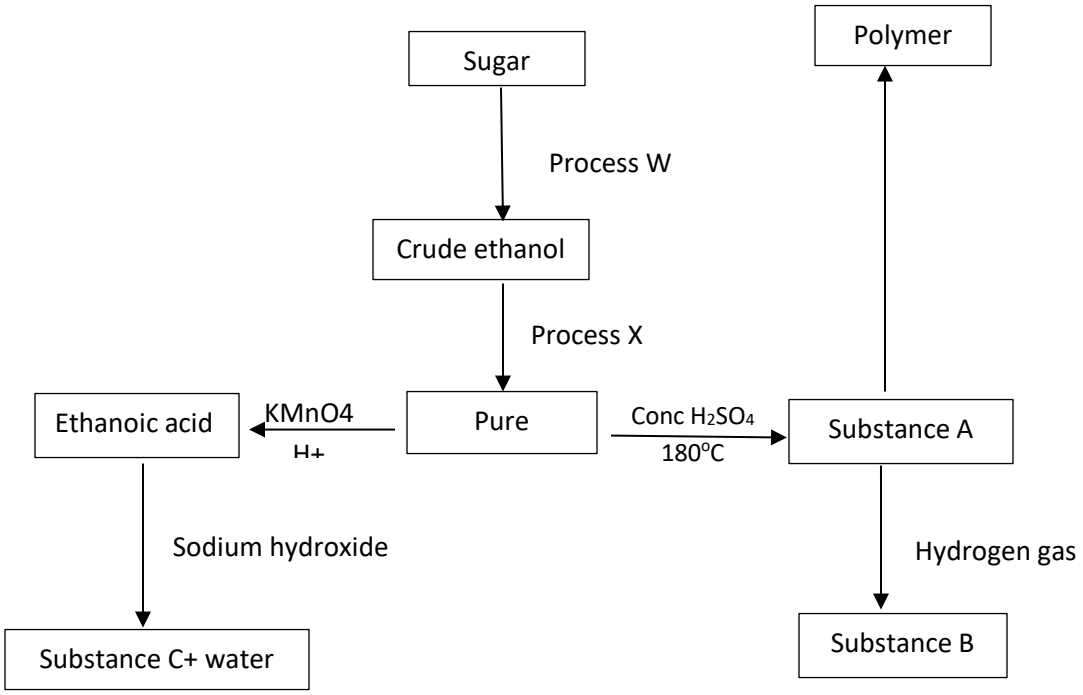
(1 mk)

(ii) $CH_3COOCH_2CH_2CH_3$ (1mk)

(b) Name any two components of crude oil found in laboratory gas (2 mks)

(c) What is the difference between thermal cracking and catalytic cracking? (2 m

(d) Study the flow chart below:-



(i) Identify process W and X (1 mk)

(ii) Name substances B and C (1 mk)

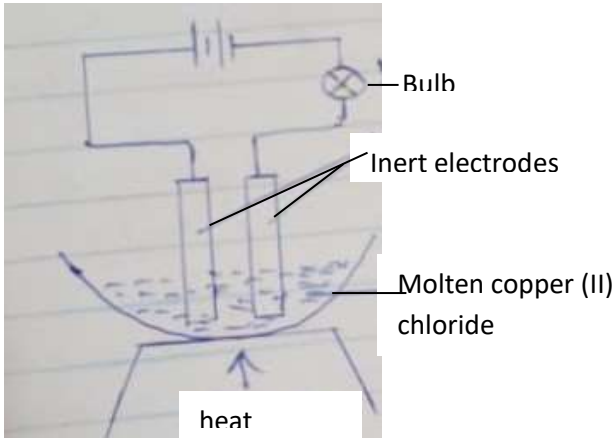
(iii) Write the equation for the reaction leading to production of substance A (1 mk)

(iv) Substance B was completely burned in air. Write the equation for the reaction (1 mk)

(v) State and explain the observation made when bromine is added to a gas jar full of substance B in the presence of sunlight (2 mk)

(vi) The polymer D has a relative molecular mass of 112, 000. Calculate the number of monomers (C=12, H=1) (2 mks)

4. (a) The diagram below shows a set up used in the electrolysis of molten copper (II) chloride using inert electrodes



(i) What happens to the brightness of the bulb as electrolysis proceeds? Explain (1 mk)

(ii) Label the cathode on the diagram above (1 mk)

(iii) Write the half equation for the reaction at the anode (1 mk)

(iv) Name a suitable pair of inert electrodes that can be used in this experiment

(b) Use the standard reduction electrode potentials given below to answer the questions that follows.

$E^{\emptyset}$ (Volts)

$Zn^{2+}_{(aq)} + Ze^{-} \longrightarrow Zn\ (s) - 0.76$

$Pb^{2+}_{(aq)} + 2e^{-} \longrightarrow Pb\ (s)\ -0.13$

$Cu^{2+}_{(aq)} + Ze^{-} \longrightarrow Cu(s) + 0.34$

$Ag+_{(aq)} + e^{-} \longrightarrow Ag_{(s)} + 0.80$

(b) (i) identify the strongest reducing agent. Give a reason (2 mks)

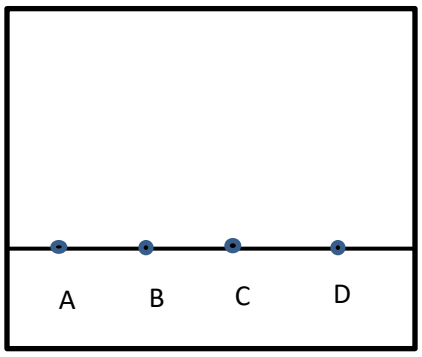
(ii) Which two half cells would give the highest emf when combined? (1 mk)

(iii) Calculate the end of the two half cells identified in (ii) above. (1 mk)

(iv) Explain whether or not the following reaction can take place: (2 mks)

(v) Draw a well labelled diagram of the electrochemical cell obtained when the half cells of lead and silver are combined. (3 mks)

5. (a) The diagram below shows spot of pure A, B and C on chromatography paper. Spot D is that of a mixture.



After development A,B and C were found to have moved 8cm, 3cm and 6cm respectively. D was separated into two sports which had moved 6cm and 8 cm.
On the diagram

(i) Label the baseline (1mks)

(ii) Show the position of all the spots after development (3mks)

(iii) Identify the substances present in the mixture D (2mk)

(b) Describe how ammonium chloride can be separated from a solid mixture of ammonium chloride and anhydrous calcium chloride (3mk)

(c) The table below shows liquids that are miscible and those that are immiscible

Liquid	L_3	L_4
L_1	Miscible	Miscible
L_2	Miscible	Immiscible

Use the information given to answer the questions that follow.

(i) Name the method that can be used to separated L1 and L3 from the mixture of the two (1 mk)

(ii) Describe how a mixture of L2 and L4 can be separated (3 mk)

6. (a) The extraction of aluminum from its one takes place in two stages, purification stage and electrolysis stage.

(i) Name the ore from which aluminum is extracted. (1 mk)

(ii) Name one impurity which is removed at the purification stage (1 mk)

(iii) Name the substance added to the electrolyte to lower in order to its melting point. (1 mk)

(iv) Write the equation for the reaction that takes place at:

Cathode (1 mk)

Anode (1 mk)

(b) Iron is extracted from its ore by the blast furnace process.

(i) Name the method used to concentrate the ore (1 mk)

(ii) Name one ore from which iron is extracted (1 mk)

(iii) One of the components of the waste gases from furnace is nitrogen (iv) oxide. Describe the adverse effects it has on the environment. (2 mks

(iv) Give two uses of wrought iron (2 mks)

(c) During the extraction of zinc, the ore is first roasted in air before feeding it into a furnace.

(i) Name the main ore from which zinc is extracted. (1 mk)

(ii) Write an equation for the reaction that takes place when the ore is roasted in air (1 mk)

(iii) Give two uses of zinc metal (2 mks)

PAPER 3

1. You are provided with:

- ✓ 4.5g of dibasic acid (**$H_2X.2H_2O$**), **Solid N**
- ✓ 0.4M sodium hydroxide, **Solution P**

You are required to:

a) You are required to determine the solubility of Solid N in water at different temperatures.
b) Determine RAM of dibasic N in $H_2X.2H_2O$.

Procedure I

(a) Place all solid N into a clean boiling tube.

(b) Using a burette, add 4cm^3 of distilled water to solid A in the boiling tube. Heat the mixture while stirring with a thermometer to about 80^{o}C. When all the solid has dissolved allow the solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid **A** first appear. Record this temperature in table I

(c) Using the burette, 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 **N** first appear.

(d) Repeat procedure (b) two more times and record the temperatures in table I.

Retain the contents of the boiling tube for use in procedure (II)

(d) Complete table I by calculating the solubility of solid **N** at different temperatures.

NOTE:

You may hasten cooling for the first two temperatures readings by pouring cold water from the tap on the sides of the boiling tube.

a) **TABLE I** **(6marks)**

Volume of water added (cm^3)	4	6	8	10
Crystallization temperature, (°C)				
Solubility of solid C in g/l00g water				

(b) Plot a graph of solubility of solid N against crystallizing temperature (3marks)

(c) Use your graph to determine

i. the solubility of solid N in water at 55°C. (1 mark)

ii. determine the temperature at which 100g of solid N would dissolve in 100 cm^3 of water. (1 mark)

Procedure II

Transfer the content of the boiling tube into 100ml Measuring cylinder. Rinse both the boiling tube and thermometer with distilled water and add to the measuring cylinder and shake thoroughly. Add more water **carefully** to make up to 100 ml mark. Label this solution **N**. Fill the burette with solution **N** ($H_2X.2H_2O$). Pipette 25cm^3 of solution **P** into a conical flask. Add 2-3 of Phenolphthalein indicator and titrate with solution **N**. Record your readings in table **II** below. Repeat the procedure and complete table **II**.

Table II (4marks)

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

i) Calculate the average volume of solution N used. (1 mark)

ii) Calculate the ;

I. Number of moles of sodium hydroxide in 25 cm^3 solution P. (1mark)

II. number of moles dibasic acid solution N used, given the equation for the reaction as;

$2NaOH + H_2X \longrightarrow Na_2X + 2H_2O$ (1mark)

III. number of moles of dibasic acid in 100cm^3 of solution N (1mark)

iii) Determine the ;

I. Relative formula mass of dibasic acid, $H_2X.2H_2O$. (1mark)

II. RAM of X in dibasic acid, $H_2X.2H_2O$. (H=1,O=16) (1mark)

2. You are provided with **solid M** containing two cations and one anion. Carry out the tests given and record your observations and deductions in the space provided.

(a) Place half of solid **M** in a clean dry test-tube and heat gently then strongly. Test any gases produced with both blue and red litmus papers.

Observation	Inference
(2 marks)	(1mark)

(b) Place the remaining solid M into a boiling tube. Add about10cm^3 of distilled water and shake thoroughly. Divide the resultant mixture into 4 portions.

(i) To the first portion add a few drops of sodium hydroxide solution till in excess.

Observation	Inference
(1 mark)	(1 mark)

(ii) To the second portion, add a few drops of ammonium hydroxide solution till in excess.

Observation	Inference
(1 mark)	(1 mark)

(iii) To the third portion, add 2-3 drops of dilute hydrochloric acid.

Observation	Inference
(1mark)	(1mark)

(iv) To the third portion, add 2-3 drops of Lead (II) nitrate solution.

Observation	Inference
(1mark)	(1mark)

(v) To the third portion, add a few drops of Barium chloride solution.

Observation	Inference
(½ mark)	(½ mark)

3) You are provided with solid **Q**. Carry out the tests below. Record your observations and inferences in the spaces provided.

i). Place about half of solid **Q** on a metallic spatula and burnt it using a non-luminous flame

Observations	Inferences
(1mark)	(1mark)

ii) Place the remaining solid **Q** in a clean boiling tube and add about $5cm^3$ of water and shake thoroughly.

I) To about $2cm^3$ of the solution **Q**, put the universal indicator paper provided to determine its P^H.

Observations	Inferences
(1mark)	(1mark)

II) To about $2cm^3$ of solution **Q**, add three drops of acidified potassium manganate (VII) solution and warm.

Observations	Inferences
(1mark)	(1mark)

III) To about $2cm^3$ of solution **Q**, add solid sodium hydrogen carbonate.

Observations	Inferences
(1mark)	(1mark)

STAREHE BOYS CENTER

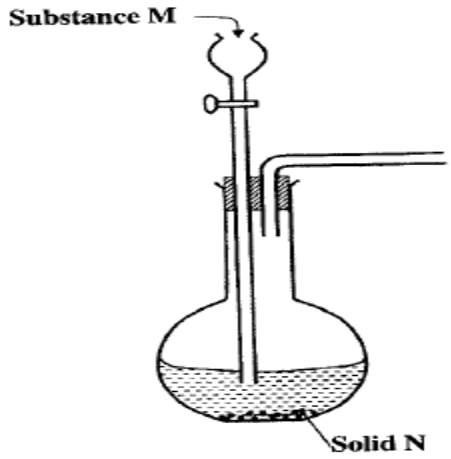
PAPER 1

1. Element **X** and **Y** have atomic numbers 12 and 8 respectively.
   (i) Write down the electron arrangement of the ions.
   (a) X^+ ……..(1mk)

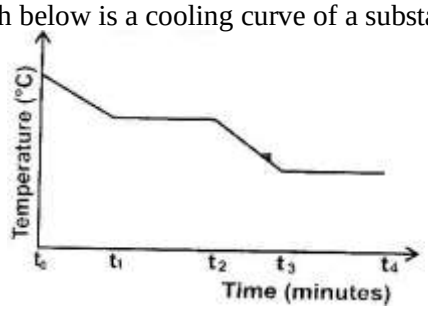
   (b) Y^- …….. (1mk)

   (ii) Write down the formula of the compound formed between **X** and **Y**. (1mk)
2. (a) when the air hole is open, the Bunsen burner produces a non-luminous flame. Explain (1mk)
   (b) Give a reason why a luminous flame is yellow and sooty. (1mk)
3. Describe how you can separate a mixture of solid Copper (II) Oxide and solid Copper (II) Nitrate (3mks)
4. A compound X is made of carbon, hydrogen and oxygen whose percentage composition by mass are 62.1%, 10.3% and the rest oxygen respectively. The relative molecular mass of X is 58. Determine the molecular formula of the compound.. (H = 1, O = 16, C = 12) (3 mks)
5. Identify the acid and base in the forward reaction using the equation below (2mks)

   $H_2O_{2(l)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + HO_2^-{}_{(aq)}$
6. A hydrocarbon, compound Z, decolourises bromine liquid in presence of light but does not decolourise acidified potassium manganate(VII).
   (i) Name and draw the structural formula of the 5^{th} member of the homologous series to which Z belongs. (2 mks)
   (ii) Draw and name an isomer of Z. (1mk)
7. (a) State Gay Lussac's law (1mk)
   (b) 15.0cm³ of ethene were mixed with 50.0cm³ of oxygen and the mixture was sparked to complete the reaction. If all volumes were measured at a pressure of one atmosphere and 25°C, calculate the volume of the resulting gaseous mixture. (2mks)
8. The set up below can be used to prepare Sulphur IV Oxide. Study it and answer the questions that follow



   (a) N is Sodium Sulphite. Name M (1mk)
   (b) Complete the diagram to show how dry Sulphur IV Oxide can be collected. (2mks)
9. The graph below is a cooling curve of a substance from gaseous state to solid state.



Give the name of the: (2mks)

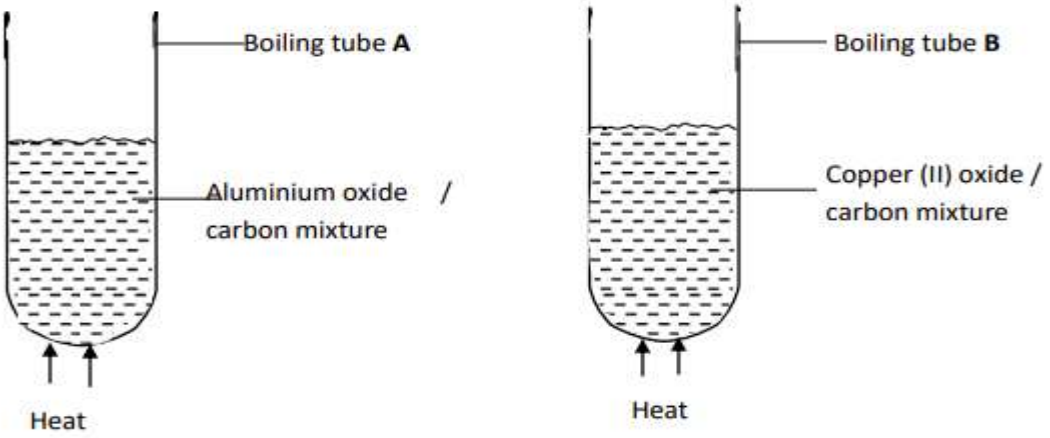
a) Process taking place between t_0 and t_1

b) Energy change that occurs between t_3 and t_4

10.Element J has two isotopes namely J-39 and J-40. Its relative atomic mass (RAM) is 39.07. Calculate the percentage abundance of each isotope. (3mks)

11. Starting with copper metal describe how crystals of copper (II) chloride can be prepared. (3mks)

12. The diagram below shows the apparatus used to investigate one of properties of carbon.



State and explain the observations in each boiling tube. (2mks)

13. 3.1g of copper (II) carbonate reacted with 100 cm^3 of 0.2 M hydrochloric acid.

a) Determine the reagent that was excess.(Cu =63.5, C= 12, O=16) (1 mk)

b) Calculate the volume of carbon(IV) oxide that was liberated at r.t.p. (2 mks)
(MGV=24.0dm^3)

14. Consider the following equilibrium reaction.

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

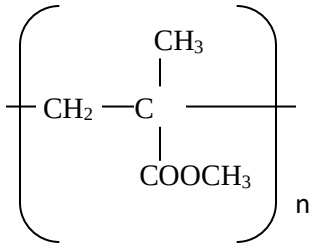
Orange Yellow

State and explain what would be observed when ***dilute hydrochloric acid*** is added into equilibrium mixture. (2 mks)

15. a) Draw a well labelled diagram to show the penetrating power of the three types of nuclear radiation (2 mks)

b) Which radiation causes more harm to human cells. Explain. (1mk)

16. Perspex is a synthetic polymer of formula;



(a) Write the structural formula of the monomer of Perspex. (1mk)

(b) State the type of polymerization involved in the formation of Perspex (1mk)

(c) Give one use of Perspex. (1mk)

17. (a)The ability of hard water to conduct electricity reduces when water is boiled but is not much affected when the water hardness is removed by addition of washing soda (Sodium carbonate). Explain.
($1^1/_2$mks)

(b)Explain how dilute hydrochloric acid can be used to differentiate between permanent and temporary hardness of water
($1^1/_2$mks)

18. Determine the oxidation state of ***manganese*** in the following; (3mks)

(i) MnO_2

(ii) $KMnO_4$

(iii)Mn_2O_3

19. Electrolysis is performed for copper (II) sulphate solution using copper electrodes.

(a) State the observation made on the electrolyte. (1mk)

……

(b) Write the equations at the anode and cathode. (2 mks)

Anode:…….

Cathode:……..

20. Briefly explain how concentration would affect the rate of reaction. (2mks)

21. (a) In an experiment to electroplate an iron watch with silver, a current of 0.5A was passed for 48minutes. Calculate the amount of silver deposited on the watch. (1F=96500C, Ag=108)
(2mks)

b) State two reasons why electroplating is important. (1mk)

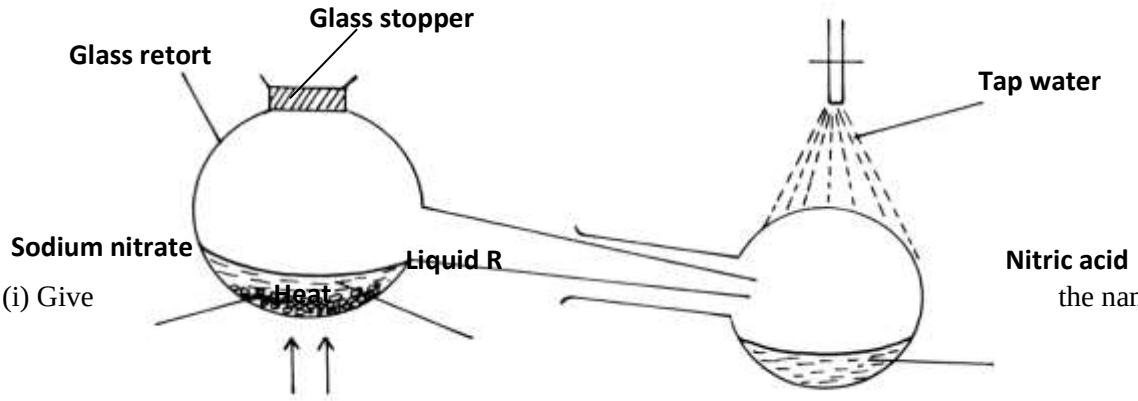
…..
…….

22. Show using dot (.) and cross (x) diagram to represent bonding in (2mks)

i) Lithium fluoride (Li=3, F=9)

ii) Carbon (iv) chloride (C=6,Cl=17)

23.The set-up below was used to prepare Nitric(V)acid.



(i) Give the name of liquid **R**. (1mk)

……..

(ii) Write an equation for the reaction which takes place in the retort flask (1mk)

……

iii) State the role of tap water. (1mk)

……

24. Chlorine dissolves in water to form two products.

(i). Name the two products. (1 mk)

…..……

……

(ii).State and explain the observations made when the mixture of the products is exposed to sunlight. (2 mks)

…..……

……

……

25. (a) State the observations made when concentrated Sulphuric (VI) acid is added to the following substances. (2 mks)

(i) Sugar crystals

……

(ii) Copper (II) sulphate crystals

……

(b) Explain why the volume of concentrated sulphuric (VI) acid tend to increase when it is left in an open place for sometimes. (1 mk)

……

……

26.Study the table below showing the solubility of a salt at various temperatures.

Temperature(degrees celcius)	Solubility(g/100g of H_2O)
0	30
30	24
70	19
100	14

325g of **a saturated solution** at 0^0C was heated to a temperature of 100^0C Calculate the mass of the salt that crystallized out. (3 mks)

……

……

……..

27. Explain the difference in melting point of magnesium oxide (3080°C) and phosphorus (V) Chloride (563°C). (3mks)

……..

……..

……..

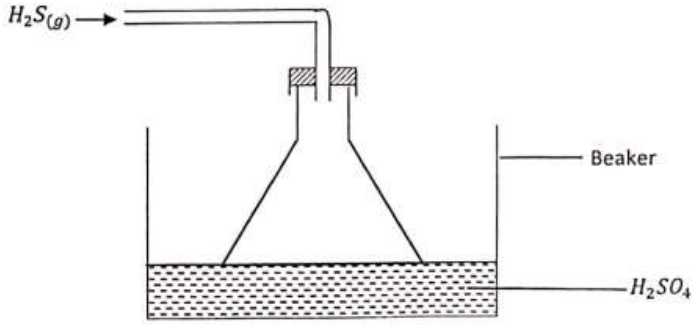
28. Classify the following salts according to their types: (3mks)

a) $Na_2CO_3.NaHCO_3.2H_2O$……

b) $CuSO_4$……

c) $NaHCO_3$……

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



(a) Give the observation made in the beaker. ($^1/_2$mk)

……

(b) Write an equation for the reaction that took place in the beaker. (1mk)

……

(c) Give one reason why the gas is directed into the beaker using the inverted funnel as above? ($^1/_2$mk)

PAPER 2

1. a) The grid below represents part of a periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of elements.

S				R	E		X	
								V
Q	Z					M		
							T	

i) Identify the most reactive non-metal (1mark)

……

ii) Which of the metal is the most reactive? Explain. (1mark)

……
……

iii) What name is given to the family of elements to which X and T belong? (1mark)

……

iv) Give reasons for the following

Ionic radius of Q is smaller than that of M 1mark

……
……

Atomic radius of Q is greater than that of S (1mark)

……
……

v) Give an element that does not form compounds under ideal conditions. Explain. (2marks)

……
……

vi) Give formula of compound formed between E and Z (1mark)

……...

b) Study the table below and answer the questions that follow.

Substance	**A**	**B**	**C**	**D**	**E**	**F**
Melting point (°C)	801	113 119	-39	5	-101	1356
Boiling point(°C)	1410	445	457	54	-36	2860
Electrical Conductivity (Solid)	Poor	Poor	Good	Poor	Poor	poor
Electrical Conductivity (Liquid)	Good	Poor	Good	Poor	Poor	Poor

i) Identify a substance with:

a) Giant metallic structure (1mark)

…….

b) Has a molecular structure and exists in gaseous state at room temperature? and pressure (1mark)

…….

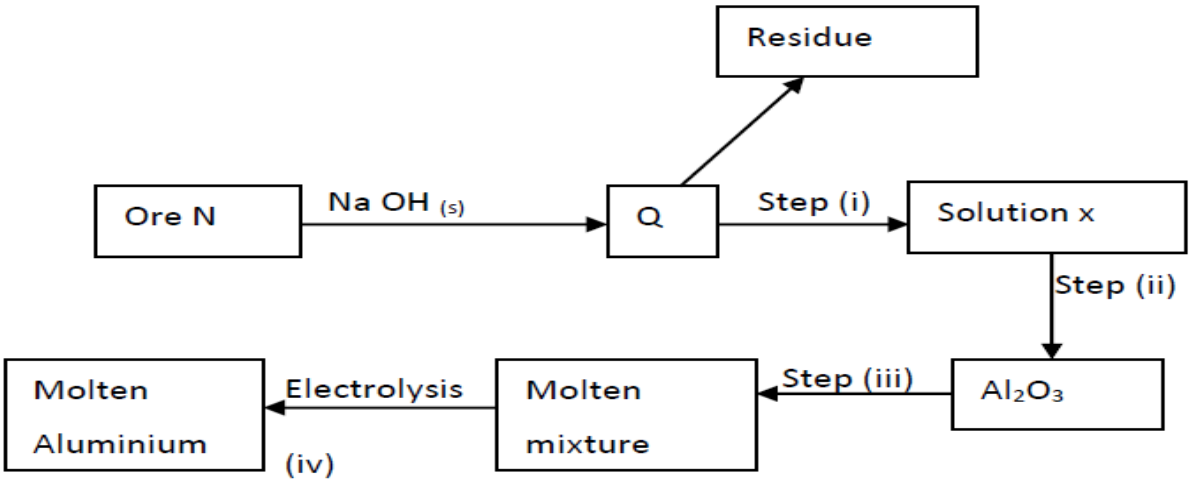
ii) Suggest a reason why substance B has two melting points. (1mark)

……..

iii) Substances A and C conduct electric current in the liquid state. State how the two substances differ as conductors of electric current. (2marks)

……

2. Study the flow chart below and answer the questions that follow.



a) Name ore N (1mark)

……..

b) Explain why the ore is first dissolved in excess sodium hydroxide solution. (1mark)

……

……

c) Name the major compound present in the residue. (1mark)

……

d) Give the formula of the aluminium compound present in solution (1mark)

……

e) **i)** Explain how to obtain aluminium hydroxide from solution X (1mark)

……

ii) Write equation for reaction that takes place in (e) above (1mark)

……

iii) What is the role of cryolite in the extraction of aluminium. (1mark)

……

f) Aluminium is a good conductor of electricity. State two uses of aluminium based on this property. (2marks)

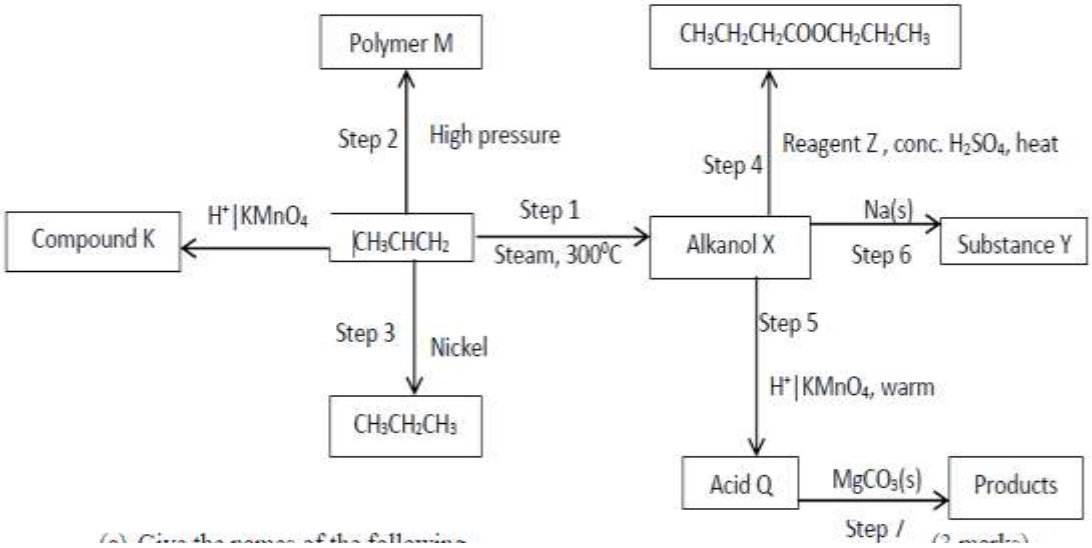
……..

g) If sodium carbonate is added to aluminium nitrate solution, effervescence occurs. Explain. (2marks)

……

……

3. Study the flow chart below and answer the questions that



follow.

a) Give the names of the following

i) Compound K (1mark)

……

ii) Substance Y (1mark)

……

iii) Product obtained in step 4 (1mark)

……

(b) Identify the **type of reaction** that takes place in step 1 and give one other condition necessary for the reaction other than the temperature indicated.

Type of reaction……. (1mark)

Condition……. (1mark)

c)Draw the structural formula of the following

i) Polymer M (1mark)

ii) Acid Q (1mark)

d) Give the **industrial application** for the reaction in step 3 (1mark)

……

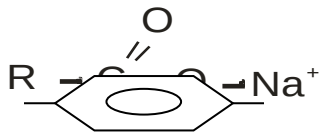
e) Write chemical equations for the reactions in step 6 and step 7 . (2marks)

Step 6 ……

Step 7

……

f) The following are structures of two cleansing agents.



R **SO_3^- Na^+**

In the table below, give one advantage and one disadvantage of each of them. (2marks)

Cleansing Agent	Advantage	Disadvantage
R-COO-Na^+		
R-OSO3-Na^+		

4. The standard reduction potentials for five half cells are shown in the table **below**. Study it and answer the questions that follow. (The letters do not represent the actual symbol of elements).

	Elements	E^θ (Volts)
(i)	$A_{2(aq)} + 2e^- \rightarrow 2A^-_{(aq)}$	$+1.09$
(ii)	$Q^{2+}_{(aq)} + 2e^- \rightarrow Q_{(S)}$	-0.13
(iii)	$R^{2+}_{(aq)} + 2e^- \rightarrow R_{(S)}$	-2.37
(iv)	$Y^{2+}_{(aq)} + 2e^- \rightarrow Y_{(S)}$	$+0.34$
(v)	$2S^+_{(aq)} + 2e^- \rightarrow S_{2(S)}$	0.00

I (a) With a reason, identify the strongest reducing agent. (1mark)

……..

(b) Which half-cell is likely to be hydrogen? (1mark)

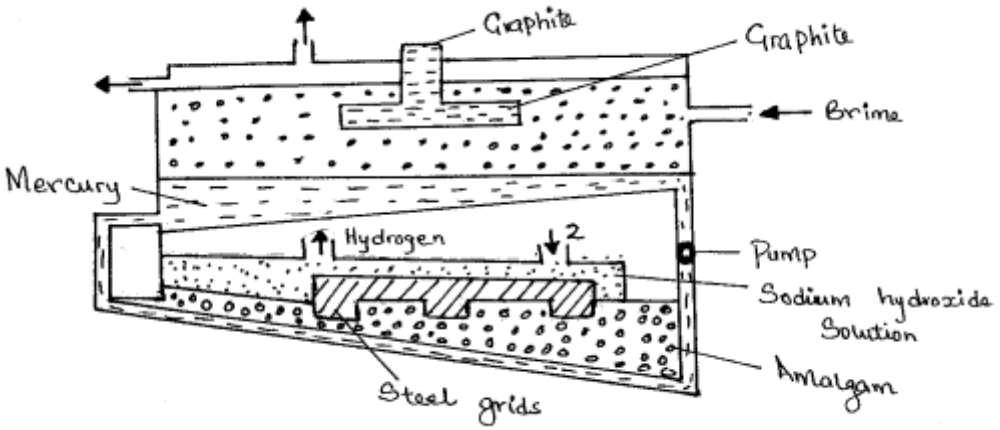
…….

(c)Write an equation for the reaction between two half cells in (ii) and (IV). (1mark)

…….

(d) Calculate the e.m.f of the cell in (c) above. (2mark)

II The diagram **below** represents a mercury cell that can be used in the industrial manufacture of sodium hydroxide. Study it and answer the questions that follow:-



(a) Name:

(i)Raw material introduced at **2**. (½ mark)

……

ii)Another substance that can be used in the cell instead of graphite. (½ mark)

……

(b)Identify the by-product that comes out at **I**. (1 mark)

……

(c)Write an equation for the reaction: -

(i)That occurred at the anode. (1 mark)

……..

(ii)In which sodium hydroxide was produced. (1 mark)

…….

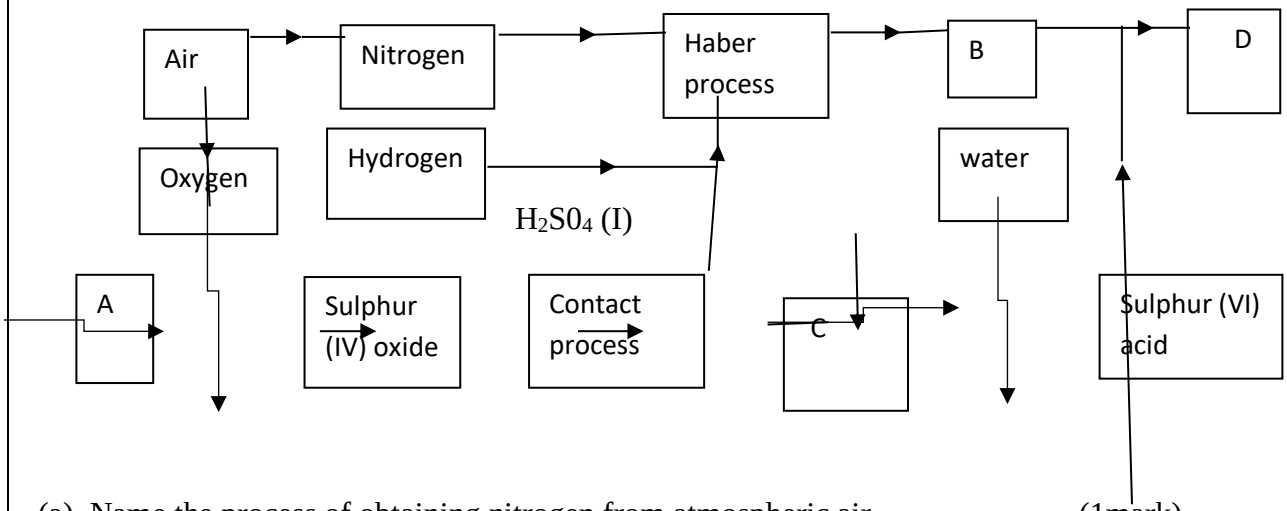
(d)Give **two** reasons why mercury is recycled. (2 marks)

…….

(e) State one use of sodium hydroxide (1mark)

……..

5. The flow chart below illustrates two industrial processes. Harber process and the contact process.



(a). Name the process of obtaining nitrogen from atmospheric air. (1mark)

.....

(b). List TWO sources of obtaining large volumes of hydrogen for industrial use.

(i) …….. (1mark)

(ii)……. (1mark)

(c) Write equation for Haber process. (1mark)

……

(d) Name the catalysts for: (1mark)

(i) Haber process

…….

(ii) Contact process

……

(e) Identify substances: (1mark)

(i) D…….

(ii) C …….

(f) Give ONE major use of compound D (1mark)

……

(g) Write an equation for dilution of C with water. (1mark)

……

h) A farmer has three plots each measuring 0.25 acres. He applied nitrogenous fertilizers as follows.

-plot A 250 kg of ammonium phosphate

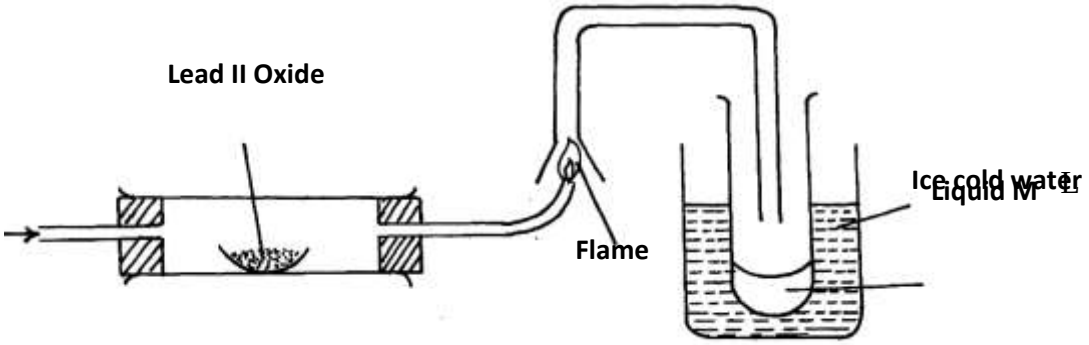
-plot B 250 kg of urea $CO(NH_2)_2$

- Plot C 250kg of ammonium nitrate

Which plot received the highest nitrogen content? (3marks)

H = 1, N = 14, 0 = 16. P = 31, C = 12.

6. Study the diagram below and answer the questions which follow.



(i) State **two** observations made when hydrogen gas pass over hot Lead (II) oxide. (2marks)

……..….

……..…..

(ii) Write the equation for the reaction which occurs in the combustion tube. (1mark)

……..…..

(iii) What property of hydrogen is shown in the experiment above. (1mark)

……..…..

(iv) Identify liquid M and describe the test for its purity (2marks)

….……

……..…..

(v) What would be observed if MgO was used instead of Lead II Oxide: Explain (2marks)

….…….

……..…..

(vi) What is the colour of the flame (1mark)

……..…..

(vii) Write a chemical equation of the reaction producing the flame. (1mark)

….……

(vii) Apart from hydrogen peroxide, state **two** other reagents that can be used to prepare oxygen gas. (1mark)

……..….

(viii) Write an equation to show how hydrogen gas is formed from the reagents chosen in (vii) above. (1mark)

……..…..

7.I. Use the data below to calculate the enthalpy change for the reaction below

$CH_{4(g)} + 2O_{2(g)} \longrightarrow CO_{2(g)} + 2H_20_{(l)}$ (3marks)

Bond	Energy (KJ)
C – H	314
O = O	296
C = O	149
H – O	283

II. Given the following Standard Molar enthalpies of combustion. Calculate the standard heat of formation of butane (C_4H_8). (3marks)

ΔH_c^θ Carbon (Graphite) = -393.5KJ/mol

ΔH_c^θ Hydrogen = 285.8KJ/mol

ΔH_c^θ butene = -2877KJ/mol

III. Use the following information to answer the questions that follow

$\Delta H_{lattice}$ $Mgcl_2$ = -2489 kJ/ mol^{-1}

$\Delta H_{hydration}$ Mg^{2+} = - 1891 kJ/ mol

$\Delta H_{hydration}Cl^-$ = -384 kJ/ mol

b) Using energy level diagram calculate the molar heat of solution of magnesium chloride. (4marks)

PAPER 3

1. You are provided with;
   - 3.6 g of solid P in a boiling tube. Solid P is a hydrated dibasic acid with the formula $H_2C_2O_4.nH_2O$
   - Solution L which is a 0.2 M sodium hydroxide solution.You are

   required to determine;
   - (i) Solubility of solid P
   - (ii) The value of n in the formula $H_2C_2O_4.nH2O$

Procedure I

I. Using a burette, add 4cm^3 of distilled water to solid P in the boiling tube. Heat the mixture while stirring with the thermometer to about 70 ºC. When all of solid has dissolved, allowthe solution to cool while stirring with the thermometer. Note the temperature at which crystals of solid P first appear. Record the temperature in **table 1** below.

II. Using the burette, add 2 cm^3 of distilled water to the contents of the boiling tube. Warm the mixture while stirring with the thermometer until all the solid dissolves again. Allow the mixture to cool while stirring. Note the temperature at which crystals of solid P appears.

III. Repeat procedure (II) three more times and record the temperatures in **table 1**. **RETAIN the contents of the boiling tube for use in PROCEDURE II**

TABLE 1

Volume of water in the boiling tube (cm^3)	Crystallization temperature (^oC)	Solubility of solid P in g/100 g of water
4		
6		
8		
10		
12		

(4marks)

(a) Complete **table 1** above by working out the solubility. (1 mark)

(b) On the graph provided, plot a graph of solubility of solid P against crystallization temperature. (3marks)

(c) From the graph, determine;

(i) The solubility of solid P at 50 ˚C (1 mark)

……

(ii) The temperature at which 65 g of solid P would dissolve in 100 g of water (1 mark)

……**Procedure II**

(i) Transfer the contents of the boiling tube from **PROCEDURE I** into a clean 250 mlvolumetric flask.

(ii) Add distilled water up to the mark

(iii) Label the resulting solution as solution P

(iv) Fill the burette with solution P

(v) Pipette $25cm^3$ of solution L into a conical flask. Add three drops of phenolphthalein indicator

(vi) Titrate solution P against solution L to an accurate end point.Record your results in **table 2** below.

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

(4 marks)

a) Calculate Average volume of solution P used. (1mark)

……

b) (i) Moles of solution L used. (1 mark)

……

……

(ii) Moles of solution P used. (1 mark)

……

……...

(iii) Moles of solution P in 250 cm^3 of solution P (1 mark)

……

……

(iv)The relative formula mass of P. (1 mark)

……

……

…..……

(c) Determine the value of n in the formula; $H_2C_2O_4.nH2O$ (H = 1, C = 12, O = 16) (2marks)

……

……

…..……

2. You are provided with solid E. Carry out the experiments below. Write your observations and inferences in the spaces provided.

Place all solid E into a boiling tube. Add about 20cm^3 of distilled water and shake. Retain the contents of the boiling tube.

Observations	inferences
1 mark	1 mark

Use 2cm^3 of solution E, in a test tube in each experiment i, ii,iii,iv and v

i. To experiment i, Add two drops of aqueous Sulphuric vi acid

Observations	inferences
1mark	1mark

ii. To experiment ii, add NaOH solution drop wise till in excess.

Observations	inferences
1mark	1mark

iii. To experiment iii, dip a stirring rod into the solution, place the rod in a non-luminous flame..

Observations	inferences
C	22

1mark 1mark

iv. To experiment iv, add two drops of lead (ii) nitrate solution.

Observations	inferences

1mark 1mark

v. To experiment v, add a piece of aluminium foil followed by sodium hydroxide solution and warm . Test the gas given out with litmus papers.

Observations	inferences

2marks 1mark

3). You are provided with liquid Q. carry out the tests below. Write your observations and inferences in the spaces provided.

i). To 2 cm^3 of liquid Q in a test tube, add universal indicator

Observations	inferences

1 mark 1 mark

ii). Place 3 drops of liquid Q on a watch glass and ignite.

Observations	inferences

1mark 1mar

iii). To 2 cm^3 of liquid Q in a test tube , add two or three drops of acidified potassium dichromate VI and warm

Observations	inferences

FRIENDS SCHOOL KAMUSINGA

PAPER 1

1. State two reasons why we use the non-luminous flame for leading in a laboratory instead of using the luminous flame. (1mk)

2. Chlorine has two isotopes with atomic mass 35 and x occurring in the ratio 3:1 respectively. The relative atomic (R.M.A) OF CHROLINE IS 35.5. Determine the value of x. (3mks)

3. The use of cfc_5 has been linked to the depletion of the ozone layer.
   a) What does CFC stand for? (1mk)

   b) Explain the problem associated with the depletion or the ozone layer. (1mk)

   c) State another environmental problem caused by CFC_5.

4. In an experiment to prepare Nitrogen C1) oxide, ammonium nitrate was gently heated in a flask.
   a) Write the equation for the reaction that took place in the flask. (1mk)

   b) State and explain how the gas was collected. (1mk)

   c) A sample of the gas was tested with damp blue and red litmus paper what observations were made. (1mk)

5. During an experiment sulphure (IV) oxide gas was formed to diffuse through a certain pore at a rate of 25cm3 per minute. When the experiment was repeated under the same conditions with another gas G, gas G was found to diffuse through the same pore at a rate of 26.26cm^3 per minute. Work out the molecular mass of Gas G. (0=16, 5=32) (3mks)

C

6. Element Y whose atomic number11 react with chlorine gas to form a compound.
    a) Name the group and period to which Y belongs. (1mk)

    b) Write an equation for the reaction. (1mk)

7. Draw all structural formulas for all the isomers with molecular formula $C_2H_3CL_3$. (2MKS)

8. Calculate the volume of 0.6M sulphuric (VI) acid solution needed to neutralize $30cm^3$ of 0.2M potassium hydroxide. (2mks)

9. Use dot (.) and crosses (x) to show the bonding of the following compounds.
    a) NH_3 (1MK)

    b) NH_4^+ (1MK)

10. Analysis of a compound showed that it had the following composition: 69.42%carbon, 4.13% hydrogen and the rest oxygen. If the molecular formula of the compound (C=12, O=16, H=1) (3MKS)

C

11. A reference book states that the solubility of $CuSO_4$ in water at 15^oc is 19g/100g of water. What is meant is meant by this statement. (1mk)

12. State two uses of hydrogen gas. (2mks)

13. Explain how a solid mixture of sulphure and potassium Chloride can be separated into solid sulphur and potassium chloride. (3mks)

14. Aqueous ammonia was added to a solution copper (ii) sulphate dropwise until in excess. State the observations made when
    a) A few drop of aqueous ammonia were added.(1mk)

    b) Excess aqueous ammonia was added. (1mk)

15. By use of chemical equations distinguish the reaction of magnesium with water and magnesium with steam. (2mks)

16. The table below gives the number of electrons, protons and neutrons in substances X, Y, and Z.

Substance	Electrons	Protons	Neutrons
X	10	10	10
Y	10	8	10
Z	8	8	8

    a) Which letter represents an ion? (1mk)

    b) Which of the substances are isotopes? Give a reason. (2mks)

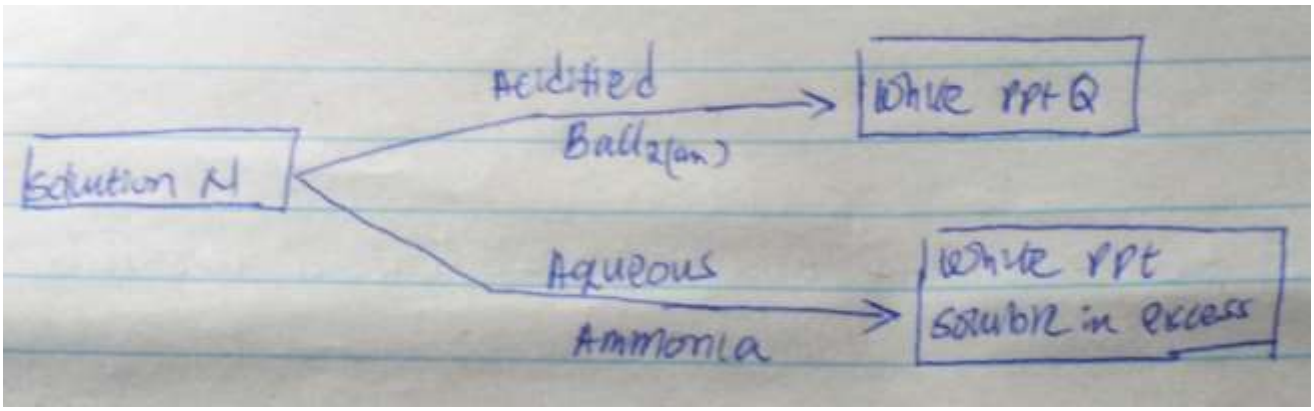
C

17. a) What is meant by the terms.
    1) Element (1mk)

    2) Atomic number (1mk)

    (b) The formula for a chloride of titanium is $TiCl_3$. What is the formula of its sulphate? (1mk)

18. The chart below shows a scheme or reactions involving a sample of solution N. Study it and answer the questions that follow.



    1) Identify the cation and the anion in solution N, (2mks)

    2) Write an ionic equation to show how Q is formed. (1mk)

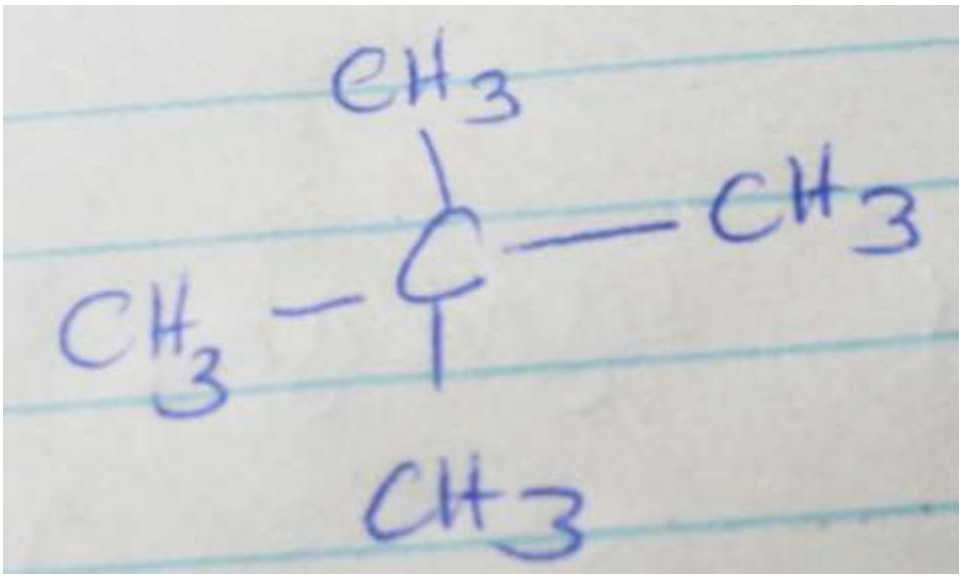
19. Name the process
    Solid carbon (IV) oxide (dry ice) changes directly into gas. (1mk)

20. When carbon (IV) oxide gas was passed through aqueous calcium hydrogen a white precipate was formed.
    a) Write an equation for the reaction that took place. (1mk)

    b) State and explain the changes that would occur when excess carbon (iv) oxide gas is bubbled through the white precipitate. (2mks)

21. Give the names of the following compounds

C



22. Explain why burning magnesium continue to burn in a gas jar full of sulphure (iv) oxide while humming splint would be extinguished. (3mks)

23. When hydrogen sulphide gas was bubbled into aqueous solution of iron (iii) chloride a yellow precipitate was formed.
    a. State another observation that was made. (1mk)

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

    c. What type of reaction was undergone by hydrogen sulphade gas in this reaction? (1mk)

24. A. What is allotropy (1mk)

    .
    B. Name two allotropes of carbon. (2mk)

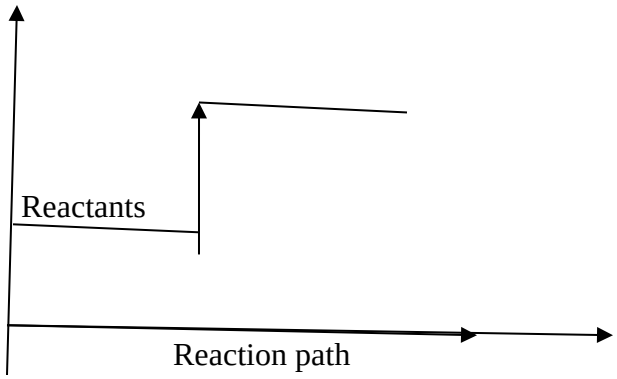
25. Ammonium sulphate is a fertilizer produced by passing ammonia gas into concentrated sulphure (VI) acid. Calculate the mass in kg of sulphure (VI) acid required to produce 25kg or the fertilizer. (s=32, 0=16, N=14,H=1) (3mks)

26. The reaction between hot concentrated Sodium hydrogen and chlorine gas produces sodium chloride (v), sodium chloride and water.
    a. Write the equation for the reaction. (1mk)

    b. Give one use of sodium chlorate (v). (1mk)

27. Explain why a solution of hydrogen chloride gas in methylbenzene does not conduct electricity but solution of a gas in water conduct electricity. (2mks)

28. Below is a sketch of a reaction profile. Study it and then answer the question that follows.
    State and explain the type of reaction represented by the profile. (2mks)



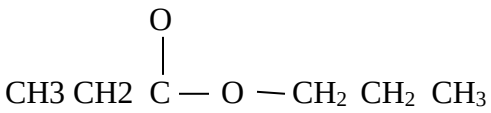
29. I) what are amphoteric oxides? (1mk)

    ii) Give a chemical formula example of an amphoric oxide. (1mk)

30. Calcium oxide can be used to dry ammonium gas.
    i. Explain why Calcium oxide is not used to dry hydrogen Chloride gas. (2mks)

    ii. Name one drying agent of hydrogen chloride. (1mk)

31. When an organic compound Y is reacted aqueous Sodium carbonate it produces carbon (iv) Oxide. Y reacts within propanal to form a pleasant smelling compound whose formula is.



i. Name and draw the structure formula of compound Y. (2mks)

ii. What is the name given to the group of compound to which Z belongs? (1mk)

32. Element X and Y have atomic numbers 20 and 8 respectively.
    i. Write the electron arrangement of their ions. (2mks)

    ii. Write the formula of the compound formed between X and Y. (1mk)

PAPER 2

1. Study the information given below and answer the questions that follow.

Element	**Atomic radius(nm)**	**Ionic radius nm**	**Formula of oxide**	**Melting point(^{0}c)**
A	0.364	0.421	A_2 O	-119
D	0.830	0.711	D O_2	837
E	0.592	0.485	E_2 O_3	1466
G	0.381	0.446	G $_2O_3$	242
J	0.762	0.676	J O	1054

   a. Which elements are non-metals .Give a reason?(2mks)

   b. I)Write a formula of a compound formed when J combines with A(1mk)

C

ii)What type of bond exist between J and D.(1mk)

c. Explain why the melting point of the oxide of E is higher than that of the oxide of G.(2mks)

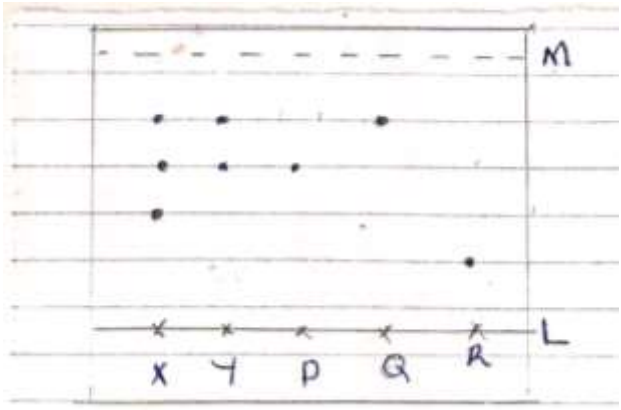
d. i)Which two elements would react with each other most vigorously.Give a reason.(2mks)

ii)Which element would be suitable for making utensils for boiling water.State two properties that make the elements suitable for the use.(2mks)

e. Elements Qand R haveelectronic configuration 2.8.2 and 2.8.6. respectfully.
i)Explain why the ionic radius of R is expected to be greater than its atomic radius.(1mk)

ii)Write the equation for the reaction between Q and R.(1mk)

2. The chromatogram below is of and acid enzyme x and y and three simple sugar P,Q and R.



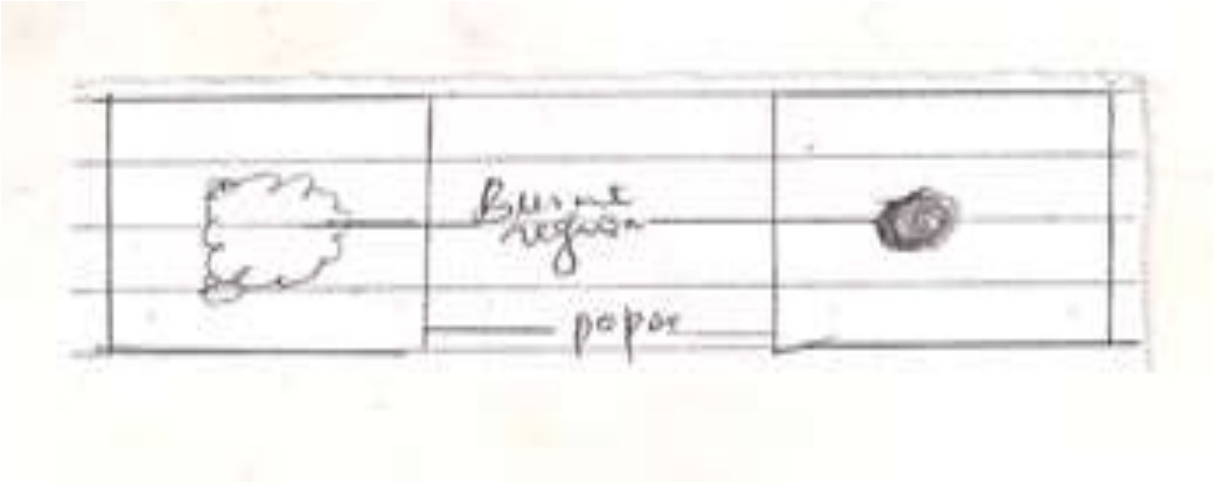
a. I)Name two simples sugars present in both x and y.(2mks)
ii)Name lines L and M. (2mks)

L-

M-
iii)What property is exhibitaed by simple sugar x.(1mk)

b.Two pieces of paper were lowered into different Bunsen burner flames and removed quickly.The results were as shown below.

C

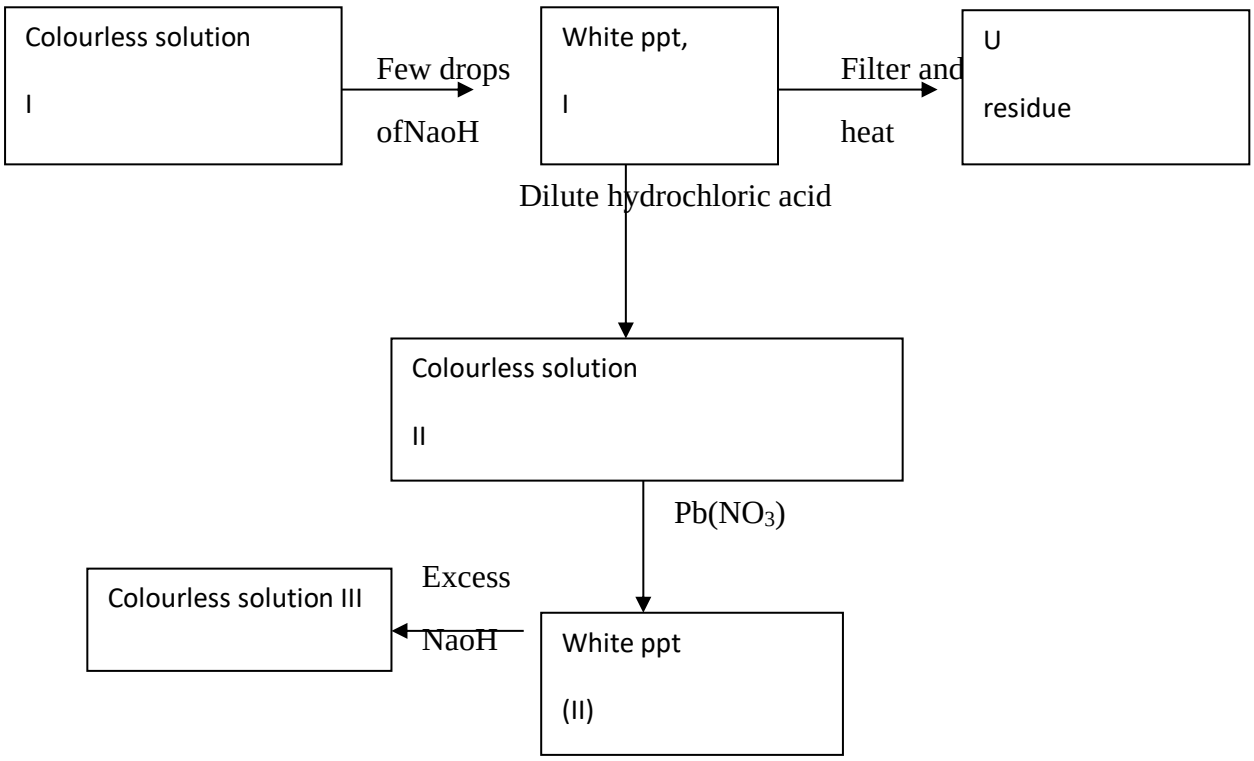


i.)Which paper was lowered into a Bunsen burner whose air hole were closed.Explain(2mks)

c.Oxygen can be obtained industrially by fractorise distribution of liquid air
i. Why is the gas mixture passed through sodium hydroxide solution.(1mk)
ii) In the final stage,which gas is distil out fuse.explain.(1mk)

iii)Name two commercial uses of oxygen gas.(1mk)

3. Study the flow diagram and answer the questions below.



a. Identify
i. White ppt I (1mk)

ii. Solution II (1mk)

iii. Residue II (1mk)

b. Write ionic equation for the reactions colourless solution (II) with $Pb(NO_3)$ 1mk

c. Write observations that would be made when ammonia solution is added drop wise till in excess to the colourless solution(II) 2mks

d. Below are P^H values of some solutions

Solution	Z	Y	X	W
P^H	6.5	3.5	2.2	7.2

i. Which solution is likely to be
   a. Acidic rain (1mk)

   b. Potassium hydroxide (1mk)

ii. A basic substance V reacted with both solutions Y and X.What is the nature of V.(2mks)

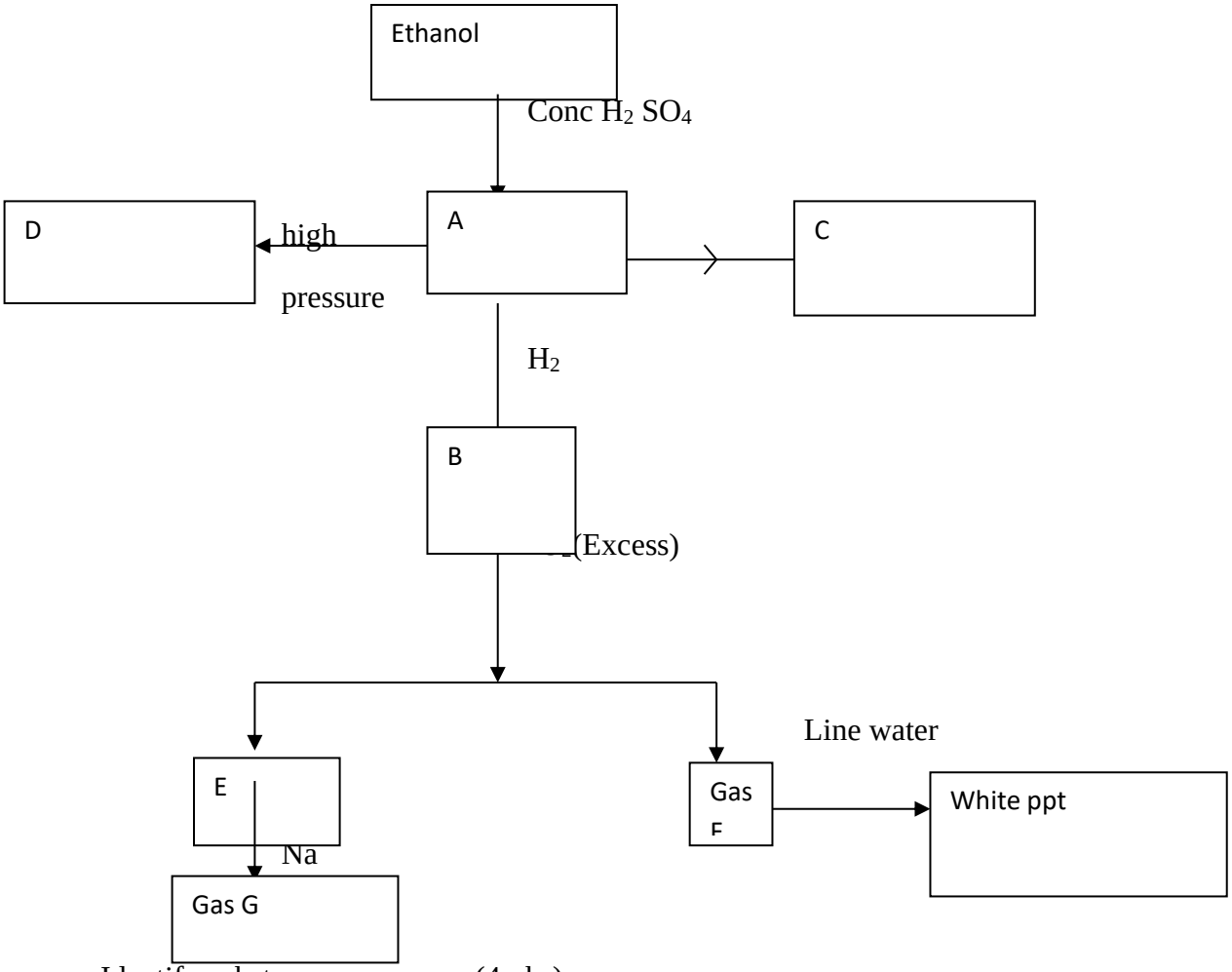
iii. Name two substances that shows this characteristics in question (ii) above.(2mks)

4. A sample of crude oil was heated and its vapour passed over red-hot pumicestore. A mixture of gases was evolved which decolourised bromine in tetra chloromethane and burnt in air with a yellow flame.
   a. What process id taking place when the vapour from the crude oil passes over heated pumice.(1mk)

   b. Name the most likely type of compound causing decolourisation of the bromine solution.(1mk)

c. Name two compounds formed when the gas mixture above burns in air.(1mk)

ii.Study the flow chart below and answer the questions that follow.



a. Identify substances (4mks)
A-
B-
F-
G-

b. Write down the equation for the formation of
i. Substance C

ii. E and F

iii. Gas G

c. Substance D was formed to have molecular mass of 42,000 .Determine the number of molecules present in the substances(H+1 ,C=12) 2mks

d. State

i. The condition necessary for the conversion of ethanol to substance A.(1mk)

ii. The catalyst required in the conversion of A and B.(1mk)

5. The table below gives the solubility of hydrated copper(ii) sulphate in mol dm^{-3} at different temperatures.

Temperature(^{0})	Solubility mol dm^{-3}
20	8×10^{-2}
40	12×10^{-2}
60	16×10^{-2}
80	22×10^{-2}
100	30×10^{-2}

i. On the drid provided plot a graph of solubility of copper(II) sulphate (vertical axis) against temperature.(3mks

ii. From the graph ,determinee the mass of copper(II) sulphate deposited when the solution is cooled from 70^0c to 40^0.(Molar mass of hydrated copper(ii) sulphate = 250g)

b.In an experiment to determine the solubility of sodium chloride ,5.0 cm^3 of a saturated solution of sodium chloride weighing 5.35g were placed in a volumetric flask and diluted to a total volume of 250$cm^{3.}$

25.0 cm^3 of the dilute solution of sodium chloride completely reacted with 24.1 cm^3 of 0.1 M silver nitrate solution.

$Ag\ No_{3(aq)} + NaCl_{(aq)} \longrightarrow Ag\ Cl_{(s)} + NaNO_3(aq)$

Calculate;

i. Moles of silver nitrate in 24.1cm^3 of solution.(1mk)

ii. Moles of sodium chloride in 25.0cm^3 of solution.(1mk)

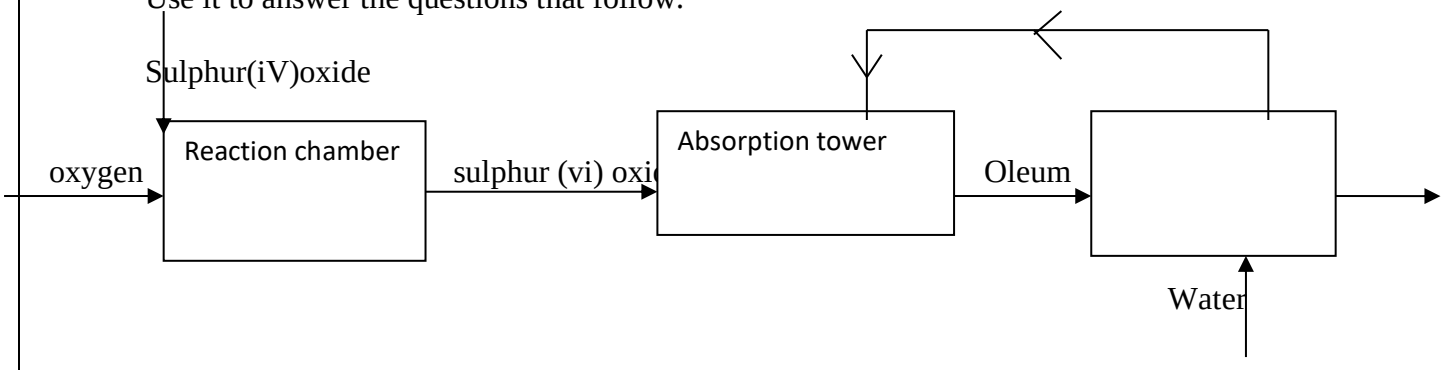
iii. Moles of sodium chloride in 250cm^3 of solution(1mk)

iv. Mass of sodium chloride in 5.0cm^3 of saturated chloride solution (Na=23.0 Cu=35.5) (1mk)

v. Mass of water in 5.o cm^3 of saturated solution of sodium chloride(1mk)

vi. The solubility of sodium chloride in g/100 g of water.(2mks)

6. The flow chart below shows some of the processes involved in large scale production of sulphur((vi) acid .
Use it to answer the questions that follow.



a. Name the process

C

b. I)Name substance A.(1mk)

ii)Write an equation for the process that takes place in the absorption tower.(1mk)

c. Vanadium (v) oxide is commonly used catalyst in the process.
   i. Name another catalyst which can be used for this process.(1mk)

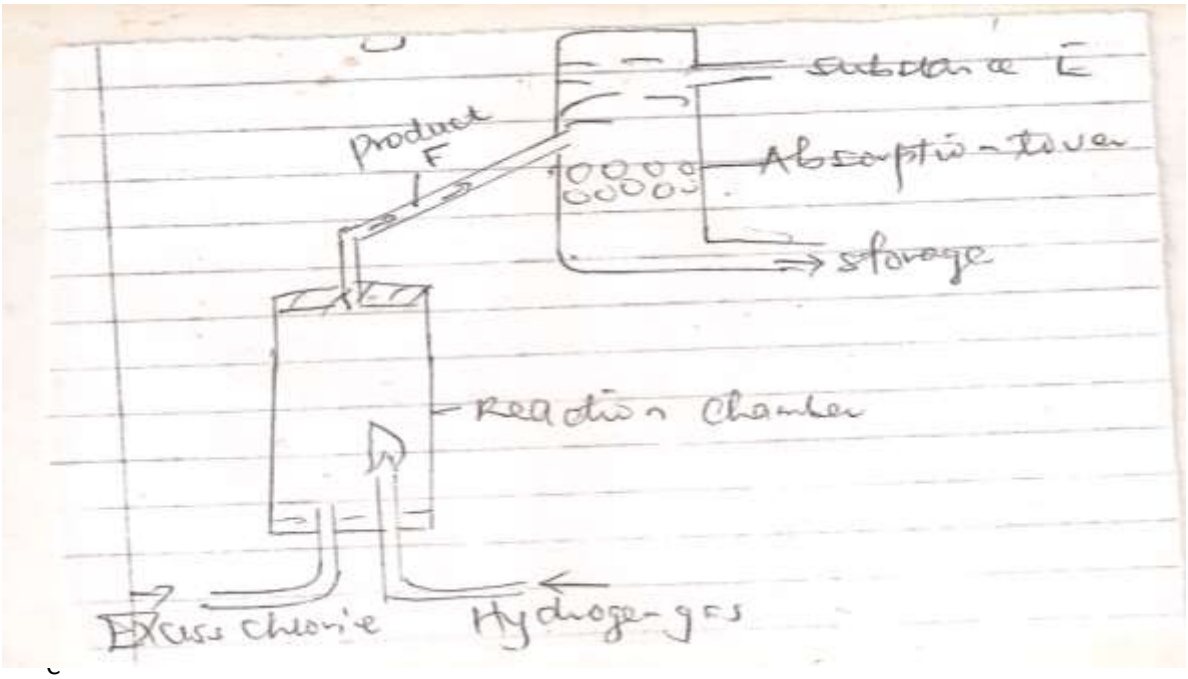
   ii. Give two why reasons vanadium (v) oxide is commonly used catalyst.(2mks)

d. Sate and explain the observations made when concentrated sulphuric (vi) acid is added to crystals copper(ii) sulphate in a beaker(2mks)

e. The reaction of concentrated sulphuric (vi) acid with sodium chloride produces hydrogen chloride gas.State the property of concentrated sulphuric (vi) acid illustrated in the reaction.(1mk)

f. Name two uses of sulphuric (vii) acid.2mks

7. The above diagram shows a set up that can be used for industrial manufacture of hydrochloric acid.Study it and answer the questions that follow.



a. Name
   i. Produce F

   ii. Substance E

b. Explain are application of hydrochloric acid in textile industry.(1mk)

c. Hydrochloricb acid was added to iron powder in a test tube and shaken thoroughly to mix to 1cm^3 of the resulting solution ,six drops of acqueous solution of ammonia were added .
   i. State the observation made on adding ammonia solution.(

   ii. Explain the observation sated above and white an ionic equation for the reaction.(2mks)

   iii. Concentrated hydrochloric is 35% pure with density 1.18g/cm^3.Calculate it's concentration in moles per litre..(3mks)

PAPER 3

You are provided with

- Anhydrous sodium carbonate solid x.
- Distilled water.
- 0.2m Hydrochloric acid solution A.

You are required to determine molar heat of solution of solid x

PROCEDURE I

i. Place 50.0ml of water in 250ml plastic beaker.

ii. Note the temperature of the water and record it in the table I below.

iii. Add all the solid X provided to the water in the beaker, stir gently with the thermometer and record the final temperature of the solution in the table I below. Keep the resulting solution for procedure 2.

TABLE I

Final temperature (^{0}C)	
Initial temperature (^{0}C)	
Change in temperature (^{0}C)	

(2 mks)

(a) What is the enthalpy change for the reaction? (Assume the density of solution is 1g/cm^3, and specific heat capacity is 4.2 Jg^{-1} K^{-1}). (2 mks)

PROCEDURE II

Transfer the contents of the beaker into 250ml volumetric flask. Rinse both the beaker and the thermometer with distilled water and ass this water into the solution in the volumetric flask. Add more water to make up to the mark. Label this solution as solution X. fill the burette with solution A. Using a pipette place 25.0ml of solution X into a conical flask. Add 3 drops of methyl orange indicator and titrate with solution A. record your readings in table II below. Repeat the titration two more times and complete the table.

TABLE II

Experiment			
Final burette reading (cm^3)			
Initial burette reading (cm^3)			
Volume of solution A used (cm^3)			

(3 mks)

(b) Calculate average volume of solution A used. (1 mk)

(c) the number of moles of solution A used. (1 mk)

(d) The number of moles of solution X that reacted with the number of moles of solution A in (c) above. (1 mk)

(e) The number of moles of solid X used in procedure I. (1 mk)

(f) Molar heat of solution of anhydrous sodium carbonate. (2 mks)

2. You are provided with:

- A solution of sodium hydroxide labeled B.

- A solution of sulphuric(vi)acid labeled C.

You are required to determine the concentration of the alkali using the following procedure.

PROCEDURE:

(i) Place 40cm^3 of sodium hydroxide solution into a 250 ml plastic beaker.

(ii) Measure 60cm^3 of sulphuric (vi) acid solution.

(iii) Determine the temperature of sodium hydroxide solution at half a minute intervals for two minutes and record it in the table below.

(iv) At 2 ½ minutes, place the 60cm^3 of solution C into the plastic beaker while stirring and resume taking the temperature in the 3rd minute.

(v) Complete the table below.

Time in minutes	0	½	1	1 ½	2	2 ½	3	3 ½	4
Temperature in ^{0}C									

Time in minutes	4 ½	5	5 ½	6	6 ½	7
Temperature in ^{0}C						

C

(3 mks)

(a) Plot a graph of temperature against time. (3 mks)

(b) From the graph, determine the highest temperature change. (1 mk)

(c) Determine the heat evolved in this experiment (Density of solution = 1 g/cm^3 specific heat capacity of solution = 4.2 Jg^{-1} K^{-1}) (2 mks)

(d) Given that the molar heat of neutralization is 56KJ/mole, determine the number of moles of sodium hydroxide used in the neutralization reaction above. (2 mks)

(e) Determine the molarity of sodium hydroxide. (2 mks)

3. You are provided with solid K. carry out the following tests and write your observations and inferences in the spaces provided.

	TEST	**OBSERVATION**	**INFERENCE**
(a)	Place a spatula full of sample K in a clean dry test tube. Heat gently and then strongly.	(1 mk)	(1 mk)
(b)	Put the remaining solid K in a boiling tube. Add about 8cm^3 of distilled water. Shake well and divide the solution into 3 portions.		
(i)	To the first portion add 3 drops of sodium hydroxide solution and then excess.	(1 mk)	(1 mk)
(ii)	To the second portion add 3 drops of ammonia solution and then excess.	(1 mk)	(1 mk)
(iii)	To the third portion add 3 drops of Barium nitrate followed by 3 drops of nitric acid.	(1 mk)	(1 mk)

(c)	You are provided with solid P. carry out the tests below and record your observations and inferences.		
(i)	Place half spatula of solid P in a non-luminous flame of a Bunsen burner.	(1 mk)	(1 mk)
(ii)	Dissolve the remaining solid in water and divide into two portions		
(a)	Add 3 drops of universal indicator to the 1st portion and determine the PH of the solution.	(1 mk)	(1 mk)
(b)	To the 2nd portion add a little sodium hydrogen carbonate	(1 mk)	(1 mk)

FOR MARKING SCHEMES INBOX 0724351706

ALL OTHER SUBJECTS ARE ALSO AVAILABLE