233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

ALLIANCE BOYS HIGH SCHOOL KCSE TRIAL AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
1		
2		
3		
4		
5		
6		
Total	**80**	

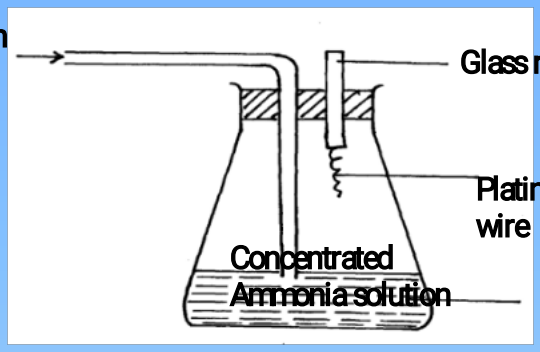
1. Hyrdogen gas is one of the lightest gas known but has not lived to its expectation to be used in Observation balloons. Explain (2mks)
2. Using dots(•) and crosses(x), show bonding in magnesium chloride. (2mks)

3. Below is a table of 1st ionization energies for elements A,B,C, and D which are metals.

Elements	A	B	C	D
Ionization energies $Kjmol^{-1}$	494	418	519	376

a) What is meant by 1st ionization energy? (1mk)
b) With an explanation, arrange the elements in order of increasing reactivities. (2mks)

4. The catalytic oxidation of ammonia gas is done as per the set up below.



a) Name the catalyst used in the above reaction. (1mk
b) After sometime, brown fumes are formed in the flask. Explain briefly how this observation occurs. (1mk)
c) Why does the metal catalyst stay red hot for some time? (1mk)

5. Using a suitable equation explain why it is not advisable to use hardwater in hot water systems. (3mks)

6. (i) Carbon(IV) oxide is one of the main contributor to global warming.
Name **two** other gases. (2mks)
(ii) What is cloud seeding ? (1mk)

7. (a) State the Lechateiler's principle. (1mk)
(b) The equation for dissolution of bismuth(III) chloride in water is

$BiCl_{3(aq)} + H_2O_{(l)} \rightleftharpoons BiOCl_{(s)} + 2Cl^-_{(aq)} + 2H^+_{(aq)}$

(colourless) (white)

Explain the effect on the position of equilibrium if sodium hydroxide solution is added to the mixture at equilibrium. (2mks)

8. Classify the following processes as either chemical or physical.

Process	Type of change
a) Heating of copper(II) suplphate crystals	(1mk)
b) Obtaining Kerosene from crude oil	(1mk)
c) Souring of milk	(1mk)

9. (a) State Gay-Lussac's law (1mk)
(b) Under certain conditions ,methane reacts with steam to form carbon (II) oxide and hydrogen only. Calculate the total volume of the gas that can be formed when $100cm^3$ of steam reacts completely with methane. (2mks)

10.

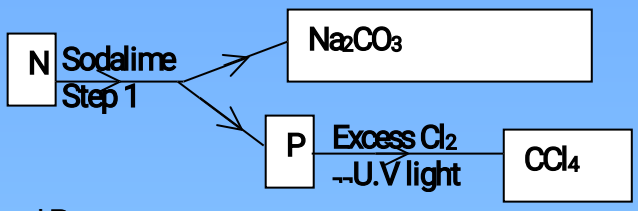
Bond	Bond energy kjmol^{-1}
C-H	414
Cl – Cl	244
C – Cl	326
H – Cl	431

Calculate the enthalpy change of the reaction. (3mks)

$CH_{4(g)} + 2Cl_{2(g)} \longrightarrow CH_2Cl_{2(g)} + 2HCl_{(g)}$

11. During the electrolysis of dilute sulphuric (VI) acid the volume of hydrogen gas collected is twice the volume of oxygen gas. Using half equations justify the above statement. (2mks)

12. Study the flow chart below and answer the questions that follow.



a) Identify **N** and **P** (2mks)

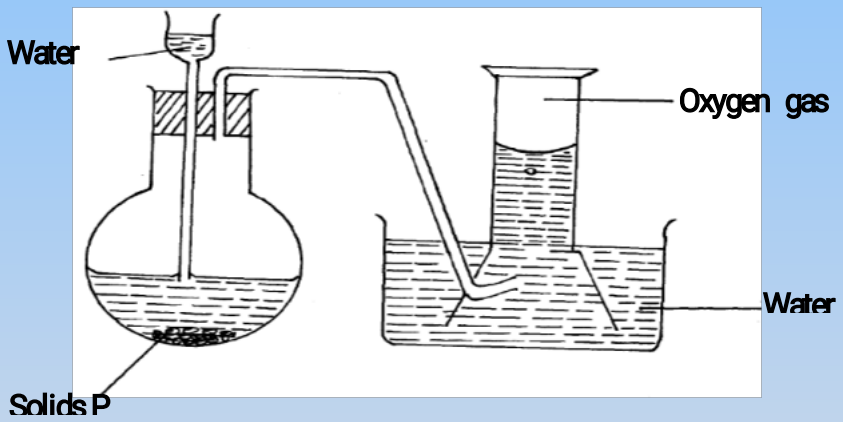
b) What name is given to the type of halogenation/Chlorination reaction in step 2 (1mk)

13. **M** grammes of a radioactive isotope decayed to 5grammes in 100days. The half-life of the isotope is 25 days.

a) What is meant by half-life? (1mk)

b) Calculate the initial mass of M of the radioactive isotope. (2mks)

14. The diagram below represents set-up that can be used to prepare and collect oxygen gas



a) Name solid **P** (1mk

b) What property of oxygen makes it possible for its collection as indicated by the diagram. (1mk)

c) Explain why it is important not to collect any gas for the first few seconds of the experiment. (1mk)

15. The compound A and B below are cleansing agents- Use it to answer the questions that follows.

A **B**

$R\text{-}COO^-Na^+$	$R\text{-}OSO_3^-Na^+$

(i) Identify cleaning agents **A** and **B** (1mk)

(ii) State **two** disadvantages of cleansing agent **B** over **A**. (2mks)

16. The standard electrode potential of four half-reactions are.

1. $Sn^{2+}_{(aq)} + 2e^- \longrightarrow Sn_{(s)}$ $E^\theta = -0.14V$
2. $Fe^{3+}_{(aq)} + e \longrightarrow Fe^{2+}_{(aq)}$ $E^\theta = +0.77V$
3. $V^{2+}_{(aq)} + 2e^- \longrightarrow V_{(s)}$ $E^\theta = -1.20V$
4. $Br_{2(aq)} + 2e^- \longrightarrow 2Br^-_{(aq)}$ $E^\theta = +1.07V$

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

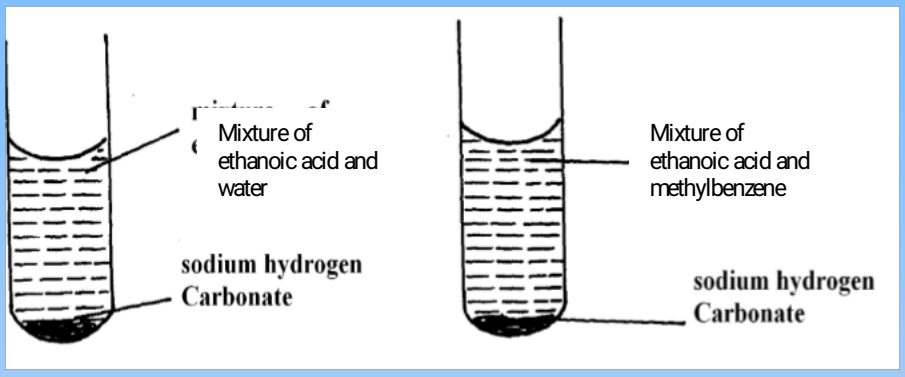
(ii) Calculate the electrode potential for the electrochemical cell constructed from half cell 3 and 4 (2mks)

17. (i) Draw the structural formula of organic compound with the formula $C_5H_{10}O_2$ giving its name. (2mks)

(ii) To which homologous series does the compound drawn above belong. (1mk)

18. $36cm^3$ of a solution of potassium hydroxide requires $25cm^3$ of 0.5M sulphuric acid to neutralize it. Calculate the concentration of alkali in g/dm^3 (3mks)

19. In an experiment , a student put equal volumes of mixture of ethanoic acid and in water and ethanoic acid in methalybenzene in two test-tubes as shown below. In each test tube equal amounts of solid hydrogen carbonate were added.



Test tube 1 Test tube 2

a) State the observation which was made in each test-tube. (1mk)

b) Explain the observation in **(a)** above. (2mks)

20. The following table gives the melting points of oxides of elements in period 3. Study it and answer the questions that follow:-

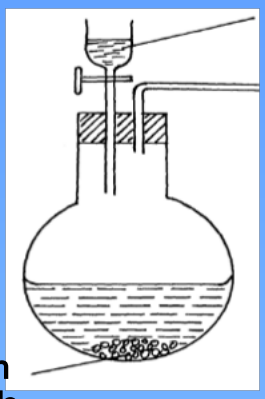
Formula of oxide	Na_2O	MgO	Al_2O_3	SiO_2	P_4O_{10}	SO_3
Melting point (°C)	1190	3080	2050	1730	560	-73

(i) Explain the difference in melting points of MgO and P_4O_{10} (2mks)

(ii) Name the compound in the above table that will dissolve both in dilute hydrochloride acid and dilute sodium hydroxide. (1mk)

21. The diagram below shows a set –up for preparation of hydrogen chloride gas.

Concentrated sulphuric acid



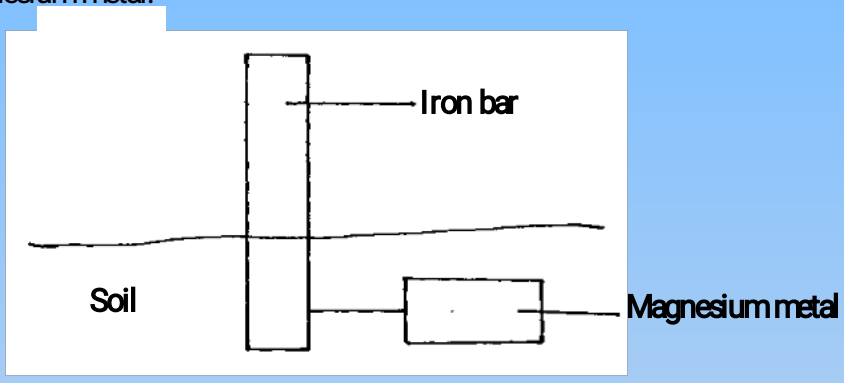
a) Complete the set-up to show how a dry sample of hydrogen chloride can be collected. (2mks)

b) Write the equation for the reaction that produces hydrogen chloride gas. (1mk)

Q

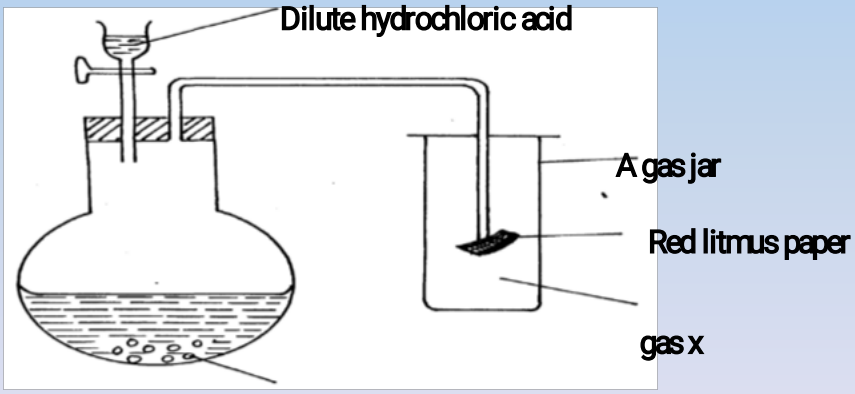
22. Describe how you would prepare crystals of sodium nitrate starting with 200cm^3 of 2M sodium hydroxide. (3mks)

23. The diagram below shows an iron bar, which supports a bridge. The iron bar is connected to a piece of magnesium metal.



Explain why it is necessary to connect the piece of magnesium metal to the Iron bar. (2mks)

24. Study the set-up below and answer the questions that follow



a) Identify gas **X** (1mk)

b) Write an equation for the reaction that produces gas **x**. (1mk)

c) What is the effect of the gas **x** above on the red-litums paper (1mk)

25. a) What do you understand by the term molar enthalpy of displacement of an element? (1mk)

b) During a displacement reaction, excess iron powder was added to 25cm^3 of 0.5M copper(II) sulphate solution. The temperature rose from 18.5°C to 33.0°C. Calculate the molar enthalpy of displacement of copper in copper (II) sulphate solution

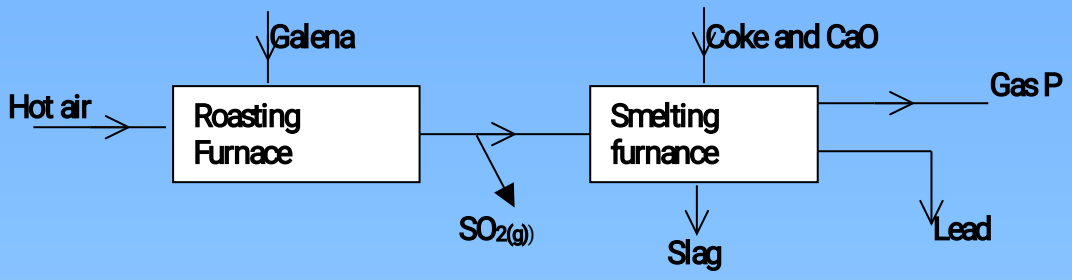
(specific heat capacity is 4.2 $Jg^{-1}K^{1}$, Density of the solution = 1.0g/cm^3) (2mks)

26. Study the scheme below and use it to answer the questions that follows.



Write down the formulae of two possible anions present in salt solution **P**.(2mks)

27. During the extraction of lead from its ores one of the main ore used is Galena

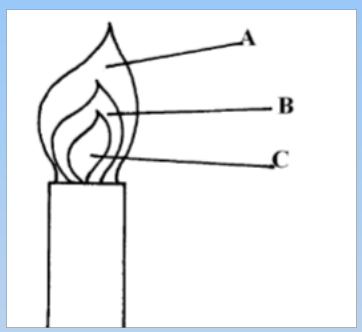


(i) Write an equation for the reaction in roasting furnace. (1mk)

(ii) Name gas

(iii) State **one** use of lead metal. (1mk)

28 The diagram below shows a Bunsen burner when in use



Which of the labeled parts is used for heating? Give a reason (2mks)

29. The table below shows solubilities of two salts M and N at different tempertarues. Study it and answer the questions that follow.

Temperature (°C)	30	90
Solubility of M in g/100g of H_2O	25.0	64.0
Solubility of N in g/100g of H_2O	32.5	48.0

A mixture of 55g of salt M in 100g of water and 30g of salt N in 100g of water were cooled from 90°C to 30°C . Calculate the mass of salt that crystallize out. (2mks)

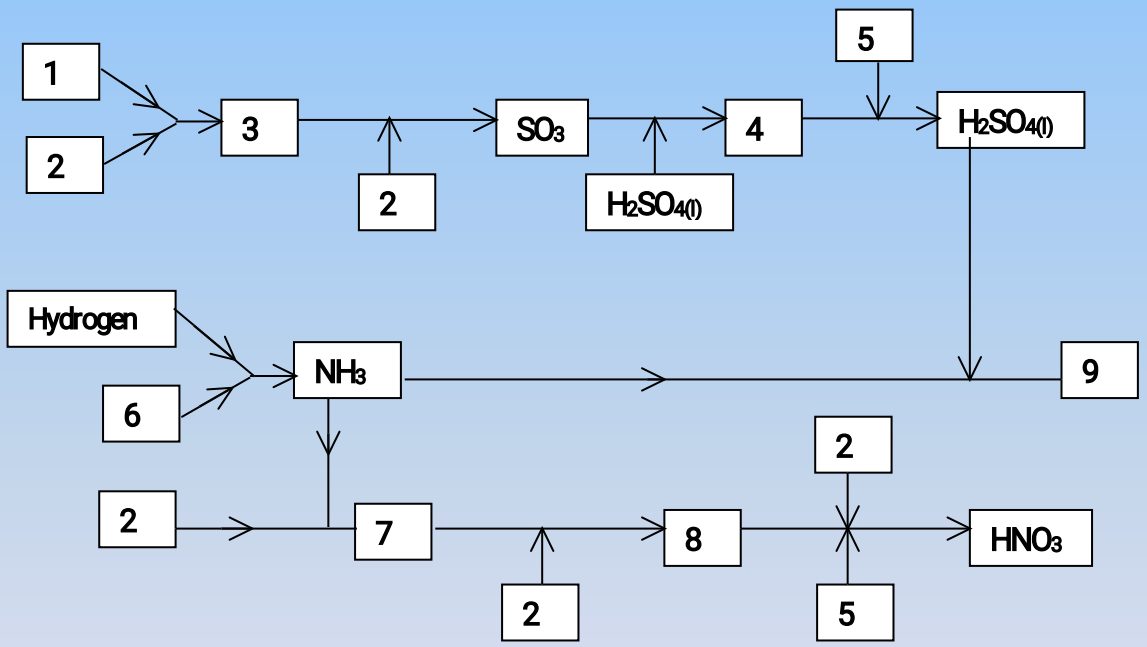
AND PRACTICE EXAM .
Paper 2

1. The table below shows the atomic numbers of some elements represented by letter J to Q (letters not their actual symbols). Study and answer the questions that follow.

Element	J	K	L	M	N	P	Q
Atomic Number	11	17	15	14	12	20	19

a) Write the electronic configuration of
(i) M (1mk)
(ii) P^{2+} (1mk)
b) Write the formula of the compound formed when **L** combines with **N** (1mk)
c) How would reactivities of element N and P with chlorine compare? Explain.(2mks)
d) Element **N** combines with oxygen to from an oxide. Using dots (•) and crosses(x) to represent the outermost electrons, show how the two elements combine. (2½mks)
e) Select the most reactive metal and non-metal and give reason for your answer. (2½mks)
f) State **one** physical and one chemical property that elements **J** and **Q** have in common (2mks)
g) What name is given to the group of elements to which element **M** belong? (1mk)
h) (i) Element K consists of two isotopes with relative abundances 75% and 25% and mass number 35 and 37 respectively find the relative atomic mass of K. (2mks)
(ii) Why is the relative atomic mass of **K** not a whole number? (1mk)

2. The chart below shows some of the chemical needed for the production of ammonia gas, nitric acid and ammonia sulphate in the industry.



(a) Name the chemical that should be in chambers **1, 2, 4, 6, 8** and **9** (3mks)
b) State **three** conditions required to convert the chemical substance in chamber 3 to $SO_{3(g)}$. (1½ mks)
c) Write balanced equations with conditions where necessary for the reactions that produces chemical substances in chambers:- (3mks)
d) Explain the following with the help of equations. When concentrated sulphulric acid

is added to copper turnings and the mixture heated, a reaction takes places producing a blue solution as one of the products, but when dilute sulphuric acid is added to copper turnings there is no charge even after heating. (1½mks)

3. a) (i) Describe how Lead(II) nitrate is prepared in the Laboratory starting from Lead (II) Oxide. (3mks)

(ii) Write an equation for the reaction that takes place. (1mk)

b) When Lead (II) nitrate crystals is heated strongly the crystals crackle and split because of the gas accumulating inside

(i) State **three** other observations that are made (3mks)

(ii) Write an equation for the reaction that takes place when Lead (II) nitrate is strongly heated. (1mk)

c) State and explain what is observed when solution is gradually added to a solution of Lead (II) nitrate until the alkali (ammonia) is in excess (2mks)

Observation:-

Explanation

d) Lead (II) ions react with iodide ions according to the equation

$Pb^{2+}_{(aq)} + 2I^-_{(aq)} \longrightarrow PbI_{2(s)}$

$300cm^3$ of 0.1M solution of iodide ions was added to a solution containing Lead (II) ions. Calculate the mass of Lead (II) iodide formed (Pb= 207, I = 127). (3mks)

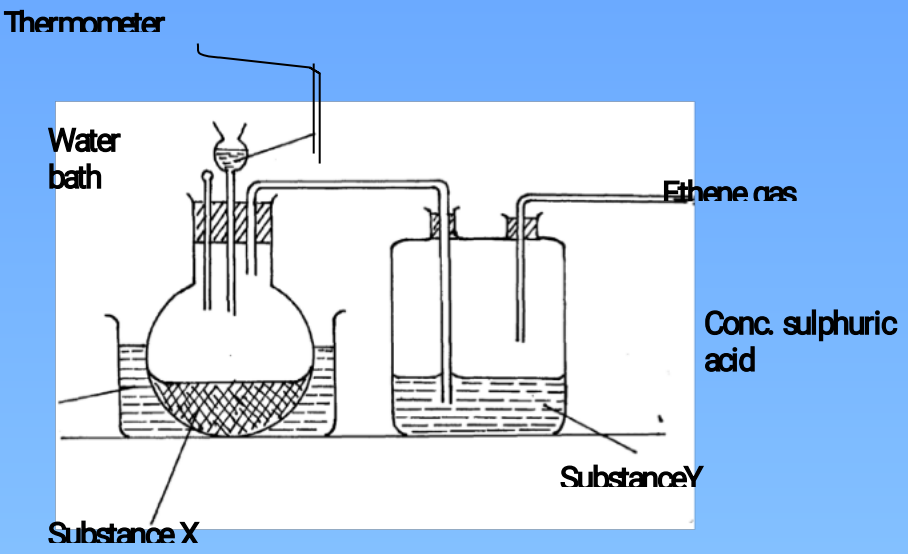
4. (a) Name the following compounds. (2mks)

(i) $H_3C - CH_2 - CH - CH - CH_3$
$\quad\quad\quad

(iv) What is a polymer. (1mk)

(v) Identify the reagent used in Step 1 (1mk)

d) The diagram below shows an incomplete set-up of the laboratory preparation and collection of ethene gas.

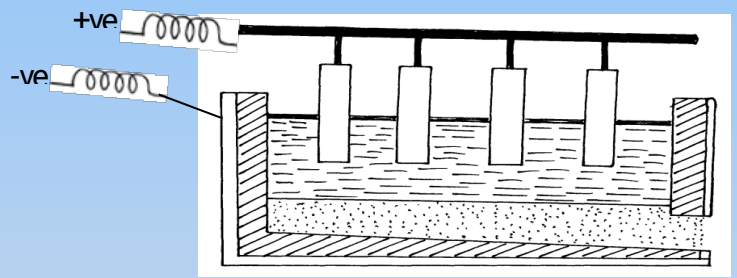


(i) Identify substances (1mk)

(ii) Complete the diagram to show how ethene gas is collected.(1mk)

(iii) Write the equation of the reaction which forms ethane gas in the above experiment (1mk)

5. a) The extraction of aluminum from it's ore takes place in two stages. Purification stage and electrolysis stage. The diagram below shows the Hall's cell for the electrolysis stage.



a) Name the chief ore from which aluminium is extract (½ mk)

b) Name an impurity which is removed at the purification stage (1mk)

c) Label on the diagram the anode, the cathode and region containing the electrolyte. (1½ mks)

d) The melting point of aluminium oxide is 2054°C but the electrolysis is carried out at temperature between 800°C – 900°C.

(i) What is done to lower the temperature? (1mk)

(ii) The aluminium produced is tapped out as liquid, what does this suggest about its boiling point? (1mk)

e) Write down the half-cell reaction at the Cathode. (1mk)

f) A typical electrolysis cell uses a current of 40,000 A, Calculate the mass in Kg of aluminium produced in One hour. (IF = 96500C, Al=27) (3mks)

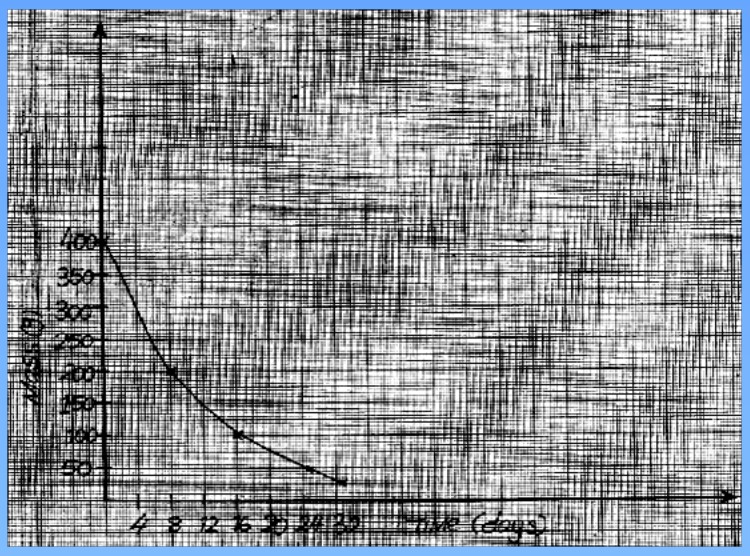
g) A part from making cooking utensils state two other uses of aluminium (2mks)

6. Define the following terms

(i) Nuclear fission (1mk)

(ii) Nuclear fussion. (1mk)

b) The graph below shows the decay for a sample of 400g of iodine-131. Study is and answer question that follow.



Decay curve of Iodine 13%

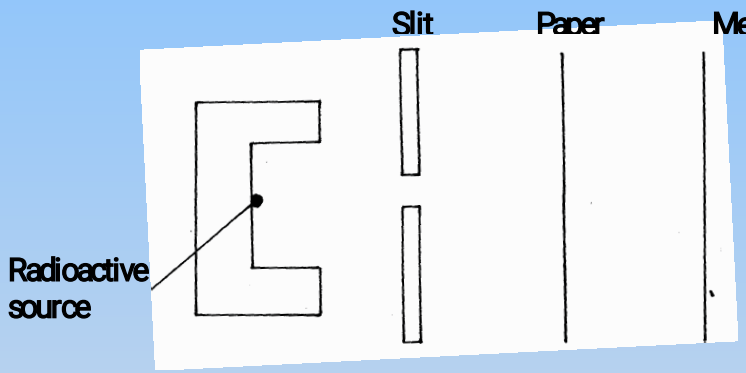
(i) Use the graph to determine the half-life of the sample (1mks)

(ii) Using a dotted line extend the graph to show what eventually happens if the sample continues decaying. (1mk)

(iii) Define the radioactive decay (1mk)

(iv) What fraction of the original sample remains after 16.2 days. (2mks)

(c) (i) Alpha (α) and Beta (β) particles can be distinguished using paper and metal foil.



Complete the diagram below to show how this is done. (2mks)

ii) Below is radioactive decay series starting from $^{210}_{82}Pb$ and ending at $^{206}_{81}Pb$

$$^{210}_{82}Pb \xrightarrow{\text{Step 1}} {}^{210}_{83}Bi \xrightarrow{\text{Step 11}} {}^{210}_{83}Pb \xrightarrow{\text{Step 111}} {}^{206}_{81}Pb$$

(i) Identify the particles emitted at step I and step II (2mks)

(ii) Write nuclear equations for reaction which takes place at step III (1mk)

e) 50g of a radioisotope $^{233}_{91}Pa$ was reduced to 6.25g after 45.5 days. Determine the half-life of $^{233}_{91}Pa$

(2mks)

f) State **two** ways in which radioisotopes poses danger to the environment.

(2mks)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

MANG'U SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
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- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 31	80	

1. Two elements **A** and **B** have electronic configurations 2.8.3 and 2.6 respectively.

a) To which group and period does element **B** belong? (1mk)

b) If the two react, what is the formula of the compound they form (1mk)

2. a) Draw a dot (•) and a cross (x) diagram to show bonding in Cl_2O. (2mks)

b) Explain why the compound Cl_2O has a very low melting and boiling point. (1mk)

3. The empirical formula of a compound is CH_2 and it has a molecular mass of 42.

a) What is the molecular formula of this compound? (1mk)

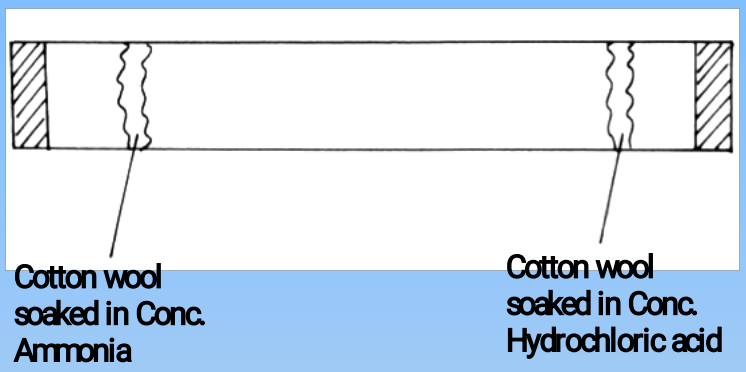
b) Write the general formula of the homologous series to which the compound belongs. (1mk)

c)

Draw the structural formula of the third member of this series and give its IUPAC name. (1mk)

4. 3.22g of hydrated sodium sulphate, Na_2SO_4 X H_2O were hearted to a constant mass of 1.42 g. determine the value of x in the formula (Na=23.0, s = 32.0, O = 16, H = 1) (3mks)

5. In an Experiment to study diffusion of gases, the following set up was used.

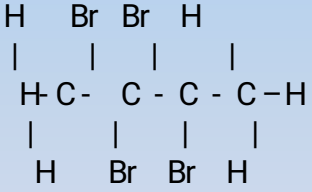


i) State and explain observations made in the experiment. (2mks)

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

6. Describe how a mixture of sodium carbonate and Lead (II) carbonate can be separated. (3mks)

7. A compound G reacts with 2 moles of bromine to form another compound whose graphical formula is.



i) What is the formula and name of compound **G** (2mks)

ii) State the observations made when acidified potassium chromate (VI) is added to compound G (1mk)

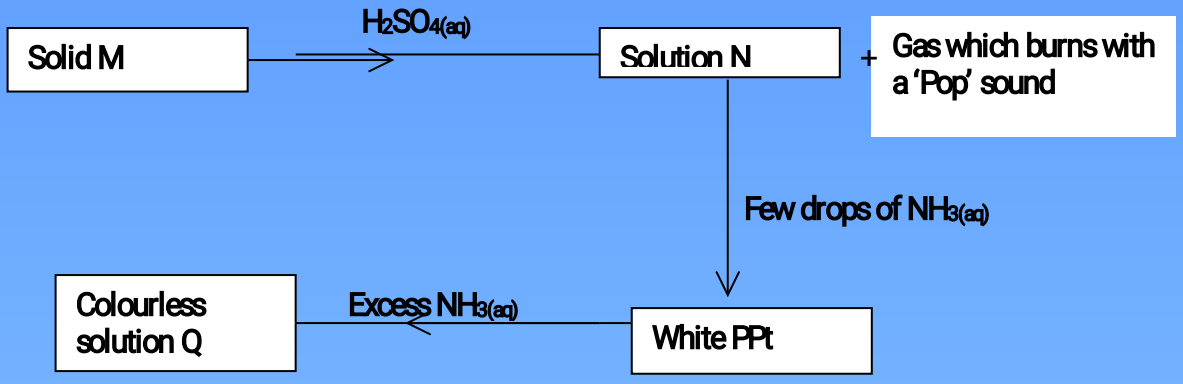
8. In terms of structure and bonding explain why diamond has a high melting point while graphite has a low melting point. (2mks)

9. Identify the acid and base in the equation below. (2mks)

$NH_4^+{}_{(aq)} + H_2O_{(l)} \rightleftharpoons NH_{3(aq)} + H_3O^+{}_{(aq)}$

10. What is the oxidation number of chlorine in $ClO^-{}_4$ (1mk)

11. The scheme below shows some reaction sequence starting with solid M



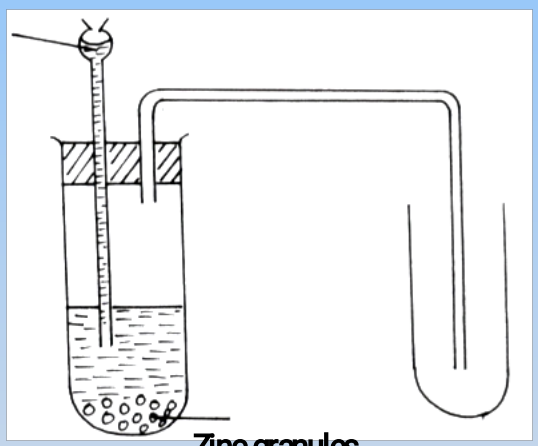
(i) Name Solid **M** (1mk)
(ii) Write the formula of complex ion present in Solution **Q** (1mk)
(iii) Write ionic equation of reaction between barium nitrate and solution N. (1mk)

12. Complete the following reactions. (2mks)

(i) $CH_3CH_2OH \xrightarrow[170^oC]{\text{Excess conc. } H_2SO_4}$

(ii) $CH_3CH_3 \xrightarrow[\text{U.V light}]{\text{1 mole } Cl_{2(g)}}$

13. Below is a set up used to collect hydrogen gas.



a) Identify with reasons, **two** mistakes in the set up. (2mks)
b) Explain the role of hydrogen in the manufacture of margarine. (1mk)

14. A white solid K was heated. It produced a brown gas **A** and another gas **B** which relights a glowing splint. The residue left was yellow even after cooling.
a) Identify gases **A** and **B** (2mks)
b) Write a balanced chemical equation for the decomposition of solid **K** (1mk)

15. $100cm^3$ of 2M Nitric acid reacted with 12.5g of a carbonate MCO3 of metal M, calculate the relative atomic mass of M (C = 12, O = 16) (3mks)

16. Dilute hydrochloric acid is warmed with sodium sulphide.
a) Write an equation for the reaction that occurs. (1mk)
b) State a chemical test for the gas evolved. (1mk)

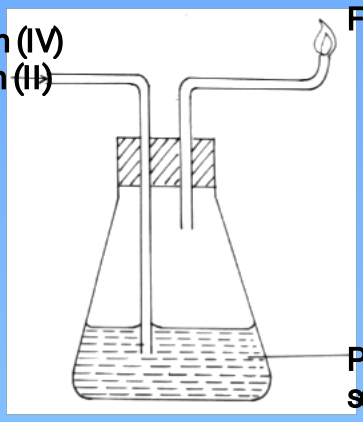
17. Write ionic equations for electrolysis of dulite sulphuric acid using platinum electrodes at: (2mks)

(i) Anode

(ii) Cathode

18. An atom X contains 90% of $^{16}_{8}X$ isotope and 10% of $^{18}_{8}X$ isotope. Calculate the relative atomic mass of X. (2mks)

19. A mixture of carbon (IV) Oxide and carbon (II) oxide is passed through potassium hydroxide solution as shown in the following set up.



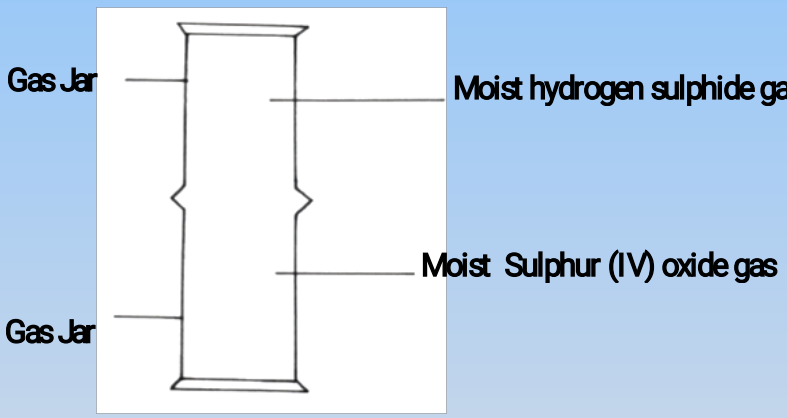
(I) Name gas X (1mk)

(ii) Why should gas X be burned. (1mk)

(iii) Write a well balanced chemical equation for the reaction that takes place in the conical flask in the first few seconds. (1mk)

20. Explain why aluminum articles are not easily corroded. (1mk)

21. State the observation made in the set-up below.



a) Observations. (1mk)

b) Explain observation in (a) above. (2mks)

22. When a current of 2.5 amperes was passed through a cell containing N^{2+} ions of a metal for 25minutes, the mass of the cathode increased by 0.36g. (*1 faraday = 96500 coulombs*)
Determine the relative atomic mass of element N. (3mks)

23. A solution containing 0.1m sulphuric acid has a pH of 2 while 5M has a pH of more than two. Explain. (2mks)

24. Explain the following:-

a) Helium is used instead of Hydrogen in balloons for metrological research. (1mk)

b) The boiling and melting points of alkali metals decreases down the group while the melting and boiling points of halogens increase down the group. (2mks)

25. Potassium exists as a radioactive Isotope $^{40}_{19}K$ as well as the non radioactive isotope $^{39}_{19}K$

a) State how the **two** isotopes differ from each other with respect to their nuclear composition. (1mk)

b) The product of a radioactive decay of $^{40}_{19}K$ is $^{40}_{20}Ca$. Explain the type of radioactive decay it undergoes. (1mk)

c) If the half-life of the radio-active isotope $^{40}_{19}K$ is 1.3×10^9 years. Determine how long it will take for 4kg of the isotope to disintegrate to 1g. (1mk)

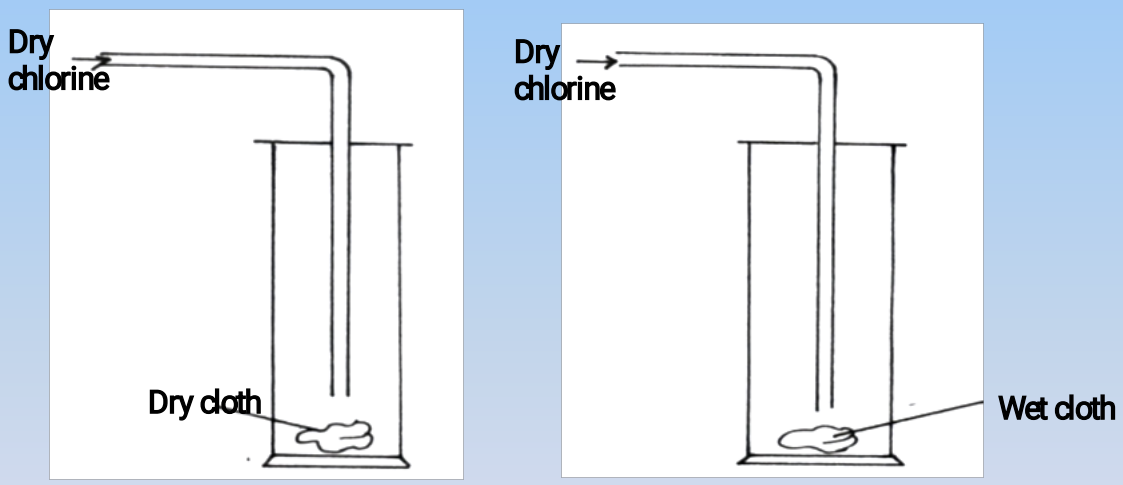
26. During the extraction of copper and Zinc from their Ores, some of the processes include.
(i) Crushing
(ii) Mixing of the crushed Ore with Oil and water and bubbling air through it.
a)(i) Name the process(ii) above. (1mk)
(ii) What is the purpose of process (ii) above? (1mk)
b) Bronze is an alloy of copper and another metal. Identify the other metal. (1mk)

27. State and explain the function of tartanic acid in baking powder. (2mks)

28. The system below is at equilibrium.
$N_{2(g)} + O_{2(g)} \rightleftharpoons 2\,NO_{(g)}$ $\Delta H = +94$ kJ.
Explain how an increase in the following affects the equilibrium position. (3mks)
(i) Temperature
(ii) Pressure.

29. The molar heat of formation of carbon (II) oxide is -105kJmol^{-1}, molar heat of combustion of carbon is -393kJmol^{-1}.
By using an energy cycle diagram, determine the molar heat of combustion of Carbon(II)oxide. (3mks)

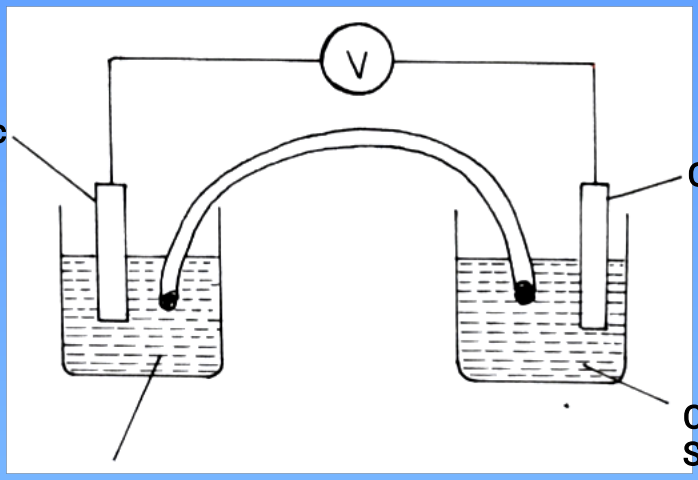
30. Dry chlorine gas was passed through two pieces of coloured cotton cloth as shown.



a) State what is observed in each experiment. (2mks)
Experiment 1
Experiment 2
b) Explain your observation using an equation. (1mk)

31. The diagram below represents an electrochemical cell.

a)



i) On the diagram label the salt bridge. (1mk)
ii) Show the direction of flow of electrons. (1mk
b) Write the overall ionic equation (1mk)

MANG'U SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .
Paper 2

1. Study the following table and then use it to answer the questions that follow

Hydrocarbon	Boiling point (k)
CH_4	112
C_2H_6	184
C_3H_8	231
C_4H_{10}	273
C_5H_{12}	309
C_6H_{14}	342

a) These organic compounds belong to the same homologous series.

i). What is meant by the term homologous series? (1mark)

ii). To which homologous series do the above hydrocarbons belong? (1mark)

iii). Select one hydrocarbon that would be a liquid at room temperature 298K. Give a reason for your answer (2marks)

iv). What is the relationship between the boiling point and the relative molecular masses of the hydrocarbons in the table above? Explain your answer (2marks)

v). Give one chemical test to distinguish between C_2H_6 and the third member to the homologous series of the general formula CnH_{2n} (3marks)

2.

a) Study the given reduction potentials and answer the questions that follow. The letters do not represent actual symbols of elements.

				E^{θ}(V)
$X^{2+}_{(aq)}$	+	$2e^-$	$\longrightarrow X_{(s)}$	-2.90
$Y^{2+}_{(aq)}$	+	$2e^-$	$\longrightarrow Y_{(s)}$	-2.38
$Z^{2+}_{(aq)}$	+	$2e^-$	$\longrightarrow Z_{(s)}$	0.00

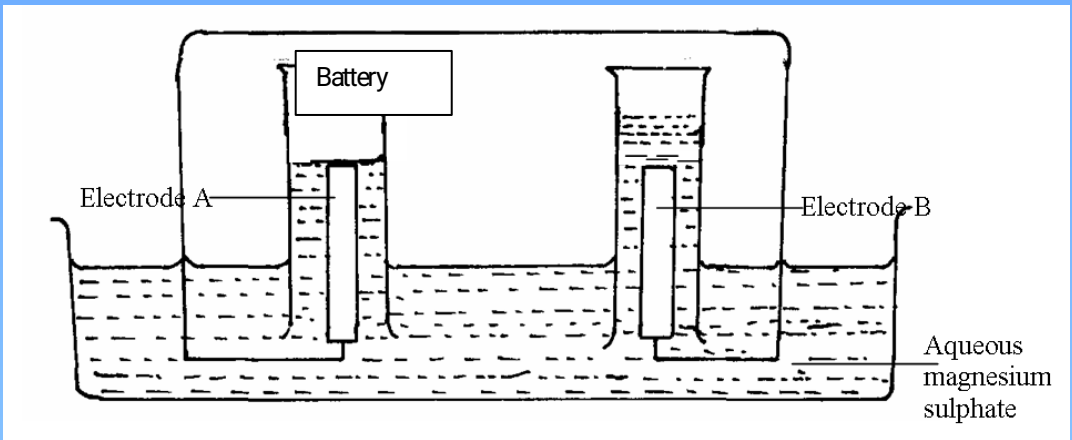
$\frac{1}{2}A_{2(g)} + e^- \longrightarrow A_{(aq)}$ +2.87

i) Which element is likely to be hydrogen? (1mark)

ii) Draw an electrochemical cell when Y and A are combined. Show the direction of flow of electrons (2marks)

iii) Draw a diagram to show how a spoon made of iron can be coated with silver metal. (2marks) b)

The set – up below was used during the electrolysis of a solution of magnesium sulphate using inert electrodes.



i). Identify the ions present in the electrolyte (1mark)

ii). Write half equations at the anode and at the cathode:

Cathode: (1mark)

Anode (1mark)

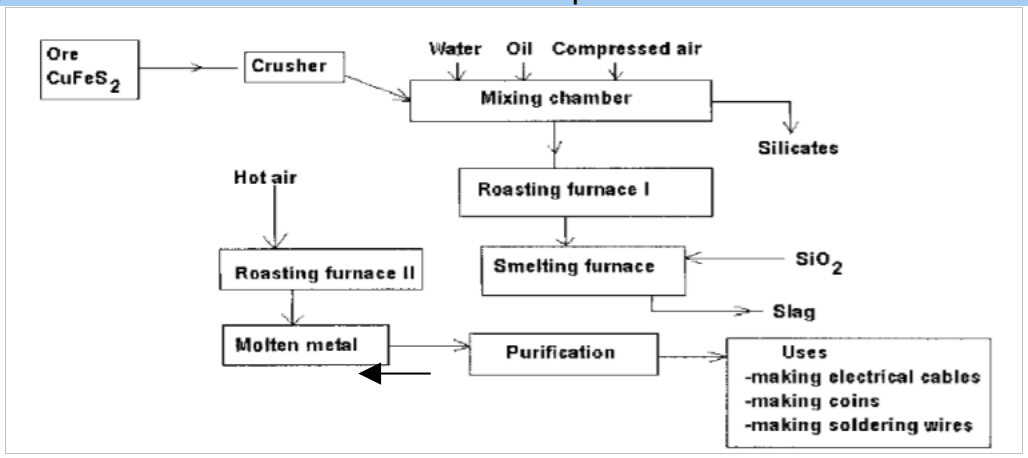
iii). Which electrode is the cathode? Explain (2marks)

a) Explain the pH changes of the electrolyte during the experiment (2marks)

b) Calculate the quantity of electricity (in coulombs) that would liberate 1.2dm^3 of oxygen gas at R.T.P

(take 1 mole of gas at r.t.p = 24dm^3, 1F = 96500C) (2marks)

3. Study the flow chart below and use it to answer the questions between.



a) Identify the process described by the flow chart (1 mark)

b) Explain why the Ore is crushed (1 mark)

c) Which process occurs at mixing chamber? (1 mark

d) Explain the use of ; (3marks)

i) water

ii) Oil

iii) Compressed airWrite down an equation for the formation of slag. (1 mark

a) Identify the cations present where the metal is being purified. (1 mark)

b) Give a reason for the following uses of this above metal.

i) making electrical wires. (1 mark)

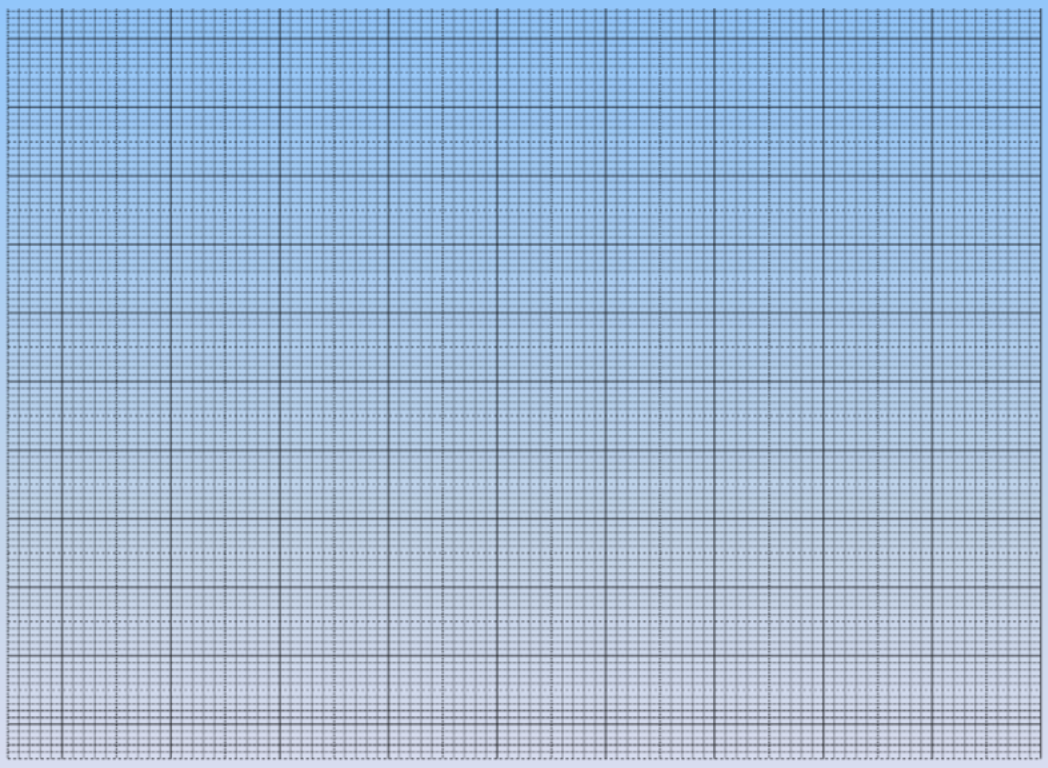
ii) Making soldering wires (1 mark)

c) Define the term half-life. (1 mark)

d) The table below gives the percentage of a radioactive isotope of Bismuth that remains after decayng at different times.

Time (Min)	0	6	12	22	38	62	100	
Percentage of Bismuth	100	81	65	46	29	12	3	

i). On the grid provided, plot a graph of the percentage of Bismuth remaining(Vertical axis) against time. (4 marks)



ii) Using the graph determine the

i) Half- life of Bismuth isotope. (1 mark)

ii) Original mass of the Bismuth Isotope given that the mass that remained after 70 minutes was 0.16g. (2 marks)

e) Distinguish between nuclear fission and nuclear fusion. (2 marks)

f) Radioactive carbon – 14 decays by emitting β- Particle to form N-14. Write a nuclear equation for the reaction. (1 mark

g) State one use of radioactive isotope in

i). Medicine (1 mark)

ii). Industry. (1 mark)

4. The grid below represents part of the periodic table. The letters do not represent the actual symbols of the elements. Study it and answer the questions that follow.

A							A	
						G	H	
B	D		E	F				J
C								

a) Explain why element A is placed in two positions in the periodic table. (2 marks)

b) Name the type of bond and structure formed when element F reacts with element G. (2 marks)

c) Select one element which forms a highly soluble carbonate. (1 mark)

d) Which name is given to the group to which element D belong?. (1 mark)

e) Compare and explain the following:

i). Atomic radii of elements B and E. (2 marks)

ii). Electrical conductivity of elements E and H. (2 marks)

f)

i). The oxide of element C was dissolved in water to form a solution of C. Compare the pH value of the solution C with that of sodium chloride solution. Give a reason for your answer. (2 marks)

ii). Give ONE use of elements of which J is a member. (1 mark)

5. 0.65 of zinc was reacted with $20cm^3$ of 2 M copper(II) sulphate solution in a plastic beaker. The copper(II) sulphate solution was in excess. The initial temperature and the highest temperature of the solution were recorded. 0.64 of copper metal was formed.

a) Other than change in temperature, state the observations made during the reaction (1 mark)

b) Calculate the

I Number of moles of Zinc that reacted (Zn=65) (1 mark)

II The number of moles of copper that was displaced from the solution (Cu=64)(1 mark)

III The mole ratio of Zn: Cu (1 mark)

c) Use the mole ratio obtained in III above to write the equation for the reaction (1 mark)

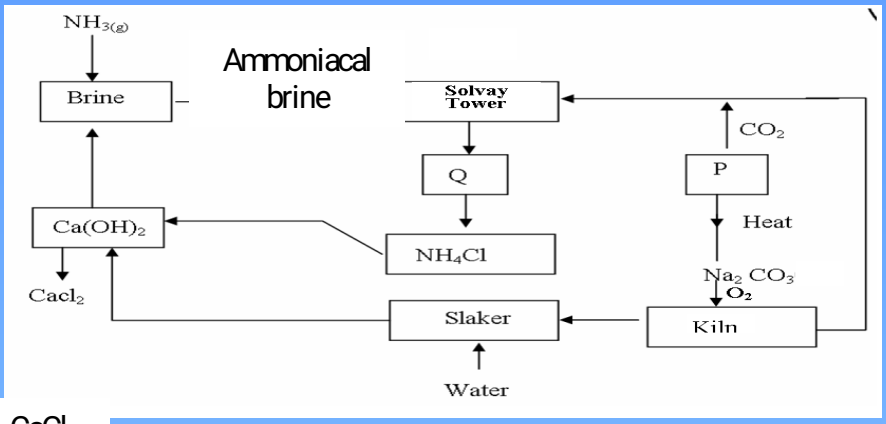
d)

i). Define the term molar heat of displacement (1 mark)

ii). The molar heat of displacement of copper by Zinc is -205.8 $KJ\,mol^{-1}$.

Determine the temperature change in the above experiment(assume density of copper(II) sulphate is $1g/cm^3$ and specific heat capacity $4.2Jg^{-1}k^{-1}$) (3 marks)

6. The flow chart below shows the manufacture of sodium carbonate. Study it carefully and answer the questions that follow.



$CaCl_2$

a) i). What is ammoniacal brine? (1mark)

ii). Ammoniacal brine reacts with carbon (IV) oxide to form a mixture of two salts which produce Q. Write an equation to show formation of Q (1mark)

Name **two** processes that are used to separate Q into NH_4Cl and P (2marks)

b) Give two uses of sodium carbonate produced in the process. (1marks)

i). Name the substance that reacts with water that comes into the slaker (1mark)

ii). What happens at the kiln? (1mark)

c) Write an equation for the reaction that occurs when P is heated to form solid Na_2CO_3 (1mark)

d) Name two substances that are recycled in the process. (1mark)

e) A factory produces 63.6 tonnes of anhydrous Na_2CO_3 on a certain day by this process. Calculate the number of tonnes of sodium chloride used on this particular day. Assume the plant is working at 100% efficiency.
(C = 12, H = 1, Cl = 35.5, Ca = 40, Na = 23) (3marks)

PAPER 1
TIME: 2 HOURS

PRECIOUS BLOOD KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

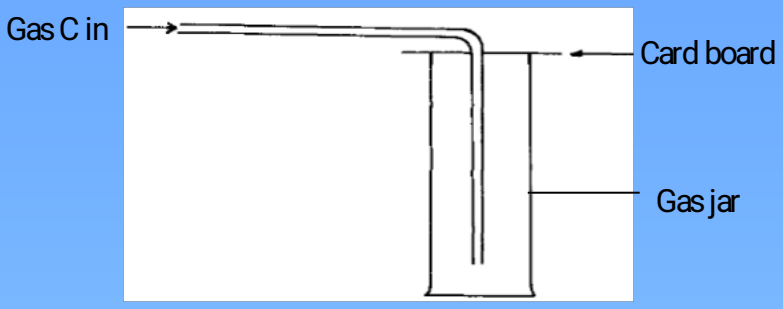
Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. a) Describe hardness of water. (1mk)

b) Explain how dilute hydrochloric acid can be used to determine the type of hardness in a sample of tap water. (1mk)

c) State **two** large scale uses of hard water. (1mk)

2. The diagram below represents a set-up of apparatus used to collect a sample of a laboratory gas C.



a) Indicate in the diagram, the direction of the movements of gas C and air inside the gas jar. Give a reason for your answer. (2mks)

b) Name **two** laboratory gases that can be collected using the same method as gas C. (1mk)

3. When burning magnesium ribbon is put into a gas jar of carbon (IV) oxide gas, it continues to burn leaving behind white solid powder and black solid specks as residue write chemical equation for the reaction that produces.

i) The white solid powder. (1mk)

ii) Black solid specks. (1mk)

4. An element X has atomic number 3, relative atomic mass 6.94 and consists of two isotopes of mass numbers 6 and 7.

a) What is the mass number of the more abundant isotope of X? (1mk)

b) Calculate the relative abundance of each of the isotopes. (2mks)

5. Explain the meanings of the following physical properties of laboratory gases.

i) A chocking smell. (1mk)

ii) An irritating smell. (1mk)

iii) A neutrol gas (1mk)

6. The following grid represents an extract of a periodic table. Use the grid to answer the questions that follow.

On the grid above;

a) Indicate by means of an arrow showing an increasing trend in the reducing power of elements. (1mk)

b) Mark element J a metal and element Q a non-metal, such that compound J,Q, has the highest ionic character. Explain. (2mks)

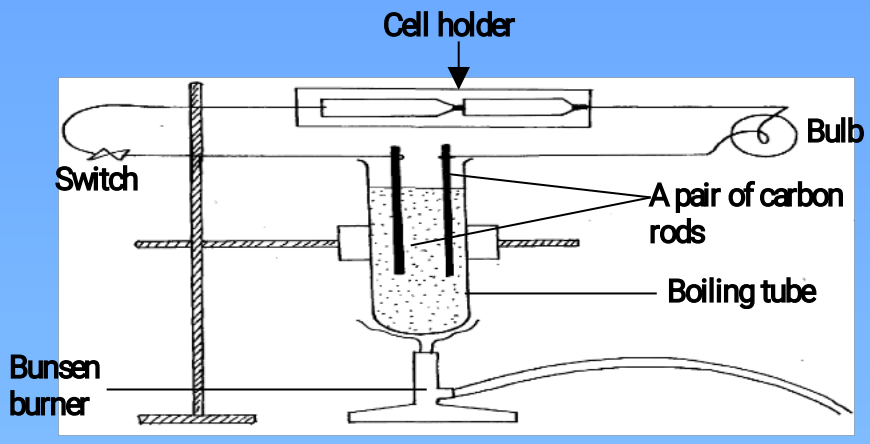
7. A hydrocarbon has an emperical formula C_2H_3 and a relative molecular mass of 54.

a) Determine the molecular formula of the hydrocarbon (C=12; H=1) (1mk)

b) Name the homologous series to which the hydrocarbon belongs. Give a reason for your answer. (1mk)

c) When **one** mole of the hydrocarbon reacts with one mole of hydrogen chloride gas, compound W is formed. Give the IUPAC systematic name of W. (1mk)

8. The diagram below represents a set-up used to investigate the effect of electric current on sodium chloride.



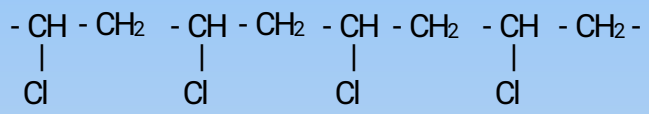
Explain why the bulb did not light when the switch was put on. (3mks)

9. In an experiment, 1g of calcium carbonate was completely dissolved 100cm^3 of 0.25M excess hydrochloric acid.

Calculate the molar concentration of the acidic solution formed. (Ca = 40; C = 12; O = 16) (3mks)

10. Describe how you would obtain pure solid samples of each of the following components of a solid mixture containing ; Lead (II) chloride, Sodium carbonate and calcium sulphate. (3mks)

11. a) Name the polymer with the following structural formula. (1mk)



b) State **one** commercial use of the polymer. (1mk)

12. a) Write a chemical equation to represent the chemical reaction between an acid and water. (1mk)

b) State **two** commercial uses of suphuric acid. (1mk)

13. When aqueous potassium hydroxide is electrolysed using platinum electrodes, hydrogen gas is produced at the cathode.

a) Give a reason why platinum is described as an inert electrode. (1mk)

b) Explain how hydrogen gas is produced in this experiment. (2mks)

14. The heat of combustion of carbon, hydrogen and methane are 405kJmol^{-1}, 286kJmol^{-1} and 886kJmol^{-1} respectively.

Calculate the heat change for the reaction, ΔH. (3mks)

$C_{(s)} + 2H2_{(g)} \longrightarrow CH_{4(g)}; \Delta H$

15. When chlorine gas is dissolved in water it acts as a bleaching agent.

a) Write a chemical equation to show the role of water in the bleaching property of chlorine. (1mk)

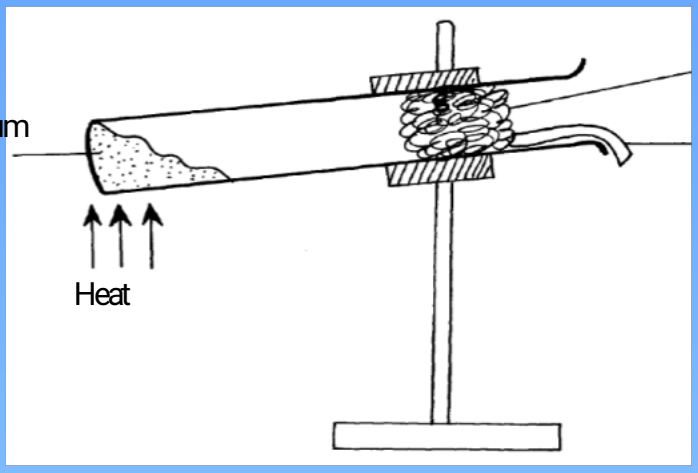
b) Name the chlorine compound that is present in the commercial bleaching agents. Give a reason for your answer. (2mks)

16. a) State Boyle's gas Law. (1mk)

b) A fixed mass of a gas has a volume of 250cm^3 at 27°C and 750mmHg pressure.

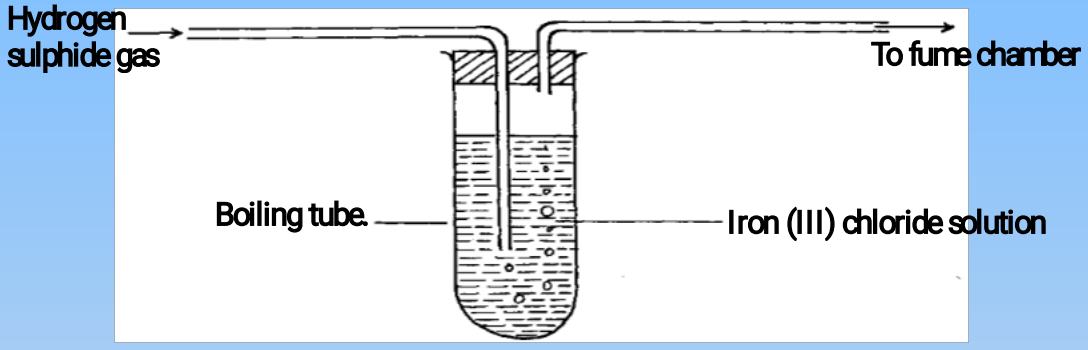
Calculate the gas volume that the gas would occupy at 41°C and 750mmHg pressure. (0° = 273k) (2mks)

17. The diagram below shows a sample of ammonium chloride being heated in a dry boiling tube containing a plug of cotton and dump red litmus paper



State and explain what would be observed on the red litmus paper (3mks)

18. The diagram below represents a laboratory experiment to investigate the reaction between hydrogen - sulphide gas and an aqueous iron (II) chloride.



a) Write chemical equation for the reaction which takes place in the boiling tube. (1mk)

b) What adjustment need to be made in the above set-up if the laboratory does not have a flame chamber. (1mk)

c) Describe a laboratory chemical test for a sample of hydrogen sulphide gas. (1mk)

19. State the main differences between alkanes and alkenes in terms of the following;
i) Structure and bonding (1mk)

Alkanes	alkenes

ii) Reaction with chlorine gas. (2mks)

Alkanes	alkenes

20. In the laboratory, chlorine gas can be prepared by the reaction;

$2Cl^-_{(aq)} + MnO_{2(s)} + 4H^+_{(aq)} \longrightarrow Cl_{2(g)} + Mn^{2+}_{(aq)} + 2H_2O_{(l)}$

Given the following half- cell reactions;

$MnO_{2(s)} + 4H^+_{(aq)} + 2e^- \longrightarrow Mn^{2+}_{(aq)} + 2H_2O_{(l)}$; $E^\theta = +1.23V$

$2Cl^-_{(aq)} \longrightarrow 2e^- + Cl_{2(g)}+$; $E^\theta = -1.36V$

Use the E^θ cell to explain how the above reaction is carried out in the laboratory. (3mks)

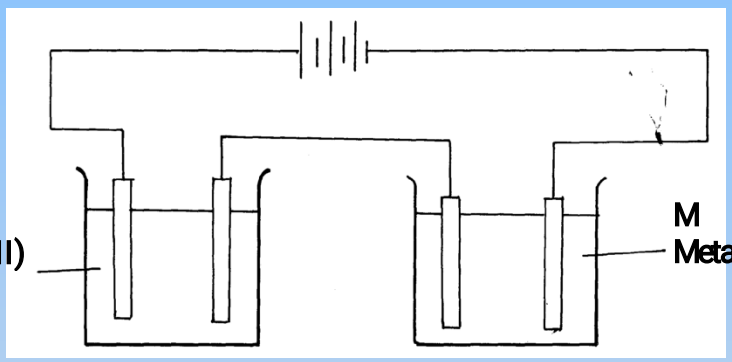
21. a) Define the term radioactivity. (1mk)

b) Q grams of a radioactive isotope sample takes 80 days to disintegrate to 7g. The half-life of the isotope is 20days. Find the initial mass Q. (2mks)

22. Explain why graphite is preferred to lubricating oil in the moving parts of the machine. (2mks)

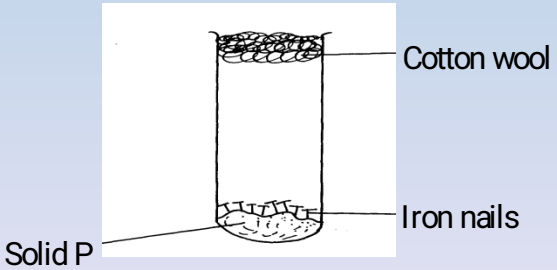
23. In the chemistry laboratory, both blue and red litmus papers are used to test for the nature of gases and solutions. Explain (2mks)

24. The following diagram was used to investigate the electrolysis of copper(II) Sulphate solution and molten G chloride using carbon electrodes.



When a fixed current was passed through the two electrolytic cells as shown, 1.27g of copper and 0.6g of G were deposited at the respective electrodes,. Calculate the numerical value of x in the formula G^{x+}. (Cu=63.5; g = 60; 1 Faraday = 96500C) (3mks)

25. a) The following diagram represents a set-up used to investigate conditions necessary from rusting of iron.



After several days it was found that the nails did not rust. Identify solid P. (1mk)

b) The following are standard electrode potentials of some half-cell reactions. Use the data to answer the questions that follow.

Metal	Electrode potentials
S	-1.37
T	-0.83
U	0.00
V	+0.58
W	+1.46

i) Suggest the identify of element U. (1mk)

ii) Draw a labeled diagram of an electrochemical cell that would produce the largest e.m.f. (2mks)

26. Study the following equilibrium equation and answert the questions that follows.

$NH_4^+{}_{(aq)} + OH^-{}_{(aq)} \rightleftharpoons NH_{3(g)} + H_2O_{(l)} \quad \Delta H = +54kJmol^{-1}$

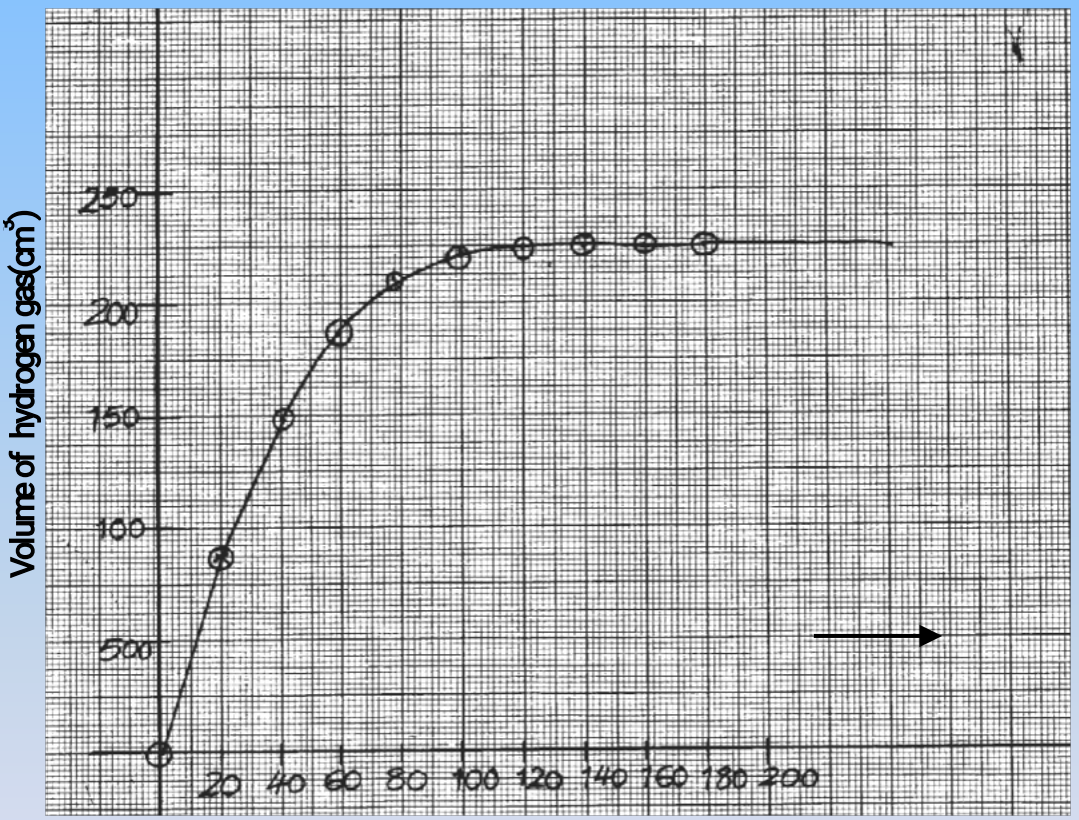
Explain how ammonia gas can be prepared in the laboratory. (2mks)

27. a) Write a chemical equation for the combustion of laboratory gas, when the Bunsen burner produces a non-luminous flame. (1mk)

b) Describe **two** observable characteristics of aluminous flame. (1mk)

28. Explain why during the extraction of metals, copper can be extracted by the electrolysis of copper (II) sulphate solution, while aluminium chloride cannot be extracted by electrolysis of aluminium sulphate solution. (2mks)

29. The graph below was obtained from an experiment used to investigate the reaction between Zinc granules and 2M hydrochloric acid.



a) Calculate the rate of reaction when t = 60secodns. (2mks)

b) Suggest how the rate of the above reaction can be reduced so that it can be studied more closely at the same temperature (1mk)

PRECIOUS BLOOD KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. The grid below represents part of the periodic table. The letters do not represent the actual symbols.

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

b) Write the formula of the compound consisting of D and Z only. (1mk)

c) Select an element that can form an ion of change +2 (1mk)

d) Which element has the least ionization energy? Explain (2mks)

e) Suggest a likely pH value of an aqueous solution of the chlorine of T. Explain. (2mks)

f) To which chemical families does elements J and V Belong? (1mk)

g) An element X has relative a tomic mass of 40.2 it has two isotopes of masses 39 and 42.

Calculate the relative abundance of each isotope. (3mks)

2 (a) Name the following compounds

i) $CH_3CH_2CH_2CH_2CH_2OH$ (1mk)

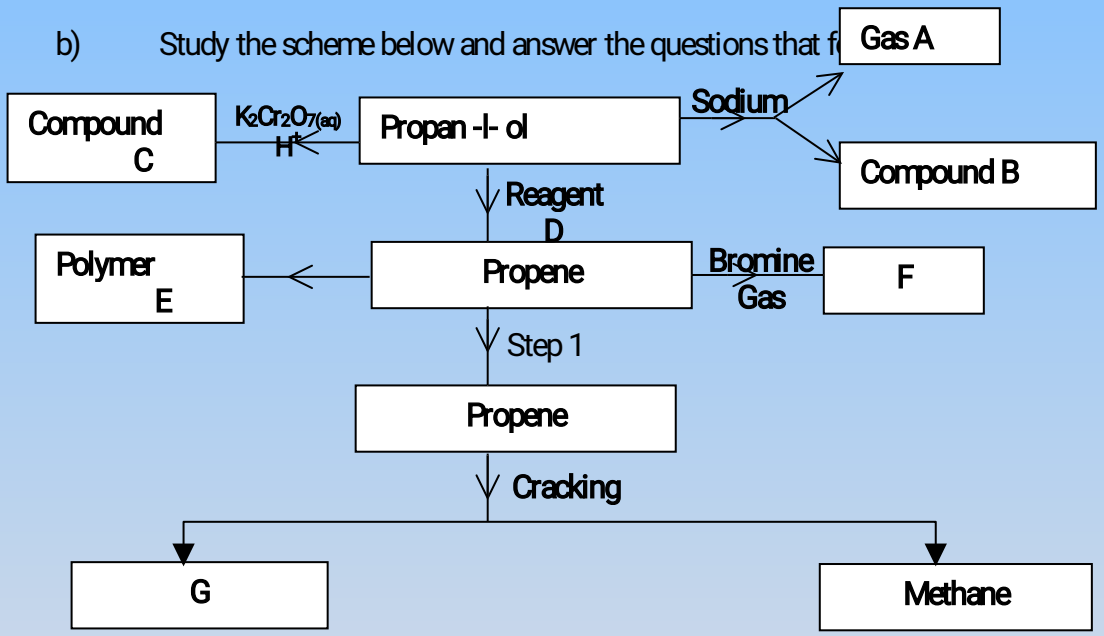
ii) CH_3CHCH_2COOH (1mk)

CH_3

iii) $CH_3CH_2\ C\text{-}O\text{-}CH_2CH_3$ (1mk)

O

b) Study the scheme below and answer the questions that f



(i) Identify the product. (1mk)

(ii) Name the compound.

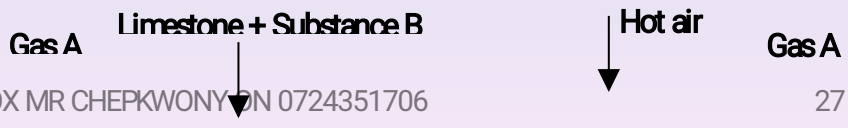
(iii) State the conditions for step 1 (2mks)

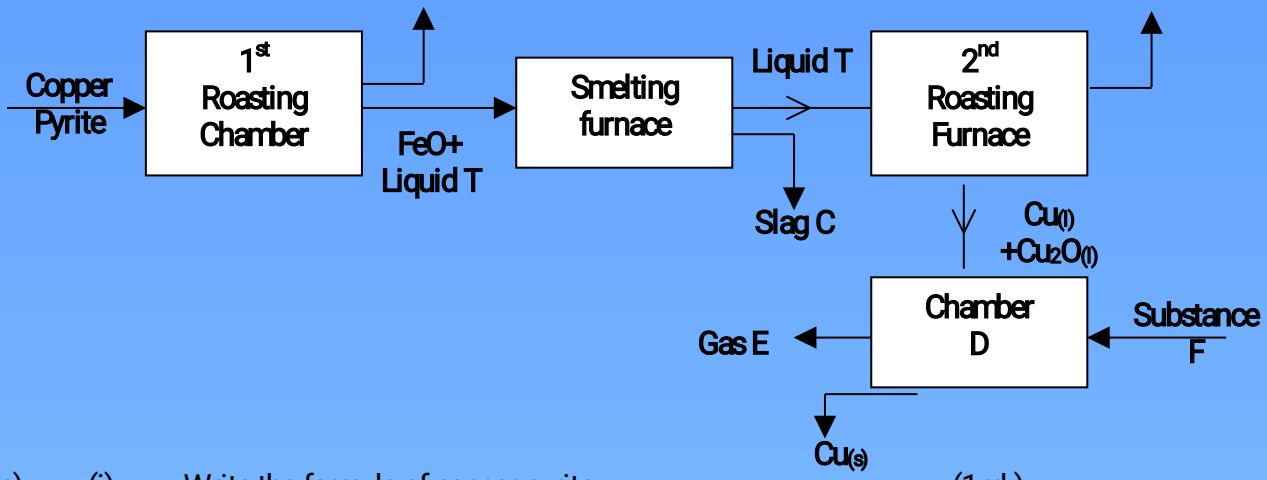
(iv) Write the equation for the reaction leading tot the formation of methane. (1mk)

(v) State **two** industrial uses of methane. (2mks)

(vi) Identify the reagent **D** (1mk)

3. The flow chart below outlines some of the process involved during extraction of copper.





a) (i) Write the formula of copper pyrite. (1mk)

(ii) Name liquid T (1mk)

(iii) Write equations for the reactions taking place in the 2nd roasting furnace. (2mks)

(iv) Identify substance B and write equation for the reaction that take place in the smelting furnace. (2mks)

(v) State the purpose of substance F (1mk)

b) Copper obtained from chamber D is impure draw a well labelled diagram showing how the copper obtained can be purified. (2mks)

4. The table below gives the solubilities of potassium chloride and potassium nitrate at various temperatures.

Temp. (°c)		0	10	20	30	40	50	60	70	80
Solubility g/100g of water	KCl	27.6	31.0	34.0	37.0	40.0	42.6	45.5	48.5	51.0
	KNO_3	13.3	21.0	31.5	46.0	64.0	83.5	110.0	138.0	169.0

a) On the same pair of axes plot the solubility curves for potassium chloride and potassium nitrate on the graph paper provide. (5mks)

b) At what temperatures are the solubities of the salt each 36.0g/100g of water

(i) Potassium chloride (1mk)

(ii) Potassium nitrate (1mk)

c) A boiling tube contains 4.0g of potassium Chloride and 4.0g of potassium nitrate in $10cm^3$ of distilled water at 80°C. If the content of the boiling tube is placed into a freezing mixture, determine the:

(i) Temperature at which crystals will first appear. (2mks)

(ii) Composition of the crystal deposited by mass at 10°C (3mks)

5. Standard electrodes potentials are

$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)}$ $E^\theta = -0.76V$

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

a) (i) Draw a diagram of an electrochemical cell Zinc-Copper (voltaic cell) (3mks)

(ii) Indicate the charge on each electrode and the direction of electron movement. (1mk)

b) Write;

(i) Equations for the reactions at (1mk)

a) Anode

b) Cathode

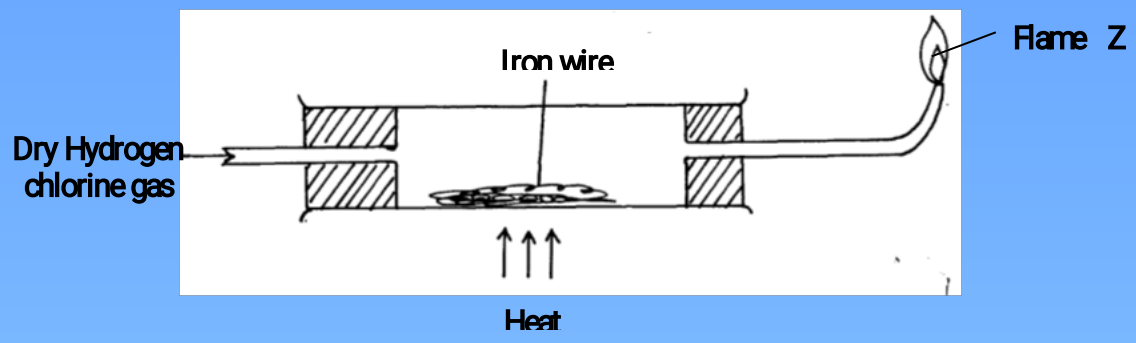
(ii) An equation for the overall reaction (1mk)

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

d) The same quantity of electricity was passed through three cells depositing silver in

the first copper in the second and 480cm^3 of hydrogen at room temperature and pressure in the third cell.
Calculate the mass of copper and silver deposited (H=1, Cu = 64, Ag = 108, 1mole of gas occupies 24cm^3 at r.t.p) (3mks)

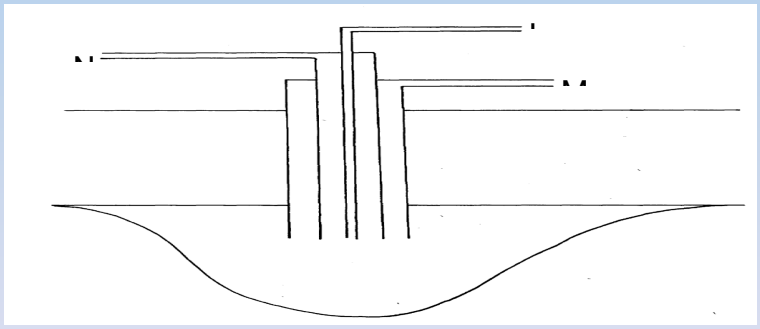
6. Dry hydrogen chloride gas was passed through heated iron wire as shown in the diagram below



a) (i) How can the identity of the substance burning with flame Z be confirmed. (1mk)
(ii) What is observed in combustion tube during the experiment? (1mk)
(iii) Write the equation for the reaction taking place in the combustion tube. (1mk)
(iv) Chlorine gas was passed over the product obtained in the combustion tube to give nother product Q
a) State **one** precaution that should be taken. Explain (2mks)
b) Identify product Q (1mk)
c) The total mass of product Q formed was found to be 5.3g. Calculate the volume of chlorine gas used.
(Cl = 35.5, Fe= 56, Molar gas volume at room temperature = 2400cm^3) (3mks)

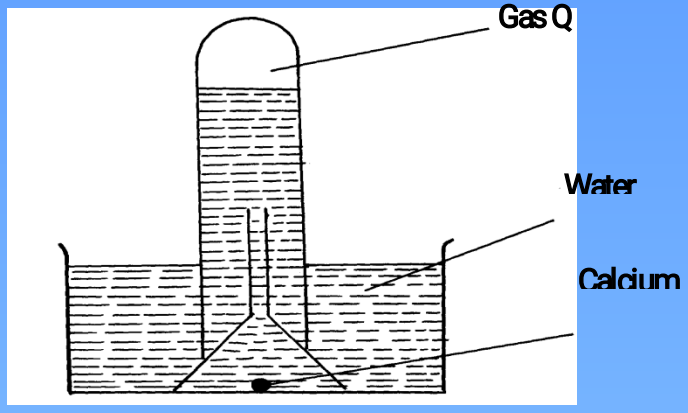
d) (i) A solution of hydrogen chloride gases in water reacts with Zinc carbonate, but a solution of hydrogen chloride in methylbenzene does not . Explain (2mks)
(ii) On heating Ammonium Chloride two gas G and J were evolved G turned moist litmus paper red and J turned Moist litmus paper blue. On cooling , the two gases recombined to form a white solid
a) Identify (1mk)
b) What property of Ammonium Chloride is shown in this experiment? (1mk)

7. a) The diagram below shows the extraction of sulphur.



i) Name the process illustrated in the diagram. (1mk)
ii) Identify the pipe through which molten sulphur flows. (1mk)
iii) Supper heated water is used in this process. How is superheated water obtained? (1mk)

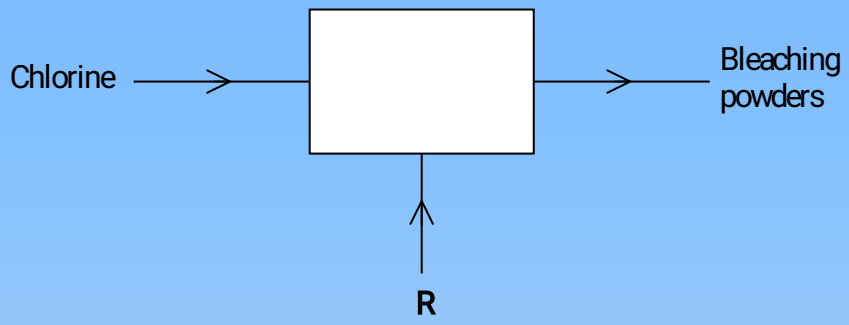
b) The reaction of water and calcium gave gas Q collected as in the diagram below



(i) Identify gas **Q** (1mk)

(ii) Explain why the solution left after the reaction is a weak base. (2mks)

c) The diagram below outlines industrial preparation of bleaching powder.



(i) Give the chemical name of bleaching powder (1mk)

(ii) Identify substance R (1mk)

(iii) Explain why water in which bleaching powder has been added needs a lot of soap during washing. (2mks)

CHEMISTRY
PAPER 1
TIME: 2 HOURS

MOI GIRLS ELDORET KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

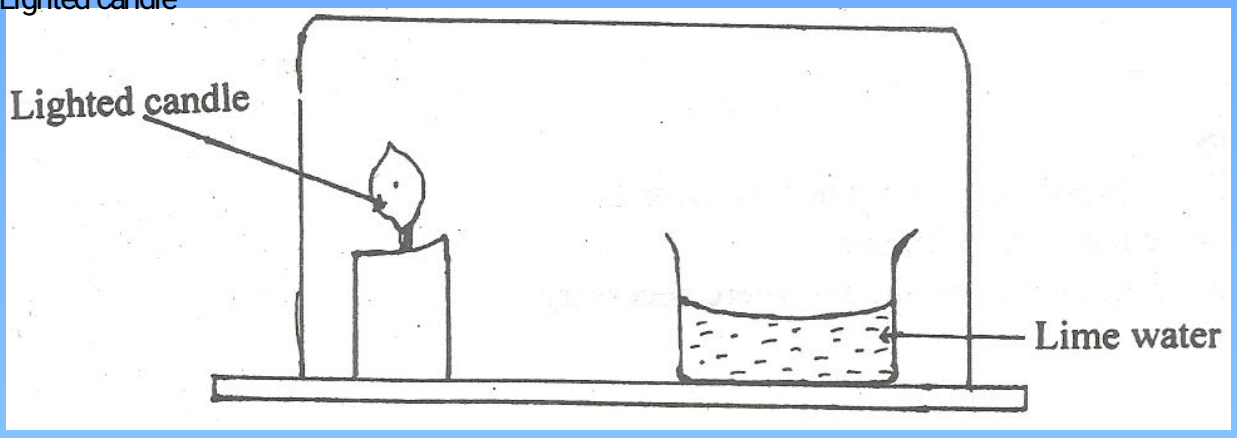
1. Use the information in the table below to determine the relative atomic mass of copper.
(2 marks)

Isotope	Fractional abudance

$^{65}_{29}Cu$ 0.31

$^{63}_{29}Cu$ 0.69

2. Study the arrangement below and answer the question that follows.
Lighted candle



Explain what will be observed after some time. (3 marks)

3. Briefly explain industrial application of the following processes.
(a) Crystallisation. (1 ½ marks)
(b) Fractional distillation. (1 ½ marks)

4. Four solutions of pH 7, 2, 8.5 and 13 respectively were each reacted with calcium turnings. In which of the solutions would hydrogen gas be produced. Explain each case. (3 marks)

5. Study the information in the table below and answer the questions that follow.

	c arrangement	lius (nm)

(a) Explain why the ionic radius of K^+ is greater than that of Na^+. (1 mark)
(b) Account for the difference in ionic radius of Mg^{2+} and Na^+. (2 marks)

6. Use the following equations to determine the heat evolved when aluminium metal is reacted with iron (III) oxide. (3 marks)

$2Al_{(s)} + {}^3/_2O_{2(g)} \longrightarrow Al_2O_{3(s)}$; $\Delta H, = -1673.6 jKmol^{-1}$

$2Fe_{(s)} + {}^3/_2O_{2(g)} \longrightarrow Fe_2O_{3(s)}$; $\Delta H_2 = -836.8 kJmol^{-1}$

7. Describe how you would prepare a dry sample of zinc carbonate in the laboratory starting with zinc chloride solid. (3 marks)

8. The solubility of salt Y at 60^0C is 40g/100g of water and 48g/100g of water at 100^0C.
(i) How much salt of Y would satulate 190g of water at 100^0C. (1 ½ marks)
(ii) 150g of saturated solution of Y at 100^0C is cooled to 60^0C. Calculate the mass of Y that crystallizes out. (1 ½ marks)

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

Bond	Bond dissociation energy
C – C	343 $kJmo^{-1}$

C – H	414 $kJmo^{-1}$
H – H	435 $kJmo^{-1}$
$C_{(s)} \longrightarrow C_{(g)}$	711 $kJmo^{-1}$

Use this information to calculate the heat of reaction for:-

$2C_{(s)} + 3H_{2(g)} \longrightarrow C_2H_{6(g)}$ (3 marks)

10. (I) An oxide of carbon contains 42.8g by mass of carbon and has R.M.M. of 28. What is its molecular formular? (3 marks)
(C = 12; O = 16)

(II) Sulphur dioxide gas was bubbled into acidified potassium dichromate and iron (iii) sulphate solutions respectively. Explain the observations made in each case.

(i) With potassium dichromate. (1 ½ marks)

(ii) With iron (III) sulphate. (1 ½ marks)

12. A known volume of ozonised oxygen diffuses through a small hole in 55 seconds; whereas the same amount of oxygen mixed with chlorine takes 67 seconds under the same conditions. Determine the molecular mass of ozone. (Cl = 35.5 ; O = 16) (3 marks)

13. (a) Give the name of the following compound $CH_3CH = CHCH_2CH_3$. (1 mark)

(b) Ethane and ethene react with bromine according to the equations given below.

(i) $C_2H_{6(g)} + Br_{2(g)} \xrightarrow{\text{u.v light}} C_2H_5Br_{(l)} + HBr_{(g)}$

(ii) $C_2H_{4(g)} + Br_{2(g)} \longrightarrow C_2H_4Br_{2(l)}$

Name the type of bromination reaction that takes place in:- (2 marks)

14. An organic compound with the formular $C_4H_{10}O$ reacts with potassium metal to give hydrogen gas and a white solid.

(a) Write the structural formular of the compound. (1 mark)

(b) To which homologous series does the compound belong. (1 mark)

(c) Write the equation for the reaction between the compound and potassium metal. (1 mark)

15. In the Haber process, the optimum yield of ammonia is obtained when a temperature of 450^0C, a pressure of 200 atmospheres and an iron catalyst are used.

$N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)}$ $\Delta H = -92kJ.$

(a) How would the yield of ammonia be affected if the temperature was raised to 600^0C. Explain. (2 marks)

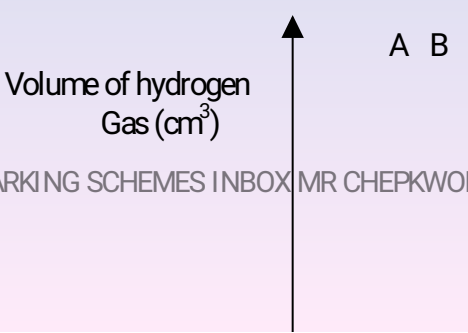
(b) Explain the effect on the yield of lowering the pressure below 200 atmospheres. (1 ½ marks)

16. Two experiments were carried out as follows and the volume of hydrogen gas evolved measured at intervals of 10 seconds for 100 seconds.

(i) 8cm of magnesium ribbon was added to 1M $HCl_{(aq)}$

(ii) 8cm of magnesium ribbon was added to 0.5M $HCl_{(aq)}$.

Graphs of volume of hydrogen gas evolved against time were plotted as shown below.



Time (mins)

(a) Which of the graphs was obtained for reaction (i). Explain. (2 marks)

(b) Explain the general shape of the graphs. (1 mark)

17. The set-up below was used to prepare hydrogen chloride gas and react it with iron powder. Study it and answer the questions that follow.

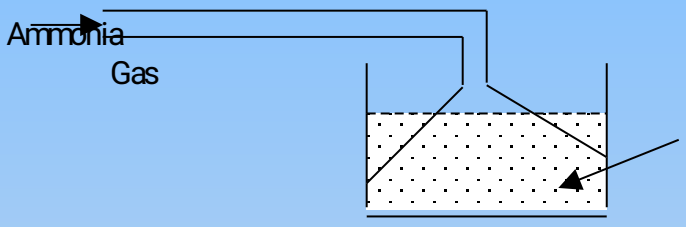
Concentrated sulphuric acid Combustion tube Iron powder Glass wool Heat To pump Sodium chloride Sodium hydroxide solution

At the end of the reaction, the iron powder turned into light green solid.

(a) Identify the light green solid. (1 mark)

(b) At the beginning of the experiment; the pH of the solution in container 'L' was about 14; at the end; the pH was found to be 2. Explain. (2 marks)

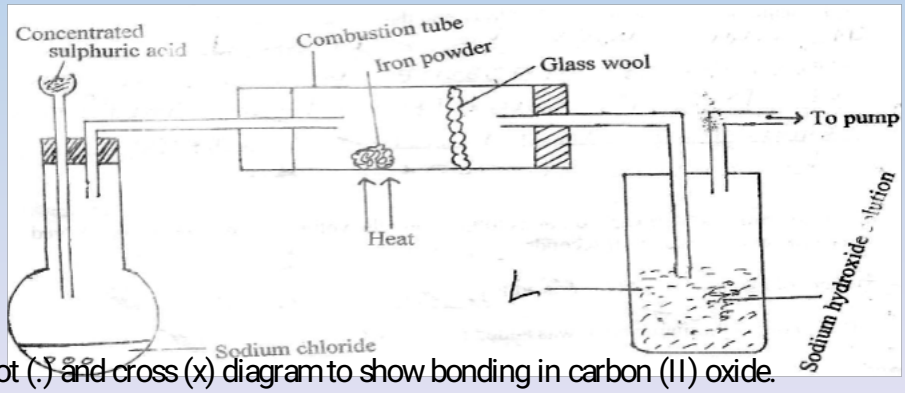
18. Ammonia gas was passed into water as shown below.



(a) When a red litmus paper was dropped into the resulting solution; it turned blue. Give a reason to this observation. (1 mark)

(b) What is the function of the funnel. (1 mark)

19. During purification of copper by electrolysis, 1.48g of copper were deposited when a current was passed through aqueous copper (II) sulphate for 2 ½ hours. Calculate the amount of current that was passed.
(Cu = 63.5; IF = 96500C) (3 marks)



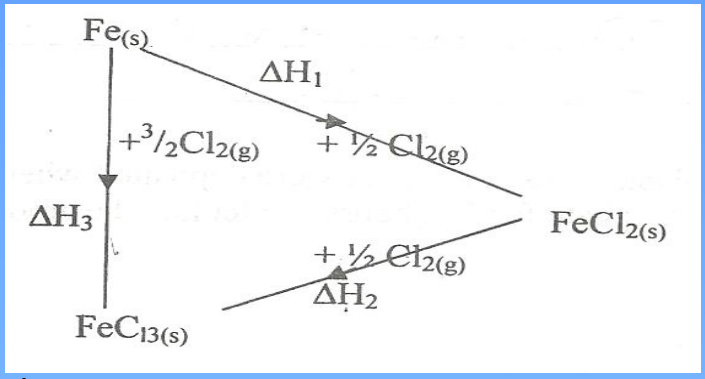
20. Draw a dot (.) and cross (x) diagram to show bonding in carbon (II) oxide. (2 marks)

21. Write the discharge equations (half equations) for the electrode reactions when molten sodium chloride is electrolysed using graphite electrodes.

Anode (1 mark)

Cathode (1 mark)

22. Study the energy diagram and then answer the questions that follow.



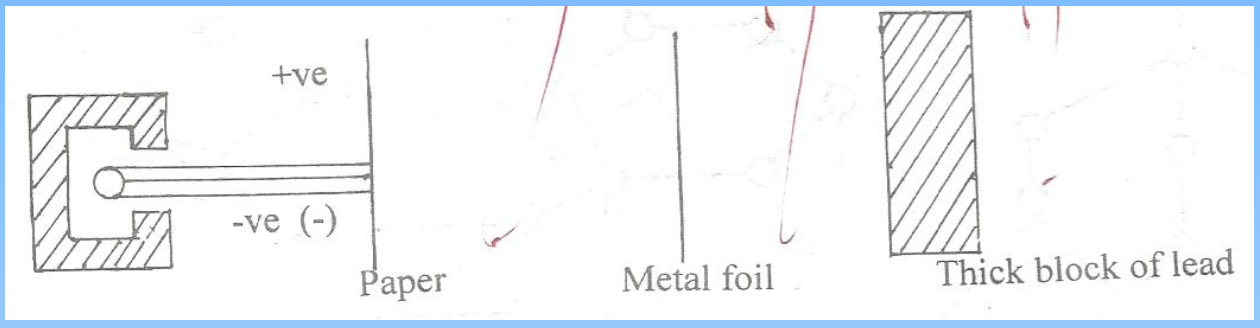
(a) What does ΔH_1 and ΔH_3 represent

(i) ΔH_1 (1 mark)

(ii) ΔH_3 (1 mark)

(b) Write down the relationship between $\Delta H_{1(l)}$, ΔH_2, and ΔH_3. (1 mark)

23. Complete the diagram below to show how particles from a radioactive source can be distinguished from each other. Label your diagram clearly.



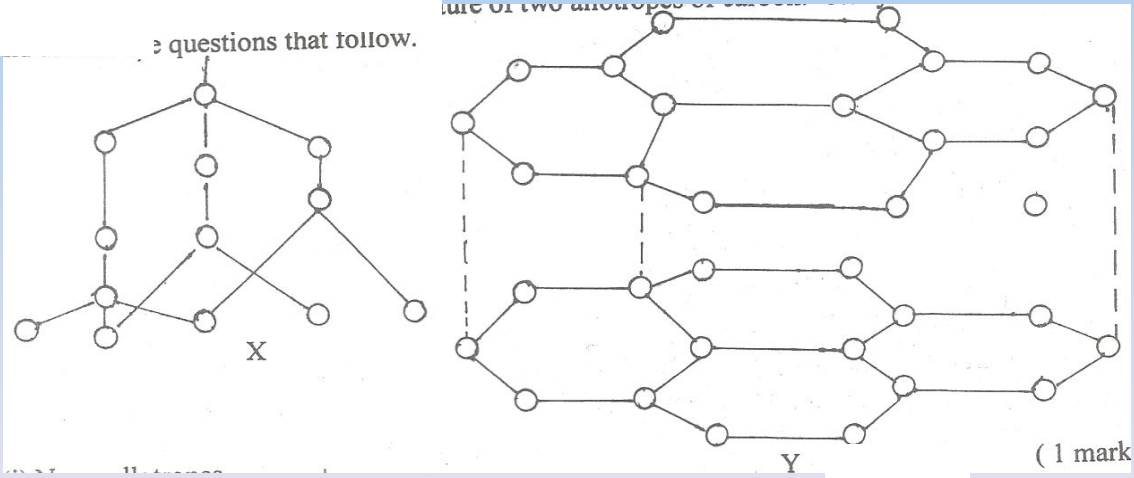
24. The diagram below represents a set-up that was used to react iron with water.
Study it and answer the questions that follow.

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

(b) Why should it not be advisable to use potassium in place of iron in the above set-up. (1 mark)

(c) The glass wool is heated prior to heating of iron. Explain this procedure. (1 mark)

25. The following diagrams show the structure of two allotropes of carbon. Study them and answer the questions that follow.



(1 mark

(i) Name allotropes (1 mark)

(ii) Give ONE use of X. (1 mark)

(iii) Which allotrope conduct electricity? Explain. (1 mark)

26. The formula below represent the active ingredients in a soap and a detergent respectively.

(i) $CH_3(CH)_{16}\ COO^-\ Na^+$

(ii) $CH_3\ (CH_2)_6\ CH\ CH_3\ CH_2\ SO_3^-\ Na^+$

(a) Explain why 1 is not suitable for washing using water from a river. (1 mark)

(b) Give one advantage and one disadvantage of II. (2 marks)

27. Use the following standard electrode potentials to answer the questions that follow.

$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)}\ \ E^{\theta}V = -0.76$

$Cl_{2(g)} + 2e^- \longrightarrow 2Cl^-_{(aq)}\ E^{\theta}V = +1.36$

(a) Calculate the e.m.f of the following cell:

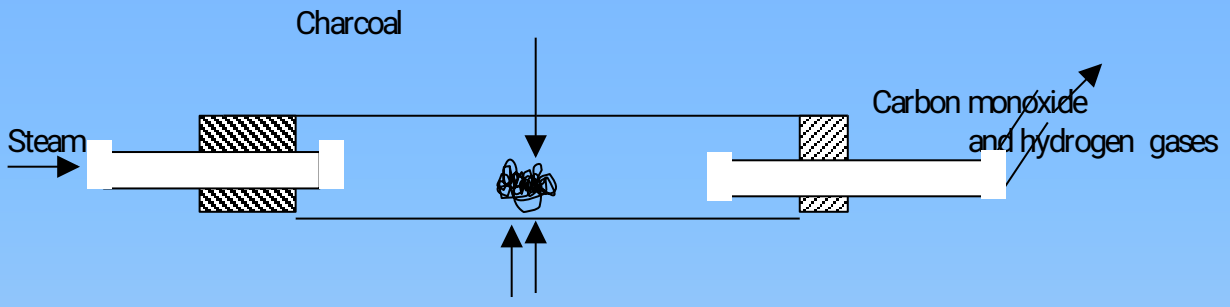
$Zn_{(s)} / Zn^{2+}_{(aq)} // 2Cl^-_{(aq)} / Cl_{2(g)}$ (2 marks)

(b) Write down the equation for the overall cell reaction. (1 mark)

28. (a) Suppose $180cm^3$ of a 2.0M solution is diluted to $1.0dm^3$. What will be the concentration of the resulting solution. (2 marks)

(b) Why is water not used to put off oil fires ? (1 mark)

29. When steam was passed over heated charcoal as shown in the diagram below hydrogen and carbon monoxide gases were formed.



(a) Write the equation for the reaction which takes place. (1 mark)

(b) Name one use of carbon monoxide gas which is also a use of hydrogen gas. (1 mark)

MOI GIRLS ELDORET KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. The grid given 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.

									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)

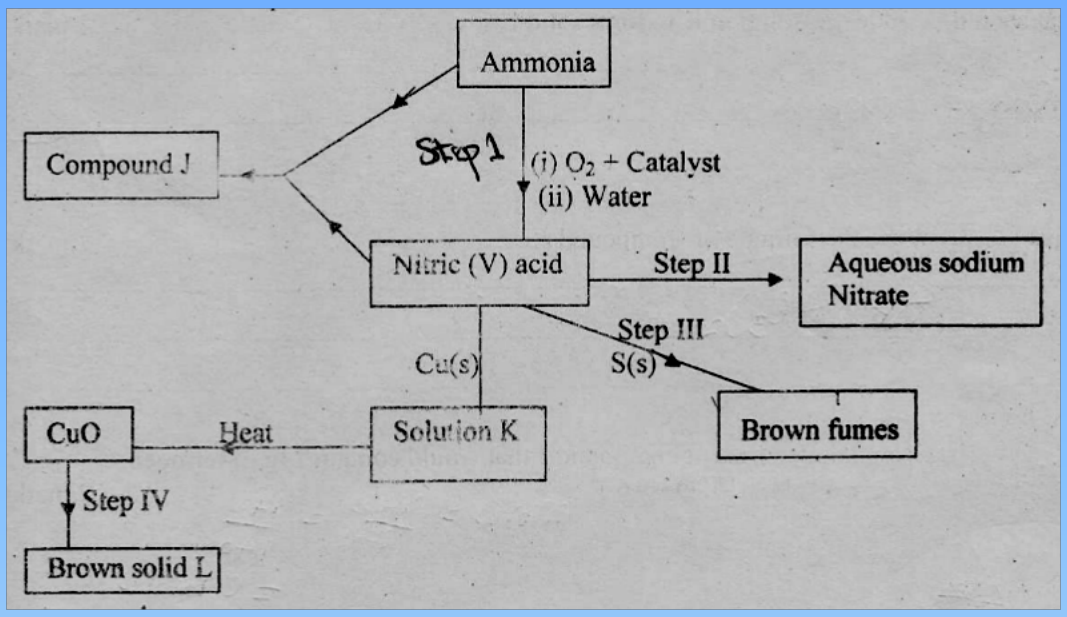
(vii) The electron configuration of a divalent anion of element N is 2.8.8. Induce the position of element N on the periodic table drawn above. (1 mark)

(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. (1 mark)

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



(i) List the raw materials used in the manufacture of ammonia. (1 mark)

(ii) What catalyst is used in step I ? (1 mark)

(iii) Write an equation for the reaction that occurs between ammonia and oxygen in presence of the catalyst. (1 mark)

(iv) Identify the process in step II (1 mark)

(v) Using an appropriate equation, explain how the reaction in step III occurs ? (2 marks)

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

(vii) (a) (i) Write the formula of compound J. (1 mark)

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

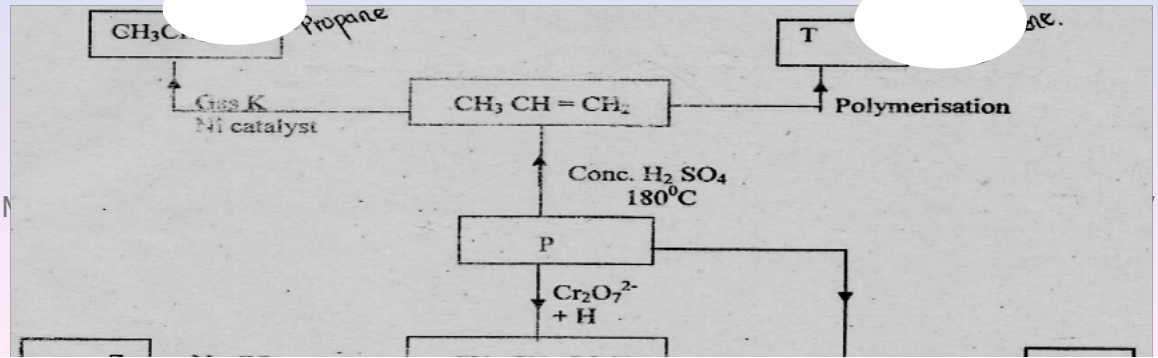
(b) State two advantages of ammonium phosphate over ammonium nitrate. (2 marks

3. (a) Give the IUPAC names of the following compounds. (2 marks)

(i) HCC CH_2 CH_3

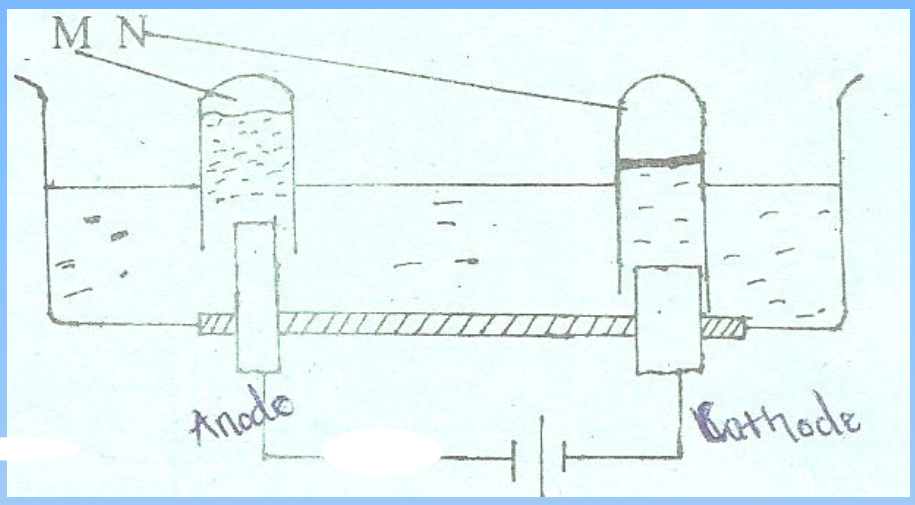
(ii) H_2 CCHCH_2 C

(b) Study the following diagram and answer the questions that follow.



(i) Identify substances (2 marks)
(ii) Draw the structure of compound P and state one use. (2 marks)
(iii) Write the equation for the reaction leading to the formation of the products in Z. (1 mark)
(iv) Show the general structure of polymer T and give its name. (2 marks)
(v) To which class of organic compounds does compound Q belong to ? (1 mark)

4. The set-up below represents electrolysis of dilute sulphuric (VI) acid.



(a) Identify gases M and N (1 mark)
(b) Write an ionic equation for the production of gas M. (1 mark)
(c) At what electrode does reduction take place. Explain your answer. (2 marks)
(d) State the most suitable electrodes that can be used in this experiment.
Explain your answer. (2 marks)
(e) The standard electrode potentials for some half cells are given below.

$Ag^{+}_{(aq)} + e \longrightarrow Ag_{(s)}$ + 0.80

$Cl_{2(g)} + 2e \longrightarrow 2Cl^{-}_{(aq)}$ + 1.36

$Zn^{2+}_{(aq)} + 2e \longrightarrow Zn_{(s)}$ -0.76

$Ba^{2+}_{(aq)} + 2e \longrightarrow Ba_{(s)}$ -2.90

(i) Arrange the metals in order of reactivity. (1 mark)
$Ag/Ag^{+}_{(aq)}$ and $Ba / Ba^{2+}_{(aq)}$ (2 marks)
(iii) What would happen if a cell with chlorine and zinc ions, the anode was made of zinc. Explain your answer. (2 marks)

5. A piece of marble chip (calcium carbonate) is put in a beaker containing excess of dilute hydrochloric acid which is placed on a reading balance. The mass of the beaker and its contents is recorded every two minutes, as shown in the table.

Time (min)	0	2	4	6	8	10	12
Mass(g)	126.4	126.3	126.2	126.1	126.0	126.0	126.0

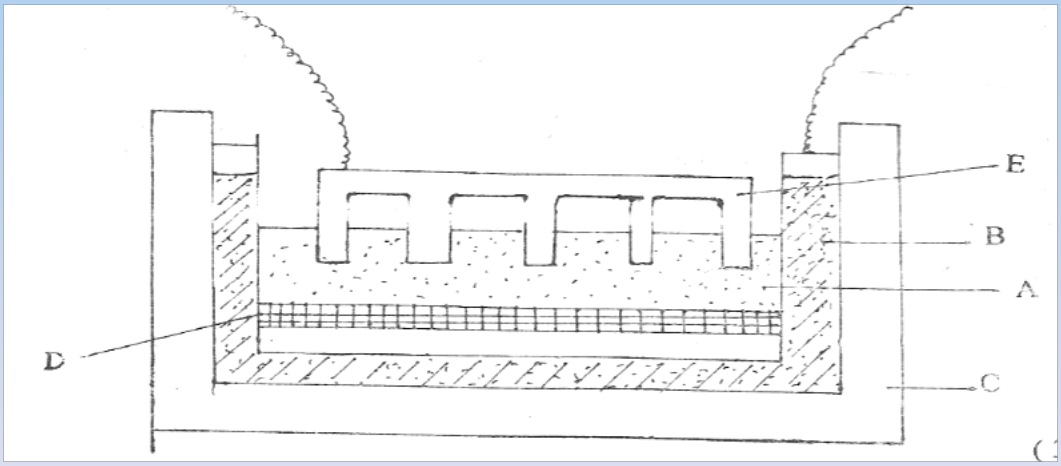
(a) Why is there a continuous loss of mass of the reaction mixture. (1 mark)
(b) Write an equation for the reaction taking place. (1 mark)
(c) State two different ways by which the reaction could have been made more rapid. (2 marks)
(d) Why does the mass remain constant after 8 minutes. (1 mark)
(e) State the observations that would be made if a few drops of silver nitrate solution Was added to $1cm^3$ of the resulting solution followed by ammonia solution. (2 marks
(f) State one environmental effect that excess carbon (IV) oxide in the air causes. (1 mark)

(g) State two uses of carbon (IV) oxide. (2 marks)

6. In an experiment to determine the molar heat of neutralization of hydrochloric acid with sodium hydroride, students of Furaha Secondary school reacted $100cm^3$ of 1M hydrochloric acid with $50cm^3$ of 2M sodium hydroxide solution. They obtained the following results.
Initial temperature of acid = 25.0^0C
Initial temperature of base = 25.0^0C
Highest temperature reached
With the acid – alkali mixture = 34.0^0C

(a) Define the term molar heat of neutralization. (1 mark)
(b) Write an ionic equation for the neutralization reaction between hydrochloric acid and sodium hydroxide. (1 mark)
(c) Calculate :
(i) The change in temperature. (ΔT) (1 mark)
(ii) The amount of heat produced during the reaction.
(Specific heat capacity of solution = 4.2 $kJkg^{-1}k^{-1}$) (2 marks)
(iii) The molar heat of neutralization of sodium hydroxide. (2 marks)
(d) Write the thermochemical equation for the reaction. (1 mark)
(e) Draw an energy level diagram for the reaction. (2 marks)

7. Aluminium is extracted from its ore by electrolysis method. The current required in the process is 4,000 amperes. Study the diagram and answer the questions that follow.



(a) Name: (3 marks)

(i) Electrolyte A

(ii) Substance D

(iii) Electrode E

(b) Name the material from which the electrodes are made. (1 mark)

(c) (i) Write the equation that produces aluminium metal. (1 mark)

(ii) Explain why E has to be replaced from time to time. (1 mark)

(iii) Why is cryolite added to the electrolyte before the process of electrolysis ? (1 mark)

(d) Name the ore from which aluminium is extracted.

(e) A current of 25 amps was passed through molten aluminium oxide for 36 hrs.

Calculate the amount of aluminium deposited in kg.

(Al = 27, IF = 96500C) (3 marks)

(f) Give two industrial uses of aluminium. (2 marks)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

KAPSABET BOYS KCSE TRIAL AND AND PRACTICE EXAM .

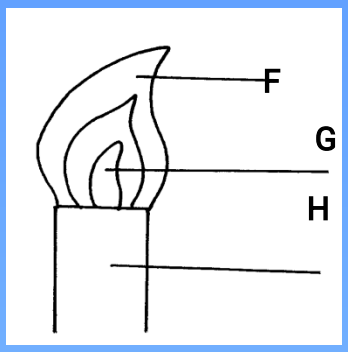
INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. State **three** properties common to both ammonia and calcium hydroxide solutions but different from solution of sulphur (IV) oxide in water. (3mks)
2. Describe a simple test that can be carried out in the laboratory to distinguish between manganese (IV) oxide and copper (II) oxide. (3mks)
3. Write any **three** balanced equations of possible reactions that take place when excess magnesium metal is burnt in air. (3mks)

4. In the figure below:



(a) Name the parts labeled **F, G,** and **H**. (1 ½mks)

(b) Describe an experiment that would confirm that region labeled G is unsuitable for heating. (1½mks)

5. Give names of the following processes used to: (2mks)

(a) Obtain a solvent from a saturated solution.

(b) Remove steam from air

(c) Separate zinc carbonate from water

(d) Separate a mixture of nitrogen and helium.

6. Define the following terms

(a) Anion (1mk)

(b) Atomic number (1mk)

(c) Isotopes (1mk)

7. (a) Explain why the following combination of reagents is unsuitable for the laboratory preparation of hydrogen.

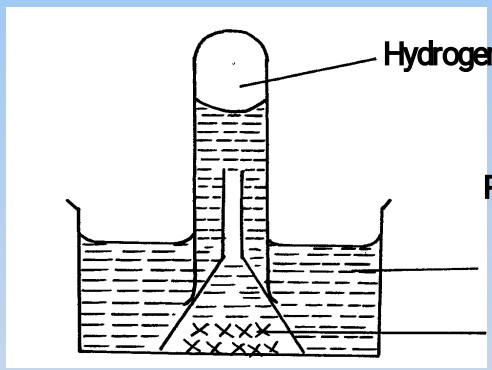
(i) Zinc + dilute nitric acid. (½mk)

(ii) Lead + dilute hydrochloric acid. (½mk)

(iii) Copper + Dilute sulphuric acid. (½mk)

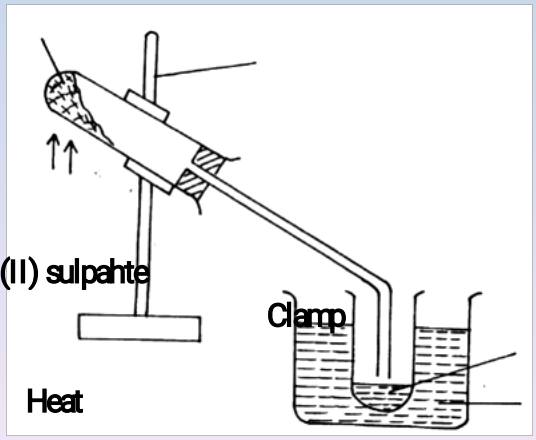
(iv) Potassium + dilute sulphuric acid. (½mk)

(b) The diagram below was used to obtain hydrogen in the laboratory.



Name reagent **Q**. (1mk)

8. The diagram below is a set up used to investigate the effect of heat on hydrated copper(II) sulphate. Study the diagram and answer the questions that follow.



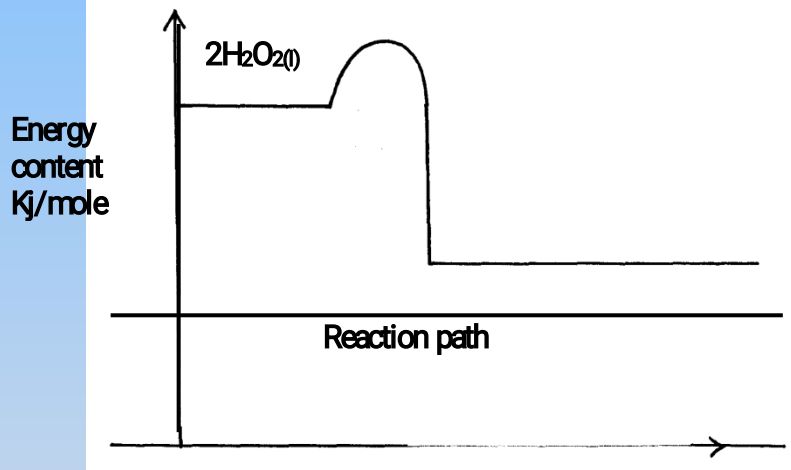
Liquid G
Ice cold water

(a) Why is boiling tube slanted as shown? (1mk)
(b) What is observed in the boiling tube. (1mk)
(c) Identify liquid **G.** (1mk)

9. In a reaction, an alkanol **B** was converted to pent-2-ene
(a) Give the structural formula of alkanol **B.** (1mk)
(b) Name (i) the type of reaction that converts alkanol **B** to pent-2-ene. (1mk)
(ii) The reagent used. (1mk)

10. In an experiment to study properties of carbon, a small amount of charcoal is placed in a boiling tube. $5.0cm^3$ of concentrated nitric acid is added. The mixture is then heated.
(a) What observations are made? (1mk)
(b) Write an equation for the reaction that took place in the boiling tube. (1mk)
(c) What property of carbon is shown in this reaction? (1mk)

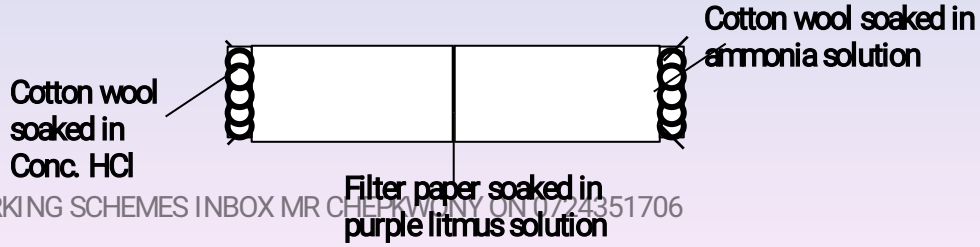
11. 0.5g of Manganese (IV) oxide were added to 50 cm^3 of 3.5M hydrogen peroxide. The temperature of the solution rose from 21°C to 64 °C. The information was represented on an energy level diagram as shown.



(a) Determine the number of moles of hydrogen peroxide that decomposed. (1mk)
(b) Calculate the molar enthalpy of decomposition of hydrogen peroxide. (1mk)
(c) On the same set of axes above sketch the curve that would be obtained if manganese (IV) oxide was not used and other conditions remained constant.

12. The electronic arrangement of two stable ions Q^{2+} and P^{2-} are 2.8.8 and 2.8.8 respectively.
(a) Write the electron arrangement of neutral atoms **Q** and **P.** (2mks)
(b) What is the most likely structure of an oxide element **P**? (1mk)

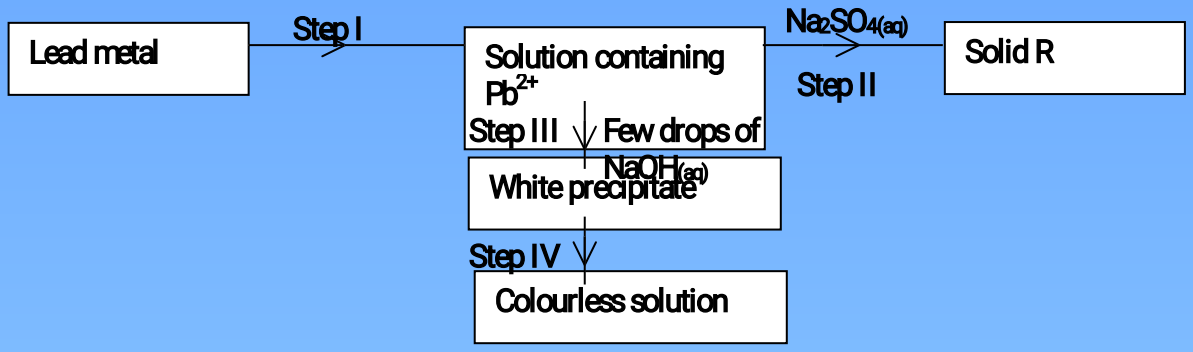
13. The set up below was used by a student. Filter paper soaked in purple litmus solution was placed in the middle of the combustion tube.



(i) What is the main aim of the experiment. (1mk)

(ii) State the **first** observation likely to have been made in the tube. Explain the observation. (2mks)

14. Study the flow chart below and use it to answer the questions that follow:



(a) Identify the reagent used in step **I**. (1mk)

(b) Name solid **A**. (1mk)

(c) Explain the observation in step **IV**. (1mk)

15. In an experiment 1.2g of granulated zinc were reacted with excess 2.0M sulphuric acid. The time taken for the reaction to be completed was recorded. The experiment was repeated using 1.2g of zinc powder.

(a) In which experiment was the time taken shorter? Explain your answer. (2mks)

(b) The mass of remaining mass of zinc was measured as time moved until when the reaction was over. Sketch on the set of axes and label the two curves obtained that would represent the mass of the remaining zinc (1mk)

Experiment I represents granulated zinc.

Experiment II represents zinc powder.



16. When a current of 2.0 amperes was passed through a cell containing aqueous solution of T^{2+} ions of metal T for 9 minutes the mass of the cathode increased by 0.36g.(1Faraday=96,500 coulombs)

(a) Calculate the quantity of electricity used. (1mk

(b) Determine the relative atomic mass of metal **T**. (1mk)

(c) Explain whether metal **T** is less or more reactive than hydrogen gas. (1mk)

17. 60 cm^3 of ozone (O_3) diffused through a semi permeable membrane in 80 seconds. Calculate the time taken for 90 cm^3 of nitrogen (IV) oxide (NO_2) to diffuse under the same conditions. (O=16, N=14). (3mks)

18. Some salts may be classified as double salts or basic salts. Trona with the formula $Na_2CO_3.NaHCO_3$ is an example of a double salt. An example of a basic salt is basic magnesium carbonate with formula $MgCO_3.Mg(OH)_2$.

(a) What is meant by a double salt? (1mk)

(b) Write equations of reactions that occur when dilute hydrochloric acid is reacted with:

(2mks)

(i) Trona

(ii) Basic magnesium carbonate

19. The thermochemical equation below shows a dynamic equilibrium between hydrogen iodide gas and its elements:

$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)} \quad \Delta H = +52.4kJ$.

(a) Explain how the following changes would affect the production of hydrogen iodide.

(i) increase in temperature

(ii) decrease in pressure. (2mks)

(b) Calculate the molar enthalpy for formation of $HI_{(g)}$. (1mk)

20. A hydrated salt has the following composition by mass. Iron is 20.2%, oxygen is 23.0% sulphur is 11.5%, water 45.3%. Its relative formula mass is 278. Determine the formula of the hydrated salt.
(Fe=56, S=32.0, O=16, H=1) (3mks)

21. Chlorine water is a mixture of some elements and compounds.

(a) Write down the formula of two elements found in chlorine water. (1mk)

(b) Name any **two** compounds in chlorine water. (1mkk) (c) State any **two** chemical properties of chlorine water. (1mk)

22. Calculate the mass of zinc carbonate that would remain if 17.0g of zinc carbonate was reacted with 50 cm^3 of 4M nitric acid. The equation of the reaction is:

$ZnCO_{3(g)} + 2HNO_{3(aq)} \longrightarrow Zn(NO_3)_2 + CO_{2(g)} + H_2O_{(l)}$

(Zn=65.4, C=12.0, O=16.0) (3mks)

23. A solution of bromine in methyl benzene turns colourless when butane gas is passed through it.

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

(b) Write equation of the reaction which takes place. (1mk)

24. Explain this observation:
When hydrogen chloride gas is dissolved in water, the solution conducts electricity while a solution of hydrogen chloride gas in propanone does not conduct electricity (2mks)

25. Francium $^{87}_{}Fr$ decays by emission 4 beta particles to form protactium (Pa)

(a) Write the equation for the nuclear reaction undergone by one radioisotope of Francium. (1mk)

(b) State **two** differences between chemical and nuclear reactions. (2mks)

26. A sealed glass tube containing 250 cm^3 of nitrogen gas at r.t.p was immersed in boiling water. Calculate the pressure inside the tube if the volume of the gas does not change due to expansion of glass. (Room pressure=760mmHg, room temperature=298K). (3mks)

27. (a) Write down the electron arrangement for an atom of element U which has a mass number 14 and contains 8 neutrons. (1mk)

(b) Draw the structure of an atom of A given in (a) above. (2mks)

28. Chlorine and hydrogen sulphide gases introduced into sealed tube as shown:

(a) State the observation that would be made in the tube. Explain. (1mk)

(b) Both chlorine and hydrogen sulphide gas can be prepared using hydrochloric acid as one of the reagents. Write two separate equations showing how each gas can be prepared using $HCl_{(aq)}$ as one of the reagents $Cl_{2(g)}$ (1mk)

$H_2S_{(g)}$ (1mk)

KAPSABET BOYS KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

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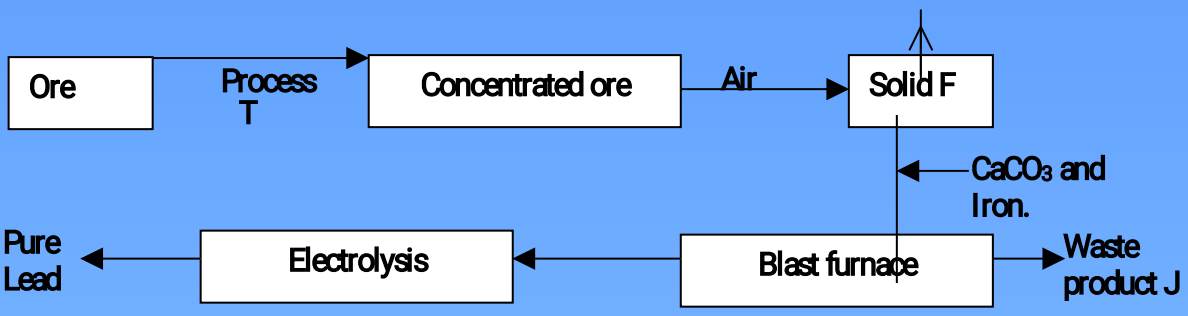
1. (a) What is an ore? (1mk)

(b) Name any **two** ores of lead. (1mk)

(c) The flow chart below summarizes the process of extraction of lead from a chief ore.



(i) Identify process **T** (1mk)

(ii) Give the name of: (2mks)

Gas **N**

Solid **F**

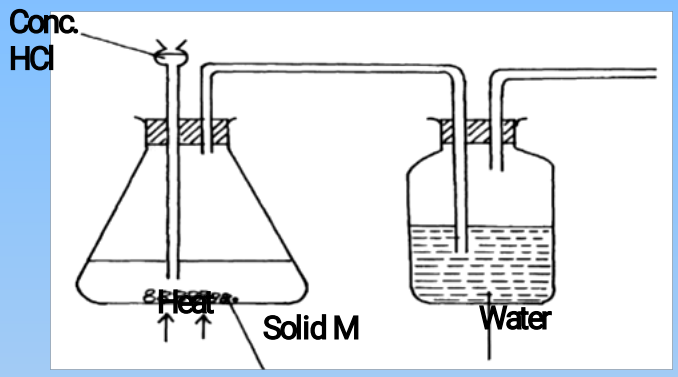
(iii) Give **two** functions of $CaCO_3$ in the extraction process. (2mks)

(iv) Write an equation to show how waste product **J** is formed. (1mk)

(v) Pure lead can be obtained by electrolysis. Identify the anode and cathode for the process. (1mk)

(vi) State **two** uses of lead. (2mks)

2. The set up below was used to prepare chlorine gas.



(i) Identify solid **M** (1mk)

(ii) What is the role of water in the experiment? (1mk)

(iii) Complete the set up to show how dry chlorine gas can be collected (2mks)

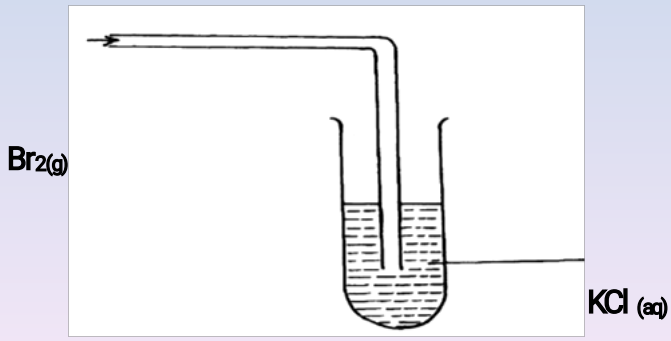
(iv) Write a chemical equation to show how chlorine gas is formed. (1mk)

(v) Chlorine reacts with cold dilute sodium hydroxide to form a bleaching agent. Name the bleaching agent. (1mk)

(vi) Give an equation to show how chlorine forms bleaching powder. (1mk)

(vii) Other than bleaching, state two other uses of chlorine gas. (2mks)

(viii) Study the diagram below.



State and explain the observation made after sometime. (2mks)

3. (a) Define standard heat of combustion of a substance. (1mk)

(b) Study the heats of combustion shown below.

$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)}$ $\Delta H = -393 KJMol^{-1}$

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H = -286 KJMol^{-1}$

$C_3H_8 + 5O_{2(g)} \longrightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ $\Delta H = -2218 KJMol^{-1}$

(i) Draw an energy cycle diagram linking heat of formation of propane with its heat of combustion and the heat of combustion of the constituent elements. (2mks

(ii) Use the in formation above to calculate the heat of formation of propane (2mks)

(c) A given amount of propane was used to heat one litre of water. The temperature of the water rose from 25°C to 50.5 °C. (S.H.C of water = $4.2 Jgk^{-1}$)

(i) Calculate the heat change for the reaction. (2mks)

(ii) Find the mass of propane burnt (C=12, H=1) (2mks)

(d) Calculate the caloric value of propane. (2mks)

(e) Apart from heating value, state two other factors to consider when choosing a fuel. (2mks)

4. Study the periodic grid below and answer the questions which follow. The letters do not represent actual symbols of the elements.

P				F				
S	T		C	E		U	X	Z
		N					Y	

(i) To which category of elements does element **N** belong? (1mk)

(ii) Compare the atomic radius of element **U** and **X**. Explain. (2mks)

(iii) An ion A^{3-} has a configuration of 2.8. Place element A on the grid above. (1mk)

(iv) Which of the group 1 elements will require the greatest amount of energy to remove the outermost electron. Explain. (2mks)

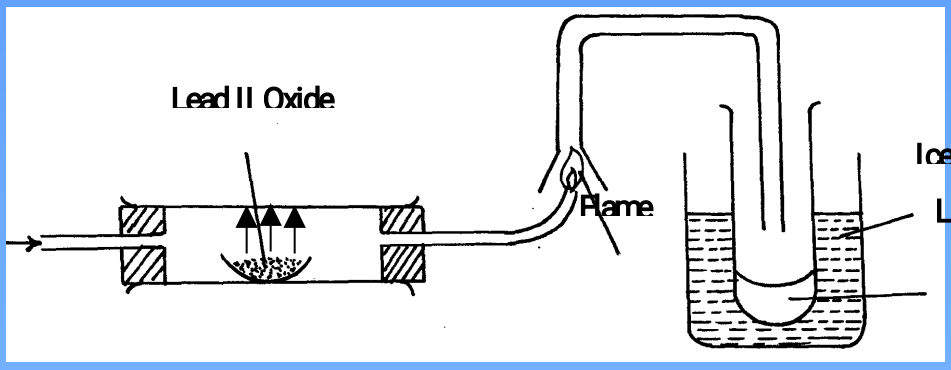
(v) Why is element **Z** used in light bulbs? (1mk)

(vi) Write the formula of the phosphate of element **T**. (1mk)

(vii) State the type of structure found in the oxide of element **F**. (1mk)

(ix) What is atomicity? (1mk)

5. Study the diagram below and answer the questions which follow.



(i) State **two** observations made when hydrogen gas pass over hot lead II oxide. (2mks)

(ii) Write the equation for the reaction which occurs in the combustion tube. (1mk)

(iii) What property of hydrogen is shown in the experiment above (1mk)

(iv) Identify liquid **M**. (1mk)

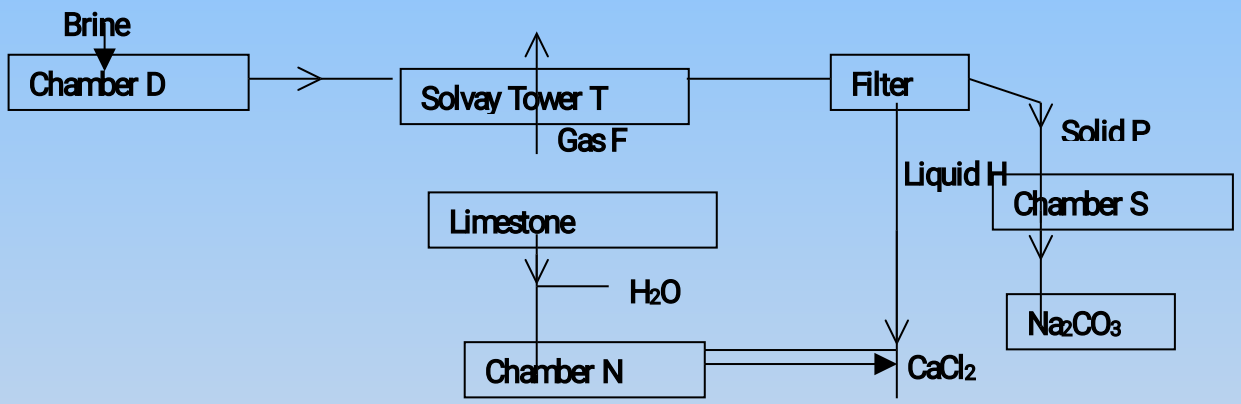
(v) What type of reaction occurs when hydrogen gas reacts with butene? (1mk)

(vi) State the condition required for the reaction (v) above (1mk)

(vii) Apart from hydrogen peroxide, state **two** other reagents that can be used to prepare oxygen gas. (1mk)

(viii) Write an equation to show how hydrogen gas is formed from the reagents chosen in (vii) above. (1mk)

6. Study the flow chart below and answer the questions which follow.



(a) Identify (3mks)

(i) Gas **F**

(ii) Liquid **H**

(iii) Solid

(b) State **one** use of calcium chloride. (1mk)

(c) Give **two** reasons why such a plant should be cited near a river (2mks)

(d) Write equations for the reactions occurring in chamber: (2mks)

(i) **N**

(ii) **S**

(e) Using an ionic equation, explain how sodium carbonate is used to soften hard water. (1mk)

(f) Explain how ammoniacal brine is formed. (1mk)

(g) State **one** use of sodium hydrogen carbonate. (1mk)

7. (a) Study the reduction potentials below.

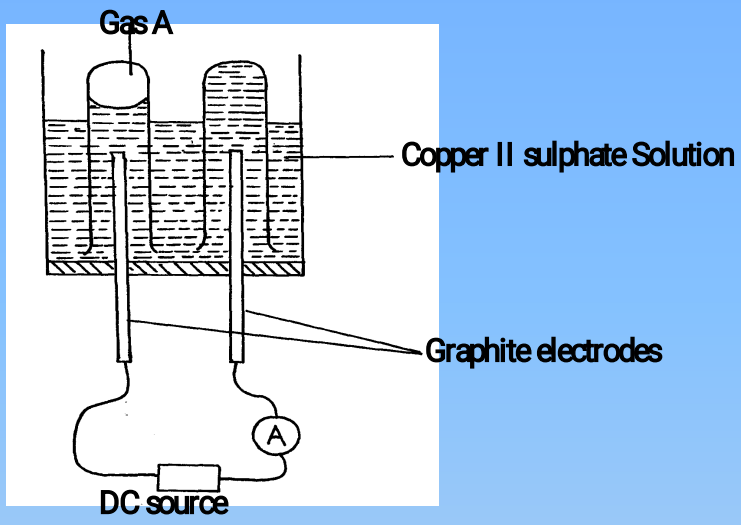
Half cell		E^{θ}(volts)
$A^{2+}(aq) + 2e^-$	$\rightleftharpoons$	+0.34
$B^{+}(aq) + e^-$	$\rightleftharpoons$	-2.92
$\frac{1}{2}C_2(g) + e^-$	$\rightleftharpoons$	+2.87

(i) Identify the weakest oxidizing agent. (1mk)

(ii) Calculate the e.m.f of the cell that would produce the highest output of voltage. (2mks)

(iii) Write the cell diagram for the cell formed above. (1mk)

(b) Study the electrolytic cell below.



(i) Identify the anode and cathode on the diagram. (1mk)

(ii) Write an equation to show how gas A is formed. (1mk)

(iii) State **two** changes that occur in the electrolyte after the experiment. (2mks)

(iv) What is electroplating? (1mk)

(v) Write the equation at the anode if copper electrodes were used. (1mk)

(vi) In electrolysis of dilute magnesium sulphate, using inert electrodes, a current of 2A was passed for 1¼hours. Calculate the volume of the gas produced at the anode at s.t.p. (1F=96500, M.G.V=22.4 L) (3mks)

TIME: 2 HOURS

BAHATI GIRLS KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

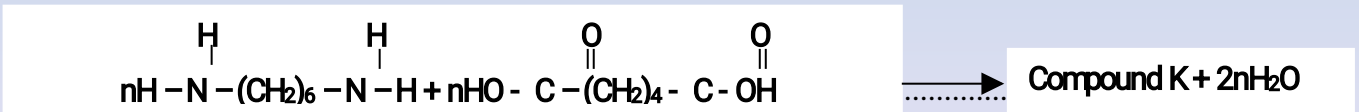
- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

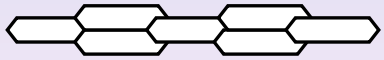
1. The atomic number of sulphur is 16. Write the electron arrangement of sulphur in the following: (2 Marks)

(a) H_2S;
(b) SO_3^{2-};

2. State **one** use of sodium hydrogen carbonate. (1 Mark)
3. Calcium oxide can be used to dry ammonia gas.
   (a) Explain why calcium oxide is not used to dry hydrogen chloride gas. (2 Marks)
   (b) Name **one** drying agent for hydrogen chloride gas. (1 Mark)
4. Using dots ( ) and crosses (x) to represent electrons, show bonding in the compounds formed when the following elements react: (Si=14, Na=11, Cl=17).
   (a) Sodium and chlorine. (1 Mark)
   (b) Silicon and chlorine. (1 Mark)
5. Zinc oxide reacts with acids and alkalis.
   (a) Write the equation for the reaction between zinc oxide and:
      (i) Dilute sulphuric acid. (1 Mark)
      (ii) Sodium hydroxide solution. (1 Mark)
   (b) What property of zinc is shown by the reactions in (a) above? (1 Mark)
6. Determine the oxidation state of sulphur in the following compounds. (2 Marks)
   (a) H_2S
   (b) $Na_2S_2O_3$
7. A certain carbonate XCO_3, reacts with dilute hydrochloric acid according to the equation given below:
   $XCO_{3(s)} + 2HCl_{(aq)} \longrightarrow XCl_{2(aq)} + CO_{2(g)} + H_2O_{(l)}$
   If 4g of the carbonate reacts completely with $40cm^3$ of 2M hydrochloric acid, calculate the relative atomic mass of X. (C=12.0 ,O=16.0, Cl=35.5). (3 Marks)
8. (a) Distinguish between a deliquescent and a inflorescent substance. (2 Marks)
   (b) Give **one** use of hygroscopic substances in the laboratory. (1 Mark)
   (a) What is meant by the terms: (2 Marks)
   (i) Isotopes
   (ii) Mass number
   (b) The formulae for a chloride of phosphorus is PCl_3. What is the formula of its sulphide? (1 Mark)
9. What is the name given to each of the following:
   (a) Ability of a metal to be made into a sheet; (1 Mark)
   (b) Minimum energy required for a chemical reaction to start; (1 Mark)
   (c) Type of force that holds molecules of argon together? (1 Mark)
10. Draw the structures and give the names of three alkanes having molecular formula of C_6H_{12}. (3 Marks)
11. A beaker contained $95.0cm^3$ of aqueous copper (ii) sulphate at 43.7^0C. When a scrap iron metal was added to the solution, the temperature rose to 49.6^0C.
    (a) Write an ionic equation for the reaction that took place. (1 Mark)
    (b) Given that the mass of copper deposited was 5.83g, calculate the molar enthalpy change in $KJmole^{-1}$. (Specific heat capacity of solution = $4.2Jg^{-1}k^{-1}$, density of solution = $1.0gcm^{-3}$, Cu=63.5). (2 Marks)
12. a) Draw the structure of compound K formed in the following reaction. (1 Mark)



    b) Give **one** use of compound K. (1 Mark)
13. a) What is meant by allotropy? (1 Mark)
    b) The diagram below shows the structure of one allotropes of carbon.



i) Identify the allotrope (½ Mark)

ii) State **one** property of the above allotrope and explain how it is related to its structure. (1½Mark) .

14. Pentane and ethanol are miscible. Describe how water can be used to separate a mixture of pentane and ethanol. (3 Marks)

15. In the redox reaction below:

$2H^+_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} + 3SO_{2(g)} \longrightarrow Cr^{3+}_{(aq)} + 3SO_4^{2-}{}_{(aq)} + H_2O_{(aq)}$

Identify the reducing agent, explain your answer. (2 Marks)

16. $60cm^3$ of oxygen gas diffused through a porous hole in 50seconds. How long will it take $80cm^3$ of sulphur(iv)oxide to diffuse through the same hole under the same conditions (S=32.0 , O=16). (3 Marks)

17. Calculate the heat of formation of propane from the following data. (2 Marks)

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

$H_{2(g)} + ½\ O_{2(g)} \longrightarrow H_2O_{(l)}$, $\Delta H = -286 KJmol^{-1}$

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

18. a) Find the value of A and B in the following equation. (1 Mark)

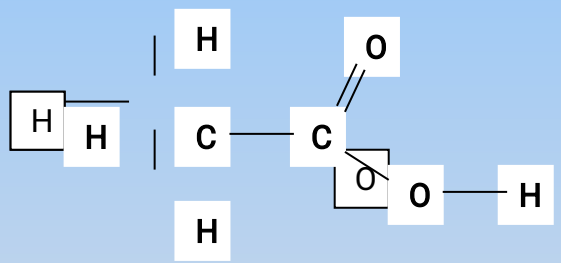
$$^{234}_{90}X \longrightarrow {}^{A}_{B}Y + {}^{-}_{-1}e$$

b) A certain radioactive element has a half-life of 6000 years. How long did it take to decay until only 25% of the original amount remained? (2 Marks)

19. a) Differentiate between thermosoftening and thermosetting plastics. (1 Mark)

b) In the test for the chloride was in solution, a littler nitric acid is added followed by silver nitrate solution. Why is nitric acid added? (1 Mark)

The structure of ethanoic acid is:



What is the total number of electrons used for bonding in a molecule of ethanoic acid? Give reasons. (2 Marks)

20. When a few drops of aqueous ammonia were added to copper(ii) nitrate solution, a light blue precipitate was formed. On addition of more aqueous ammonia, a deep blue solution was formed.
Identify the substance responsible for the:
(a) Light blue precipitate (1 Mark)
(b) Deep blue solution (1 Mark)

21. When a current of 0.82A was passed for 5 hours through an aqueous solution of metal Z, 2.65g of the metal was deposited. Determine the charge on the ions of metal Z. (1 faraday=96500coulombs; relative atomic mass of Z=52). (3 Marks)

22. The standard reduction potentials of two half cells are:

$Ag^+_{(aq)} + e^- \longrightarrow Ag_{(s)}$; $E^i = 0.86V$

$2H_2O_{(l)} + 2e^- \longrightarrow H_{2(g)} + 2OH^-_{(aq)}$; $E^i = 0.89V$.

(i) Calculate the e.m.f of the cell formed by the above two half-cells (1 Mark)

(ii) Draw a labelled diagram of an electrochemical cell that can be constructed using the two half-

cells. (3 Marks)

23. The ionisation energies for three elements X,Y, and Z are shown in the table below:

Element	X	Y	Z
Ionisation energy (KJ/mole)	419	318	394

(a) What is meant by ionisation energy? (1 Mark)

(b) Which element is the strongest reducing agent? Give a reason. (2 Marks)

24. a) What condition is necessary for an equilibrium to be established? (1 Mark)

b) When calcium carbonate is heated, the equilibrium shown below is established

$CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$

How would the position of the equilibrium be affected if a small amount of dilute potassium hydroxide is added to the equilibrium mixture? Explain. (2 Marks)

25. Some animal and vegetable oils are used to make margarine and soap. Give reagents and conditions necessary for converting oils into:

(a) Margarine (2 Marks)

(b) Soap (1 Mark)

26. Classify the following processes as either chemical or physical. (3 Marks)

Process	Type of change
(a) Souring of milk	
(b) Obtaining butane from crude oil	
(c) Heating copper(ii)sulphate crystals	

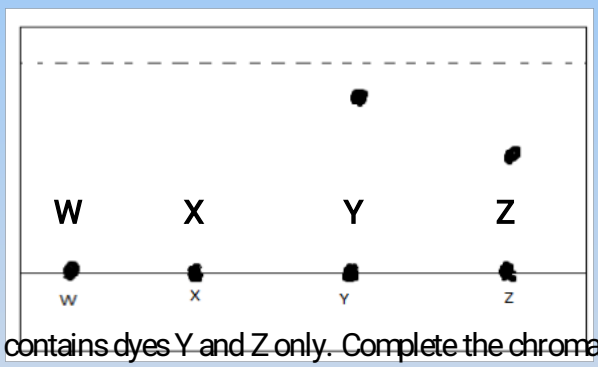
27. A sample of fertiliser is suspected to be calcium ammonium nitrate. Describe chemical tests for each of the following ions in the sample.

(a) Calcium ions (2 Marks)

(b) Ammonium ions (1 Mark)

28. State the **two** ions that cause hardness in water. (1 Mark)

29. The diagram below represents an incomplete paper chromatogram of pure dyes X, Y, Z and mixture W.



Mixture W contains dyes Y and Z only. Complete the chromatogram to show how mixture W separates. (2 Marks)

BAHATI GIRLS KCSE TRIAL AND AND PRACTICE EXAM .

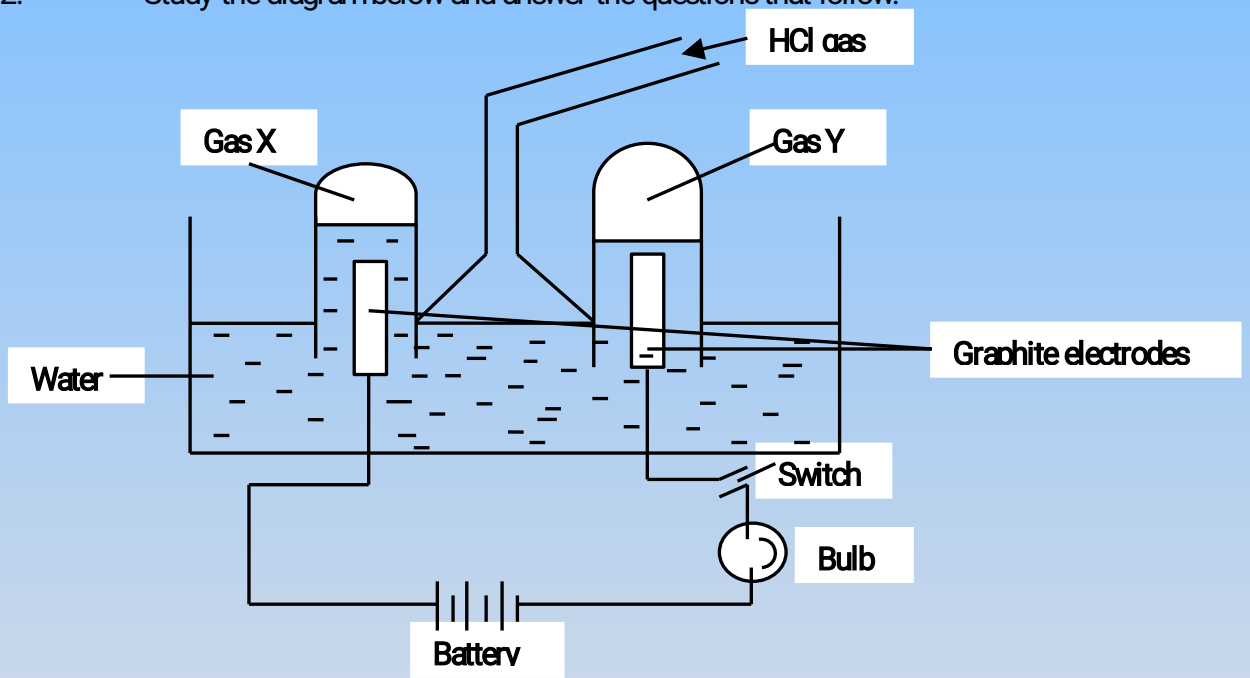
Paper 2

1. The table below gives information on four elements by letters A, B, C and D. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Element	Electronic arrangement	Atomic radius (nm)	Ionic radius (nm)
A	2.8.2	0.136	0.065
B	2.8.7	0.099	0.181
C	2.8.8.1	0.203	0.133
D	2.8.8.2	0.174	0.099

(a) Which **two** elements have two similar chemical properties? Explain. (2 Marks)
(b) What is the most likely formula of the oxide of B? (½ Mark)
(c) Which element is a non-metal? (1 Mark)
(d) Which one of the elements is the strongest.
(i) Reducing agent? (1 Mark)
(ii) Oxidising agent? (1 Mark)
(e) Explain why ionic radius of D is less than that of C. (1 Mark)
(f) Explain why the ionic radius of B is bigger than its atomic radius. (1 Mark)
(g) Give the chemical family to which the element.
(i) A and D belong (½ Mark)
(ii) B belong (½ Mark)
(iii) C belong (½ Mark)
(h) State any **two** uses of element B. (1 Mark)

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



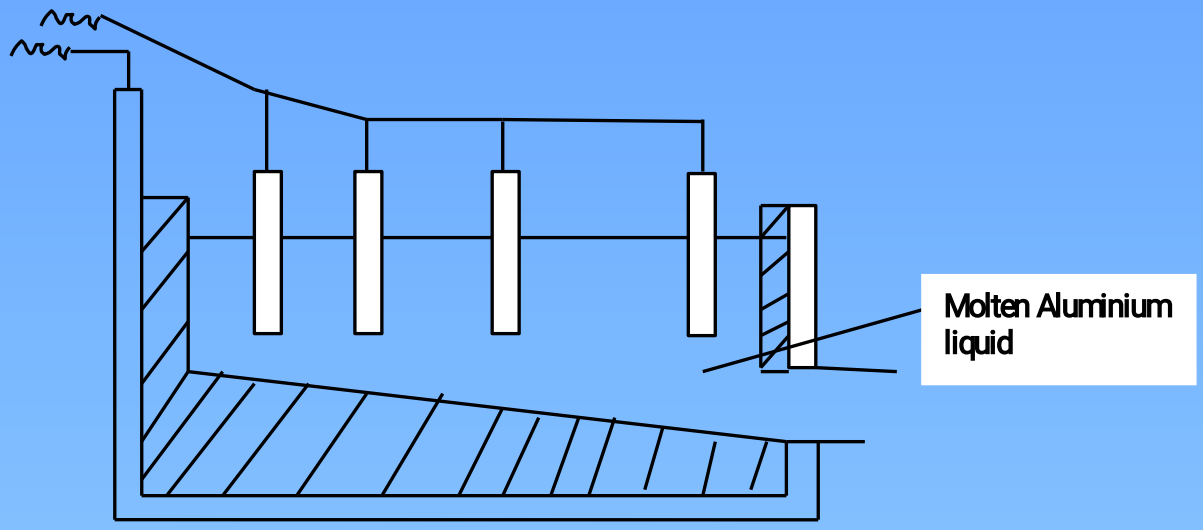
When some hydrogen gas is allowed into the water and the mixture stirred the bulb lights up and gases X and Y are formed.

(a) Name gas X Q (½ Mark)
gas Y (½ Mark)
(b) Write the chemical equations of how each of the gases is formed.
Gas X (1 Mark)
Gas Y (1 Mark)
(c) State any **two** uses of gas X. (1 Mark)

(d) Explain why the bulb does not light before the hydrogen chloride gas is let into water. (1 Mark)

(e) Explain using equations why the volume of gas X is less than that of gas Y. (2 Marks)

3. The extraction of aluminium from its ore takes place in two stages, purification stage and electrolysis stage. The diagram below shows the set up for the electrolysis stage.



(a) Name the ore from which aluminium is extracted. (½ Mark)

(b) Name **one** impurity which is removed at purification stage. (½ Mark)

(c) Label on the diagram each of the following:

Anode (½ Mark)

Cathode (½ Mark)

Region containing the electrolyte (½ Mark)

(d) The melting point of aluminium oxide is 2054^0C but electrolysis is done between 800^0C - 900^0C.

(i) Why is the electrolysis not carried out at 2054^0C.? (1 Mark)

(ii) What is done to lower the temperature of the electrolysis cell to 800^0C - 900^0C? (1 Mark)

(iii) The aluminium which is produced is tapped off as liquid. What does this imply about its melting point? (1 Mark)

(e) A typical electrolysis cell uses a current of 40000 ampheres. Calculate the mass (in kilograms) of aluminium produced in one hour. (2 Marks)

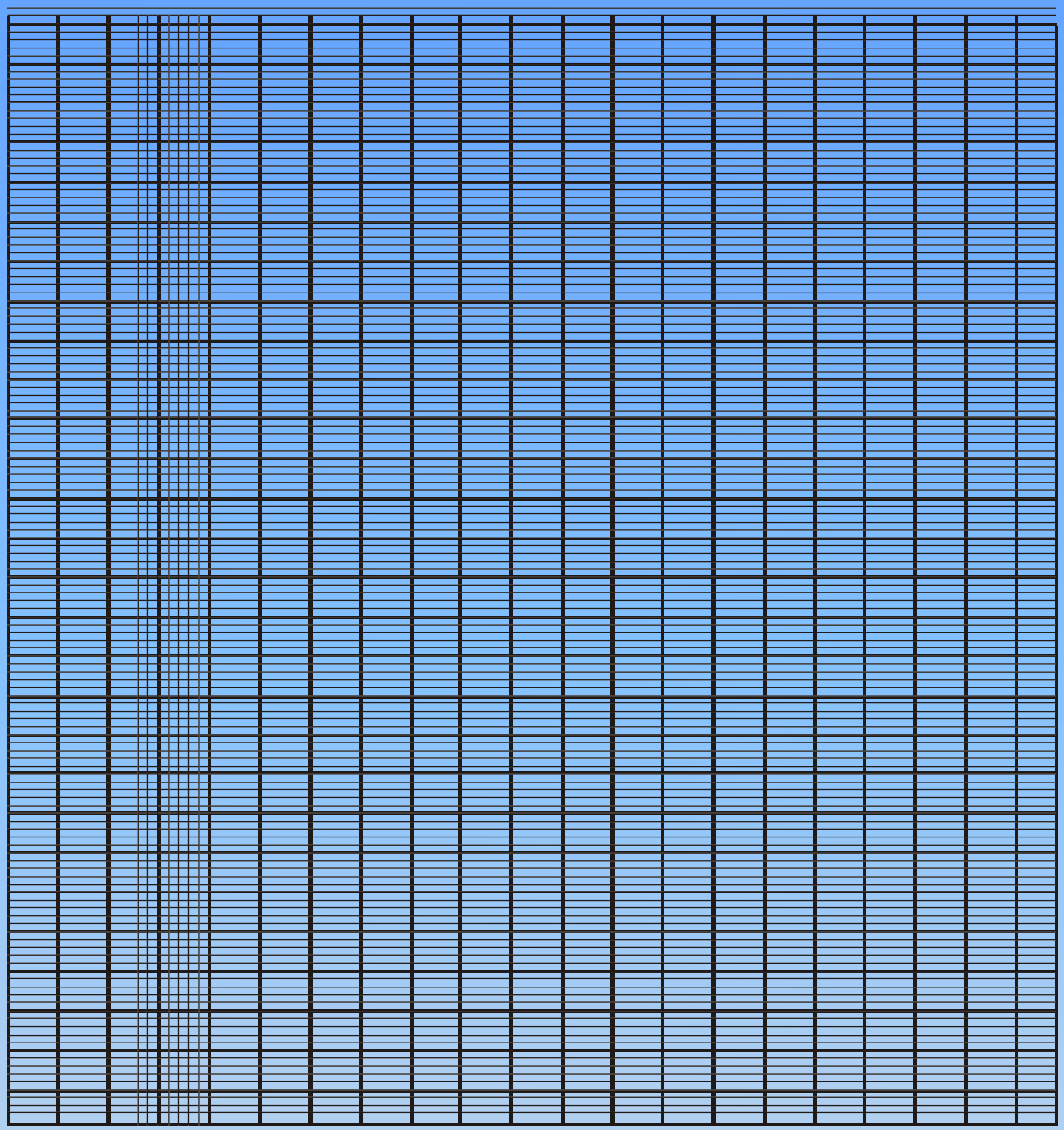
4. The table below gives the volume of the gas provided when different volumes of 2M hydrochloric acid were reacted with 0.6g of magnesium powder at room temperature.

Volume of 2M hydrochloric acid (cm^3)	Volume of gas (cm^3)
0	0
10	240
20	480
30	600
40	600
50	600

(a) Write an equation for the reaction between magnesium and hydrochloric acid, (1 Mark)

(b) On the grid provided, plot a graph of the volume of gas produced (vertical axis) against the volume of acid added (note the reaction comes to completion, the volume of the gas produced directly proportional to the volume of the acid added).

(3 Marks)



(c) From the graph determine:

(i) The volume of the gas produced if 12.5cm^3 of 2M hydrochloric acid had been used. (1 Mark)

(ii) The volume of 2M hydrochloric acid which when reacted completely with 0.6g of magnesium powder. (1 Mark)

(d) On the same graph paper sketch the curve of the reaction when reacted with,

(i) 0.6 g of magnesium ribbon were used instead of magnesium powder with 2M hydrochloric acid. (1 Mark)

(ii) 3M hydrochloric acid was used instead of 2M hydrochloric acid. (1 Mark)

(iii) 0.6g of magnesium powder were used with 2M hydrochloric acid at a lower temperature than the original temperature of the 2M hydrochloric acid in the first case (1 Mark)

(e) Given that one mole of the gas occupied 24000cm^3 at room temperature, calculate the relative atomic mass of magnesium. (2 Marks)

(f) State and explain the effect on the rate of bubbling of the gas if :

(i) 0.6g of Magnesium ribbon was used instead of magnesium powder.(1 Mark)
(ii) 3M hydrochloric acid was used instead of 2M hydrochloric acid. (1 Mark)
(iii) When 0.6g of magnesium powder is used 2M hydrochloric acid at a lower temperature instead of the temperature of the initial experiment. (1 Mark)

5. Petrol (octane) a long hydrocarbon alkane can be converted to ethene and hydrogen gas mixtures as follows:

$C_8H_{18(l)} \longrightarrow 4C_2H_{4(g)} + H_{2(g)}$

Octane ethene hydrogen

(a) (i) What do we call the process by which the products are obtained from octane? (½ Mark)

(ii) Give **two** conditions needed in this reaction. (1 Mark)

(b) Unleaded fuel is now widely used and has to be used in modern cars fitted with catalytic converters.

(i) State the merits of unleaded petrol over 'leaded' petrol. (1 Mark)
(ii) What is the role of the catalytic converter? (1 Mark)
(iii) Why wouldn't the converters work with leaded petrol? (1 Mark)
(iv) List **four** air pollutants produced by leaded petrol fuel used in automobile engines or any other petrol propelled engine. (2 Mark)

6. A natural element represented by letter Y has two types of atoms. The composition of the particles is as summarised below.

Type of atom	Nucleons present	% composition
$^{63}_{29}Y$	29, 34	69.1
$^{65}_{29}Y$	29, _____	30.9

(a) Complete the missing number. (½ Mark)
(b) What is the name assigned to these two types of atoms? (½ Mark)
(c) Which atom has the least percentage of abundance? (½ Mark)
(d) Calculate the relative atomic mass of Y. (2 Marks)
(e) Explain what is made by nuclear particles giving examples where possible. (1½Marks)

7. a) State graham's law of gas diffusion. (1 Mark)
b) 60cm^3 of oxygen gas diffuses through a porous plug in 50 seconds. How long would it take 60cm^3 of sulphur (iv) oxide gas to diffuse through the same plug under the same condition? (S=32, O=16). (2 Marks)

8. Below is a list of potential differences obtained when metals X, Y, Z, K and L are used in the following electrochemical cell.
Metal(s)/metal ion (aq)//copper(ii)ions/copper.

Metal	E^θ (volts)
X(Valence 2)	-1.10
Y	-0.46
Z	0.00
K	+0.45
L(Valence 2)	+1.16

(a) What is metal Z? Explain. (1 Mark)
(b) Which **two** of the above metals in an electrochemical cell would produce the largest electromotive force across the cell? What is this electromotive force? (2 Marks)

(c) Write the cell equation of the pair of metals that will produce the largest potential difference. (1 Mark)

(d) Write the cell equation of the pair of metals that will produce the largest negative potential difference. Determine this voltage. (3 Marks)

9. a) A mass of 56g a saturated solution of salt X at 25^0C yield 14g of the solid when evaporated to dryness. What is the solubility of the salt at 25^0C. (2 Marks)

b) Bromine reacts with hydrogen to form hydrogen bromide gas as shown below.

$H_{2(g)} + Br_{2(g)} \longrightarrow 2HBr_{(g)} \quad \Delta H = -128Kj$

(i) Determine the molar heat of the above reaction. (1 Mark)

(ii) Write the equation for the above case that show the molar heat of formation of hydrogen bromide gas. (½ Mark)

c) State and explain the effect of the following on the equilibrium of the reaction indicated below.

$H_{2(g)} + Cl_{2(g)} \rightleftharpoons 2HCl_{(g)} \quad \Delta H = -108KJ.$

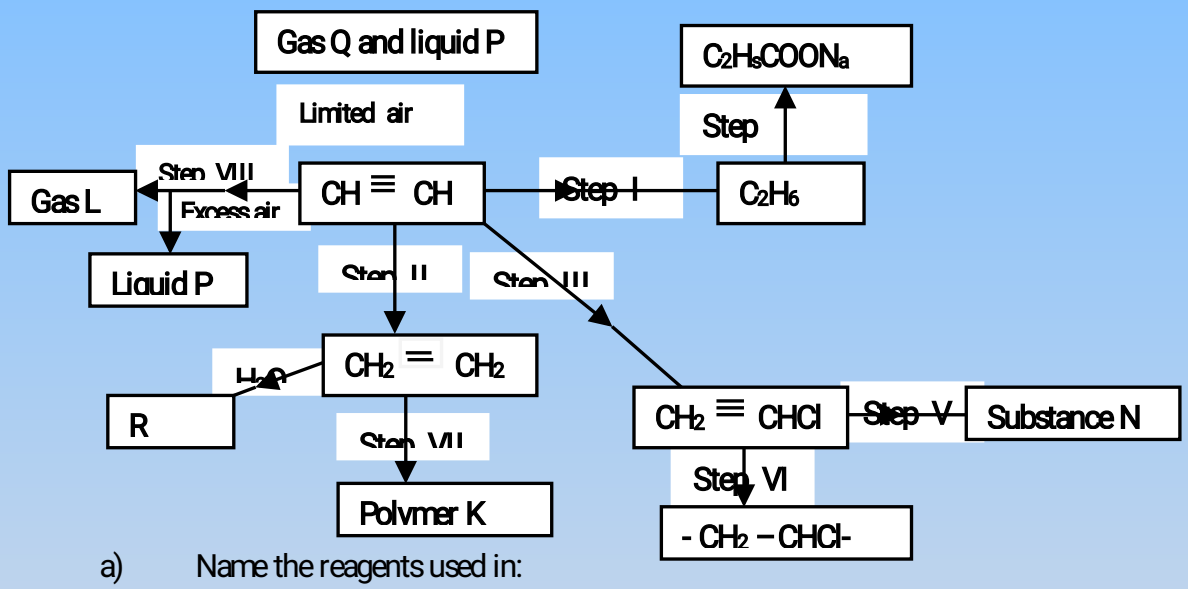
(i) Increase in pressure. (1 Mark

(ii) Increase in temperature. (1 Mark)

(iii) Removal of chlorine gas. (1 Mark)

10. a) A sample of mass of X grammes of a radioactive isotope decays to 50 grammes in 100 days. The half life of the isotope is 25days. Calculate the initial mass of the isotope X. 2 Marks)

Study the scheme given below and answer the questions that follow;



a) Name the reagents used in:

b) Identify substance:

c) Draw structural formula for the following substances (½ Mark)

d) State **one** disadvantage of continued use of substance K. (½ Mark)

11. a) 0.1mole of sodium chloride was dissolved in $100cm^3$ of water. Calculate the concentration of this aqueous solution in grams per dm^3 (Na=23, Cl=35.5). (2Marks)

b) Draw reaction cycles for the cases shown below. (2Marks)

$S_{(s)} + ½ O_{2(g)} \longrightarrow SO_{(g)}$

$SO_{(g)} + ½ O_{2(g)} \longrightarrow SO_{2(g)}$

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

KABARAK HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

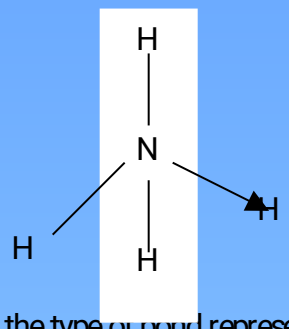
- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. Define the following terms (3mks)
   (a) Isotopes
   (b) Mass number
   (c) Isobars

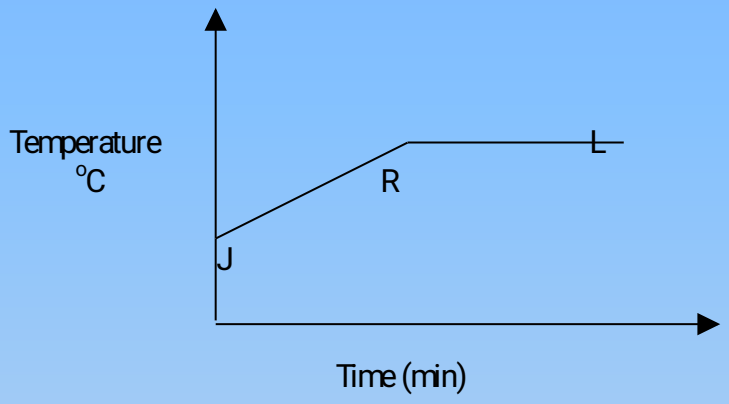
2. Calcium oxide can be used to dry hydrogen chloride gas.
(a) Explain why calcium oxide is not used to dry chlorine gas (2mks)
(b) Name one drying agent for hydrogen chloride gas other than the one named above (1mk)

3. (a) Give a reason why ammonia gas is highly soluble in water. 1mk)
(b) The structure of ammonium ion is shown below



Name the type of bond represented in the diagram by N ⟶H ……
(1mk)

4. The graph below shows part of a temperature –time curve obtained when solids naphthalene was heated.



(a) Explain what happens to the naphthalene molecules along the curves.
(i) JR (1mk)
(ii) RL (1mk)

5. (a) Define the term standard enthalpy of formation of a substance (1mk).

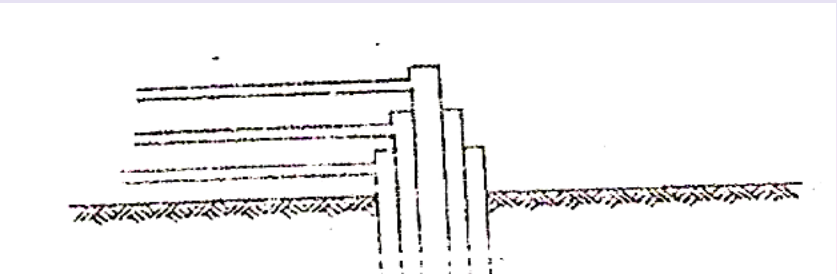
$C_3H_8 + SO2 \longrightarrow 3CO2 + 4H_2O \quad \Delta H = -1202\ Kj\ mol^{-1}$

$C_{(s)}$ graphite + $O_2 \longrightarrow CO_2 \quad \Delta H = -394 Kj\ mol^{-1}$

$H_{2(g)} + ½\ O_2 \longrightarrow H_20 \quad \Delta H = 286\ KJ\ mol^{-1}$

Using the above thermo chemical equations:
(b) Name two types of heat changes represented by ΔH_3 (1mk)
(c) Using an energy cycle diagram, calculate the molar enthalpy of formation of propane (2mks)

6. The diagram below illustrates how sulphur is extracted by frasch process





Ground level



Sulphur beds

(a) Label the pipe through which super heated water is pumped in (1mk)

(b) The equation below shows the oxidation of sulphur(IV) oxide to sulphur (VI) oxide in contact process.

$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H = -196 Kj^{mol-1}$

(i) Name one catalyst for this reaction (1mk)

(ii) State and explain the effect on the yield of sulphur (VI) oxide when

I the temperature is increased (1mk)

II the amount of oxygen is increased (1mk) (1mk)

7. Both diamond and graphite have giant atomic structures. Explain why diamond is hard while graphite is soft. (2mks)

8 (a) Using dot (.) and crosses(x) to represent electrons, show bonding in the compounds formed when the following elements reacts. (C-=6, Na=11, F=9)

(a) Sodium and fluorine (1mk

(b) Carbon and fluorine (1mk)

9 The list below gives the formulae of some organic compounds. Use it to answer the questions that follow

I $CH_3CH_2CH_2CH_2OH$

II $CH_3CH_2CH_3$

III $CH_3CH_2CH_2 \overset{O}{\overset{\|}{C}} OH$

IV $CH_3CH_2CH_2\ CH_3$

10. The table below gives the solubility of potassium bromide and potassium sulphate at 0^oc and 40^oC

Substance	Solubility g/100g H_2O at	
	0^oc	40^oC
Potassium bromide	55	75
Potassium sulphate	10	12

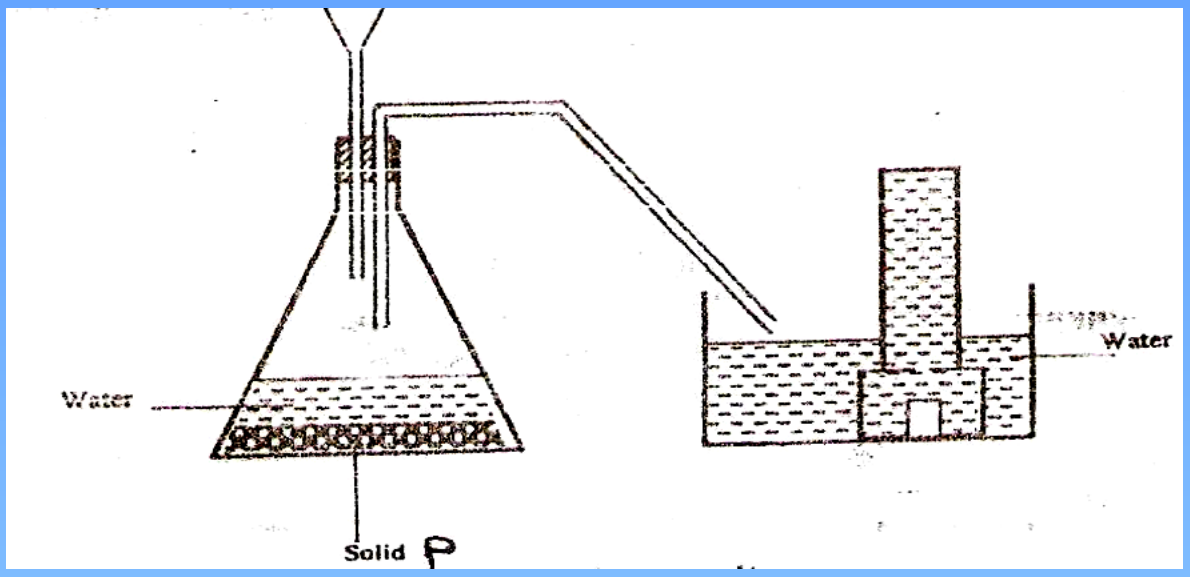
When an aqueous mixture containing 60g of potassium bromide and 7g potassium sulphate in 100g of water at 80^oc was cooled to 0 ^oC, some crystals were formed

(a) Identify the crystals (1mk)

(b) Determine the mass of the crystals (1mk

(c) Name the method used to obtain the crystals (1mk

11. The diagram below shows a set-up used by a student in an attempt to prepare and collect oxygen gas.



(a) Complete the diagram by correcting the mistakes in the set ups (2mk)

(b) Identify solid P (1mk)

12. The table below gives information about the major components of crude oil. Study it and answer the questions that follow.

Components	Boiling point ^{o}C
Gases	Below 40
Petrol	40-175
Kerosene	175-250
Diesel oil	250-350
Lubricating oil	350-400
Bitumen	Above 400

(i) Which of the compounds of crude oil has molecules with the highest number of carbon atoms?

Explain (1mk)

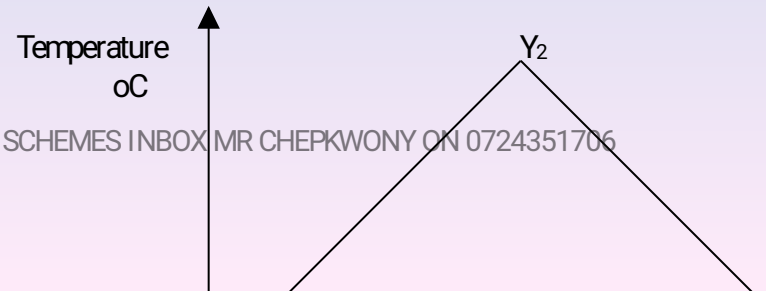
(ii) Name the process you would use to separate a mixture of diesel and petrol (1mk)

(iii) What condition could cause a poisonous gas to be formed when Kerosene is burnt (1mk)

13 In order to determine the molar heat of neutralization of sodium hydroxide 100cm3 of 1M sodium hydroxide and 100cm^3 of 1M 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 30 seconds until the highest temperature of the solution was attained. Thereafter the temperature of the solution was recorded for further two minutes

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

(b) The sketch below was obtained when the temperatures of the mixture were plotted against time. Study it and answer the questions that follow





i) What is the significance of point Y_2 (1mk)

ii) Explain the temperature change (1mk)

(a) Between Y_1 and Y_2

(b) Between Y_2 and Y_3 (1mk)

14. For each of the following experiments, give the observations, and the type of change that occurs (Physical or chemical)

Experiment	Observation	Type of change
A few drops of concentrated sulphuric acid added to small amounts of sugar		
A few crystals of Iodine are heated gently in a test tube		
A few crystals of copper (II) Nitrate are heated strongly in a test tube.		

15. In the lab. Ammonia gas is prepared by heating an ammonium salt with an alkali.

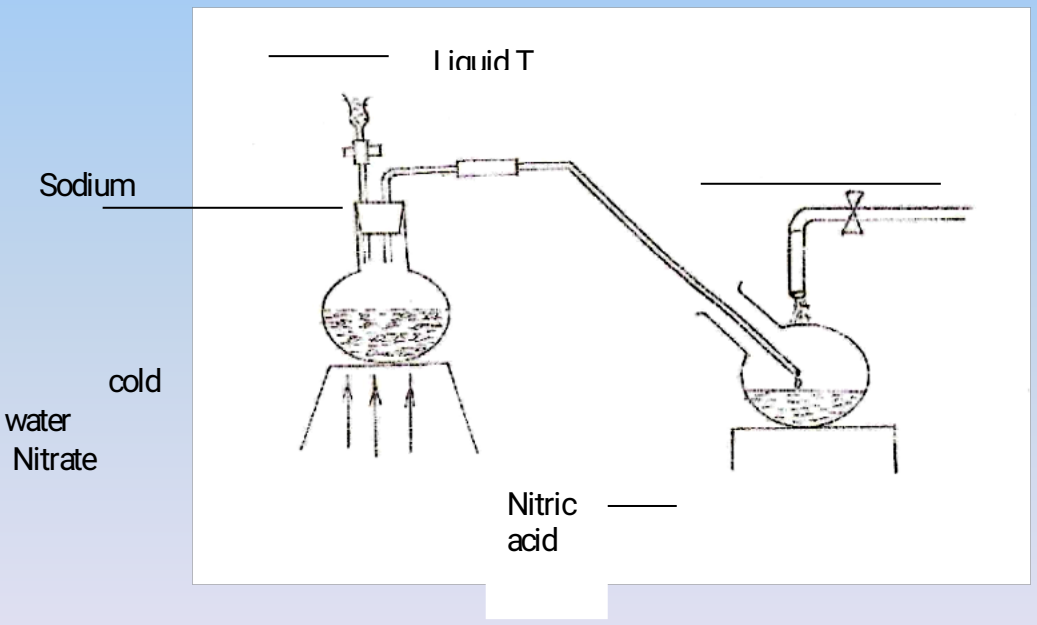
(a) What is meant by the term alkali (1mk)

(b) i) Explain using the physical properties of the gas, why ammonia is not collected

(i) Over water (1mk

(ii) By downward delivery (1mk)

16 The set up below was used to prepare nitric acid



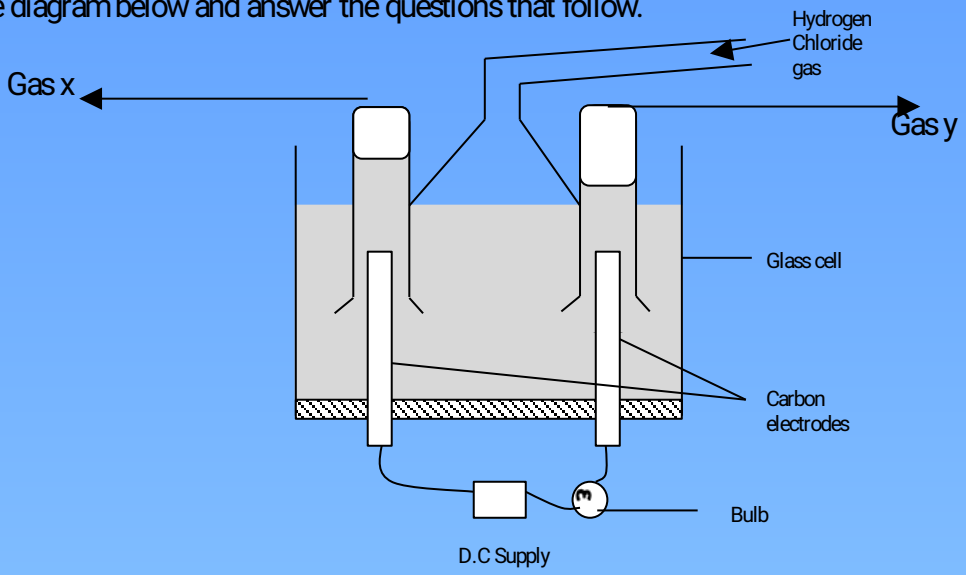
(a) Give the name of liquid T(1mk) T (1mk)

(b) Write the equation for the reaction which took place in the reaction flask

(1mk)

(c) Explain why nitric acid is stored in a dark bottle (1mk)

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



When some hydrogen chloride gas is allowed into water and the mixture stirred, the bulb lights and gasses X and Y are formed (2mks)

(a) Name

(i) Gas X

(ii) Gas Y

(b) Explain why the bulb does not light before the chloride gas is let into the water (2mks)

18 The table below gives information on four elements represented by K L M & N. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Elements	Electron arrangement	Atomic radius	Ionic radius
K	2, 8 2	0.136	0.065
L	2, 8, 7	0.099	0.181
M	2, 8, 8, 1	0.203	0.133
N	2, 8, 8, 2	0.174	0.099

(a) Which two elements have similar chemical properties? Explain (2mks)

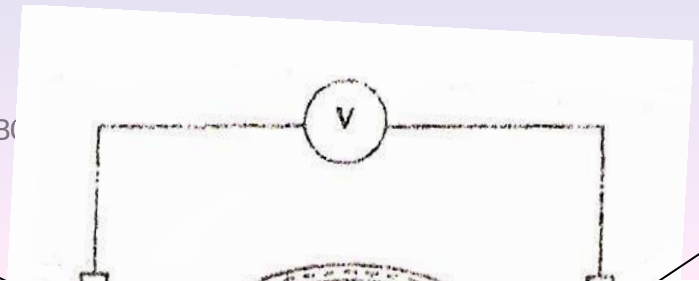
19. The table below gives reduction potentials obtained when the half-cells for each of the elements represented by A, B, C, D and E were connected to a copper half-cell as the reference electrode.

Metal	Reduction Potential (Volts)
A	-1.10
B	-0.47
C	0.00
D	+0.45
E	+1.16

(a) What is element C likely to be? Give a reason (2mks)

(b) Which of the metals cannot be displaced from the solution of its salt by any other metal in the table. Give a reason (2mk)

(c) Metal B and D were connected to form a cell as shown below



D

B

$D^+(aq)$

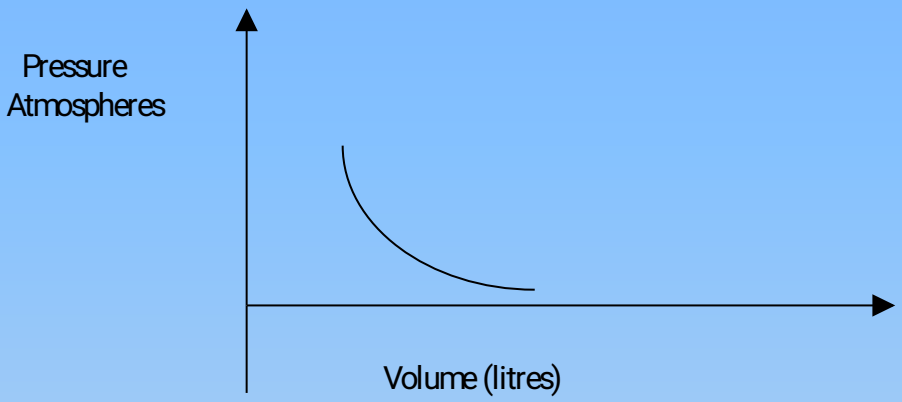
B+(aq)

Salt bridge

Salt bridge

Write the equation for the half cell reaction that occur at metal B electrode (1mk)

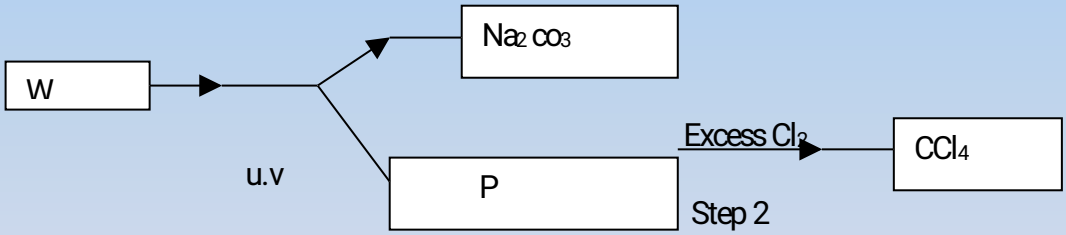
20. The graph below shows the behaviour of a fixed mass of a gas at constant temperature



(a) What is the relationship between the volume and the pressure of the gas (1mk)

(c) 3 litres of oxygen at one atmospheres pressure were compressed to two atmospheres Pressure at constant temperature. Calculate the volume occupied by the oxygen gas (2mks)

21 Study the flow chart below and answer the questions that follow



(a) Identify W and P (2mks)

(b) What name is given to the type of halogenation reaction in step 2. (1mk)

22 (a) Define the term half-life as used in radioactivity (1mk)

(b) 100g of a radio active substance was reduced to 12.5g in 15.6 years. Calculate one half-life of the substance

23 (a) Define the term oxidation state. (1mk)

(b) Calculate the oxidation states of chromium and manganese in the following ions.
(2mks)

(i) Chromium in $Cr_2O_7^{2-}$

(ii) Manganese in MnO_4^-

24 Write one structural formulae of

(i) Methanol 1mk)

(ii) Methanoic acid (1mk)

(b) Write the equation for the reaction between methanoic acid and sodium hydroxide
(1mk)

(c) Name the product formed when methanol reacts with methanoic acid (1mk)

(d) State one condition necessary for the reaction in (c) to take place (1mk)

25. In an experiment to electroplate a copper spoon with silver, a current of 0.5A was passed for 18 minutes. Calculate the amount of silver deposited on the spoon (IF =96500 coulombs ,Ag=108)
(3mks)

KABARAK HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. The table below shows results recorded on an experiment carried out to determine the solubility of potassium nitrate.

Temperature (oC)	20	30	40	50	60	70	80	90
Solubility in g per 100g of water	32	46	64	86	110	138	169	202

(a)

(b) Use the data above to plot a graph of solubility against temperature on the grid Provided (3mks)



(b) From the graph determine the solubility of potassium nitrate at
(2mks)

(i) 25°C

(ii) 83 °C

© What mass of potassium nitrate will crystallise when a saturated solution is cooled from $75^{o}C$ to $20^{o}C$. (2mks

(d) On the same axis sketch a graph showing how solubility of chlorine gas varies with temperature (1mk)

(e) The table represents results on four samples of water. Study it an answer the questions that follows.

Sample of water	Drops of soap used to produce lather	
	Before boiling	After boiling
A	20	10
B	3	3
C	15	3
D	20	20

(i) Which sample is likely to be temporary hard water? Explain (2mks)

(ii) Give 2 advantages of hard water (2mks)

2 (a) Draw the structural formulae of the following compounds (3mks)

(i) 2 methyl propene

(ii) Butan –2-ol

(iii) 2-3-di methyl Butane

b) State the observation made when compound (ii) in (a) above is reacted with a piece of Sodium metal (1mk)

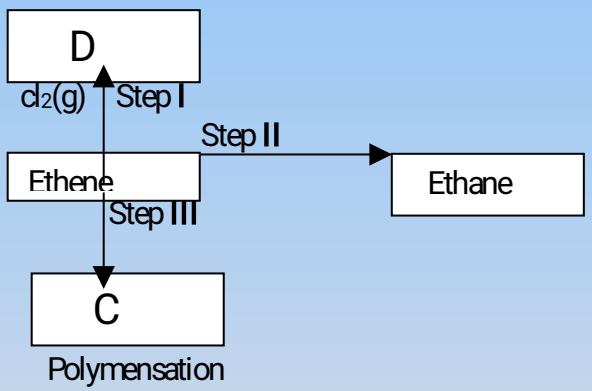
c) Compounds (i) and (ii) in (a) above belong to different homologous series

I. what is a homologous series (1mk)

II. Give a chemical test that will distinguish Butan-2-ol from butanoic acid (2mks)

(c) Write an equation for the complete combustion of ethane gas. (1mk)

(d) Study the flow chart below and answer the questions that follows.

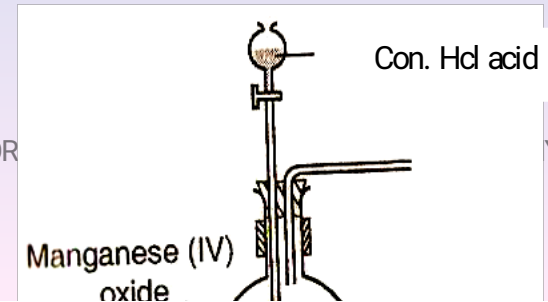


(i) Give the reagents and conditions for step II to occu (2mks)

(ii) Give the industrial importance of step II (1mk)

(iv) Name the compounds (2mks)

3 The setup below was used to prepare and collect a dry sample of gas X. Study it and answer the questions that follow.



potassium manganate (VII)

X ..... (1mk)

te the setup to show

a) Identify gas X (1mk)

(b) Complete the setup to show how gas X is dried and collected. (3mks)

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

(d) An aqueous solution of zinc sulphate is electrolysed using platinum electrodes. State and explain what happens to the concentration of zinc sulphate (2mks)

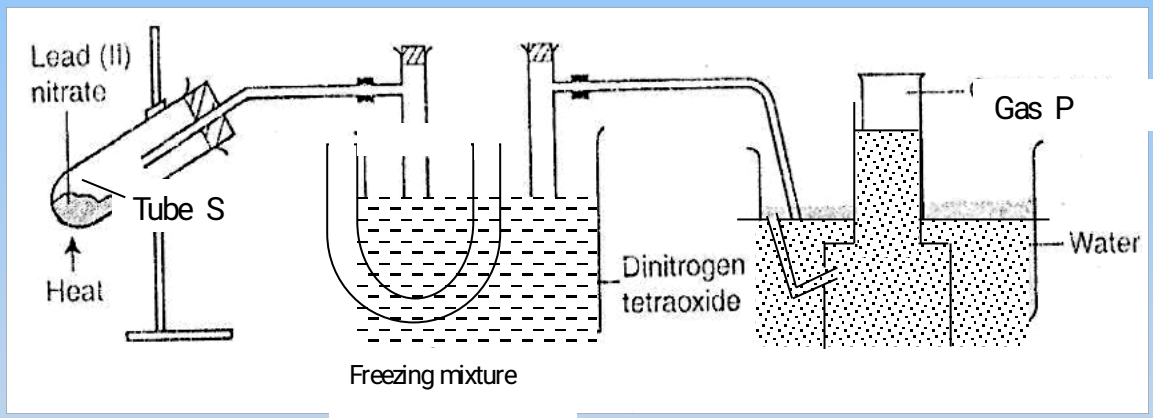
(e) State the ratio of the products of the anode and cathode using the equations (2mks)

(f) Give one use of electrolysis (1mk)

(g) What is anodization of aluminium (1mk)

4 The diagram below represents a set up that can be used to prepare and collect Nitrogen (IV) oxide.

Name gas P (1mk)



(a) Write an equation for the reaction that takes place (1mk)

(b) Give **Two** observation that would be made in tube S 2mks)

(c) What property of Nitrogen (IV) oxide make it possible for its collection as shown above. (2mks)

(d) Why is it not advisable to use other Nitrates (1mk)

(e) Write an equation showing a reaction of Nitrogen (IV) oxide and water (1mk)

(f) Explain the following observation, a piece of burning magnesium is lowered in a gas jar full of Nitrogen (IV) oxide it continues to burn forming a white solid and a colourless gas. (2mks)

(i) Name the white solid (1mk)

(ii) Name the colourless gas (1mk)

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

A		

				D				E			
B	C						F	G			
	K							H			

(a) Choose the most reactive non-metal (1mk)

On the grid indicate the position of element X whose ion is X^{2} and has an electron Arrangement of 2,8 (2mks)

(b) Write the formulae of the compound formed between G and D. (1mk)

(c) What is the family name of E,G, H (1mk)

(d) How does the electronegativity of E, G, and H vary? Explain (2mks)

(e) Compare the reactivity of A and water and that of C and water (2mks)

(f) Name the type of oxide formed by B (1mk)

(g) Give one use of element F (1mk)

6 (a) Name the process in which sodium metal is extracted (1mk)

(b) What is the function of calcium chloride during extraction of sodium metal (1mk)

(c) Write an equation for the reaction taking place at the anode (1mk)

(d) Apart from liquid sodium what else can be collected at the cathode, and how is it separated from sodium. (2mks)

(e) Calculate the volume of hydrogen gas produced at s.t.p when 1.15g of sodium metal react with water. (Na=23, molar gas volume=22400cm^{3}) (3mks)

(f) (i) State one environmental hazard that is caused during extraction of sodium metal (2mk

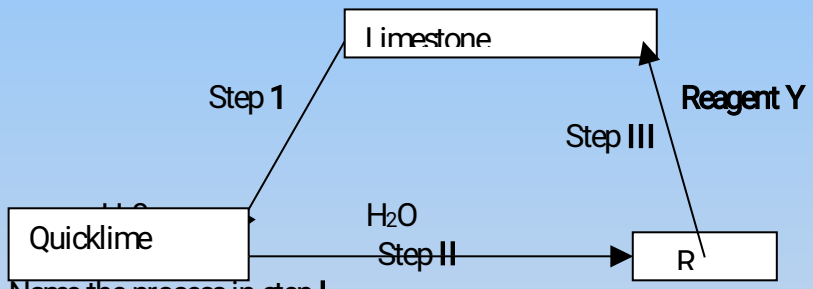
(ii) Give 2 uses of sodium metal (2mks)

7 (a) Define the following terms (2mks)

(i) Duplet

(d) Hydrogen bonding

(b) Below is a flow chart. Study it and answer the questions that follow: -



(i) Name the process in step I (1mk)

(ii) Name compound R (1mk)

Reagent Y (1mk)

(iii) Write equation for the reaction in step II (1mk)

(c) Explain why 0.1 M hydrochloric acid has a pH of 1 while 0.1M ethanoic acid has a pH of 3 (2mks)

(d) (i) Write down the observation made when a sample of copper (II) carbonate is heated in a test tube (1mk)

(ii) Write an equation for the action of heat on copper (II) carbonate (1mk)

233/1
CHEMISTRY
PAPER 1

TIME: 2 HOURS

SACHO HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

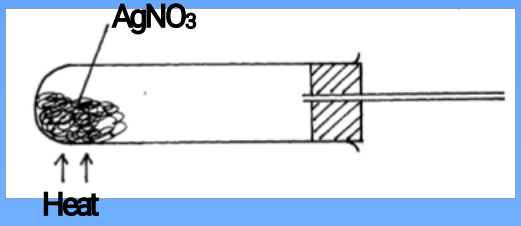
INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. (a) Define isotope? (1mk)
   (b) Silver exists naturally as $^{107}_{47}Ag$ and $^{109}_{47}Ag$ only. Determine the relative atomic mass of silver if they have same abundance (2mks)
2. An organic compound is believed to have the structure CH_3CH_2 CH = CHCOOH. Give

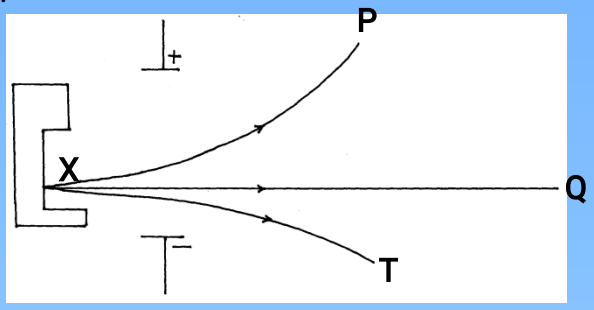
two reactions which can be used to characterize the compound. (3mks)

3. 

(a) Give **one** observation made when $AgNO_3$ solid is heated. (1mk)

(b) Complete the diagram above to show how the products is/are collected. (2mks

4. The figure below shows the behaviour of emissions by a radioactive isotope x. Use it to answer the question follow.



(a) Explain why isotope **X** emits radiations. (1mk)

(b) Name the radiation labeled **T** (1mk)

(c) Arrange the radiations labeled **P** and **T** in the increasing order of ability to be deflected by an electric filed. (1mk)

5. Identify the species that acts as a base in the reverse reaction given below. Give a reason. (2mks)

$$HSO_4^-{}_{(aq)} + OH^-{}_{(aq)} \rightleftharpoons SO_4^{2-}{}_{(aq)} + H_2O_{(l)}$$

6. A given volume of ozone (O_3) diffused from a certain apparatus in 96 seconds. Calculate the time taken by an equal volume of carbon(IV) oxide to diffuse under the same conditions. (C=12, O=16) (3mks)

7. The table below shows tests carried out in a separate sample of water drawn from a well and results obtained.

Test	Results
(i) Addition of excess aqueous ammonia	White precipitate
(ii) addition of afew drops of dilute sulphuric (IV) acid	No white precipitate formed
(iii) addition of dilute hydrochloric acid followed by a few drops of barium chloride.	White precipitate

Identify the cation and anion present in the water

Cation (1mk)

Anion (1mk)

8. The table below shows the first ionization energies of elements A and B

What do these values suggest about reactivity of **B** compared to **A**? Explain (2mks)

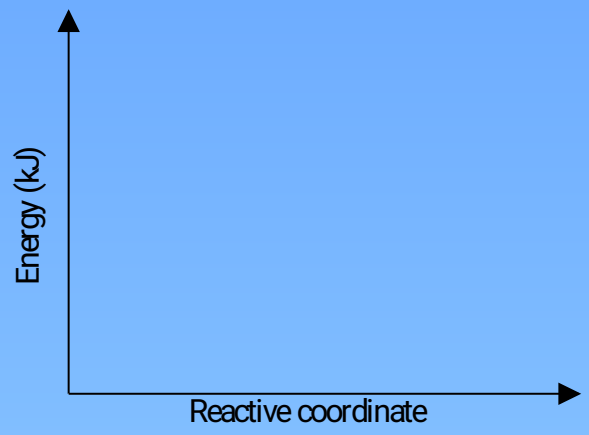
9. How would you obtain a sample of pure iodine and barium sulphate from a mixture of the two. (3mks)

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

11. Hydrogen and Flourine react according to the equation.

$H_{2(g)} + F_{2(g)} \rightleftharpoons 2HF_{(g)} \quad \Delta H = -538kJ$

(a) On the grid provided below, sketch the energy level diagram for the reverse reaction. (1mk)



(b) Calculate the molar enthalpy of formation of HF(1mk)

12. Explain why burning magnesium continues to burn in a jar full of sulphur (IV) oxide while a burning wooden splint would be extinguished. (3mks)

13. An element Q has a relative atomic mass of 88. when a current of 0.5 amperes were passed through the fused chloride of Q for 32 minutes and 10 seconds. 0.44g of Q were deposited at the cathode. Determine the charge on the ion of Q. 1 faraday = 96500 C) (3mks)

14. (a) what observations would be made if hydrogen sulphide gas was bubbled through a solution of Copper (II) sulphate. (1mk)

(b) Write an equation fro the reaction that takes place in (a) above. (1mk)

Element	Ionization energy KJ/Mol
A	500
B	740

15 Chlorine reacts with methane as shown below.

$CH_{4(g)} + Cl_{2(g)} \longrightarrow CH_3Cl_{(g)} + HCl_{(g}$

(a) What condition is necessary for this reaction to take place?(1mk)

(b) Identify the bonds which are broken and those that rare formed.

(i) Bonds broken. (1mk)

(ii) Bonds formed. (1mk)

16. Aluminium chloride is slightly soluble n organic solvents whereas anhydrous magnesium chloride. Explain (2mks)

17. What is the colour of the following?

Metal oxide	Colour when hot	Colour when cold
Zinc oxide	(i)	(ii)
Lead (II) oxide	(iii)	(iv)

(4mks)

18. A concentrated solution of sulphuric (VI) acid contain 72.5% sulphuric (VI) acid. If the density of the

acid is 1.8g/cm^3 determine the molarity of the acid solution. (H= 1, O=16, S = 32)
(3mks)

19. In a closed system an equilibrium exists between nitrogen(IV) oxide and dinitrogen tetraoxide as shown in the equation.

$N_2O_{4(g)}$ $\quad$ $2\ NO_{2(g)}$ $\quad$ $\Delta H = +27.5kJ$

Pale yellow $\quad$ red brown.

(a) State and explain the observation made when a glass syringe containing the equilibrium mixture is immersed in ice-cold water. (2mks)

(b) If the piston of the syringe is pushed state the effect on the position of the equilibrium. (1mk)

20. Hydrogen peroxide decomposes according to the equation shown below.

$H_2O_{2(g)} \longrightarrow H_2O_{(l)} + \frac{1}{2} O_{2(g)} \quad \Delta H = -98kJ/mol$

8.5g of hydrogen peroxide contained in 100cm^3 of solution with water were completely decomposed.

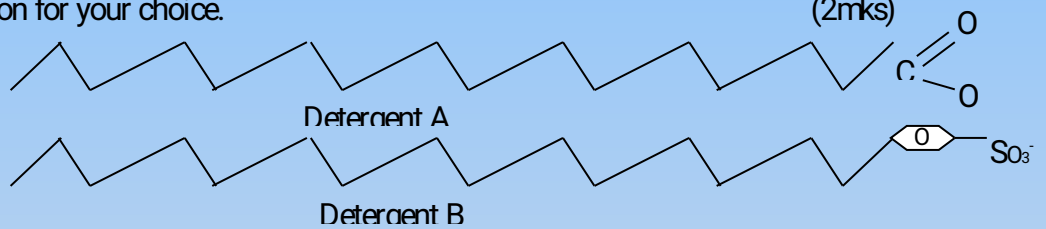
Calculate the rise in temperature due to the reaction.(specific heat capacity on water = 4.25g^{-1}

21. Below is a table of first five alkanes and their boiling points.

Name	Boiling point ^oC
Methane	-161.5
Ethane	-88.5
Propane	- 42.1
Butane	-0.56
Pentane	36.1

(a) What is the state of pentane at room temperature (25°C)? Give a reasons.
(2mks)

22. The diagram below shows two types of detergents which one of these detergents is a soap? Give a reason for your choice. (2mks)



23. Iron has two oxidation states, so it can form ions Fe^{2+}. How can you test a solution to find out which ion is present. Outline the tests and give the results for both ions. (3mks)

24. 5 g Sodium hydrogen carbonate were dissolved in 10cm^3 of water in a boiling tube. Lemon juice was then added dropwise with shaking until there was no further observable change.

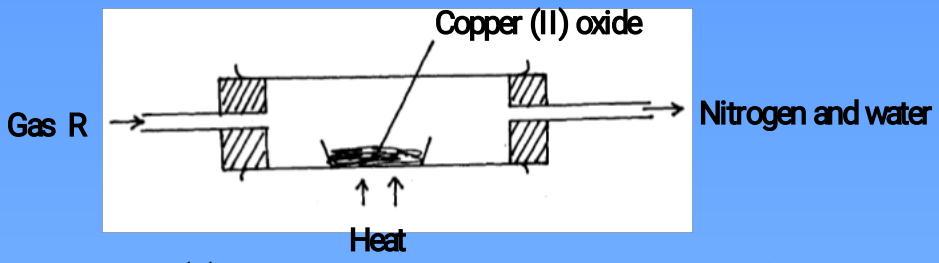
(a) Explain the observation which was made in the boiling tube when the reaction was in progress. (2mks)

(b) What observation would have been made if the lemon juice had been added to copper turnings in a boiling tube. Explain (2mks)

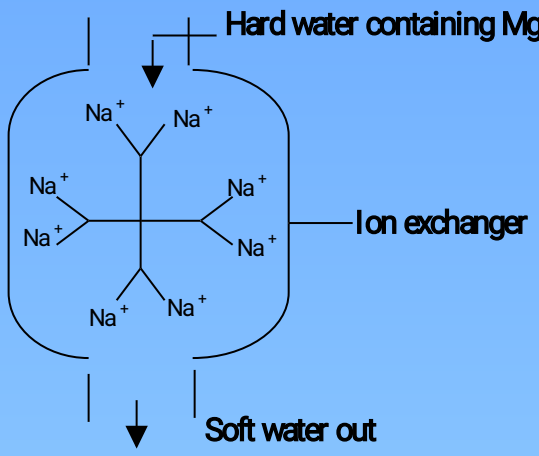
25. 5.0g of calcium carbonate were allowed to react with 25cm^3 of 1.0m hydrochloric acid until there was no further reaction. Calculate the mass of calcium carbonate that remained unreacted. (Ca =40.0, O=16.0, C= 12.0) (3mks)

26. Construct a cell diagram fro a cell in which the following overall reaction takes place.
(3mks)

$$Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$$

27. 

The copper(II) oxide was converted to copper metal. Name the two diatomic genes that form R. (2mks)

28. 

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

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

29. The table below gives some properties of three metals: Aluminium, iron and copper. Use it to answer the questions that follow.

Metal	Density	Tensile Strength 10^{10}pa	Electrical conductivity
Aluminium	2.70	7.0	0.38
Iron	7.86	21.1	0.10
Copper1	8.92	13.0	0.59

Assuming that steel and stainless steel have similar properties to iron.

(a) Why do some stainless steel sauce pans have a copper base? (1mk)

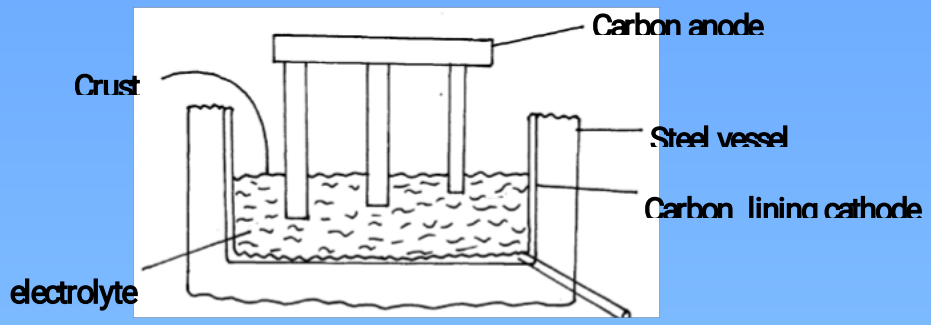
(b) Aluminum with a steel core is used for overhead power cables in preference to copper. Why is aluminum preferred ? (1mk)

(c) Apart from over head power cables copper is chosen for almost all other electrical uses. Suggest **two** reasons fort he choice of copper. (2mks)

SACHO HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. The diagram below shows method used to extract aluminium by the electrolysis of molten bauxite.



(i) Give equation for the reaction occurring at the two electrode.
Anode (1mk)
Cathode (1mk)

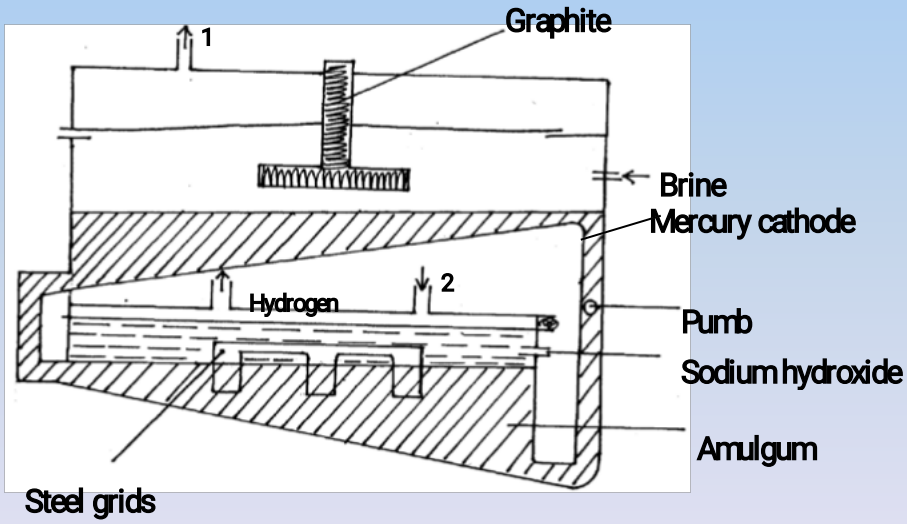
(ii) In this process the anode rod have to be replaced from time to time. Explain.
(1mk)

(iii) The working temperature in this cell is below the normal melting point of the purified ore. Explain the significance of this situation and how it is achieved.
(2mks)

(iv) State **four** industrial uses of Aluminium (2mks)

(v) A current of 100 ampere flows a through the electrolyte of this cell for 15hrs calculate the volume of the gaseous product produce in this cell at 15°C and 800mmHg (*molar gas volume of s.t.p 22.4dm^{3}*)

2 (a) The diagram below represents a mercury cell that can be used in the industrial manufacture of sodium hydroxide. Study it and answer questions that follow.



(I)Name
(i) The raw material introduced at 2. (1mk)
(ii) Another substance that can be used in the cell instead of graphite (1mk)

II. *Give*

(i) **Two** uses of sodium hydroxide

(ii) **Two** reasons why mercury is recycled. (2mks)

III. Write an equation for the reaction in which sodium hydroxide was produced. (1mk)

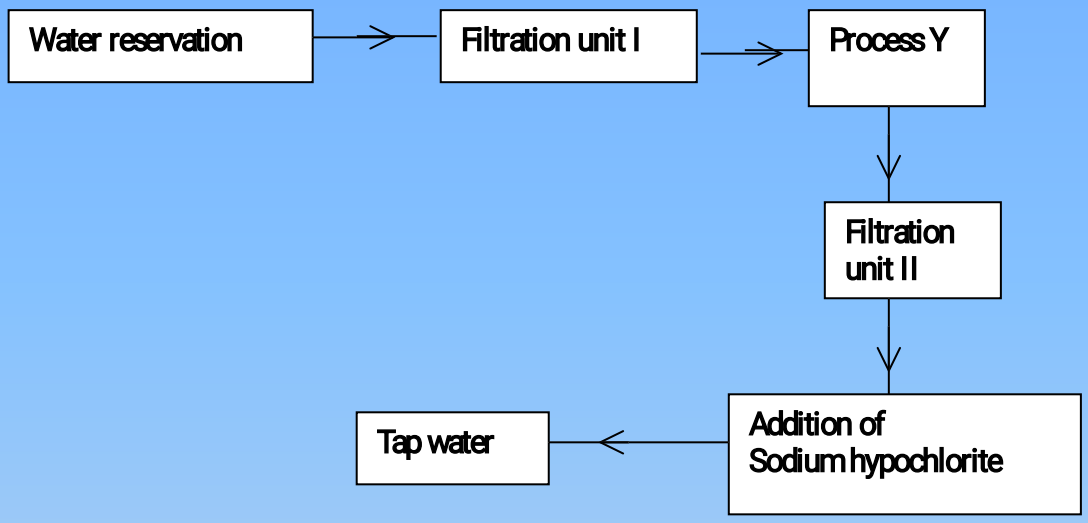
(b) If the mass of hydrogen gas produced was 50litres start. Calculate the mss of solution hydroxide that was formed. H= 1.0, NO = 23.0 O = 16.0 (2mks)

3. A student was supplied with a colourless liquid supposed to be water.

a) (i) Describe one chemical test that could have been used to that the liquid was water. (2mks)

(ii) How could it have been shown that it was pure water? (1mk)

b.) The flow chart below shows the various stages of water treatment.



(i) Which substance are likely to be removed in filtration unit 1? (1mk)

(ii) What is the name of Process Y ? (1mk)

(iii) What is the purpose

I) Process Y ? (1mk)

II) Addition of solution hypochlorite? (1mk)

c) It was confirmed that magnesium sulphate was in the tap water

(i) What type of hardness was k present in the water. (1mk)

(ii) Explain how the hardness can be removed. (2mks)

4. The gird given below represents part of the periodic table study it and answer the questions that follow. (The letters do not represent the actual symbols of the elements.)

											A
						B					
	C				D			E			
	F										

(i) What name is given to the group of elements to which C and F being? (1mk)

(ii) Which letter represents the element that is the least reactive? (1mk)

(iii) What type of bond is formed when B and E react? Explain (2mks)

(iv) Write formula of the compound formed where elements D and oxygen gas react.

(1mk)

(v) On the grid indicate the a tick (√) the position of element G which is in the third period of the periodic table and forms G^{3-} ions. (1mk)

(b) Study the information in the table below and answer the questions that follow. (The letter do not represents that actual symbols of the substance.

Substance	Melting point ^{o}C	Boiling point ^{o}C	Solubility in water	Density at room Temp/g/cm^3
H	-117	78.5	Very soluble	0.8
J	-78	-33	Very soluble	$0.77x\ 1^{-3}$
K	-23	77	Insoluble	1.6
L	- 219	-183	Slightly Soluable	1.33×10^{-3}

(i) Which substance would dissolve in water and could be separated from the solution by fractional distillation. (1mk)

(ii) Which substances is a liquid at room temperature and when mixed with water two layers would be formed? (1mk)

(iii) which letter represents a substances that is a gas at room temperature and which can be collected by.

(i) Over water? (1mk)

(ii) By downward displacement of air? Density of air at room temperature = 1.29×10^{-3} g/C (1mk)

5. In what homologous series do the following compounds belong?

(i) CH_3CCH (1mk)

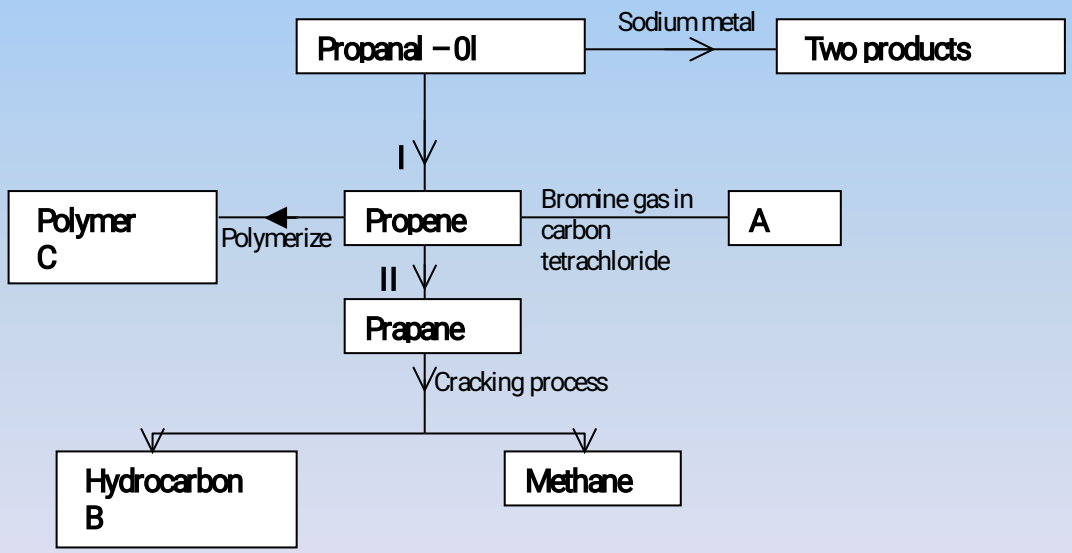
(ii) $CH_3CH_2OOCCH_3$ (1mk)

b) Raw rubber is heated with sulphur in the manufacture of natural rubber.

(i) What name is given to the process? (1mk)

(ii Why is the process necessary. (1mk)

c).



(i) Write an equation for the reaction between propan – l- ol and sodium metal. (1mk)

(ii) Name process I and II (2mks)

(iii) Identify the products A and B (2mks)

(iv) Name catalyst used in product II (1mk)
(v) Draw the structural fromular of the repeating unit to the polymer C (1mk)
d) State **two** industrial use of methane. (2mks)
e) State and explain the observations when sodium metal is put unto a boiling tube containing propan–l-ol (3mks)

6. The solubility of salt x at various temperature is as storm in the data given below.

Temperature °C	Solubility in g/100g $H_2O_{(l)}$
1	10
2	15
40	26
60	40
80	63
100	100

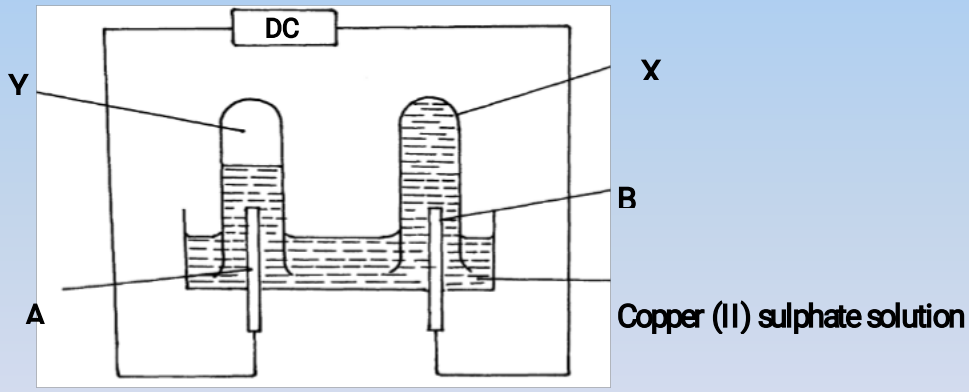
(ii) Using a suitable scale draw a solubility curve of salt **x** on the grid provided below (4mks)
(i) A solution containing 20g of salt X in 100g of water was cooled from 50°C
(ii) At what temperature will crystals of salt **x** first form? (1mk)
(iii) Determine the mass of X that crystallizes if the solution is cooled to 12°C
(iv) Describe how 30g dry salt x can be obtained from a saturated solution of x at 65°C

(b) Use the information below on solubility to answer questions that follow.

Salt	Solubility	g/100g of water 20°C
$KClO_3$	55	12
Na_2CO_3	80	31

A mixture containing 30g Potassium chloride and 30g of sodium carbonate in 100g of water at 80°C was cooled to 20°C. Some crystals were formed.
(i) Which of the **two** salts crystallized out? (1mk)
(ii) Name the method that can be used to obtain the crystals. (1mk)
(iii) State the salt that would be unsaturated at 20°C (1mk)

7. (a) Use the diagram below and answer the questions that follow.



a) The above experiment was performed using carbon electrode and another electrode
(i) Identify electrode **B** (1mk)
(ii) Name the colourless gas observed in test tube Y (1mk)
(iii) Explain why no gas was observed in list tube X (2mks)
(b). Use the data in the table below where appropriate to answer the questions which follow.

Standard electrode potential		Eθ volts
$Fe^{3+} + e^-$	$\longrightarrow Fe^{3+}$	+ 0.71
$Cl_{2(g)} + 2e$	$\longrightarrow 2Cl^-_{(aq)}$	+ 0.71
$2BrO^-_{Rn} + 12H^+ + 10e^-$	$\longrightarrow Br_2 + 6H_2O_{(l)}$	+ 0.71
$O_{3(s)} + 2H^+_{(aq)} + 2e^-$	$\longrightarrow O_{2(g)} + HlO_{(l)}$	+ 0.71
$F_2O_{(g)} + 2H + 4e$	$\longrightarrow 2\ Fo_4 - + H_2r$	+ 0.71

Each of the above can be reversed under suitable conditions

(a) (i) identify the strongest reducing agent (1mk)

(ii) Oxidizing agent

(b) Identify all the species in the tables which can be oxidized to acidic solution by $Br_3^{0-}{}_{(aq)}$ (1mk)

(c) the set we below in wells representation study it and use it to answer questions which follow

Pt| | $Fe^{2+}_{(aq)}$ | $Fe^{3+}_{(aq)}$ | | Br $O_3^-{}_4$ | $Br2_{(aq)}$ | Pt

(i) Deduce the e.mf of this Cell (2mks)

(ii) Write a half – equation for the reaction occurring at the negative electrode when current is taken from this cell (1mk)

(iii) State and explain the effect on the e.m.f of cell if the concentration of Fe^{3+} ions is increased. (2mks)

CHEMISTRY
PAPER 1
TIME: 2 HOURS

STRATHMORE SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

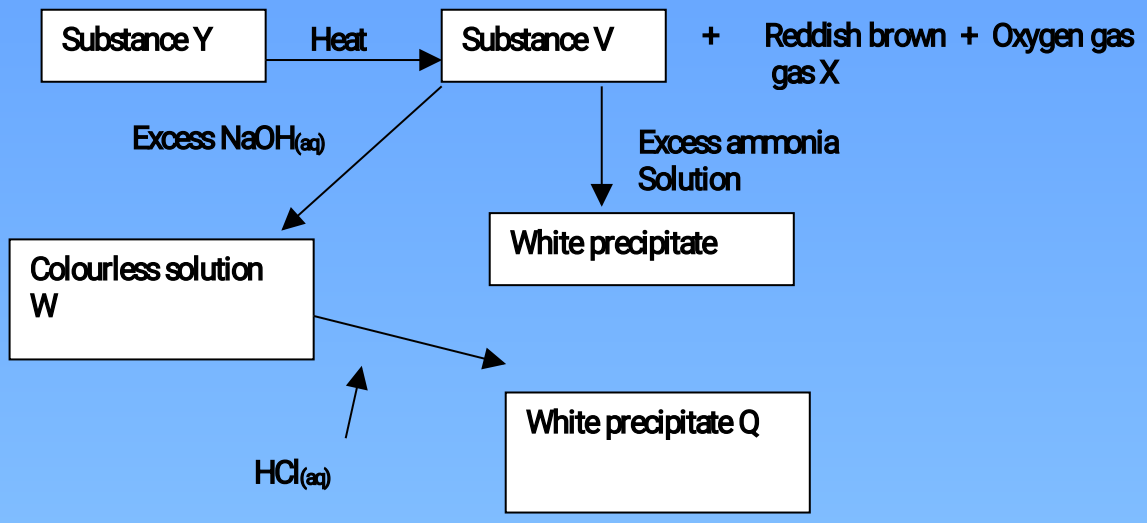
1. A mixture contains sodium chloride, ammonium chloride, and silver chloride. Explain how you can obtain pure samples of each salt. (3mks)

2. Elements **Q, S, T, U, R** and **P** belong to the same period in the periodic table. The ions formed by the atoms of the elements are given below: Q^{2+}, U^{-}, T^{2-}, R^{3+}, P^{+} and S^{3-} .

(a) Arrange the elements in order of increasing atomic size. (2mks)

(b) Suggest a reason why elements **P** and **Q** cannot react with each other to form a compound. (1mk)

3. Study the reaction scheme below and answer the questions that follow.



(a) Suggest the possible anions in **Y** and **V** (2mks)

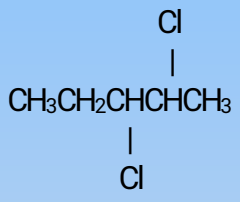
(b) Predict the name of gas X. (1mk)

4. (a) Draw the structure of the following compounds:

(i) 2 – Methyprop-i-ene (½ mk)

(ii) Hexan – 2- ol (½ mk)

(b) A compound **W** react with chlorine to form another compound Y whose structural formula is as follows:



(i) Give the name and structural formula of Compound **W** (1mk)

(ii) What type of reaction leads tot the formation of compound **Y** from compound **W**. (1mk)

5. The table below shows the PH values of some solutions.

Solution	J	K	L	M	N
pH	6	13	2	10	7

(a) Which solution is likely to be:

(i) Potassium hydroxide (½ mk)

(ii) Lemon juice (½ mk)

(b) Explain why a solution of hydrogen chloride gas in methyl benzene was identified as **N**. (1mk)

(c) Compare the electrical conductivity of solutions **J** and **L** (1mk)

6. When a solid sample of sulphur is heated in a test tube, it changes into a liquid which flows easily. On further heating , the liquid darkens and does not flow easily. Explain these observations. (3mks)

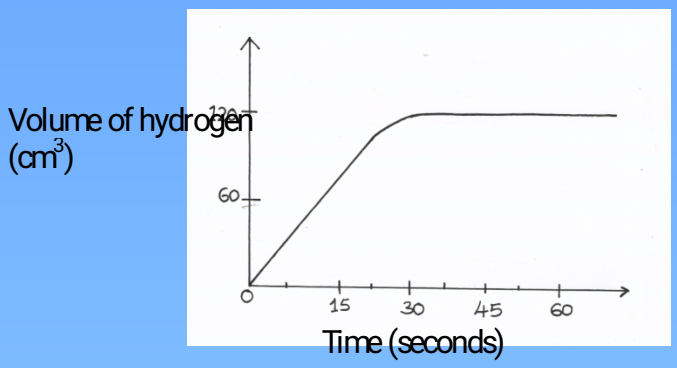
7. $50cm^3$ of oxygen gas diffuse through a porous plug in 80 seconds. How long will it take $100cm^3$ of sulphur (IV) oxide to diffuse through the same plug? (S= 32 O=16 (3mks)

8. When 5g of ammonium nitrate were dissolved in $250cm^3$ of water a drop in temperature of 1.5^oC was

observed. Determine the molar enthalpy of solution of this salt. (N=14,H= 1,O=16 specific heat capacity of solution = 4.2 $J g^{-1} K^{1}$ density f water 1 g/cm^3) (3mks)

9. (a) Using dots (•) and cross (x) show the bonding in hydroxonium ion H_3O^+. (2mks)
(b) Flourine has very low melting and boiling points and yet its atoms are joined by covalent bonding. Explain. (1mk)

10. 6.5 g of zinc granules were reacted with 25cm^3 of 4M hydrochloric acid. The graph below shows the results:



(a) Explain the shape of the curve. (1mk)
(b) How long did it take for the reaction to be complete? (1mk)
(c) Calculate the average rate of reaction. (1mk)

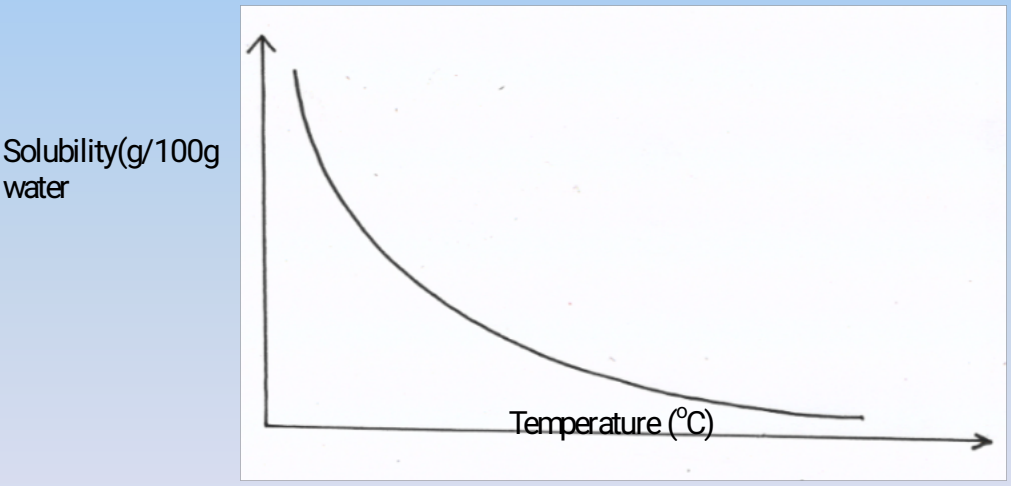
11. When a current of 0.5 amperes was passed for 32 minutes and 10 seconds through the fused chloride of metal P, 0.44g of P was deposited. Determine the charge on the ion of metal P (if 1faraday=96500 R.A.M of P = 88) (3mks)

12. Iron is extracted from its ore, heamatiie in the blast furnace. The main reaction during extraction is

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

Calculate the mass of iron which will be produced from 320 tonnes of haematite.
(Fe= 56 O=16) (2mks)

13. The graph below represents the solubility curve of a gas in water.



(a) State and explain the conclusion that can be drawn from this curve about the solubility of the gas. (1mk)
(b) The solubility of potassium chlorate at 80°C is 40g/100g of water. What mass of potassium chlorate will saturate 65g of water at 80°C. (2mks

14. Below is a radioactive decay series starting from $^{210}_{82}Pb$ and ending at $^{210}_{82}Pb$

$$^{210}_{82}Pb \xrightarrow{\text{Step I}} {}^{214}_{83}Bi \xrightarrow{\text{Step II}} {}^{210}_{81}Po \xrightarrow{\text{Step III}} {}^{206}_{82}Pb$$

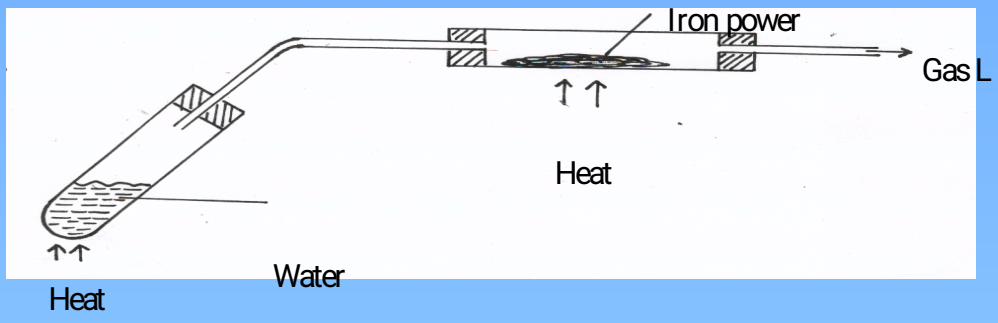
(a) Identify the particles emitted at step I and Step II (1mk)

(b) Write the nuclear equation for the reaction which takes place in step (II) (1mk)

(c) State **one** application of radioactivity. (1mk)

15. $25cm^3$ of 0.1m sulphuric (VI) acid required $20cm^3$ of sodium carbonate solution for complete nuetralisation. Calculate the concentration of sodium carbonate in moles per litre. (3mks)

16. The following set up was used to react steam with Iron Powder.



(a) The water was heated before heating the iron powder. Explain why this was necessary. (1mk)

(b) Write an equation for the reaction that took place between steam and iron powder (1mk)

(c) State how gas **L** would be collected without using water. (1mk)

17. Starting with Lead (II) Oxide, describe how you would prepare a solid sample of Lead (II) chloride. (3mks)

18. Painting, oiling, galvanizing or tin-plating are methods of preventing rusting.

(a) Explain how these methods are similar in the way they prevent rusting. (1mk)

(b) Explain why galvanized iron objects are better protected even when scratched. (1mk)

19. Nelly's lungs can hold $2500cm^3$ of air at 37^oC and 1 atmosphere. What would be the pressure if this air was put in a bottle of capacity $500cm^3$ at 27^oC? (3mks)

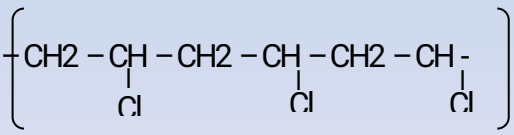
20. Sulphuric acid is manufactured in large scale by the contact process. The basic reaction in the contact process is catalytic oxidation of sulphur(IV) oxide.

(a) Name the catalyst used. (1mk)

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

(c) State **one** large scale use of sulphuric (VI) acid (1mk)

21. Study the structure below and answer the questions that follow.



(a) Name the polymer represented by the structure.

(b) Draw the structure of the monomer and name it.

Structure Name

22. Given that:

$Q^{2+}_{(aq)} + 2e^- \longrightarrow Q_{(s)}$ $E^\theta = -0.13V$

$Ag^+_{(aq)} + e^- \longrightarrow Ag_{(s)}$ $E^\theta = +0.80V$

(a) State and explain whether silver nitrate can be stored in a container made of Q (2mks)

23. When anhydrous calcium chloride is exposed to the atmosphere it forms a solution.

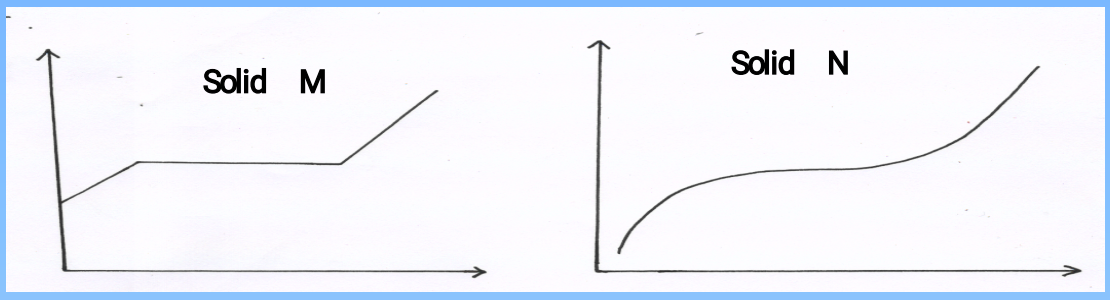
$$CaCl_2 \xrightarrow{H_2O_{(l)}} CaCl_{2\,(aq)}$$

(a) Name the process that takes place. (1mk)

(b) State **one** use of the process displayed by anhydrous calcium chloride. (1mk)

24. When solid magnesium carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no apparent reaction. On addition of water to that resulting mixture, there was vigorous effervescence. Explain these observation. (2mks)

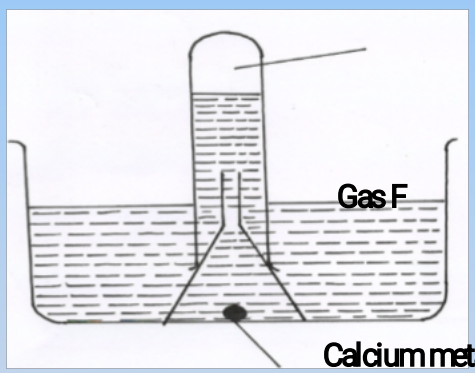
25. The graphs below represents the temperature-time curves for solids M and N



(a) What is the name given to the curves above? (1mk)

(b) Which of the **two** solids is an impure substance? Explain. (2mks)

26. The set-up below was used to collect gas F produced by the reaction between water and calcium metal.



(a) Name gas **F** (1mk)

(b) Give **one** laboratory use of the solution formed in the beaker. (1mk)

(c) After some time there was formation of a white precipitate formed at the top of the solution in the beaker. Explain this observation. (1mk)

27. (a) Name and give the chemical formula of the chief ore of copper. (1mk)

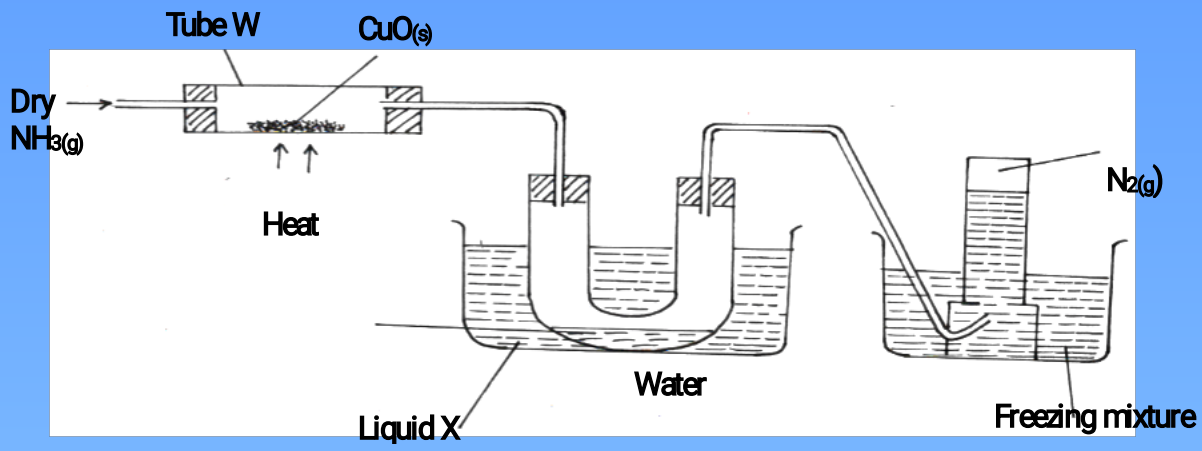
(b) The main ore of copper is low grade. Describe how the main ore can be concentrated. (2mks)

28. $40cm^3$ of carbon(II) oxide and 40 cm^3 of oxygen were sparked in a closed vessel.

(i) Write a chemical equation for the reaction that occurs. (1mk)

(ii) Determine the composition of the residual gases. (2mks)

29. The diagram below represents a set-up that can be used to obtain nitrogen gas in the laboratory.



Use the information on the diagram to answer the questions that follow.

(a) Name liquid X (1mk)

(b) What observations are made in the tube after heating for about 10 minutes? (1mk)

(c) Write an equation for the reaction that took place in tube W (1mk)

30. Determine the relative atomic mass of the argon whose isotopic mixture is: (2mks)

$^{36}_{18}Ar$ (0.34%) $^{38}_{18}Ar$ (0.06%) $^{40}_{18}Ar$ (99.6%)

STRATHMORE SCHOOL KCSE TRIAL AND AND PRACTICE EXAM.
Paper 2

1 (a) The table below shows some properties and electronic arrangement of ions of elements represented by letters P to X. Study the information and answer the questions that follow. The letters are not the actual symbols of elements.

Element	Formula of ion	Electronic arrangement of ion	Atomic radius (nm)	Ionic radius (nm)
P	p^{2+}	2.8.8	0.174	0.097
Q	Q^{-}	2.8	0.072	0.136
R	R^{+}	2.8.8	0.203	0.133
S	S^{3+}	2.8	0.125	0.050
T	T^{2+}	2.818.8	0.191	0.113
U	U^{2+}	2.8	0.136	0.065
V	V^{+}	2.8	0.157	0.095
W	W^{+}	2	0.133	0.060
X	X^{-}	2.8.8	0.099	0.181

(i) Give the atomic numbers of elements T and V (1mk)

(ii) What is the name given to the family of elements to which R, V and W belong. (1mk)

(iii) Explain why:

I. The atomic radius of S is smaller than that of V (1mk)

II. the atomic radius of R is larger than its ionic radius (1mk)

(iv) Using dots (•) and crosses (x) to represent outermost electrons, show the bonding in

the compound formed between U and X (2mks)

(v) Describe how a mixture of V chlorine s Lead(II) chloride can be separed

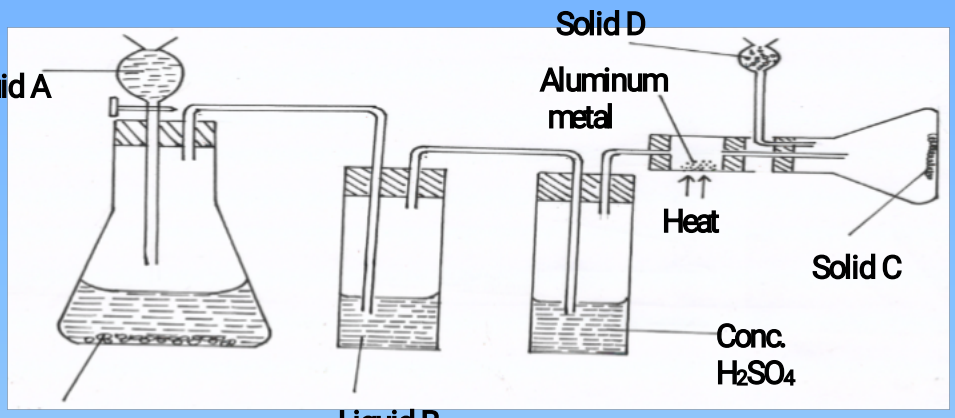
(b) Study the information given in the table below and answer the questions that follow.

formula of compound	NaCl	$MgCl_2$	$AlCl_3$	$SiCl_4$	PCl_3	LCl_2
Boiling point (^oC)	1470	1420	Sublimes at 180^oC	60	75	60
Melting point (^oC)	800	710		-60	-90	-80

(i) Explain why the melting point and boiling points of $MgCl_2$ are very high yet melting point and boiling point of PCl_3 are very low. (2mks)

(ii) Explain by use of a chemical equation why a solution when $AlCl_3$ reacts with water has a pH of 3 (2mks)

2. (a) Study the diagram below and use it to answer the questions that follow.



(i) Name liquids **A** and **B**

(ii) Suggest a suitable reagent that can be used as solid **D** (1mk)

(iii) State the role of Solid **D** (1mk)

(iv) Write a balanced chemical equation for the reaction in the conical flask (1mk)

(v) Explain why solid C collects further away from the heated aluminium metals. (1mk)

(vi) In the combustion tube above, 0.675g of aluminium metal reacted completely with 1800cm^3 of chlorine gas at room temperature. Determine the molecular formula of Solid C, given that its relative formula mass is 267 (Al= 27.0, Cl= 35.5 molar gas volume at r.t.p = 24.0 litres) (3mks)

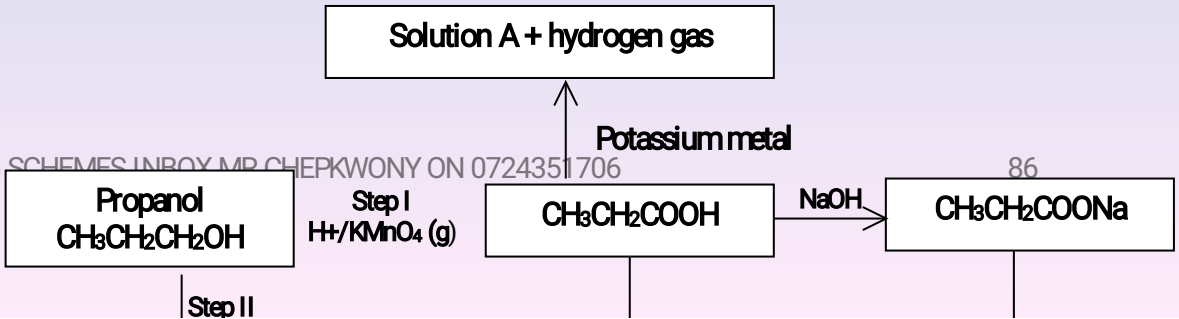
(b) The reaction between hot concentrated sodium hydroxide and chlorine gas produces Sodium Chlorate (V) as one of the products

(i) Write the equation for the reaction. (1mk)

(ii) Give **one** use of sodium chlorate.(V) (1mk)

(c) Explain the difference between bleaching by chlorine and bleaching by sulphuric (IV)oxide gases. (2mks)

3. The scheme below shows a series of reactions starting with Propanol. Study it and answer the questions that follow.



Step III

1 mole of Cl_2O)

(a) (i) Name the type of reaction in steps I and II

(b) Write the equation for the reaction that takes place in Step III (1mk)

(c) Name substances labeled **A,C,D** and **E** (2mks)

(d) Draw the structural formula of product **C** . (1mk)

(e) Name the process in Step (IV). (1mk)

(f) Name compound **B** and state the type of reaction involved in its formation

Name of compound **B**…… (½ mk)

Type of reaction…… (½ mk)

(g) If the relative molecular mass of B is 35,700 determine the value of n (2mks)

.(h) Below are structures of two cleaning agents

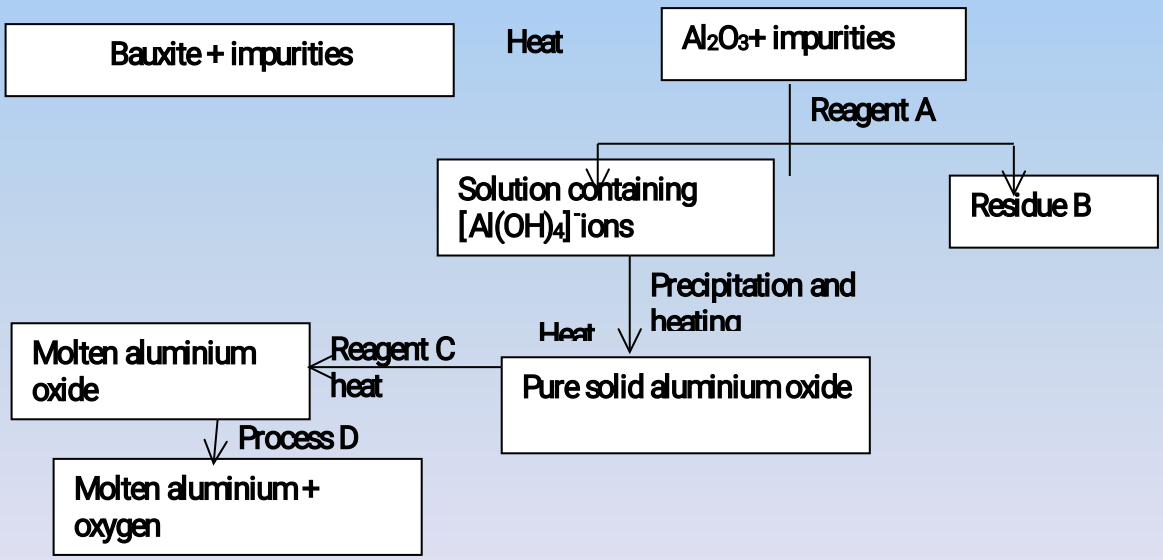
$R - COO^-Na^+$…….. A

R -  $-OSO^-_3\ Na^+$……. B

(i) Identify the cleaning agent suitable to be used in water containing magnesium chloride.

(ii) State **one** advantage of using cleaning agent B (1mk)

4. The flow chart below shows industrial extraction of aluminium metal. Study it and answer the questions that follow.



(a) Name **two** main impurities found in bauxite (1mk)

(b) Name reagents **A** and **C**

(c) Name residue **B**. Give a reason (2mks)

(d) When 3.12g of hydrated aluminium oxide ($Al_2O_3.nH_2O$) was heated to a constant

mass, 2.06g of aluminium oxide was obtained. Determine the value of n in hydrated aluminium oxide.
(Al=27.0,O=16.0 H=1.0) (3mks)

(e) Explain why it is necessary to heat aluminium oxide in the presence of reagent **C** before process **D** is Carried out . (1mk)

5. (a) State the particles responsible for conductivity of an electric current in (2mks)
(i) Solution
(ii) A metal

(b) Study the standard electrode potentials for the half-cells given below. The letter do not represent the actual symbols of the elements .

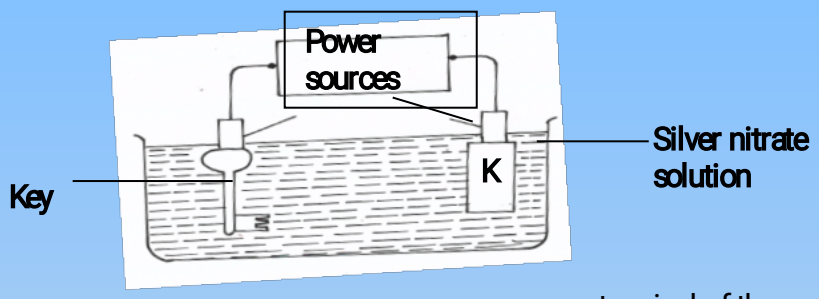
half cell			$E^{\circ}V$
$U^{+}_{(aq)} + e^{-}$	⟶	$U_{(s)}$	-3.02
$V^{2+}_{(aq)} + 2e^{-}$	⟶	$V_{(s)}$	- 2.87
$W^{2+}_{(aq)}\ 2e^{-}$	⟶	$W_{(s)}$	+ 0.34

(i) Calculate the e.m.f of a cell made by (1mk)
I. **U** and **V**
II . Identify the Strongest oxidizing agent. (1mk)

(ii) Determine the equation of the cell reaction made of **U** and **W.** (1mk)

(iii) Show the conrentional cell representation for the cell reaction in b(ii) above. (1mk)

(e) One use of electrolysis is electroplating as shown below.



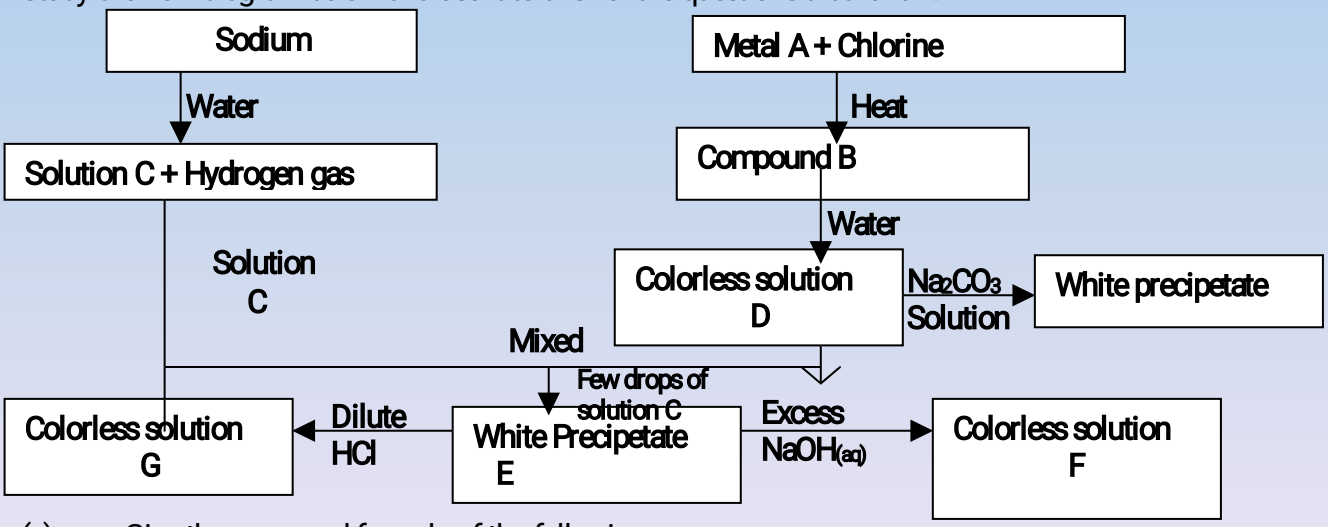
(i) To what terminal of the power source is the key connected (1mk)

(ii) Name the most suitable material for electrode **K** (1mk)

(iii) Write the

(iv) If 3A power source was used for 5 hours, calculate the increase in mass of the Key.
(Ag = 108, 1 Fa=96500C) (3mks)

6. 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**
(ii) Colourless solution F

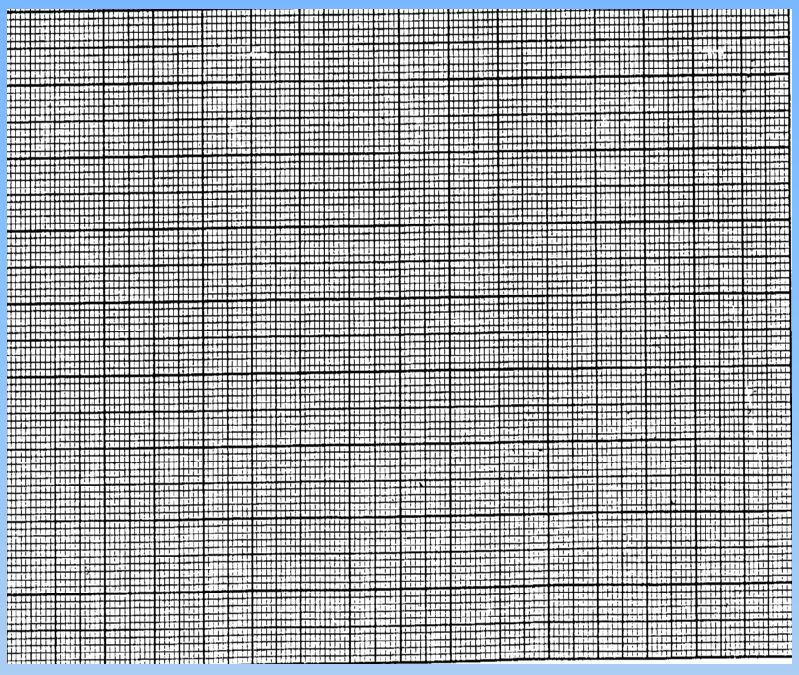
(b) What property is exhibited by white precipitate E when it reacts with Sodium hydroxide and HCl acid. (1mk)

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

(d) The information below gives the solubilities (In g/100g of water) of substances X and Y at various temperatures

Temperature		0	20	40	60	80	100
Solubility g/100g of water	X	10	15	26	40	63	100
	Y	30	34	37	40	44	48

(i) Plot a graph of solubility against temperature for the two salts X and y on the same axis. (4mks)



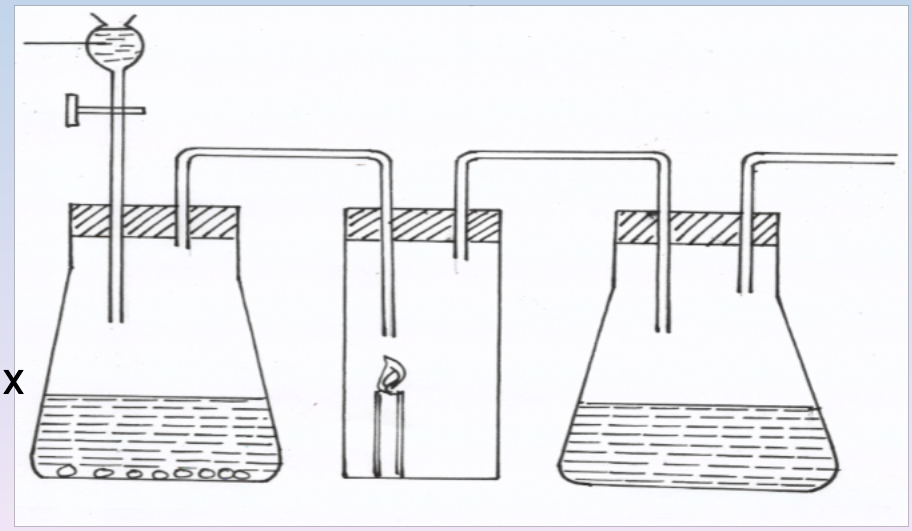
(i) From the graph state:

I. The solubility of X at 50°C (1mk)

II. The temperature at which solubility of Y is 36g/100g of water (1mk)

III. Calculate the mass of crystals of substance X which will deposit when a solution containing 50g of X in 100g of water initially at 80°C is cooled to a temperature of 30°C (1mk)

7. The diagram below shows a set – up that was used to prepare oxygen gas and passing it over a burning candle. The experiment was allowed to run for some time.





(i) Name liquid **X** (1mk)

(ii) Suggest the PH of the solution in conical flask **K**.(1mk)

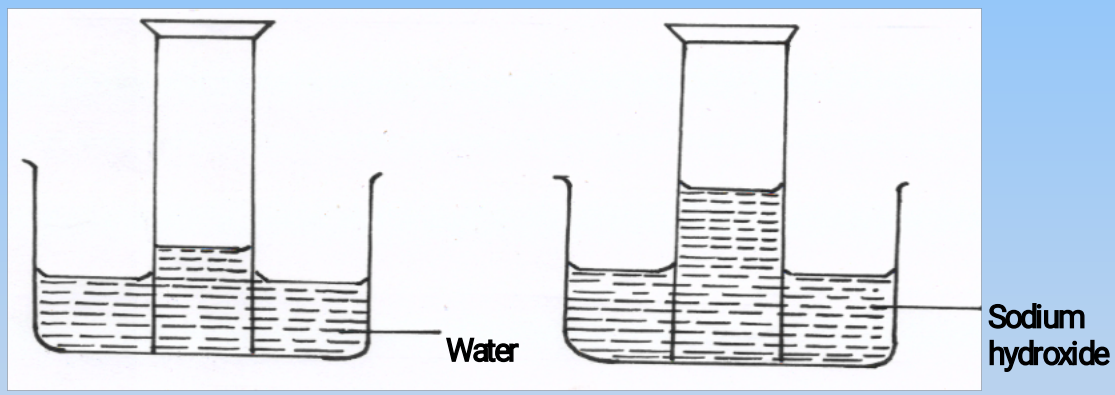
(iii) Write an equation for the reaction taking place in the conical flask M. (1mk)

(b) State and explain the two observation made when hydrogen sulphide is bubbled in to the solution containing Iron (III) chloride. (2mks)

(c) (i) Describe a simple chemical test that can be used to distinguish carbon (IV) oxide and Carbon(II) oxide gases. (1mk

(ii) Give **one** use of carbon (II) Oxide (1mk)

(d) A form two student inverted a gas jar full of carbon(IV) oxide over water and sodium hydroxide solution separately as shown below



Explain the observations made. (2mks)

TIME: 2 HOURS

ALLIANCE GIRLS HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. Ethanol and pentane are miscible liquids. Explain how water can be used to separate a mixture of ethanol and pentane. (2mks)
2. A warm red phosphorous was lowered to a gas jar of chlorine using a deflagrating spoon.
   (i) State **one** observation made in the experiment.

(ii) Identify the substance formed in the above reaction. (1mk)

3. (a) Give the structural formula of 3, 3-dimethly pent-l-yne (1mk)

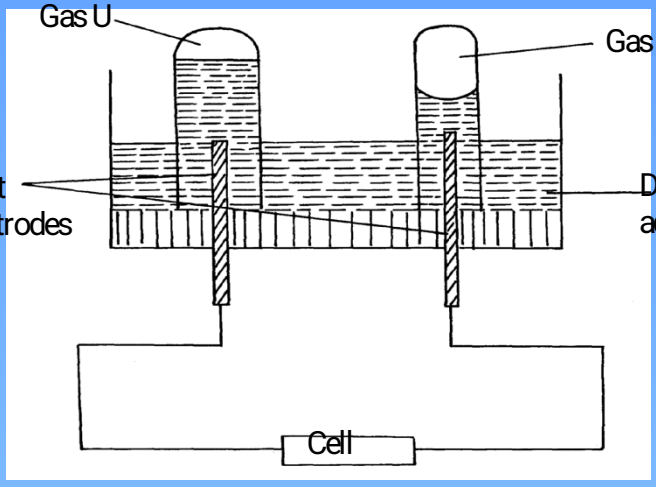
(b) Name the following compounds using the IUPAC system.

(i) $CH_3CH_2CH_2OOCCH_3$ (1mk)

(ii) $CH_3\ CH_2\ CH\ C=\ CH_2$
$\quad\quad\quad

(3mks)

8. The figure below shows the electrolysis of dilute sulphuric acid.



(i) On the diagram, label the cathode and the anode. (1mk)

(ii) Name the gases (1mk)

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

9. Given the equation for reaction $2Al_{(s)} + 3Cl_{2(g)} \longrightarrow 2AlCl_{3(s)}$ Calculate

(i) Volume of chlorine at (r.t.p) required to react with 3g of Aluminium (Molar gas volume at r.t.p = 24litres, Al = 27, Cl = 35.5) (1½ mks)

(ii) Mass of Aluminium chloride formed. (1½ mks)

10. Consider the Zinc nuclide below

$$^{65}_{30}Zn$$

Determine the number of protons and neutrons in the nuclide. (2mks)

11. Using reagents provided only, explain by means of balanced chemical equations how you could prepare a salt of Zinc carbonate solid. (3mks

- Zinc powder
- Nitric (V) acid (dilute)
- Water
- Solid sodium carbonate

12. Below is part of the Thorium decay series.

$$^{232}_{90}Th \xrightarrow{(i)} {}^{228}_{88}Ra \xrightarrow{(ii)} {}^{228}_{89}Ac \xrightarrow{(iii)} {}^{228}_{90}Th \xrightarrow{(iv)} {}^{224}_{88}Ra$$

(i) Write an overall nuclear equation for the conversion of $^{232}_{90}Th$ to $^{224}_{88}Ra$ (1mk)

(ii) Give any **two** commercial uses of radio isotopes (2mks)

13. Explain the following observations.

(a) When lead (II) carbonate reacts with dilute hydrolic acid, very little carbon (iv) oxide is produced (2mks)

(b) When hydrogen chloride gas is dissolved in water the solution formed turns blue litmus paper red but there is no effect on blue litmus paper when the gas is dissolved in carbon tetra chloride. (CCl_4) (2mks)

14. Element A has atomic mass 23 and element **B** atomic mass 7 and also have 12 neutrons and 4 neutrons respectively.

a) Write the electron arrangement of **A** and **B** (2mks)

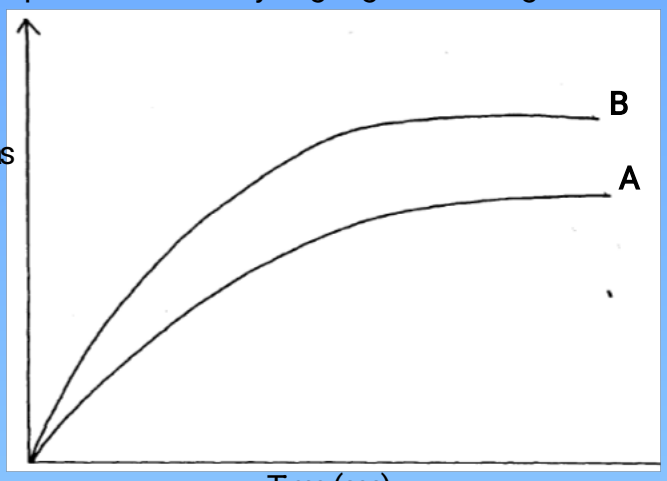
b) Which element has higher ionization energy? Explain (2mks)

15. Two experiments were carried out as follows and the volume of hydrogen gas evolved measured at intervals of 10seconds for 100 seconds.

(i) 8 cm of magnesium ribbon was added to 1M hydrochloric acid.

(ii) 8cm of magnesium ribbon was added to 0.5M hydrochloric acid.

Graphs of volume of hydrogen gas evolved against time were plotted.



a) Which of the graphs was obtained for reaction (i) ? Explain (2mks)

b) Explain the general shape of the graphs. (1mk)

16. D grams of potassium hydroxide were dissolved in distilled water to make $100cm^3$ of solution $50cm^3$ of the solution required $50cm^3$ of 2.0M nitric acid for complete neutralization.

Calculate the mass D of potassium hydroxide.

$KOH_{(aq)} + HNO_{3(l)} \longrightarrow KNO_{3(aq)} + H_2O_{(l)}$ (relative formula of KOH=56) (3mks)

17. Painting, Oiling, galvanizing and or tin plating are methods of rust prevention.

a) Explain the similarity of these methods in the ways they prevent rusting. (1mk)

b) Explain why galvanized iron objects are better protected even when scratched. (1mk)

18 . Study the following equilibrium reaction

$2A_{2(g)} + B_{2(g)} \rightleftharpoons 2A_2B_{(g)}$ $\Delta H = -197kJmol^{-1}$

Suggest **two** ways of increasing the yield of A_2B (2mks)

19. Solutions can be classified as acids bases or neutral. The table below shows solutions and their Ph values.

Solution	pH values
K	1.5
L	7.0
M	14.0

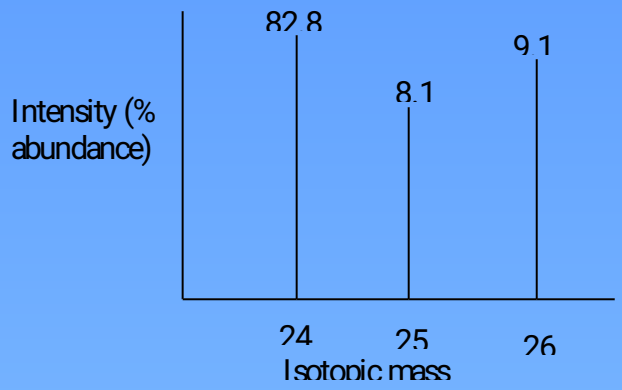
(i) Select any pair that would react to form a solution of pH 7 (1mk)

(ii) Identify **two** solutions that would react with Aluminium hydroxide. Explain. (2mks)

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

21. State **two** uses of Argon. (1mk)

22. The peaks below show the mass spectrum of element X



Calculate the relative atomic mass of X (2mks)

23. The chemical equations below are the main reactions in large scale manufacture of sodium carbonate.

$NH_{3(g)} + CO_{2(g)} + H_2O_{(l)} \longrightarrow NH_4HCO_{3\ (aq)}$

$NH_4HCO_{3\ (aq)} + NaCl_{(aq)} \longrightarrow NaHCO_{3(s)} + NH_4Cl_{(aq)}$

a) Explain how the **two** products, $NaHCO_3$ and NH_4Cl are separated. (1mk)

b) (i) How is sodium carbonate finally obtained? (1mk)

(ii) Explain how ammonia is recovered and recycled? (1mk)

24. Name **two** allotropes of sulphur. (2mks)

25. Study the information below and answer the following questions. A mixture contains three solid A,B and C. the solubility of these solids in different liquids is as shown below

	Water	Alcohol	Ether
A	Soluble	Insoluble	Insoluble
B	Insoluble	Soluble	Very Soluble
C	Soluble	Soluble	Insoluble

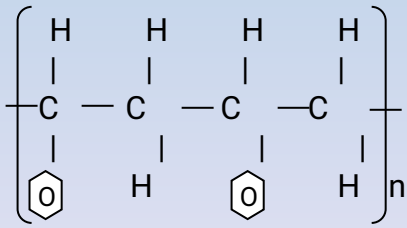
Explain how you will obtain sample C from the mixture. (3mks)

26. $20cm^3$ of an unknown gas Q takes 12.6 seconds to pass through small orifice. $10cm^3$ of oxygen gas takes 11.2 seconds to diffuse through the same orifice under the same conditions of temperature and pressure .Calculate the molecular mass of unknown gas Q

(O=16) (3mks)

27. Using dot (•) and cross (x) diagram, show the bonding in the compound phosphonium ion PH^+_4 (P=15.0, H=1.0). (2mks)

28. The formula given below represents a portion of polymer



a) Give the name of the polymer (1mk)

b) Draw the structure of the monomer used to manufacture the polymer. (1mk)

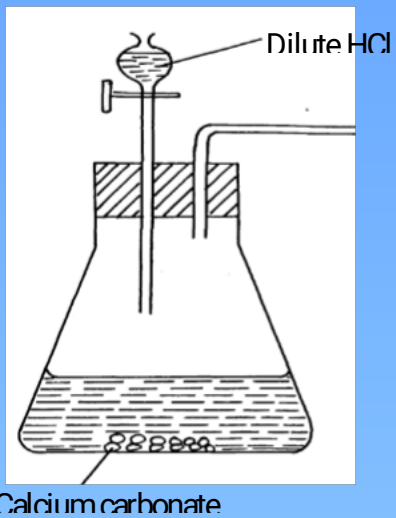
29. A compound of carbon, hydrogen and oxygen contains 71.12 by mass of oxygen, 2.2 hydrogen and

the rest is carbon. It has relative molecular mass of 90.

a) Determine the empirical formula of the compound. (2mks)

b) Determine the molecular formula of the compound. (2mks)

30. The diagram below shows an incomplete set up of the laboratory preparation of carbon (IV) oxide gas. Complete it. (3mks)



ALLIANCE GIRLS HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM.

Paper 2

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1. Use the information below on standard electrode potentials to answer the questions that follow.

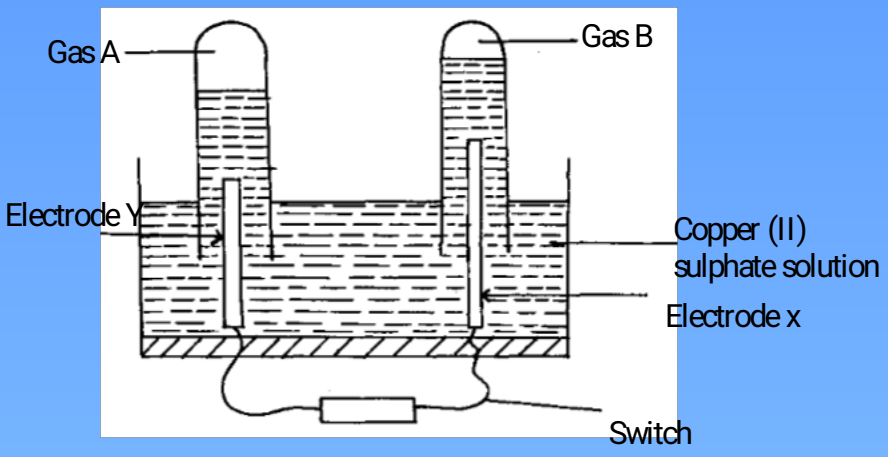
Electrode reaction			E^{θ} volts
$C^{2+}_{(aq)} + 2e^{-}$	$\rightleftharpoons$	$C_{(s)}$	+ 0.34
$D^{2+}_{(aq)} + 2e^{-}$	$\rightleftharpoons$	$D_{(s)}$	+ 0.44
$E^{+}_{(aq)} + e^{-}$	$\rightleftharpoons$	$E_{(s)}$	- 2.92
$Fe^{2+} + 2e^{-}$	$\rightleftharpoons$	$F_{(s)}$	- 2.71
$G^{2+} + 2e^{-}$	$\rightleftharpoons$	$G_{(s)}$	−0.14
$\frac{1}{2} H_{2(g)} + e^{-}$	$\rightleftharpoons$	$H^{-}_{(aq)}$	+ 2.87
$\frac{1}{2} K_{2(g)} + e^{-}$	$\rightleftharpoons$	$K_{(aq)}$	+ 1.09
$L^{+}_{(aq)} + e^{-}$	$\rightleftharpoons$	$\frac{1}{2} L_2$	0.00

a) (i) Identify the strongest reducing agent and the strongest oxidizing agent. Give reasons. (2mks)

(ii) Calculate the e.m.f of the cell formed by connecting half cells **C** and **D**. (1mk)

b) Draw and label a diagram of a cell formed by –connecting half cells of E and D. On the diagram indicate the flow of electrons. (3mk)

c) An aqueous solution of Copper (II) Sulphate was electrolysed using platinum electrodes. When a current was passed a gas that relights a glowing splint was produced.



(i) Name the electrode which acts as cathode. Give a reason. (1mk)

(ii) Write an equation for the reaction at the anode. (1mk)

d) 0.11g of metal R deposited by electrolysis when a current of 0.03 amperes flow for 99 minutes. (R =92.) ,(1 Faraday = 96500 C)

(i) Find the number of moles of metal deposited. (2mks)

(ii) Find the number of moles of electrons passed. (2mks

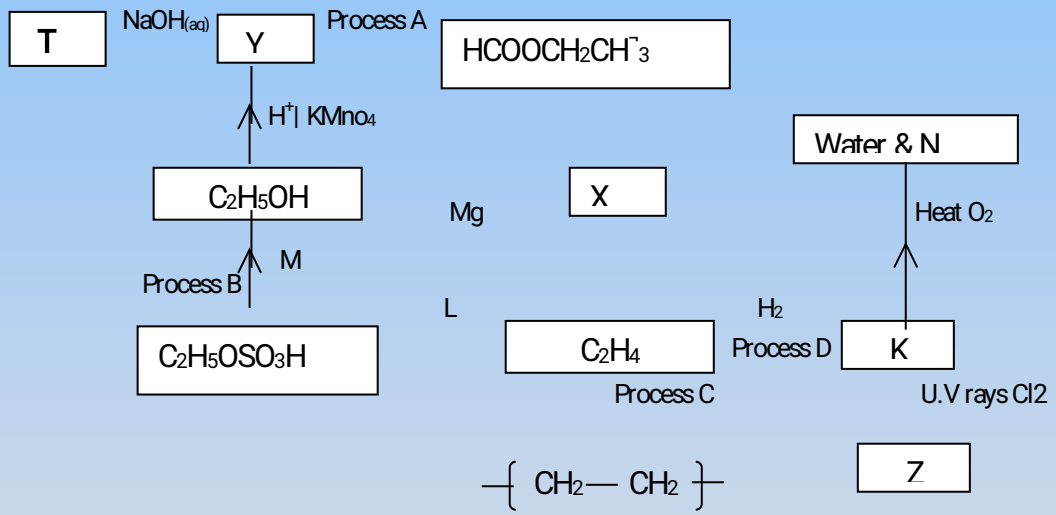
(iii) Determine the value of n in the metallic ion R^{nt}. (2mks)

2. (a) Define Isomerism. (1mk)

(b) Draw and name one of the position isomers of Butene. (2mks)

(c) Filter paper dipped in acidified Potassium Manganate (VII) were placed in two separate gas jars A and B containing pentane and Pent-l-ene respectively. Explain what was observed in each case. (2mks)

(d) The scheme below shows some products that can be obtained starting from ethene.



(i) Name the compounds (4mks)

(ii) Name the process (2mks)

(iii) State **one** condition necessary for the processes in (ii) above to take place. (3mks)

3. In the preparation of magnesium carbonate magnesium was burnt in air and the product collected.

Dilute sulphuric acid was added and the mixture filtered and cooled. Sodium carbonate was added to the filtrate and the content filtered. The residue was washed and dried to give a white powder.

a) Give the chemical name of the product formed when magnesium burns in air (1mk)

b) Write a chemical equation for the formation of product. (1mk)

c) (i) Name filtrate collected after sodium carbonate was added (1mk)

(ii) Name the white powder. (1mk)

d) Write chemical equation for the reaction between product in (a) and acid. (1mk)

e) Name the ions present in the filtrate after addition of sodium carbonate. (1mk)

f) Write an ionic equation to show the formation of the white powder (1mk)

g) Write an equation to show what happened when white powder is strongly heated. (1mk)

4. Elements **V, W** and **X** have atomic number 17, 19 and 20 respectively.

(a) What is the valencies of **V** and **W** respectively (1mk)

(b) To which groups of the periodic table do **V**, and **X** belong. (1mk)

(c) In which periods do elements **V** and **W** lie.? (1mk)

(d) Which of the three elements is a non-metal? (1mk)

(e) Write down the formula of the compounds formed when:

(i) **V** reacts with **W** (1mk)

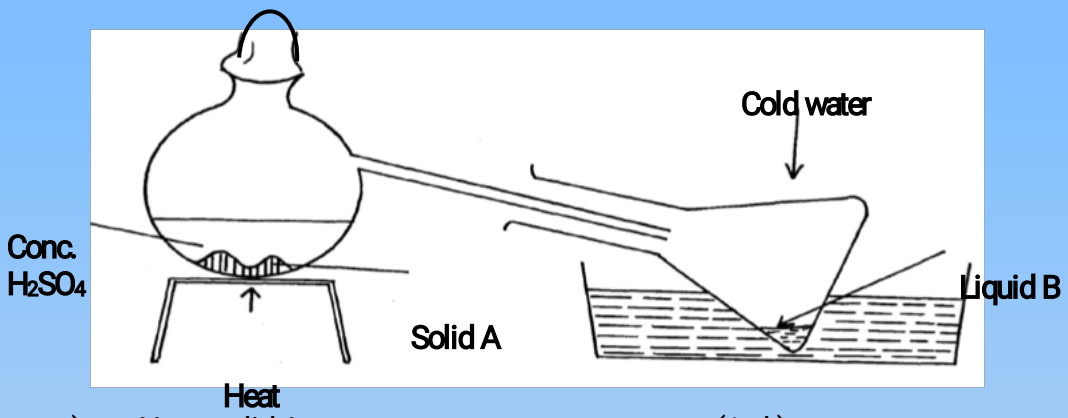
(ii) **X** reacts with Oxygen (1mk)

f) How many

(i) Neutrons does V have? if its mass number is 35 (1mk)

(ii) Protons does W have ? (1mk)

5. The diagram below shows the preparation of nitric acid.



a) Name solid A (1mk)

b) Under what conditions does sulphuric acid react with solid A (1mk)

c) What is the colour of liquid B (1mk)

d) What is the purpose of cold water (1mk)

e) 1 cm^3 of liquid B was diluted with distilled water and afew drops of copper turnings dropped into it

A colourless gas and later brown gas were produced.

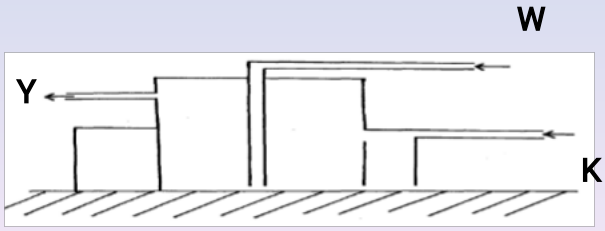
(i) Name the colourless gas (1mk)

(ii) Name the brown gas formed? (1mk)

(iii) Give an equation for the formation of the brown gas (1mk)

(iv) Give **two** uses of the nitric acid. (1mk)

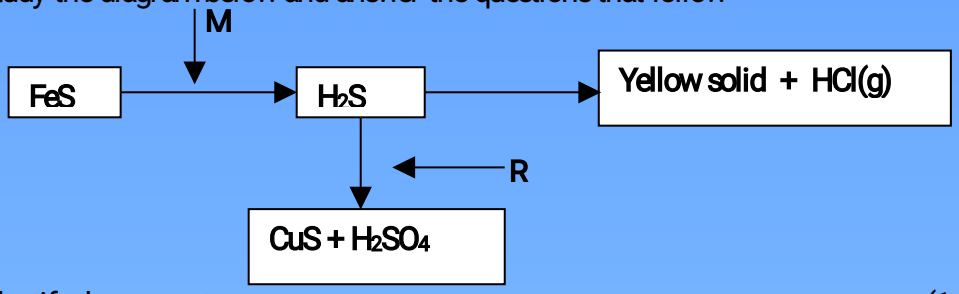
b) The diagram below shows the process of extracting sulphur from its ore. Study it and answer the questions that follow.



a) Name the substances that pass through

b) Explain the purpose of what passes through (1mk)

c) Study the diagram below and answer the questions that follow



(i) Identify the reagents (1mk)

(ii) Name the yellow solid. (1mk)

(iii) By using a chemical test, how can you distinguish $H_2S(g)$ and $SO_2(g)$ (2mks)

d) What would be the effect of the yield of sulphur (VI) oxide when

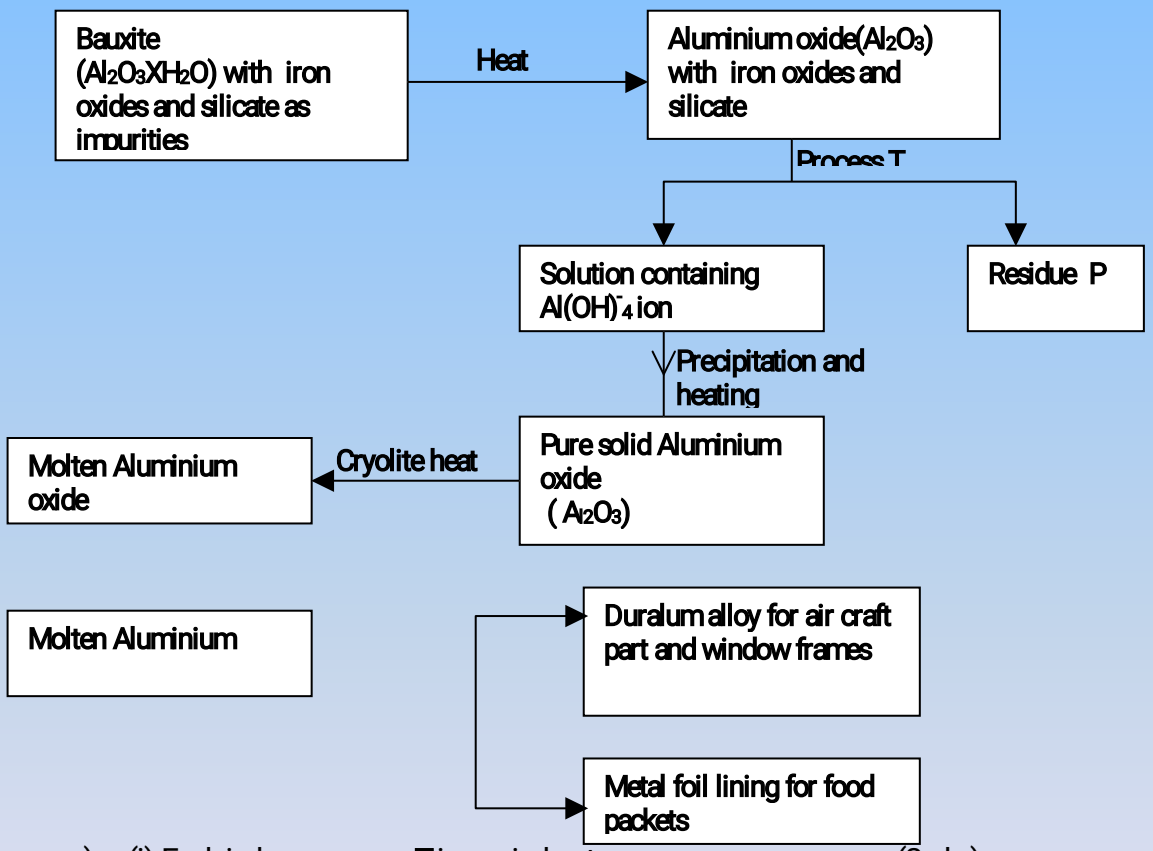
(i) Increasing the concentration of oxygen. (1mk)

(ii) Increasing the temperature . (1mk)

e) (i) Describe how sulphuric acid is manufactured from sulphur (VI) oxide. (2mks)

(ii) Name **two** uses of sulphur (VI) acid. (2mks)

6. The flow chart below shows industrial extraction Aluminium metal. Study it and answer the questions that follow.



a) (i) Explain how process **T** is carried out. (2mks)

(ii) Name residue **P**, give a reason. (2mks)

(iii) Explain why it is necessary to heat Aluminium oxide in presence of cryolite before electrolysis is carried out. (1mk)

b) Suggest a reason why:

(i) Aluminum is not used for marine purpose (1mk)

(ii) Carbon is not used for the reduction of Aluminum oxides. (1mk)

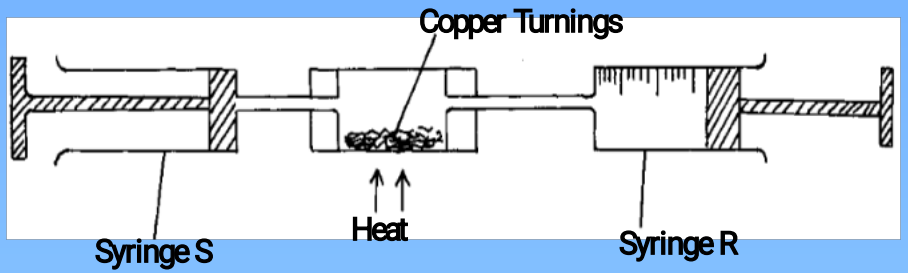
c) What properties of Aluminium and its alloys make them suitable for the uses indicated? (1mk)

d) When 31.2g of hydrated. Aluminium oxide ($Al_2O_3XH_2O$) was heated to a constant mass of 20.6g of Aluminium oxide (Al_2O_3) was obtained. Determine the value of x in hydrated oxide. (3mks)
(Al= 27.0, O=16.0, H=1.0)

7. (a) Name the solution and the catalyst used in preparation of oxygen in the laboratory. (2mks)

(b) Give a chemical equation for the reaction above. (1mk)

(c) In an experiment to determine the proportion of oxygen in air, Copper turning were packed in excess in a long combustion tube connected to two syringes of $120cm^3$ each in a volume . Syringe R contained $120cm^3$ of air while syringe S was closed and empty as shown.



Air was passed over heated turnings slowly and repeatedly until there was no further change in volume. $95.5cm^3$ of air remained in syringe **R**.

(i) Why was copper packed in excess? (1mk)

(ii) Why was air passed over heated copper slowly? (1mk)

(iii) State **one** observation made in the combustion tube during experiment. (1mk)

(iv) Give an equation for the reaction that took place in combustion tube (1mk)

(v) Determine the percentage of oxygen used up during the experiment . (2mks)

(vi) Give a hospital use of oxygen. (1mk)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

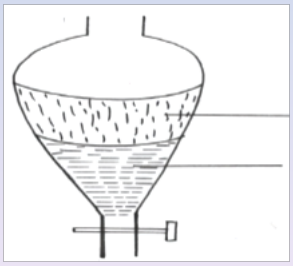
FRIENDS SCHOOL KAMUSINGA KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. A mixture of hexane and water was shaken and left to separate out as shown in the diagram below:-



A

b

(i) Identify liquids A and B (2mks)

(ii) Apart from density, state **one** other property that makes it possible to separate them using the set-up above? (1mk)

2. Concentrated sulphuric (vi) acid is a common drying agent.
   (i) Use an equation to explain why it cannot be used to dry ammonia gas. (1mk)
   (ii) Name a suitable drying agent for ammonia. (1mk)
3. Determine the oxidation number of;
   (i) Manganese in $KMnO_4$. (1mk)
   (ii) Chromium in $Cr_2O_7^{2-}$ (1mk)
4. Starting with Lead (ii) oxide, describe how lead (ii) sulphate can be prepared in the laboratory. (3mks)
5. A mass of 3.2g of XOH reacts completely with $20cm^3$ of 2M sulphuric (vi) acid. (O=16, H=1)
   (i) Write the equation for the reaction. (1mk)
   (ii) Calculate the relative atomic mass of X in the formula XOH. (2mks)
6. In the Haber process, the industrial manufacture of ammonia is given by the following equation:-

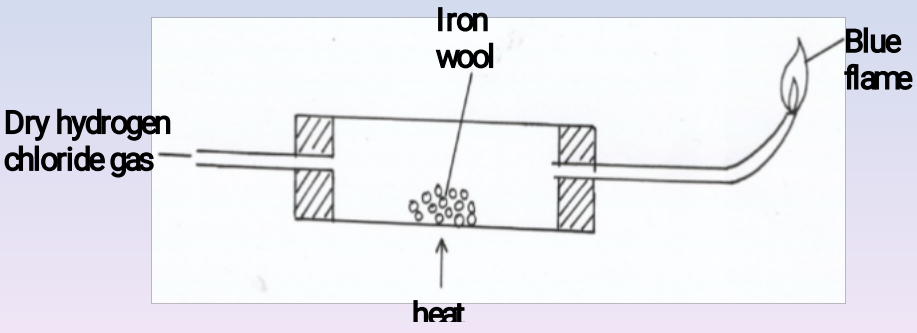
   $N_{2(g)} + 3H_{2(g)} \rightleftharpoons 2NH_{3(g)} \quad \Delta H = -97KJ/Mol$

   (i) Name **one** source of hydrogen used in this process. (1mk)
   (ii) Name the catalyst used in the above reaction. (1mk)
   (iii) What is the effect of increasing temperature on the yield of ammonia? Explain. (1mk)
7. Explain the following concepts in respect to aluminium extraction:-
   (a) Why cryolite is added to Aluminium Oxide. (1 ½mks)
   (b) Why graphite anode is replaced from time to time. (1½mks)
8. When concentrated hydrochloric acid was electrolysed for a long time, two gases were obtained at the anode.
   (i) Name the **two** gases. (1mk)
   (ii) Explain why the gases were obtained. (2mks)
9. Given the following bond energies:-

C- H	414 KJ/Mol
CL-Cl	244KJ/Mol
C- Cl	326KJ/Mol
H- Cl	431KJ/Mol

   Calculate the enthalpy change when methane reacts with excess chlorine. (3mks)

10. Dry hydrogen chloride gas was passed over heated iron wool as shown below:-



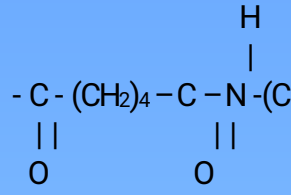
(a) State the observation made in the combustion tube at the end of the experiment. (1mk)

(b) Write the equation for the reaction taking place:-

(i) in the combustion tube (1mk)

(ii) Leading to a production of a blue flame. (1mk)

11. The structure below shows the repeat unit showed in a polymer.



(i) Name the polymer (1mk)

(ii) Draw the structures of the two monomers forming the polymer (1mk)

12. The table below shows the number of valence electrons in elements D, E and F.

Element	D	E	F
No. of valence electrons	1	2	7

(i) Explain why D and E would not be expected to react together to form a compound. (1mk)

(ii) Write a chemical equation to show the effect of heat on a carbonate of E. (1mk)

13. The following pairs of compounds were reacted together and the maximum temperature rise recorded for each reaction.

A- 50cm^3 of 2M ammonia solution and 50 cm^3 of 2M ethanoic acid.

B- 50 cm^3 of 2M sodium hydroxide and 50 cm^3 of 2M hydrochloric acid.

C- 50 cm^3 of 2M sodium hydroxide and 50 cm^3 of 2M ethanoic acid.

(a) State the pair which showed:-

(i) the highest temperature rise. (1mk)

(ii) the lowest temperature rise. (1mk)

(b) Explain your answers above. (1mk)

14. (a) Radium 226, whose atomic number is 88, undergoes beta decay to form a new element X. Write an equation for this change. (1mk)

(b) State **two** differences between nuclear and chemical reactions. (2mks)

Nuclear	Chemical
(i)	
(ii)	

15. The reaction below had attained a state of equilibrium between chromate and dichromate ions.



State and explain the effect of adding a few drops of sodium hydroxide to the equilibrium mixture. (2mks)

16. Diamond and graphite are allotropes of carbon.

(i) What are allotropes? (1mk)

(ii) Explain why graphite conducts electricity while diamond does not. (2mks)

17. During electrolysis of copper (ii) sulphate solution using graphite electrodes, a current of 2 amperes was passed for 15 minutes. Determine the mass of the products at the cathode. (1F=96,500C Cu=63.5)

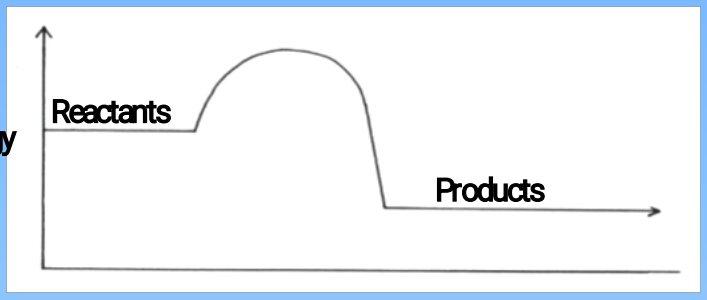
(3mks)

18. Pieces of blue and red litmus papers were placed into a beaker containing water into which Aluminium Chloride had been dissolved.
(i) Is dissolving of aluminium chloride in water a physical or chemical process? Explain (1mk)

(ii) State the observations made on the papers. Explain your answer. (2mks)

19. Two cleansing agents are X=R-COO^-Na^+ and Y=R-C_6H_5-$SO_3^-Na^+$ where R is a long hydrocarbon chain.
(i) Identify the two cleaning agents. (1mk)
(ii) Write the formula of the salt that would be formed when cleaning agent X is added to water containing calcium ions. (1mk)
(iii) State **one** disadvantage of cleaning agent Y. (1mk)

20. The energy level diagram for the reaction:-
$2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)}$
Given below:-



(i) State **two** ways of increasing the yield of $SO_{3\,(g)}$ (2mks)
(ii) On the same axis, draw the curve that would be obtained if a catalyst is used. (1mk)

21. Carbon (II) oxide and nitrogen (iv) oxide are some of the gases released from car exhaust pipes. State how these gases affect the environment. (3mks)

22. When a few drops of aqueous ammonia were added to copper (ii) chloride solution, a light blue precipitate was formed. On addition of excess ammonia solution, a deep blue solution was formed.
(a) Identify the substance responsible for the:-
(i) light blue precipitate. (1mk)
(ii) deep blue solution. (1mk)
(b) Write an equation for the reaction leading to observation in (a) (ii) above. (1mk)

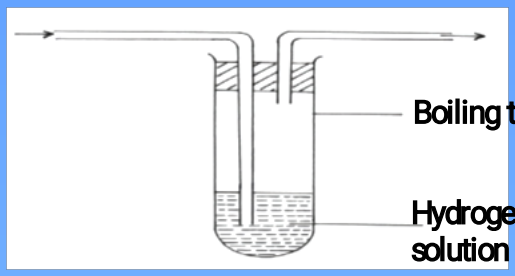
23. A volume of nitrogen gas diffuses through a porous pot in 70 seconds. How long would it take 400cm^3 of carbon (iv) oxide to diffuse through the same porous pot? (C=12 O=16 N=14) (3mks)

24. Consider the following electrochemical cell.
$Zn_{(s)}/Zn^{2+}{}_{(ag)}$// $Pb_{(ag)}/Pb_{(s)}$
(i) Name the electrodes for the above cell. (1mk)
(ii) Write the electrodes for the above cell (1mk)
(iii) Name a possible salt bridge. (1mk)

25. Lead (ii)nitrate was heated strongly for some time.
(i) State **two** observations made during heating. (2mks)
(ii) Write an equation for the reaction. (1mk)

26. Draw a dot (.) and cross (x) diagram to show bonding in:-
(i) Ammonium ion (NH_4) (1 ½mks)
(ii) Silane (SiH_4) (1 ½mks)
(N=14 H=1 Si=14)

27. Chlorine gas was bubbled into a solution of hydrogen sulphide as shown below:-



(i) Explain the observations made in the boiling tube. (2mks)

(ii) What precautions should be taken in this experiment? (1mk)

28. What is the difference between thermosoftening and thermosetting plastics? (2mks)

FRIENDS SCHOOL KAMUSINGA KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

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1. a) Study the information given below and answer the questions that follow.

Element	Atomic radius (nm)	Ionic radius (nm)	Formula of oxide	Melting point of oxide ('C)
P	0.364	0.421	A_2O	-119
Q	0.830	0.711	BO_2	837
R	0.592	0.485	E_2O_3	1466
S	0.381	0.446	G_2O_5	242
T	0.762	0.676	JO	1054

(i) Which elements are non-metals? Give a reason. (2mks)

(ii) Explain why the melting point of the oxide of R is higher than that of the oxide of S. (2mks)

(iii) Give **two** elements that would react vigorously with each other. Explain your answer. (2mks)

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

		Ionization Energy_KJ/Mole	
Element	Electronic configuration	1st 1.E	2nd 1.E
A	2.2	900	1800
B	2.8.2	736	1450
C	2.8.8.2	590	1150

(i) What chemical family do the elements A, B and C belong? (1mk)

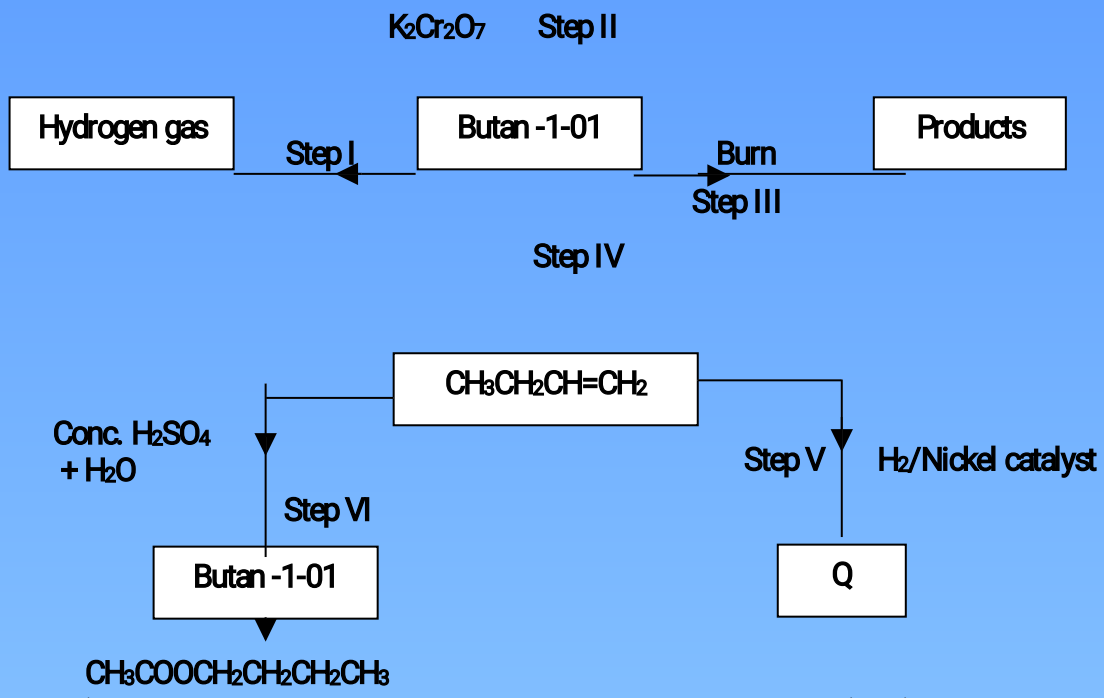
(ii) What is meant by the term ionization energy? (1mk)

(iii) The 2nd ionization energy is higher that the 1st ionization energy of each. Explain (1mk)

(Iv) When a piece of element C is placed in cold water, it sinks to the bottom and an effervescence of a colourless gas that burns explosively is produced. Use a simple diagram to illustrate how this gas can be collected during this experiment. (3mks)

2. Use the information in the scheme below to answer the questions that follow.

P



a) Name substance P (1mk)

b) Give the structure and name of compound Q. (1mk)

c) Write the equation for the chemical reaction in steps III (1mk)

d) Name the reagents and conditions necessary for the reaction in

(i) Step IV

Reagents (1mk)

Conditions (1mk)

(ii) Step VII

Reagents (1mk)

Conditions (1mk)

e) What name is given to the reaction in step VII? (1mk)

f) Below are **two** reactions showing how a long chained alkanoic acid can be converted into detergent B.

I. $CH_2 - C_{17}H_{35}COOH$
$CH - C_{17}H_{35}COOH + 3H_2O \longrightarrow 3C_{17}H_{35}COOH + C_3H_8O_3$
$CH_2 - C_{17}H_{35}COOH$

II. $3C_{17}H_{35}COOH + 3NaOH \longrightarrow C_{17}H_{35}COONa + 3H_2O$
(detergent B)

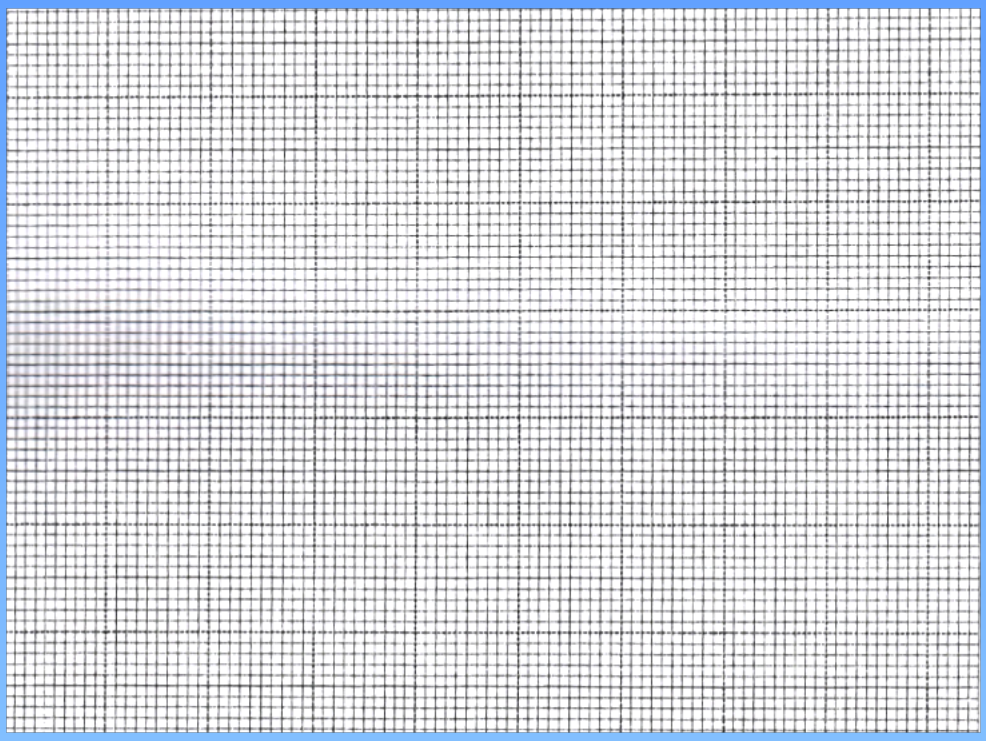
(i) Name the type of reaction in (2mks)

(ii) Give **one** disadvantage of using detergent B in washing clothes. (1mk)

3. 2.5g of a metal carbonate, MCO_3 was reacted with excess 2M nitric (v) acid, the volume of carbon (IV) oxide evolved measured and recorded at 10 second intervals. The results were recorded as shown in the table below.

volume of gas (cm^3)	0	90	150	210	280	305	390	450	480	480	480
Time in seconds	0	10	20	30	40	50	60	70	80	90	100

a) (i) On the grid provided, plot a graph of volume (vertical axis) against time. Label it as A (3mks)

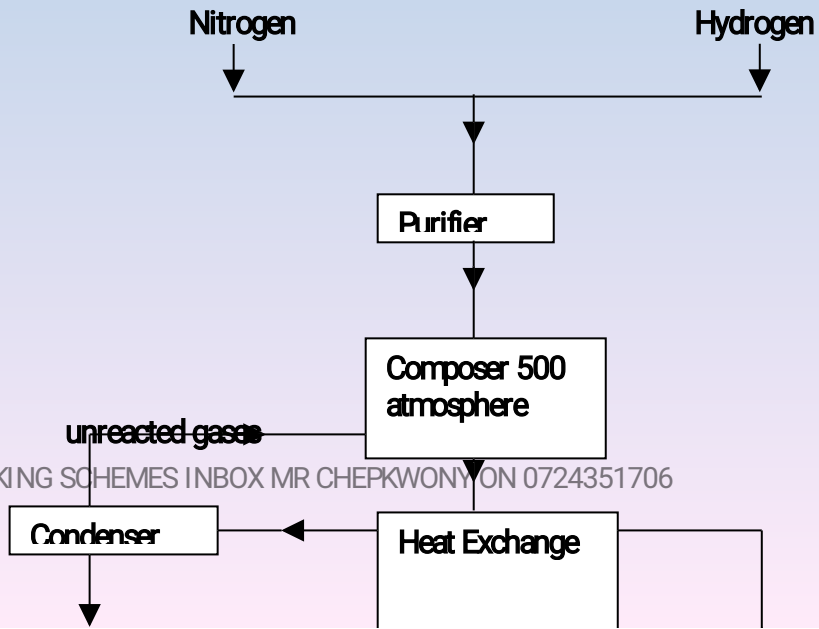


(ii) From your graph, determine the rate of reaction between 25 seconds and 40 seconds. (2 mks)

(iii) On the same grid, sketch a curve that would be obtained if the same experiment was repeated using excess IM Nitric (V) acid. Label it as B. (I mk)

(iv) Given that carbon (IV) oxide was measured at room temperature and pressure, work out the relative atomic mass of metal M. (MGV = 24dm^3, C 12, 0= 16) (3mks)

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



a) Name any **two** impurities removed by the purifier. (2mks)

b) The catalyst used in the process is finely divided iron. Why iron is finely divided? (1mk)

c) 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. (1mk)

d) A part from iron catalyst and pressure of 500 atmospheres, name any other condition required for this process. (1mk)

e) Give any **two** uses of ammonia (1mk)

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

(i) Name the catalyst used in the reaction (1mk)

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

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

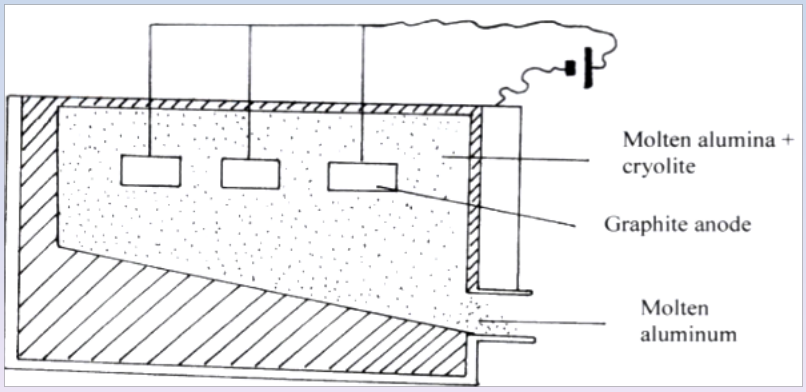
g) (i) In the preparation of chlorine gas in a school laboratory, either manganese (IV) oxide or potassium manganate(VII) may be used on concentrated hydrochloric acid. State **one** advantage of potassium manganate (VII) over manganese(IV) oxide in this reaction. (1mk)

(ii) State and explain what would be observed when dry litmus papers are dipped in a gas jar of chlorine. (2mks)

(iii) Freshly prepared chlorine water bleaches but chlorine water exposed to sunlight for sometime does not bleach. Explain. (2mks)

(iv) When preparing hydrogen chloride gas from sodium chloride and sulphuric (VI) acid, two conditions are necessary. State them. (1mk)

5. The diagram below shows industrial extraction of aluminum



a) Name and write the formulae of the major ore for this process. (1mk)

Name Formulae

b) Write the equation of the reaction taking place at the:

Anode (1mk)

Cathode (1mk)

c) Write the formula of the molten alumina. (1mk)

d) State the role of cryolite added to molten alumina (1mk)

e) It is cheaper to recycle aluminum other than to extract it. Explain. (1mk)

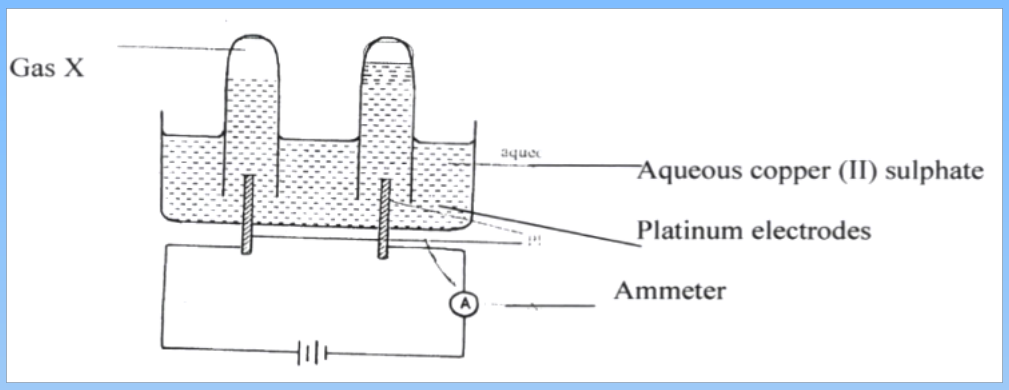
f) Explain why graphite anodes must be replaced after some time. (1mk)

g) State **one** property of aluminum that makes it suitable for wrapping food. (lmk)

h) Aluminum is high in the reactivity series yet it does not react with both acid and air. Explain. (1mk)

i) Calculate the mass of aluminum obtained when a current of 3A is passed through fused aluminum oxide for 4 hour 30 minutes, (Al=27, I F=96500C) (2mks)

6. Aqueous copper (II) sulphate was electrolyzed using the set-up represented by the diagram below.



a)

(i) Name the gas X. (1mk)

(ii) Write an ionic equation for the reaction that produces gas X. (1mk)

b) What happens to the pH of the electrolyte during electrolysis? Explain your answer. (2mks)

c) If in the above set-up, copper electrodes were used instead of platinum electrodes.

i) Write the electrode half- equations for the reactions at the anode and the cathode. (2mks)

Anode:

Cathode:

ii) What happens to the color of the electrolyte during electrolysis? Explain your answer. (2mks)

d) An iron spoon is to be electroplated with silver. Draw a labeled diagram to represent the apparatus that could be used to carry out this process. (3mks)

e) The table below shows the ammeter reading obtained when two different electrolytes of the same concentration were tested.

Electrolyte	Current (amps)
Copper (II) su lphate solution	4.0
Ethanoic acid	1.2

Why does ethanoic acid give a lower reading? (1mk)

f) Use the information in the table below to answer the questions that follow.

Reaction E^{θ} (volts)

$Zn^{2+}_{(aq)} + 2e^- \longrightarrow Zn_{(s)}$ -0.76

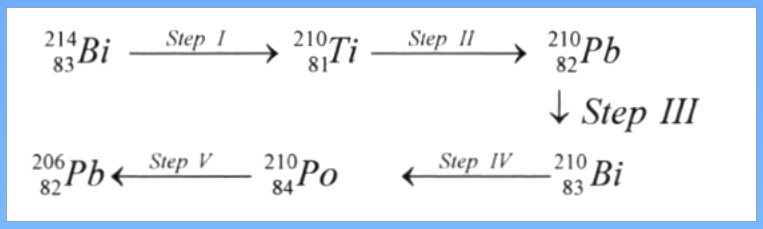
$Al^{3+}_{(aq)} + 3e^- \longrightarrow Al_{(s)}$ -1.66

$Fe^{3+}_{(aq)} + 3e^- \longrightarrow Fe_{(s)}$ -0.44

i) Write the cell representation of the cell made of aluminum and iron half-cells. (1 mk)

7. (a) State **two** differences between chemical and nuclear reactions. (2mks)

(b) Below is a radioactive decay series starting from $^{214}_{83}Bi$ and ending at $^{206}_{82}Pb$. Study it and answer the questions that follow;



(i) Identify the particles emitted in steps III and V (2mks)

(ii) Write the nuclear equation for the reaction which takes place in Step I. (1mk)

(c) (i) Define the term half– life. (1mk

(ii) 800g of a radioactive isotope decays to 50g in 100 days. Determine the half-life of this isotope. (2mks)

(d) State **two** medical uses of radioactive isotopes. (1 mk)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

MOI GIRLS SCHOOL NAIROBI KCSE TRIAL AND

AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. When an electric current was passed through molten substances M and N in different containers the observations in the table below were made

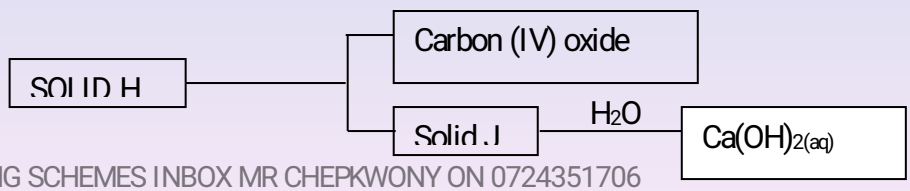
Molten M	Conduct electric current and is not decomposed
Molten N	Conduct electric current and a gas is formed at one of the electrodes

Suggest the type of bonding present in;

a) Substance M (1mk)

b) Substance N (1mk)

2. Use the scheme below to answer the questions that follow



a) Identify the solids

i) H - (1mk)

ii) J - (1mk)

b) State one laboratory use of $Ca(OH)_{2(aq)}$ (1mk)

3. Explain why potassium is kept under paraffin while phosphorous is kept under water (2mks)

4. Sulphur is soluble in ethanol but not in water while common salt is soluble in water but not in ethanol

a) Explain why sulphur is soluble in ethanol but hot in water (1mk)

b) Explain how a pure sample of sodium chloride can be obtained from a mixture of the two (1mk)

5. Ammonia gas is prepared by harber process according to the equation below

$N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)} + Heat$

Complete the table below by stating the effect of equilibrium when the following conditions are applied. Give explanation in each case

Condition	Effect on equilibrium	Explanation
a) Pressure increased	½ mk	1mk
b) Temperature increased	½ mk	1mk

6. Alkaline earth metals are generally less reactive than alkali metals, explain. (2mks)

7. A fixed mass of an ideal gas occupies $200cm^3$ at a pressure of 740 mmHg

a) State Charles's law (1mk)

b) Calculate the volume of the gas at 77-mmHg pressure (2mks)

8. State what would be observed if concentrated sulphuric acid is added to

a) Sugar crystals. (1mk)

. b) Hydrated copper (II) sulphate solution (1mk)

c) What type of reaction has taken place above (1mk)

9. Two gases X and Y have relative densities 1.98 and 2.90 respectively. They diffuse under the same conditions

a) How do their rate of diffusion compare? (2mks)

b) Determine the relative molecular mass of X given that the relative molecular mass of Y is 64 (1mk)

10. A mass of 2.5g of acid HX was dissolved in water and the resulting solution was diluted to a total of $250cm^3$, $15cm^3$ of the final solution was required to neutralize $25.0cm^3$ of 0.1M aqueous potassium hydroxide. Calculate the relative molecular mass of the acid (3mks)

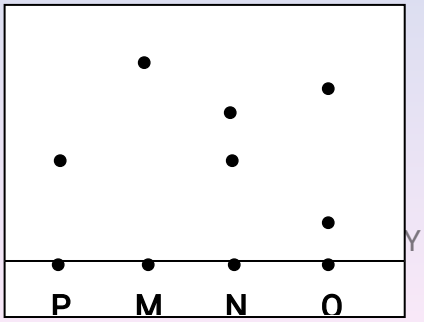
11. Name three sub – atomic particles found in an atom and state where they are found (3mks)

12. a) Using dots (•) and cross (x) show the formation of Carbon (II) oxide gas (1mk)

b) Name two types of bonds present in the molecule in 'a' above (2mks)

13. When a certain hydrocarbon burnt completely in excess oxygen 5.28g of Carbon (IV) oxide and 2.16g of water were formed. If the molecular mass of the hydrocarbon is 84, determine the molecular formula of the hydrocarbon (3mks)

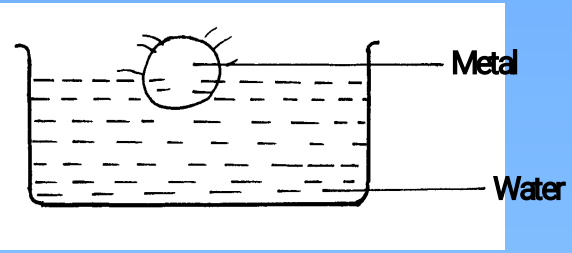
14. Three brands of inks M, N and O were suspected to be contaminated with substance P. The result is shown below;



i) Which ink was contaminated with substance P (1mk)
ii) Name the ink which was pure (1mk)
iii) Identify the other ink which was not pure (1mk)

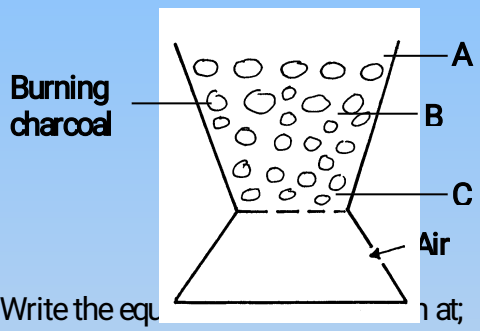
15. a) Name one gas used together with oxygen in welding other than acetylene gas(1mk)
b) State two other uses of the gas named above (2mks)

16. Study the experiment below and answer the questions that follow. The gas produced ignites spontaneously



i) Which metal is used above (1mk)
ii) Which gas was produced (1mk)
iii) What will be the colour of phenolpthalein indicator in the resulting solution? (1mk)

17. The following diagram represents a charcoal burner. Study it and answer the questions that follow



Write the equ n at; (3mks)

18. 75g of a saturated solution contains 30g of salt calculate
a) The solubility of the salt (2mks)
b) The percentage of the salt in the saturated solution (1mk)

19. State two disadvantages of hard water (2mks)

20. a) Define oxidation and reduction in terms of electrons (1mk)
b) Calculate the oxidation number of Chromium in $Cr_2O^{2-}_7$ (1mk)

21. The cell convention for an electrochemical cell is shown below
$Zn_{(s)} / Zn^{2+}_{(aq)} // Pb^{2+}_{(aq)} / Pb_{(s)}$
a) Name two substances that can be used as electrolytes in the above cell (2mks)
b) Which of the electrodes is the anode? (2mks)

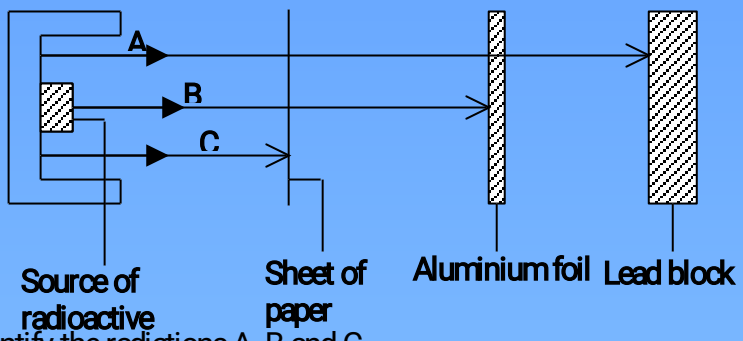
22. a) Name one chief ore of copper and give its formula (2mks)
b) Calculate the mass of copper that would be deposited on the cathode when a steady current of one ampere flows for 20 minutes through copper (II) sulphate solution (Cu = 63.5; Faraday Constance = 96500Cmol^{-1}) (3mks)

23. a) Give a reasons why ethanoic acid has a higher boiling point than ethanol which has the same number of Carbon atoms (1mk)
b) Draw the structural formula of ethanoic acid (1mk)

24. $RCOO^-Na^+$ and $RCH_2OSO_3^-Na^+$ represent two types of cleansing agents

a) Name the class of cleansing agent to which each belongs (1mk)
b) Which one of the two cleansing agents is likely to polute the environment. Explain.(2mks)

25. a) State three differences between chemical and nuclear reactions. (3mks)
b) Study the figure below and answer the questions that follow



Identify the radiations A, B and C (3mks)

26. A volume of 80cm^3 of a mixture of propane (C_3H_8) and oxygen were ignited in an experiment. The products were cooled and passed through an aqueous sodium hydroxide. The final volume was reduced by 30cm^3
a) Write the equation for the combustion of propane (1mk)
b) Determine the volume of;
i) The component of the original mixture (2mks)
ii) Residual oxygen (1mk)

27. Use the information below to answer the questions that follow
Ethanol is formed as shown below
$2C_{(s)} + 3H_{2(g)} + ½\ O_{2(g)} \longrightarrow C_2H_5OH_{(l)}$
ΔHc carbon = -393kJmol^{-1}
ΔHc Hydrogen = - 286kJmol^{-1}
ΔHc ethanol = - 1368kJmol^{-1}
Draw the energy cycle diagram and for the formation and combustion of ethanol and calculate the heat of formation of ethanol (3mks)

28. Differentiate between empirical and molecular formula (2mks

MOI GIRLS SCHOOL NAIROBI KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. Use the information in the table below to answer the questions that follow

Element	Atomic Radii (nm)	Tonic radii nm
D	0.231	0.133
E	0.181	0.099
F	0.160	0.065
G	0.195	0.114

a) i) Are the members in this group likely to be conductor or non – conductors?(1mk)
ii) Which element would have the lowest atomic number? Explain. (1mk)

b) 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)

V								W			
X	Y										Z

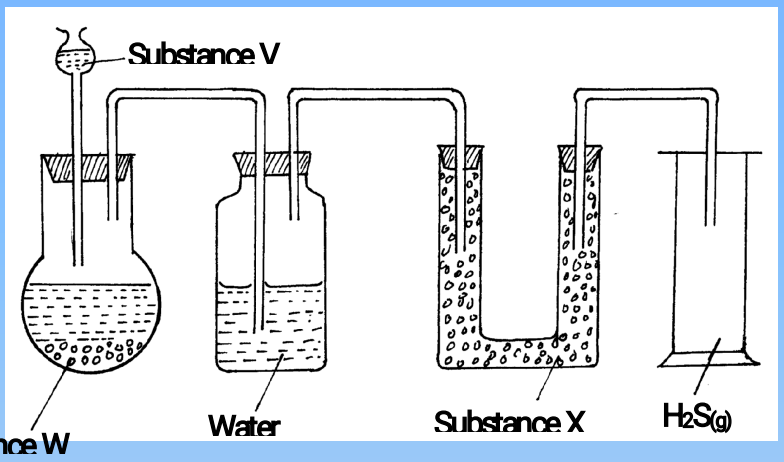
i) Select the element in period three which has the shortest atomic radius. Give a reason for your answer. (2mks)

ii) Using dots (•) and crosses (x) to represent outermost electrons, draw a diagram to show the bonding in the compound formed when chlorine reacts with element X (1mk)

iii) When three liters of chlorine gas were completely reacted with element Y, 11.85g of the product were formed. Calculate the relative atomic mass of element Y (3mks)

(R.A.M of chlorine = 35.5, molar gas volume = 24 liters)

2. The apparatus shown below were used for the preparation of hydrogen sulphide gas in the laboratory



a) Name;

i) Substance V (1mk)

ii) Solid X (1mk)

b) Write an equation for the preparation of hydrogen sulphide (1mk)

c) What property of the gas enables it to be collected by the method shown in the diagram? (1mk)

d) What is the purpose of the water in the second flask? (1mk)

e) What precaution should be taken when preparing the gas? (1mk)

f) Explain the observations made when dry hydrogen sulphide is exposed to wet Lead (II) acetate paper (2mks)

g) State the observation that would be made when hydrogen sulphide gas is bubbled through acidified Potassium dichromate (VI) solution (1mk)

h) Explain why it is not advisable to dispose off hydrogen sulphide gas by burning (1mk)

3. The empirical formula of a hydrocarbon is (CH_2). It has a density of 0.001167g/cm^3 at room temperature and pressure. (Molar gas volume at r.t.p is 24dm3)

a) Determine the molecular formula of the hydrocarbon (3mks)

b) Draw the structural formula of the hydrocarbon (1mk)

c) Ethene gas burns in Oxygen to form Carbon (IV) oxide and water.

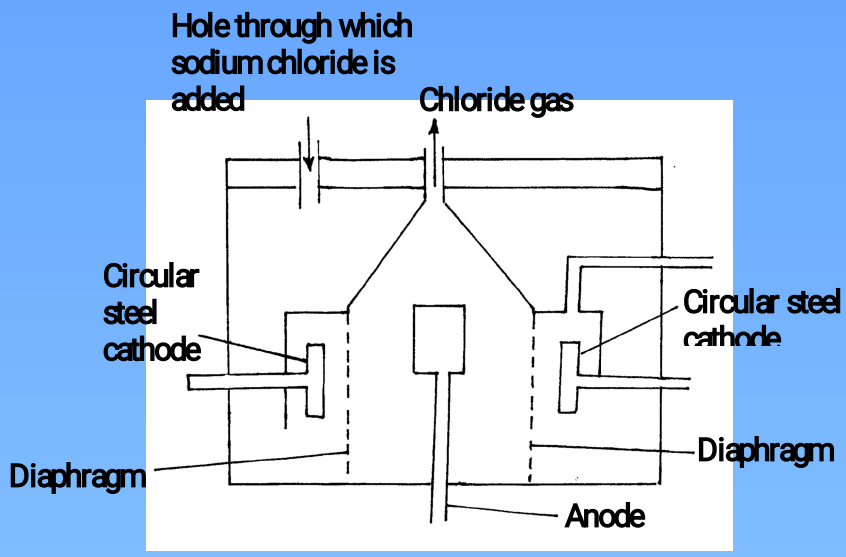
i) Write an equation for the reaction between ethane gas oxygen gas (1mk)

ii) 15cm^3 of ethene gas were mixed with 50cm^3 of oxygen gas and the mixture was ignited into complete combustion. Calculate the volume of excess unreacted gas (3mks)

d) What happens when ethene gas is bubbled through bromine water? (2mks)

e) Give any two uses of ethene gas (2mks)

4. Below is a simplified diagram of a Down's cell used for the manufacture of Sodium metal. Study it and answer the questions that follow.



a) Name the substance the anode is made of (1mk)

b) Explain your answer in (a) above (1mk)

c) What is the role of the diaphragm in Down's cell (1mk)

d) In Down's cell for the manufacture of Sodium metal, Calcium chloride salt is added to lower the melting point from 800^0C to 600^0C. Explain why it is necessary to lower the melting point (1mk)

e) Calculate the mass of sodium metal produced if a current of 50 amperes is passed through the molten Sodium chloride for two (2) hours (Na = 23, F = 96500C) (2mks)

f) Below is a list of potential differences obtained when metal P, Q, R, S and T are used in the following electrochemical cell

Metal (s) / Metal ions // Copper (II) ions / copper (s)

Metal	Reduction Electrode Potential
P	- 1.10V
Q	- 0.46V
R	0.00
S	+ 0.45V
T	+ 1.16V

i) Which metal is likely to be Copper. Explain (2mks)

ii) Identify the strongest reducing agent (1mk)

iii) Which two half – cells would be combined to produce the highest voltage? (1mk)

iv) Give a cell representation of the cell in F (iii) above. (2mks)

5. The table below gives the volume of hydrogen gas produced when different acids of $50cm^3$ were each reacted with 10cm piece of magnesium ribbon in a conical flask.

Time	Volume of the gas evolved in cm^3 using	
	1M Sulphuric Acid	1M ethanoic acid
10	35	2
20	56	4.5
30	73	7

40	85	11
50	91	13
60	97	15
70	100	17
80	100	20
90	100	23
100	100	26.5
120	100	30

a) On the grid provided, plot on the same axis, the graph of volume of gas produced against time (4mks)

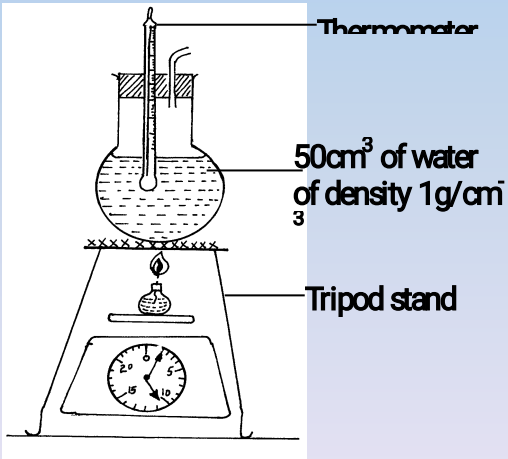
b) From the graph, determine the rate of reaction of both acids at 55 seconds
   i) 1M sulphuric (VI) acid (1mk)
   ii) 1M ethanoic acid (1mk)

c) Explain the difference in the rate of evolution of the gas as determined in (b) above (2mks)

d) Calculate the number of moles of hydrogen gas produced when 10cm magnesium ribbon is completely reacted with 1M sulphuric (VI) acid. (Molar gas volume = $24dm^3$ at r.t.p) (2mks)

e) What mass of magnesium had therefore reacted? (Mg = 24) (2mks)

6. The following set – up was made in an experiment by a group of form four students. The readings of the balance before and after experiment were indicated in the diagram below. Given that the initial temperature of water was 26.7^0C respectively. The specific heat capacity of water is $4200Jkg^{-1}k^{-1}$



Determine:

a) Temperature change that occurred (1mk)
b) Amount of ethanol used (1mk)
c) Moles of ethanol used 2mks)

d) Amount of heat gained by water (2mks)

e) Molar enthalpy of combustion of ethanol (2mks)

f) Use the following thermochemical processes to answer the questions that follow;

$C_3H_{8(g)} + 5O_{2(g)} \rightarrow 3CO_{2(g)} + 4H_2O_{(l)}$ $\Delta Hc = -125kJmol^{-1}$

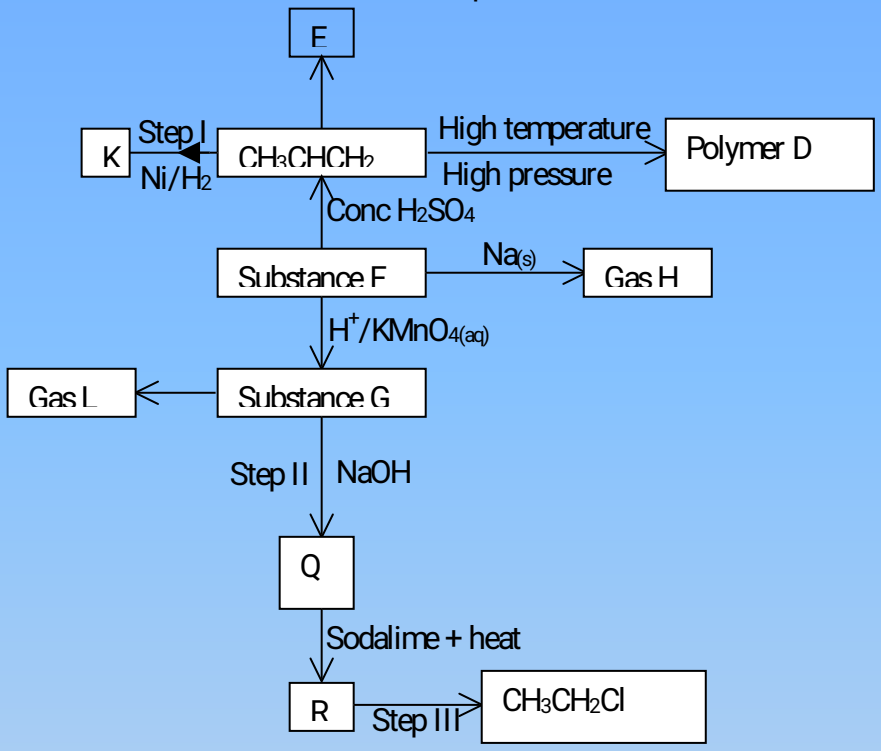
$C_{(s)} + O_{2(g)} \rightarrow CO_{2(g)}$ $\Delta Hc = -393kJmol^{-1}$

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

i) Draw an energy level diagram representing the formation and combustion processes of propane, carbon and hydroge (2mks)

ii) Hence or otherwise, determine the heat of formation of propane(2mks)

7. Use the flow chart below to answer the questions that follow



a) Name the following;

i) Gas L (1mk)

ii) Gas H (1mk)

iii) K (1mk)

b) Name the processes involved in the following steps

i) Step I (1mk)

ii) Step II (1mk)

iii) Step III (1mk)

c) Draw the structure of compound E (1mk)

d) Write a chemical equation for the complete combustion of substance F (1mk)

e) Name the condition and reagents in step III

i) Condition (1mk)

ii) Reagent (1mk)

f) Calculate the mass of salt Q that would be formed by using 21.9kg of G when it reacts with excess sodium hydroxide (2mks)

(C = 120, H = 1.0, Na = 23.0, O = 16.0)

g) i) Draw the structure of polymer D (1mk)

ii) State one use of the above polymer (1mk)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

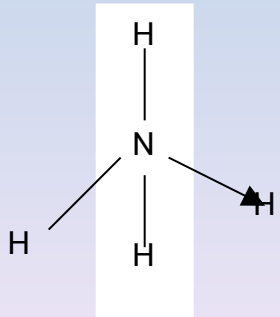
KENYA HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

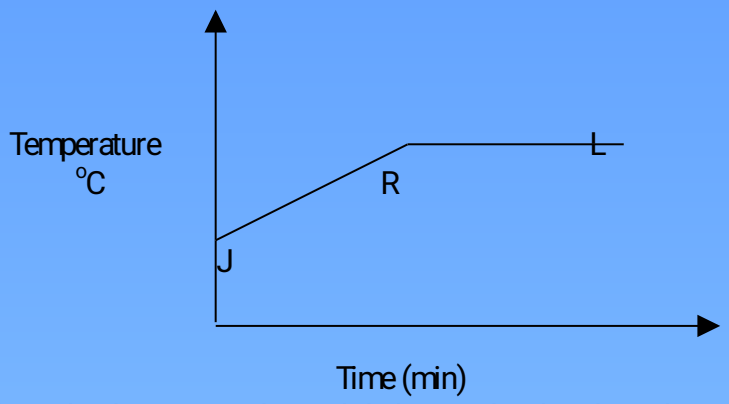
Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. Define the following terms (3mks)
   (a) Isotopes
   (b) Mass number
   (c) Isobars
2. Calcium oxide can be used to dry hydrogen chloride gas.
   (a) Explain why calcium oxide is not used to dry chlorine gas (2mks)
   (c) Name one drying agent for hydrogen chloride gas other than the one named above (1mk)
3. (a) Give a reason why ammonia gas is highly soluble in water. (1mk)
   (b) The structure of ammonium ion is shown below



Name the type of bond represented in the diagram by N —H→ (1mk)

4. The graph below shows part of a temperature –time curve obtained when solids naphthalene was heated.



a) Explain what happens to the naphthalene molecules along the curves.

(i) JR (1mk)

(ii) RL (1mk)

5. (a) Define the term standard enthalpy of formation of a substance (1mk).

$C_3H_8 + SO2 \longrightarrow 3CO2 + 4H_2O \quad \Delta H = -1202\ Kj\ mol^{-1}$

$C_{(s)}$ graphite + $O_2 \longrightarrow CO_2 \quad \Delta H = -394 Kj\ mol^{-1}$

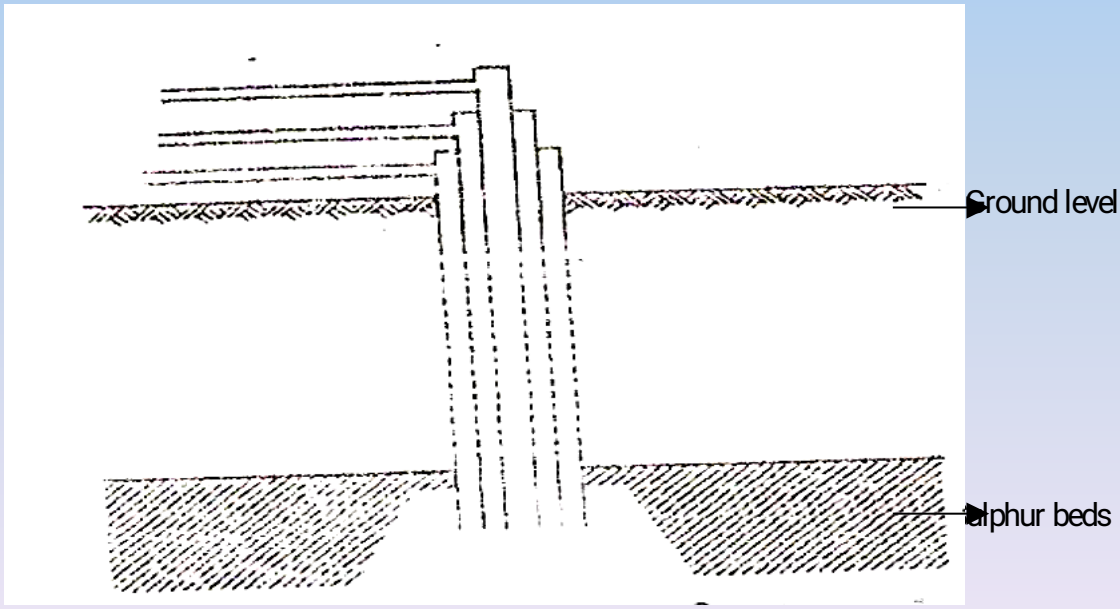
$H_{2(g)} + ½\ O_2 \longrightarrow H_20 \quad \Delta H = 286\ KJ\ mol^{-1}$

Using the above thermo chemical equations:

(b) Name two types of heat changes represented by ΔH_3 (1mk)

(c) Using an energy cycle diagram, calculate the molar enthalpy of formation of propane (2mks)

6. The diagram below illustrates how sulphur is extracted by frasch process



(a) Label the pipe through which super heated water is pumped in (1mk)

(b) The equation below shows the oxidation of sulphur(IV) oxide to sulphur (VI) oxide in contact process.

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \Delta H=-196Kj^{mol-1}$$

(i) Name one catalyst for this reaction (1mk)

(ii) State and explain the effect on the yield of sulphur (VI) oxide when

I. the temperature is increased (1mk

II. the amount of oxygen is increased (1mk) (1mk)

7. Both diamond and graphite have giant atomic structures. Explain why diamond is hard while graphite is soft. (2mks)

8 (a) Using dot (.) and crosses(x) to represent electrons, show bonding in the compounds formed when the following elements reacts. (C-=6, Na=11, F=9)

(a) Sodium and fluorine (1mk)

(b) Carbon and fluorine (1mk)

9 The list below gives the formulae of some organic compounds. Use it to answer the questions that follow

I $CH_3CH_2CH_2CH_2OH$

II $CH_3CH_2CH_3$

III $CH_3CH_2CH_2\overset{\overset{\displaystyle O}{\|}}{C}\cancel{O}H$

IV $CH_3CH_2CH_2\ CH_3$

10. The table below gives the solubility of potassium bromide and potassium sulphate at 0^oc and 40^oC

Substance	Solubility g/100g H_2O at	
	0^oc	40^oC
Potassium bromide	55	75
Potassium sulphate	10	12

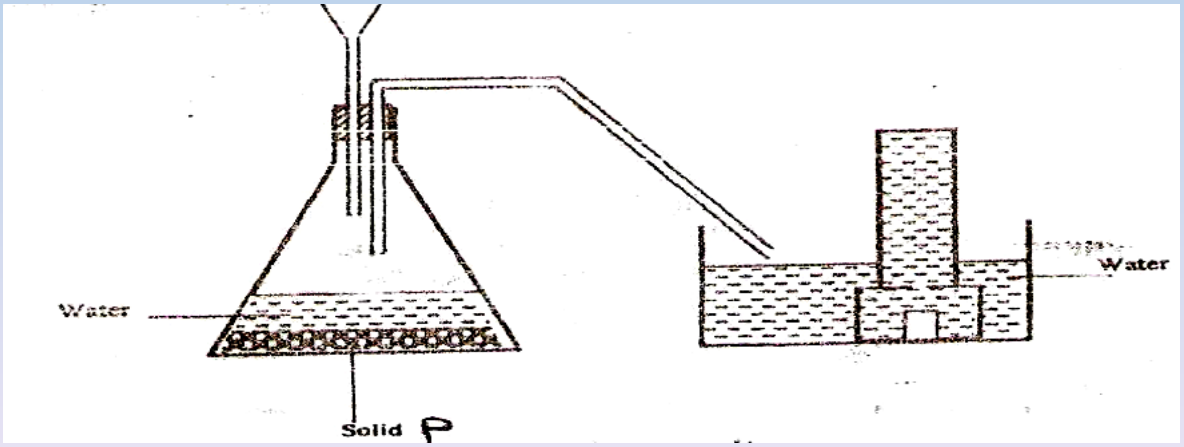
When an aqueous mixture containing 60g of potassium bromide and 7g potassium sulphate in 100g of water at 80^oc was cooled to 0 ^oC, some crystals were formed

(a) Identify the crystals (1mk)

(b) Determine the mass of the crystals (1mk

(c) Name the method used to obtain the crystals (1mk

11. The diagram below shows a set-up used by a student in an attempt to prepare and collect oxygen gas.



(a) Complete the diagram by correcting the mistakes in the set ups (2mk)

(b) Identify solid P (1mk)

12. The table below gives information about the major components of crude oil. Study it and answer the questions that follow.

Components	Boiling point ^{o}C
Gases	Below 40
Petrol	40-175
Kerosene	175-250
Diesel oil	250-350
Lubricating oil	350-400
Bitumen	Above 400

(j) Which of the compounds of crude oil has molecules with the highest number of carbon atoms? Explain (1mk)

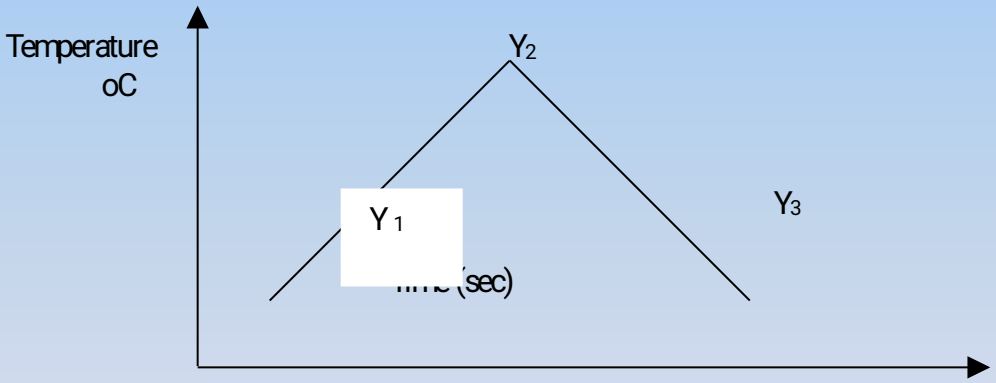
(ii) Name the process you would use to separate a mixture of diesel and petrol (1mk)

(iii) What condition could cause a poisonous gas to be formed when Kerosene is burnt (1mk)

13 In order to determine the molar heat of neutralization of sodium hydroxide 100cm3 of 1M sodium hydroxide and 100cm^3 of 1M 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 30 seconds until the highest temperature of the solution was attained. Thereafter the temperature of the solution was recorded for further two minutes

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

(b) The sketch below was obtained when the temperatures of the mixture were plotted against time. Study it and answer the questions that follow



I, What is the significance of point Y_2 (1mk)

II Explain the temperature change

(a) Between Y_1 and Y_2 (1mk)

(b) Between Y_2 and Y_3 (1mk)

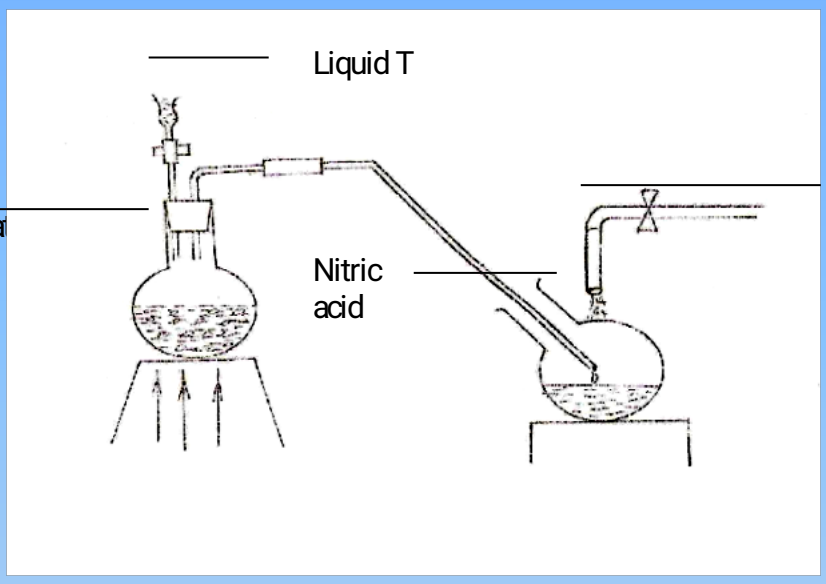
14. For each of the following experiments, give the observations, and the type of change that occurs (Physical or chemical)

Experiment	Observation	Type of change
A few drops of concentrated sulphuric acid added to small		

amounts of sugar		
A few crystals of Iodine are heated gently in a test tube		
A few crystals of copper (II) Nitrate are heated strongly in a test tube.		

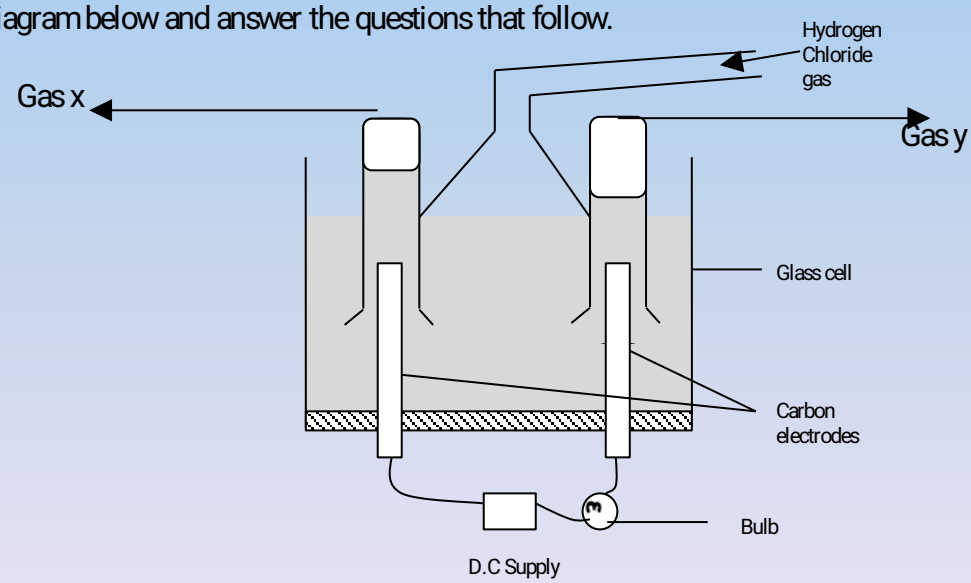
15. In the lab. Ammonia gas is prepared by heating an ammonium salt with an alkali.
    (a) What is meant by the term alkali (1mk)
    (b) (i) Explain using the physical properties of the gas, why ammonia is not collected
    (i) Over water (1mk
    (ii) By downward delivery (1mk)

16 The set up below was used to prepare nitric acid



    (a) Give the name of liquid T(1mk)
    (b) Write the equation for the reaction which took place in the reaction flask (1mk)
    (c) Explain why nitric acid is stored in a dark bottle (1mk)

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



When some hydrogen chloride gas is allowed into water and the mixture stirred, the bulb lights and gasses X and Y are formed (2mks)

(a) Name
Gas X
Gas Y

(b) Explain why the bulb does not light before the chloride gas is let into the water (2mks)

18 The table below gives information on four elements represented by K L M & N. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

Elements	Electron arrangement	Atomic radius	Ionic radius
K	2, 8 2	0.136	0.065
L	2, 8, 7	0.099	0.181
M	2, 8, 8, 1	0.203	0.133
N	2, 8, 8, 2	0.174	0.099

(a) Which two elements have similar chemical properties? Explain (2mks)

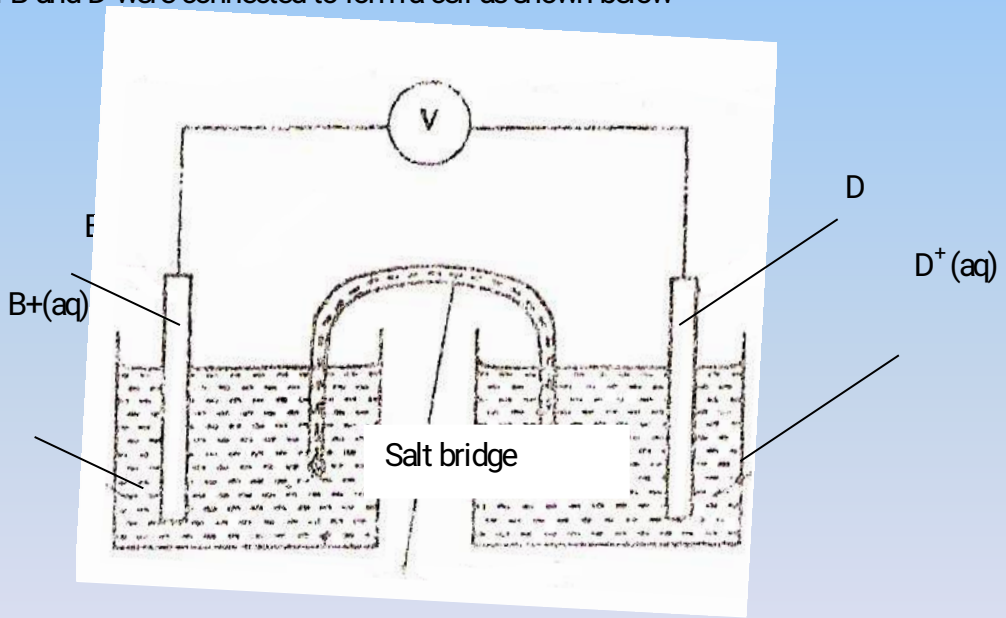
19. The table below gives reduction potentials obtained when the half-cells for each of the elements represented by A, B, C, D and E were connected to a copper half-cell as the reference electrode.

Metal	Reduction Potential (Volts)
A	-1.10
B	-0.47
C	0.00
D	+0.45
E	+1.16

(d) What is element C likely to be? Give a reason (2mks)

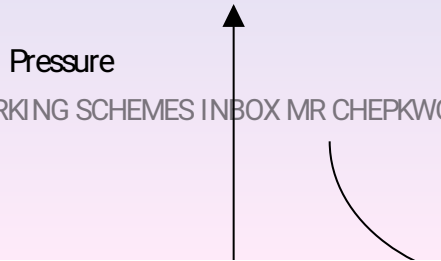
(e) Which of the metals cannot be displaced from the solution of its salt by any other metal in the table. Give a reason (2mk)

(f) Metal B and D were connected to form a cell as shown below



Write the equation for the half cell reaction that occur at metal B electrode (1mk)

20. The graph below shows the behaviour of a fixed mass of a gas at constant temperature

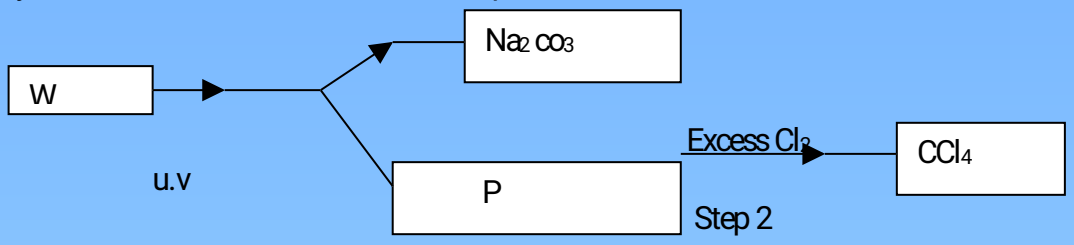


Volume (litres)

(a) What is the relationship between the volume and the pressure of the gas (1mk)

(b) 3 litres of oxygen at one atmospheres pressure were compressed to two atmospheres Pressure at constant temperature. Calculate the volume occupied by the oxygen gas (2mks)

21 Study the flow chart below and answer the questions that follow



(a) Identify W and P (2mks)

(b) What name is given to the type of halogenation reaction in step 2. (1mk)

22 (a) Define the term half-life as used in radioactivity (1mk)

(c) 100g of a radio active substance was reduced to 12.5g in 15.6 years. Calculate one half-life of the substance

23 (a) Define the term oxidation state. (1mk)

(b) Calculate the oxidation states of chromium and manganese in the following ions. (2mks)

(i) Chromium in $Cr_2O_7^{2-}$

(ii) Manganese in MnO_4^-

24 Write one structural formulae of

(i) Methanol 1mk)

(ii) Methanoic acid (1mk)

(b) Write the equation for the reaction between methanoic acid and sodium hydroxide (1mk)

(c) Name the product formed when methanol reacts with methanoic acid (1mk)

(d) State one condition necessary for the reaction in (c) to take place (1mk)

25. In an experiment to electroplate a copper spoon with silver, a current of 0.5A was passed for 18 minutes. Calculate the amount of silver deposited on the spoon (IF =96500 coulombs ,Ag=108) (3mks)

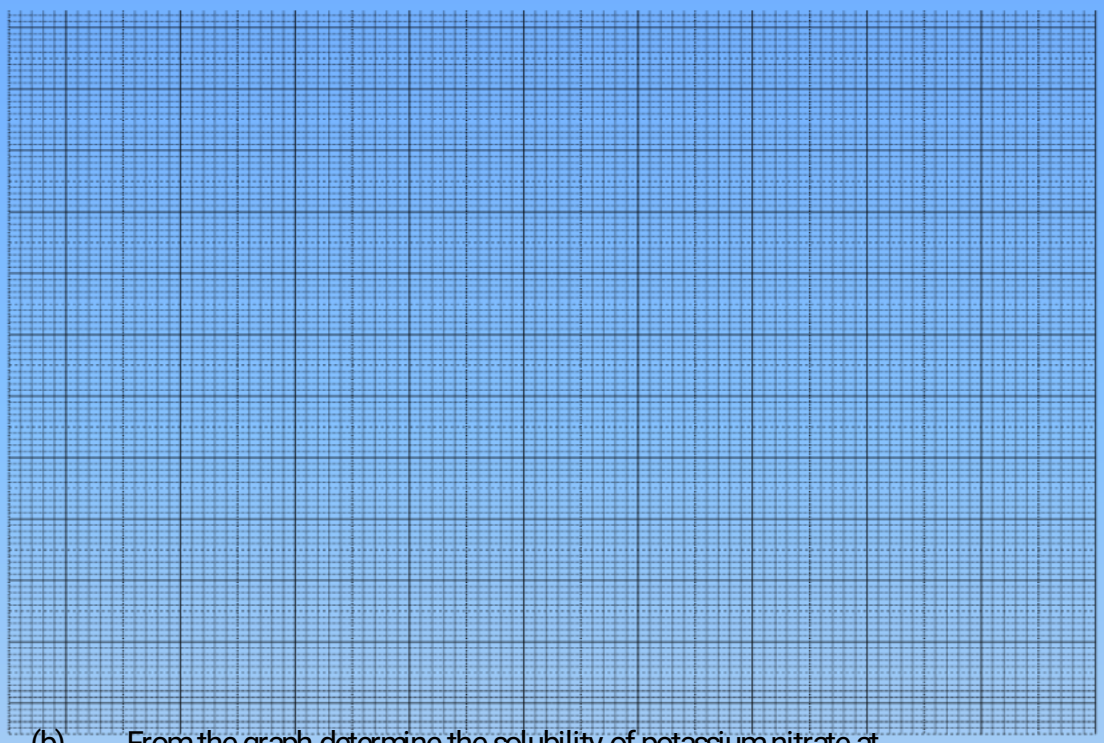
KENYA HIGH SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. The table below shows results recorded on an experiment carried out to determine the solubility of potassium nitrate.

Temperature (oC)	20	30	40	50	60	70	80	90
Solubility in g per 100g of water	32	46	64	86	110	138	169	202

(a) Use the data above to plot a graph of solubility against temperature on the grid Provided (3mks)



(b) From the graph determine the solubility of potassium nitrate at (2mks)

(i) 25°C

(ii) 83 °C

© What mass of potassium nitrate will crystallise when a saturated solution is cooled from 75°C to 20°C. (2mks)

(d) On the same axis sketch a graph showing how solubility of chlorine gas varies with temperature (1mk

(e) The table represents results on four samples of water. Study it an answer the questions that follows.

Sample of water	Drops of soap used to produce lather	
	Before boiling	After boiling
A	20	10
B	3	3
C	15	3
D	20	20

(i) Which sample is likely to be temporary hard water? Explain (2mks)

(ii) Give 2 advantages of hard water (2mks)

2 (a) Draw the structural formulae of the following compounds (3mks)

(i) 2 methyl propene

(ii) Butan –2-ol

(iii) 2-3-di methyl Butane

(b) State the observation made when compound (ii) in (a) above is reacted with a piece of Sodium metal (1mk)

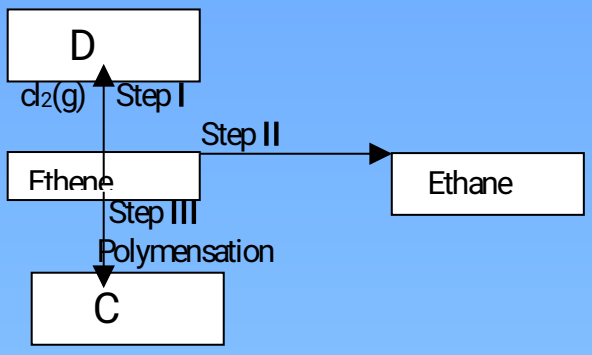
© Compounds (i) and (ii) in (a) above belong to different homologous series

(i) what is a homologous series (1mk)

(ii) Give a chemical test that will distinguish Butan-2-ol from butanoic acid (2mks)

(e) Write an equation for the complete combustion of ethane gas (1mk)

(f) Study the flow chart below and answer the questions that follows.

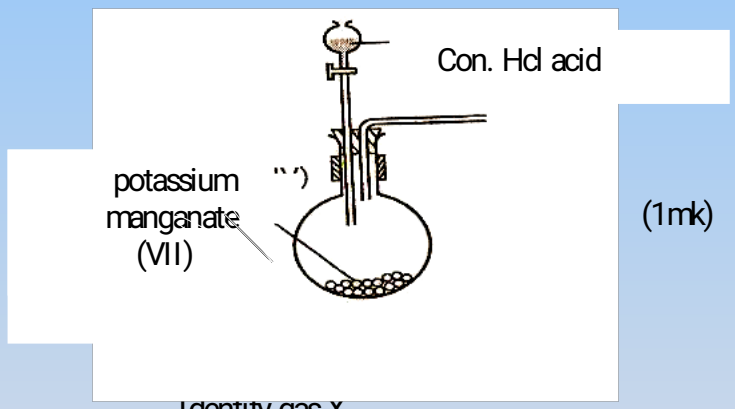


(i) Give the reagents and conditions for step II to occur (2mks)

(ii) Give the industrial importance of step II (1mk)

(iii) Name the compounds

3 The setup below was used to prepare and collect a dry sample of gas X. Study it and answer the questions that follow.



(1mk)

Identify gas X .(1mk)

(a) Complete the setup to show how gas X is dried and collected (3mks)

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

© An aqueous solution of zinc sulphate is electrolysed using platinum electrodes. State and explain what happens to the concentration of zinc sulphate (2mks)

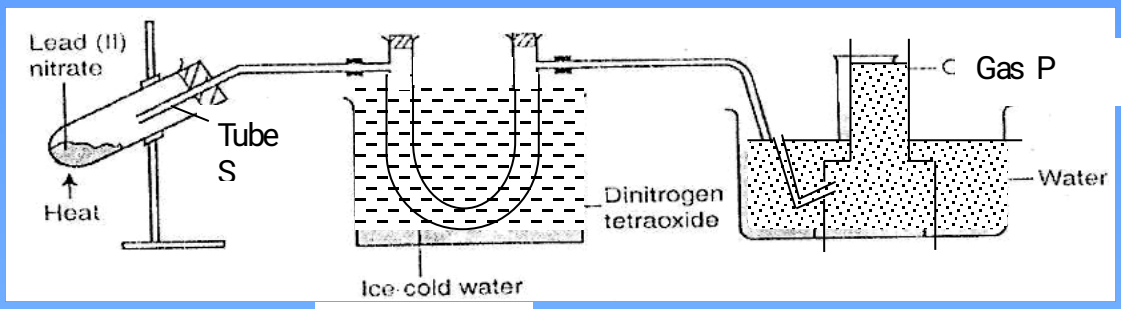
(d) State the ratio of the products of the anode and cathode using the equations (2mks)

(f) Give one use of electrolysis (1mk)

(g) What is anodization of aluminium (1mk)

4. The diagram below represents a set up that can be used to prepare and collect Nitrogen (IV) oxide.

(a) Name gas P (1mk)



(b) Write an equation for the reaction that takes place (1mk)

© Give **Two** observation that would be made in tube S (2mks)

(d) What property of Nitrogen (IV) oxide make it possible for its collection as shown above. (2mks)

(e) Why is it not advisable to use other Nitrates (1mk)

(f) Write an equation showing a reaction of Nitrogen (IV) oxide and water (1mk)

(g) Explain the following observation, a piece of burning magnesium is lowered in a gas jar full of Nitrogen (IV) oxide it continues to burn forming a white solid and a colourless gas. (2mks)

(i) Name the white solid (1mk)

(ii) Name the colourless gas (1mk)

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

A							
				D			E
B	C					F	G
	K						H

(a) Choose the most reactive non-metal (1mk)

(b) On the grid indicate the position of element X whose ion is X^{2} and has an electron Arrangement of 2,8 (2mks)

© Write the formulae of the compound formed between G and D. (1mk)

(d) What is the family name of E,G, H (1mk)

(e) How does the electronegativity of E, G, and H vary? Explain (2mks)

(f) Compare the reactivity of A and water and that of C and water. (2mks)

(g) Name the type of oxide formed by B (1mk)

(h) Give one use of element F (1mk)

6 (a) Name the process in which sodium metal is extracted (1mk)

(b) What is the function of calcium chloride during extraction of sodium meta (1mk)

(c) Write an equation for the reaction taking place at the anode (1mk)

(d) Apart from liquid sodium what else can be collected at the cathode, and how is it separated from sodium. (2mks)

(e) Calculate the volume of hydrogen gas produced at s.t.p when 1.15g of sodium metal react with water. (Na=23, molar gas volume=22400cm^{3}) (3mks)

(f) (i) State one environmental hazard that is caused during extraction of sodium metal (2mk

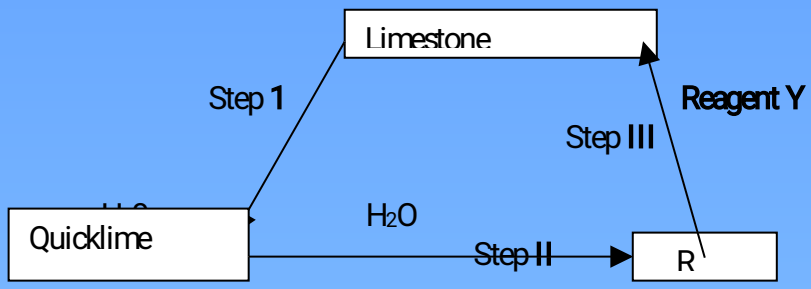
(ii) Give 2 uses of sodium metal (2mks)

7 (a) Define the following terms (2mks)

(i) Duplet

(f) Hydrogen bonding

(b) Below is a flow chart. Study it and answer the questions that follow: -



(i) Name the process in step I (1mk)

(ii) Name compound R (1mk)

Reagent Y (1mk)

(iii) Write equation for the reaction in step II

(c) Explain why 0.1 M hydrochloric acid has a pH of 1 while 0.1M ethanoic acid has a pH of 3 (2mks)

(d) (i) Write down the observation made when a sample of copper (II) carbonate is heated in a test tub (1mk)

(ii) Write an equation for the action of heat on copper (II) carbonate (1mk)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

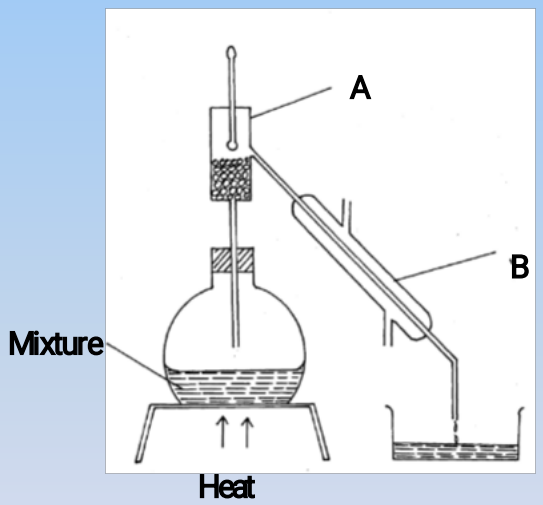
MARANDA SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	Maximum score	Candidate's score
Score 1 - 29	80	

1. The diagram below shows a set-up of apparatus used to separate immisible liquids.



(a) Name the parts labelled A and B (1mk)

(b) State the function of the part labeled A. (1mk)

(c) State the property of the mixture that makes it suitable to be separated by the method above. (1mk)

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

Element	Atomic Number	Melting point (^{o}C)
L	11	97.8

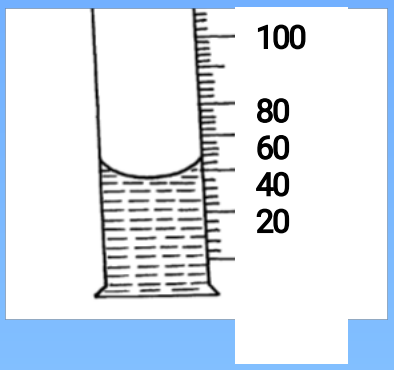
M	13	660
R	19	63.7

(i) Write the formulae of carbonate R and M (1mk)

(ii) Describe how the carbonate of M can be obtained from a mixture of carbonate R and M. (2mks)

(iii) R is more reactive than L. Explain (1mk)

3. In an Experiment, concentrated sulphuric acid was put in a beaker and exposed to air for one week as shown below.



(i) What observation was made after one week . Explain. (2mks)

(ii) What property of sulphuric acid was being investigated in the experiment (1mk)

4. a) Define the term solubility. (1mk)

b) A form four student wanted to determine the solubility of potassium nitrate. He obtained the following results.

Mass of evaporating dish = 15.13g

Mass of evaporating dish and solution. = 36.51g

Mass of evaporating dish and salt = 19.41g

Use the information above to calculate the solubility of potassium nitrate. (3mks)

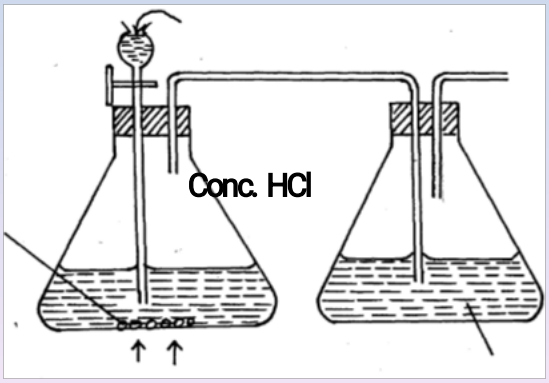
5. The table below shows the standard electrode potentials of two elements P and Q.

Half reactions	Eθ (v)
$P^{2+}_{(aq)} + 2e^- \rightarrow P_{(s)}$	-2.37
$Q^{2+}_{(aq)} + 2e^- \rightarrow Q_{(s)}$	-0.402

(i) Draw a well labelled diagram of a cell that could be constructed from the pair of elements. (2mks)

(ii) Calculate the e.m.f of the cell above. (1mk)

6. The diagram shows an incomplete set-up for the laboratory preparation and collection of chlorine gas. Study it and answer the questions that follow.



Water

Black solid
Q

Heat

(a) Complete the set-up to show how dry chlorine gas is collected. (2mks)

(b) Name substance Q. (1mk

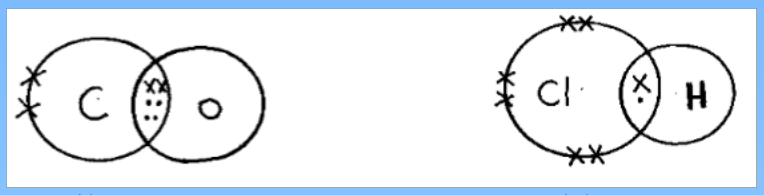
7. If aqueous lead (II) nitrate is added to aqueous solution potassium iodide, abright yellow precipitate is formed.

(i) Write down the formula of the precipitate formed.(1mk)

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

8. Zinc carbonate decomposes on heating producing a gaseous product and a residue. What volume of the gaseous product at s.t.p is produced from 2.5 g of the carbonate? (Zn = 65, C=12,O=16 M.G.V at s.t.p = 22400cm^3) (3mks

9. Identify the type of bond formed in (i) and (ii) . (2mks)



(I) (II)

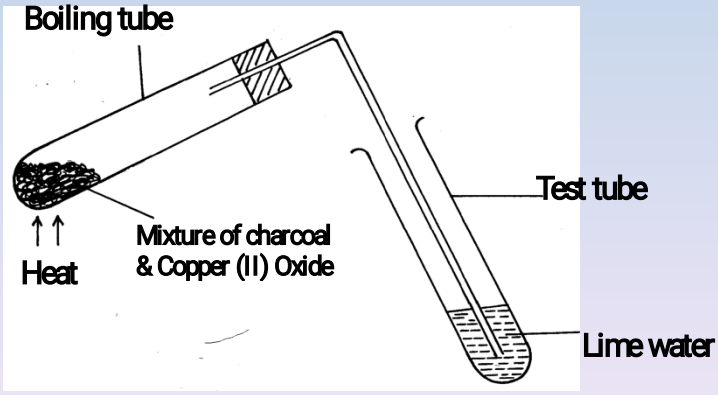
10. Give the systematic name sof the following compounds. (3mks)

(a) $CH_3 - C(=CH_2) - CH_3$

(b) $CH_3\,CH(C_2H_5)\,CH_2CH_2OH$

(c) $CH_3CH_2CH_2COOH$

11. The set up below was used to investigate a chemical property of carbon. Study it and answer the questions that follow.



(i) What observations were made on heating the mixture. (2mks

(ii) What is the industrial application of carbon in terms of property investigated above. (1mk)

12 In an experiment, a few drops of concentrated nitric (IV)acid were added to aqueous Iron (II) sulphate in a test tube. excess sodium hydroxide solution was then added to the mixture.

(a) State the observations that were made when:

(i) Concentrated nitric (V) acid was added to aqueous Iron (II) sulphate (1mk)

(ii) Excess sodium hydroxide was added to the mixture. (1mk)

(b) Write an ionic equation for the reaction that occurred in a(ii) above. (1mk)

13. Consider the reaction represented by the equation:

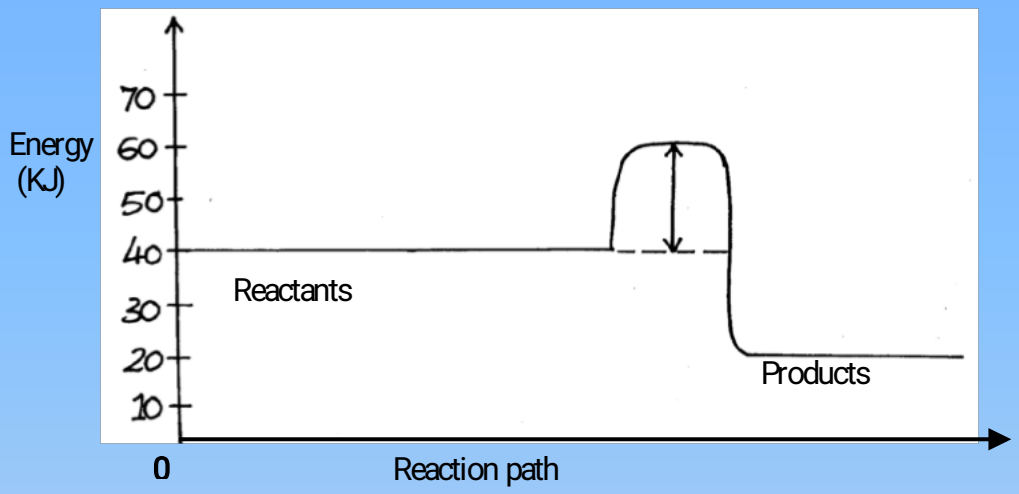
$N_{2(g)} + O_{2(g)} \rightleftharpoons 2NO_{(g)} \quad \Delta H = +12\ 59\ KJ$

Explain the effect of the following on the reaction;

(a) An increase in pressure (1mk)

(b) Increase in temperature (2mk)

14. Study the energy level below and answer the questions that follow.



(i) State and explain whether the reaction represented in the diagram is endothermic or exothermic. (1mk)

(ii) From the diagram, determine;

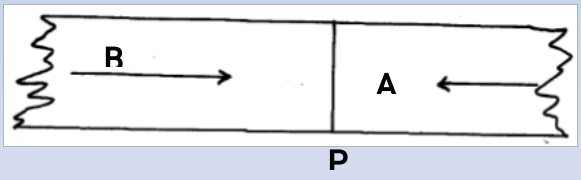
I. the activation energy (1mk)

II. enthalpy of reaction (1mk)

15. Explain why when heating substances with non-luminous flame, tubes should not be placed very close to the top of the chimmey. (2mks)

16. State Graham's law of diffusion. (1mk)

Two gases A and B diffuses from two opposite ends of the glass tube as shown. After 12 seconds gas B was detected at point P and A was detected 4 seconds later



Calculate the relative molecular mass of A given that the relative molecular mass of B is 2. (2mks)

17. Starting with copper metal, describe how a sample of crystals of copper (II) chloride may be prepared in the laboratory. (3mks)

18. Thorium ^{232}Th undergoes two consecutive alpha decays followed by two consecutive beta decays

to form the nuclide $^{x}_{y}Ra$. Identify the values of x and y (3mks)

19. Explain why the reaction between 1g of calcium carbonate and 1M hydrochloric acid is faster than the reaction between 1 g of calcium carbonate and 1M butanoic acid. (2mks)

20. A hydrocarbon gas Y in which the percentage of hydrogen by mass is 14.3% occupies a volume of 2.24dm^3 at s.t.p and weighs 7g
    (i) Determine the empirical formula of y. (C= 12,H=10)(1 ½ mks)
    (ii) Give the structural molecular formula of Y. (1 ½ mks)

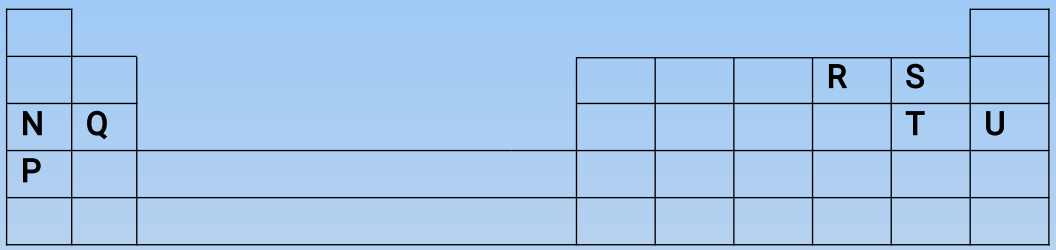
21. When magnesium was burnt in air, a solid mixture was formed. On addition of water to the mixture a Gas which turned moist red litmus paper blue was evolved. Explain these observations. (2mks)

22. In an experiment to prepare nitrogen (I) oxide, ammonium nitrate was gently heated in a flask.
    (a) State and explain how the gas collected. (1mk)
    (b) A sample of the gas was tested with damp blue and red litmus papers. What observations were made? (1mk)

23. Complete the table below. (2mks)

Element	Latin Name	Symbol
_____	Plumbum	_____
Copper	_____	Cu
Potassium	_____	K

24. The grid below is part of the periodic table. Use it to answer the questions that follow. (The letters do not represent the actual symbols of elements.)



    (a) Indicate in the grid the position of an element represented by letter V, whose atomic number is 14. (1mk)
    (b) Select a letter which represents a monoatomic gas. (1mk)
    (c) write an equation for the reaction between Q and T (1mk)

25. In an Experiment, dilute hydrochloric acid was added to sodium hydroxide solution drop – wise. The concentration of sodium hydroxide was noted at regular time intervals.
    (i) Sketch a graph of concentration (y-axis) against time interval to show how the concentration of sodium hydroxide changes. (2mks)
    (ii) Explain the shape of the curve sketched above. (1mk)

26. A compound whose general formula is $M(OH)_3$ reacts as shown by the equations below.

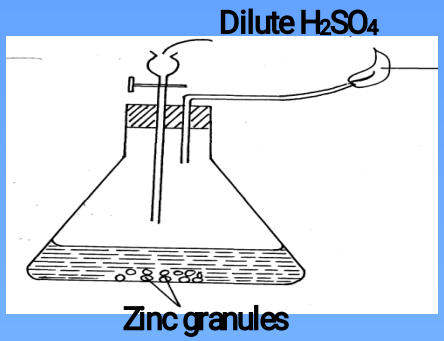
$$M(OH)_{3(s)} + OH^-_{(aq)} \longrightarrow M(OH)_4^-{}_{(aq)}$$

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

    (i) what name is given to the compounds which behave like $M(OH)_3$ in the two reactions above? (1mk)
    (ii) name two elements whose hydroxides behave like that of M. (1mk)

27. Below is a set-up of apparatus used to prepare hydrogen gas in the laboratory study it and answer

the questions that follow.



(a) Write the chemical equation for the two reactions taking place in the above set up. (2 mks)

(b) State the chemical test for hydrogen gas. (1mk)

28. Draw a well labelled diagram to illustrate how copper metal is purified. (3mks)

29. (a) What are alkali metals. (1mk)

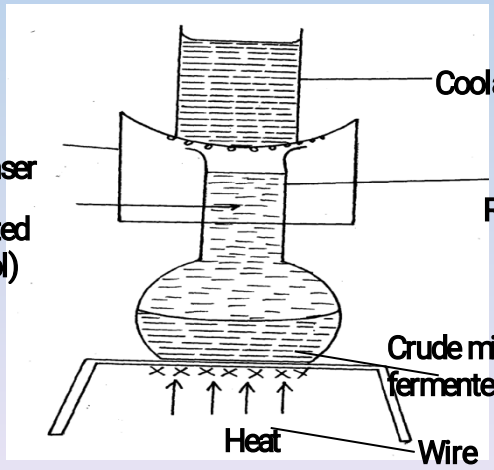
(b) Explain why potassium atom is larger that n Sodium atom. (1mk)

MARANDA SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

1. (a) What is a saturated solution? (1mk)

(b) The diagram below represents an arrangement for a large scale manufacture of ethanol for domestic consumption.



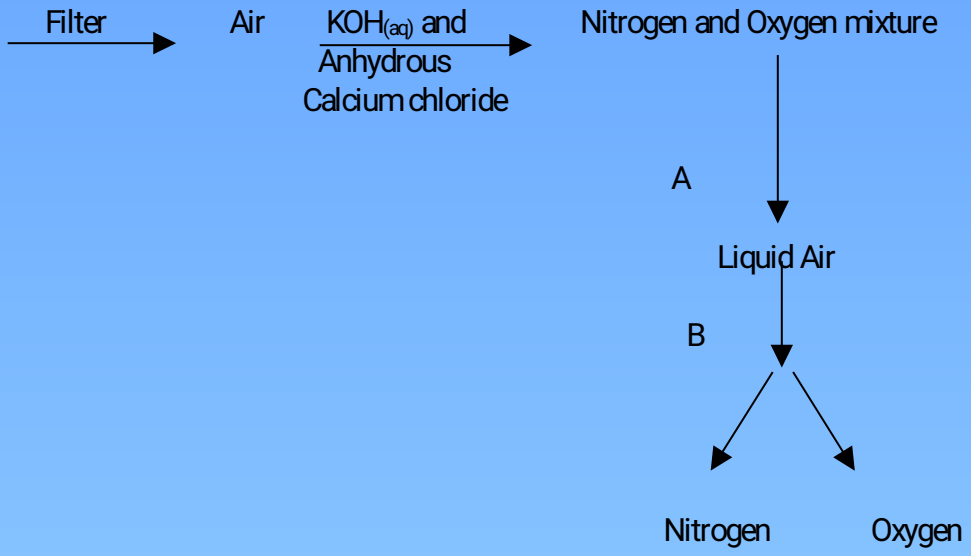
(i) Name the process by which ethanol is obtained from the crude oil. (1mk)

(ii) Suggest **two** reasons why water is a coolant in this process. (2mks)

(iii) Why is it possible to separate ethanol from the mixture by this process. (1mk)

(c) (i) Describe how the mixture of Ammonium chloride, sodium chloride and lead II chloride can be separated if all the components of the mixture are to be recovered. (3mks)

(ii) The following process shows how Nitrogen and Oxygen can be obtained from air.



I. Name the processes (1mk)

II. What is the purpose of

Potassium hydroxide solution $KOH_{(aq)}$ in the process. (1mk)

Anhydrous Calcium Chloride solid. (1mk)

2. (a) Give the names of the following compounds.

(I) $CH_3CH_2CH_2OH$ (1mk)

(ii) CH_3CH_2COOH (1mk)

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

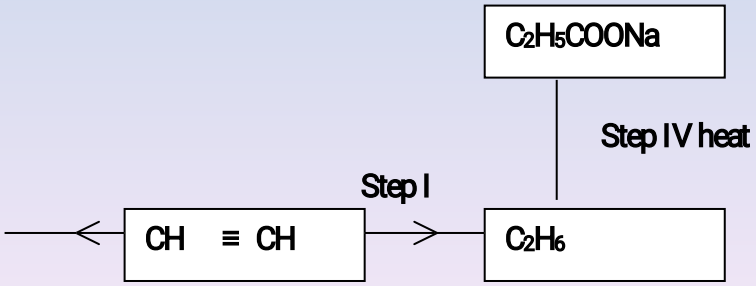
No. of carbon atoms per molecule	Relative molecular mass of hydrogen
2	28
3	42
4	56

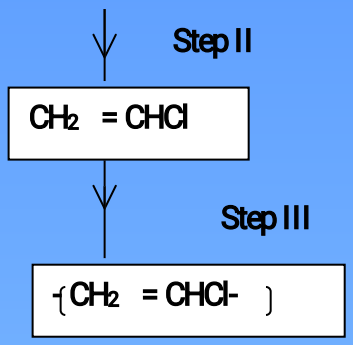
(i) Write the general formula of the hydrocarbons in the table. (1mk)

(ii) Predict the relative molecular mass of the hydrocarbon with 5 carbon atoms. (1mk)

(iii) Determine the molecular formula of the hydrocarbon in (ii) and draw its structural formula. (2mks)

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



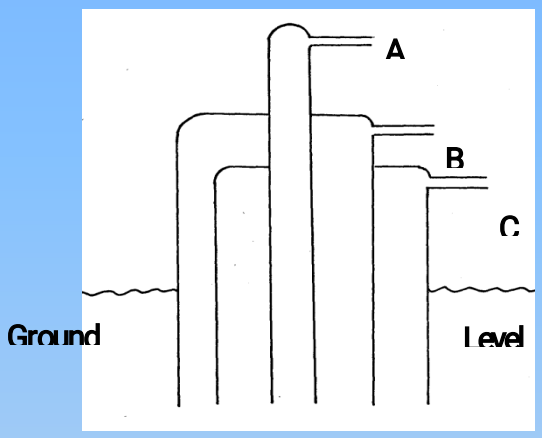


(i) Name the reagent used in
Step I (1mk)
Step I (1mk)
Step III (1mk)

(ii) Write an equation for complete combustion of CH≡CH. (1mk)

(iii) Explain **one** disadvantage of the continued use of items in step III. (1mk)

3. (a) The diagram below represents the extraction of sulphur by the frasch process.



(i) Identify and state the use of the substances that pass through tubes A and C. (2mks)

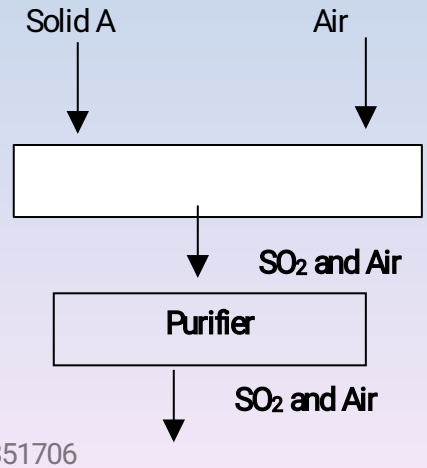
(ii) Rhombic and monoclinic are Allotropes of sulphur. They are inter convertible as shown below.

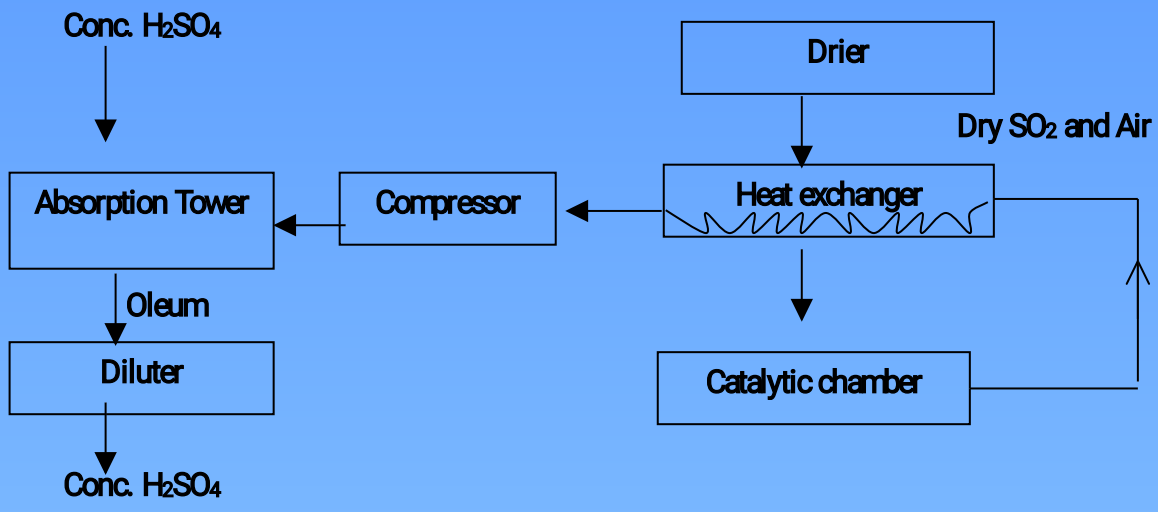
$$\text{Rhombic} \underset{96^{o}C}{\rightleftharpoons} \text{Monoclinic}$$

I. What does the temperature 96°C represent. (1mk)

II. State the differences in crystalline appearances between rhombic and monoclinic crystals. (1mk)

(b) The following scheme represents the steps followed in the contact process, study it and answer the questions which follow.





(i) Name **three** possible identities of solid A. (1mk)

(ii) Name **two** impurities removed by the purifier. (1mk)

(iii) Why is it necessary to remove impurities. (1mk)

(c) The following chemical equation shows a reaction taking place in the catalytic chamber/converter.

$2SO_{2S} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$ $\Delta H^{o} = -197 kjmol^{-1}$

(i) How would the following factors affect the production of sulphur (IV) oxide.

I. Increase in temperature. (1mk

II. Decrease in pressure (1mk)

(ii) Name the catalyst which is commonly used in this process and why? (1mk)

(iii) State and explain one environmental effect of sulphur (IV) oxide in the atmosphere. (2mks)

4. The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters do not represent the actual symbols of the elements.

A									K
B	D				G		I		
			F		H				L
C	E						J		

(a) (i) Which letter represents an element that is least reactive. (1mk)

(ii) Why are elements D and E referred to as alkali earth metals. (1mk)

(b) How does the atomic radius of F and H compare? (2mks)

(c) Select **two** letters representing a pair of elements that would react most explosively. (2mks)

(d) Write an equation showing how D forms its ions. (1mk)

(e) Write the formulae of

(i) Bromide of D (½ mk)

(ii) Sulphate of C (½ mk)

(f) What type of bonding exists between
(i) E and I (½ mk)
(ii) G and J (½ mk)

(g) Explain why the melting point of J is higher than that of I. (1mk)

(h) The 1st, 2nd and 3rd ionization energies in KJ/mol of element B and C are given below.

Element	1st I.E	2nd I.E	3rd I.E
B	520	7,300	9,500
C	420	3,100	4,800

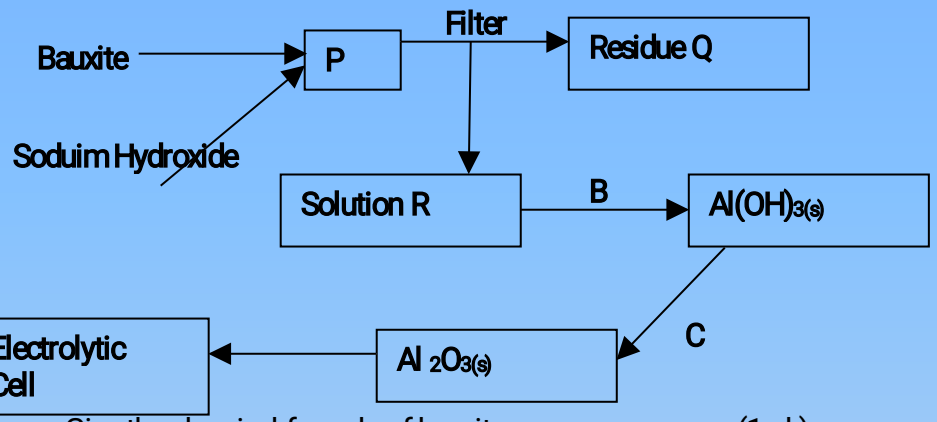
(I) What is the 1st ionization energy. (1mk)

(ii) Apart from the decrease in energy levels, explain the difference between 1st and 2nd Ionization energies. (1mk)

(iii) Calculate the amount of energy in KJ/mol for the process.

$C_g \rightarrow C_g^{3+} + 3e^-$ (1mk)

5. The flow chart below illustrates the major steps in extraction of aluminium from bauxite.



(a) (i) Give the chemical formula of bauxite. (1mk)
(ii) Write the equation for the reaction in chamber P. (1mk)
(iii) Write the formula of the main impurity in chamber Q. (1mk)
(iv) Name and explain the process that takes place at B. (2mks)

(b) state the role of cryolite(Na_2AlF_6)in the extraction of alluminium (2mrks)

(c) Write an equation for the reaction taking place at :
i) Anode (1mrk)
ii) Cathode (1mrk)

(d) Give two properties which make alluminium and its alloys suitable for making aircraft bodies. (2mrks)

6. Use the standard electrode potentials given below to answer the questions that follow.

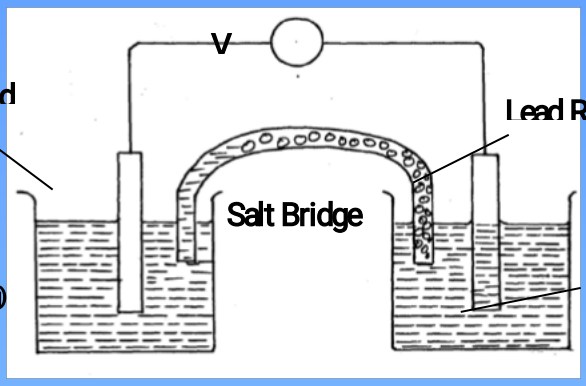
			$E^\theta V$
$Ag^+_{(aq)} + e^-$	$\longrightarrow$	$Ag_{(s)}$	+ 0.80
$Cu^{2+}_{(aq)} + 2e^-$	$\longrightarrow$	$Cu_{(s)}$	+ 0.34
$Pb^{2+}_{(aq)} + 2e^-$	$\longrightarrow$	$Pb_{(s)}$	- 0.13
$Zn^{2+}_{(aq)} + 2e^-$	$\longrightarrow$	$Zn_{(s)}$	- 0.76

(a) Select **two** half-cells which when combined give the lowest workable cell.(lowest e.m.f) (1mk)

(b) Calculate the e.m.f of the cell formed by combining the two half-cells in (a) above. (1mk)

(c) (i) Select the strongest oxidizing agent. (½ mk)
(ii) Strongest reducing agent. (½ mk)

(d) A cell was set up using lead and zinc electrodes as shown below.



(i) Write the half equation for the half-cell in which oxidation occurs. (1mk)

(ii) Write the overall cell equation. (1mk)

(iii) What is the role of the salt bridge. (2mks)

(e) An iron cup was electroplated using chromium. The chromium electrode and the iron cup was thoroughly cleaned and weighed before being dipped into the elcolyte.

(i) Why was it necessary to clean the metals before dipping them into the electrolyte. (1mk)

(ii) A current of 0.75 A was passed through the solution for one hour and four minutes. The mass of chromium deposited on the cup was 0.52g (1Faraday=96500C) Cr=52

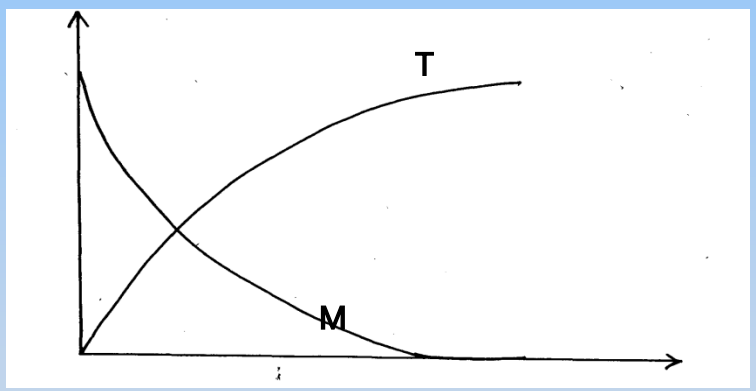
I. Calculate the quantity of electricity. (1mk)

II. How many mole of chromium were deposited. (1mk)

III. Calculate the quantity of electricity to deposit one mole of chromium (1mk)

IV. Calculate the number of Faradays required to deposit one mole of chromium and hence deduce the charge of ion. (2mks)

7. (a) The curve below represents the change of concentration with time in a chemical reaction.



(i) Which curve represents change in concentration for:

Reactants (½ mk)

Products (½ mk)

(ii) On the same axes sketch the curves of T and M for the catalysed reaction. (1mk)

(b) (i) Y grammes of a radioactive isotope take 120 days to decay to 3.5 grammes. The half-life period of the isotope is 20 days. Find the initial mass of the isotope. (2mks)

(ii) Below is a radioactive decay series starting from $^{214}_{83}Bi$ and ending at $^{206}_{82}Pb$

Step I $^{210}_{214}Bi \rightarrow {}^{210}T$ Step II $^{210}T \rightarrow {}^{210}Pb$ Step I II $^{210}Bi \rightarrow {}^{219}Po \rightarrow {}^{206}Pb$

$^{83} \longrightarrow {}^{81} \longrightarrow {}^{82} \longrightarrow {}^{83} \longrightarrow {}^{82} \longrightarrow {}^{84}$

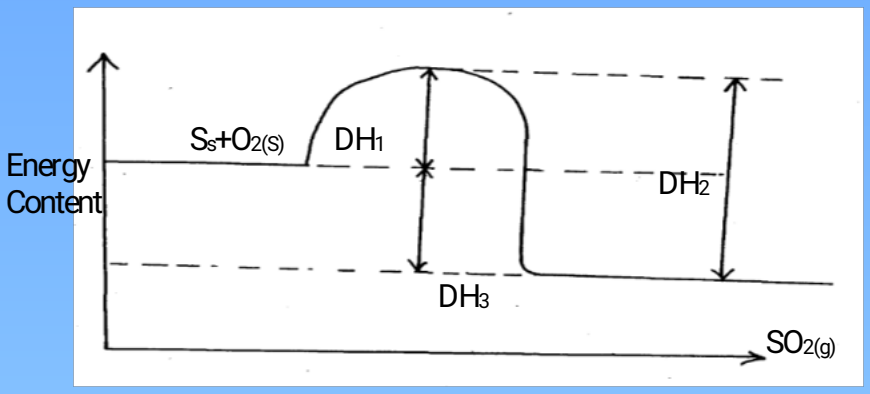
I. Identify the particles emitted in Steps I and II.

Step I .

Step II

II. Write the nuclear equation which takes place in step V. (1mk)

(c) (i) Sulphur burns in air to form sulphur IV oxide. A simple energy level diagram for the reaction is given below. Study it and answer the questions that follow.



(i) What do the following represent

DH_1 (1mk)

DH_3 (1mk)

(ii) Write an expression for DH_3 in terms of DH_1 and DH_2.(1mk)

233/1
CHEMISTRY
PAPER 1
TIME: 2 HOURS

NAIROBI SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

INSTRUCTIONS TO CANDIDATES:

- Write your name and Index number in the space provided above.
- Answer ***all*** the questions in the spaces provided.
- All working **must** be clearly shown where necessary.
- Mathematical tables and electronic calculators can be used.

Question	**Maximum score**	**Candidate's score**
Score 1 - 29	80	

1. The electron arrangement of ions R^{2-} and Q^{3+} are 2.8.8 and 2.8 respectively
   (a) Write the electron arrangement of the elements.
   (b) Write the formula of the compound that would be formed when **Q** and **R** react. (1mk)

2. (a) Complete the table below (1mk)

Species	Number of electrons	Number of neutrones
$^{3}_{2}He^{2+}$		

   (b) An element **Z** has atomic number 15. It can form the ions Z^{3-} and Z^{3+}. Identify the stable ion.
   Explain (1mk)

3. Methanol is manufactured from carbon (IV) oxide and hydrogen gas according to the equation below:

$$CO_{2\,(g)} + 3H_{2\,(g)} \rightleftharpoons CH_3OH_{(g)} + H_2O_{(g)}$$

The reaction is carried out in the presence of a chromium catalyst at 700K and 30kPa. Under these conditions, an equilibrium is reached when 2 % of the carbon (iv) oxide is converted to methanol?

   (a) How does the rate of forward reaction compare with that of the reverse reaction when

2% of the carbon(iv)oxide is converted to methanol? (1mk)

(b) Explain how each of the following conditions would affect the yield of methanol:

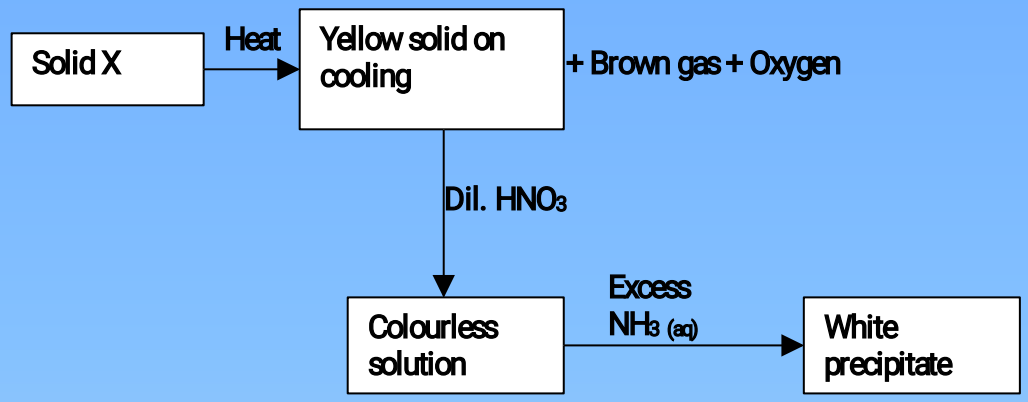
(i) Reduction in pressure (1mk)

(ii) Using a more efficient catalyst. (1mk)

(c) If the reaction is carried out at 500K and 30kPa the percentage of carbon (iv) oxide converted is higher than 2%. What is the sign of ΔH for the reaction? Explain. (1mk)

4. A volume of 280 cm^3 of nitrogen gas diffuse through a membrane in 70 seconds. How long will it take 400cm^3 of carbon (IV) oxide to diffuse through the same membrane?
(*N = 14, C =12, O = 16*) (2mks)

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



(a) Identify

(i) Solid **X** (1mk)

(ii) Yellow solid (1mk)

(iii) White precipitate (1mk)

(b) Write ionic equations for reactions that would occur if excess sodium hydroxide is added to the colourless solution (2mks)

6. The table below shows the number of drops of soap solution needed to lather with 10cm^3 of water.

Sample	Cold water	Heated water
A	5	5
B	6	2
C	2	2

(a) Identify the anions likely to be in:

(b) State **two** methods used in removing temporary hardness of water. (1mk)

7. The table below shows the atomic numbers of elements **P**, **Q** and **R**

Elements	P	Q	R
Atomic No.	13	7	12

(a) Explain why **P** and **R** would not be expected to form a compound (1mk)

(b) Write an equation to show the effect of heat on the carbonate of **R** (1mk)

8. Calculate the volume of chlorine gas in cm^3 (measured at s.t.p) that is formed when a current of 0.9 A is passed through a solution of concentrated sodium chloride for 30 minutes.
(Na = 23, Cl = 35.5, Faraday constant = 96500, M.G V = 22.4dm^3) (2mks)

9. Ethene and ethyne are unsaturated hydrocarbons.

(a) Explain what is meant by unsaturated hydrocarbon. (1mk)

(b) Apart from using combustion, bromine liquid or potassium manganate (VII) solution, describe how you would distinguish between ethene and ethyne by chemical means (2mks)

10. Describe how a sample of Iron (II) Carbonate can be prepared using dilute hydrochloric acid

(3mks)

11. In an experiment a gas jar containing 70cm^3 of chlorine gas was inverted over another containing 70cm^3 of hygrogen sulphide gas. The two gases reacted according to the equation below to form 80cm^3 of hydrogen chloride gas.

$H_2S_{(g)} + Cl_{2\ (g)} \longrightarrow S_{(s)} + 2HCl_{(g)}$

(a) Using oxidation number identify the oxidizing agent (1mk)

(b) Calculate the percentage yield of hydrogen chloride gas (2mks

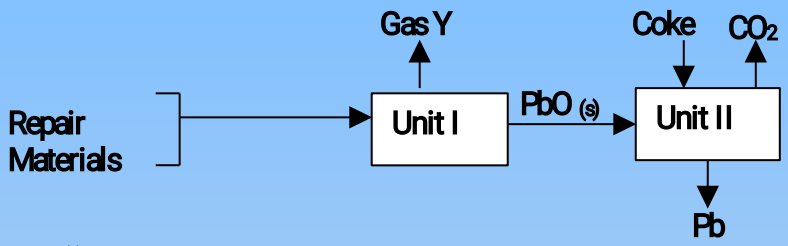
12. The table below gives the standard electrode potentials for a number of half reactions

	E^{θ} (volts)
$A^{2+}_{(aq)} + 2e^- \longrightarrow A_{(s)}$	– 2.90
$B^{2+}_{(aq)} + 2e^- \longrightarrow B_{(s)}$	–2.38
$C^{+}_{(aq)} + e^- \longrightarrow \frac{1}{2} C_{2(g)}$	0.00
$D^{2+}_{(aq)} + 2e^- \longrightarrow D_{(s)}$	+ 0.34
$\frac{1}{2} E_{2\ (aq)} + e^- \longrightarrow E_{(aq)}$	+ 2.87

(i) Write a cell representation of the two half cells which would produce the highest e.m.f (1mk)

(ii) Calculate the e.m.f of the cell above. (1mk)

13. The flow chart below shows some process involved in extraction of lead metal. Study and answer the questions that follow.



(a) (i) Name **two** main raw materials that were fed into unit I (1mk)

(ii) State the process taking place in unit I (1mk)

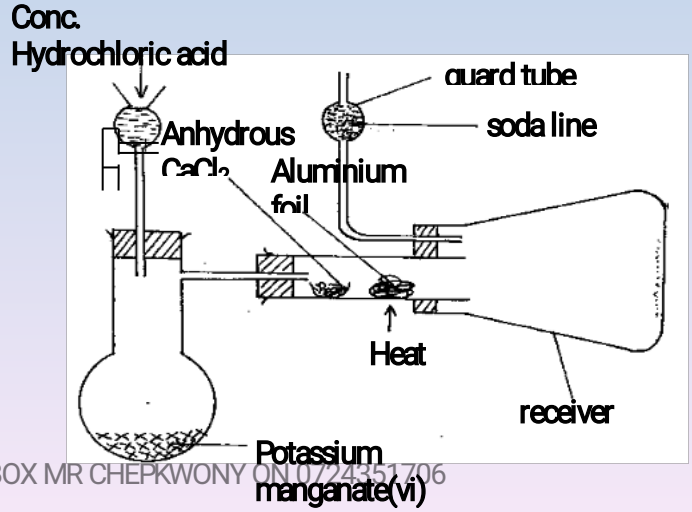
(b) State **two** environmental hazards associated with process in unit I (1mk)

14. The table below shows information about three substances **K, L** and **M**. Study it and answer the questions that follow.

SOLID	COLD WATER	HOT WATER
K	Soluble	soluble
L	Insoluble	Insoluble
M	Insoluble	Soluble

Describe how you will separate the **three** solids from a mixture of three. (3mks)

15. The diagram below shows the set up used in an experiment to prepare chlorine gas and react it with aluminium foil. Study it and answer the questions that follow



(a) State any **one** precaution that should be taken in carrying out this experiment (½mk)

(b) Write the formula of another compound that could be used instead of potassium manganate (VII) crystals (½mk)

(c) Explain why it is necessary to allow the acid to drip slowly onto potassium manganate (VII) crystals before heating the aluminium foil. (1mk)

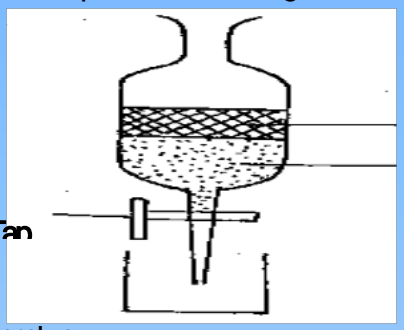
(d) When 1.08g of aluminium foil were heated in a stream of chlorine gas the mass of the product formed was 3.47g.

Calculate;

(i) The maximum mass of the product if chlorine was in excess. (Al = 27, Cl = 35.5) (2mks)

(ii) The percentage yield of the product formed (1mk)

16. Methyle benzene was added to a solution of iodine and sodium chloride. The mixture was placed in the apparatus below for separation. The diagram below shows the results obtained.



(i) Name the apparatus (½mk)

(ii) Explain the purpose of using methylbenzene (1mk)

(iii) Name the major component of layer **L** (½mk)

17. The table below shows the relative molecular masses and the boiling points of pentane and propan –1-ol

	Relative molecular mass	**Boiling point (°C)**
Pentane	72	36
Propan-1-ol	60	97

Explain why the boiling point of propan –1-ol is higher than that of pentane. (2mks)

18. (a) State the function of glass beads during fractional distillation in

(i) Boiling flask (1mk)

(ii) Fractionating column (1mk)

(b) Give **one** industrial application of solvent extraction (1mk)

19. $20cm^3$ of sodium hydroxide solution containing $8.0g/dm^3$ were required for complete neutralization of 0.18g of a dibasic acid H_2X.

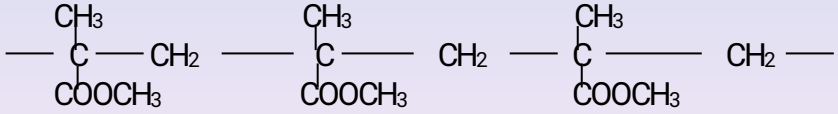
Calculate the relative molecular mass of the acid . (3mks)

20. A dry gas **X** was passed over heated lead (II) oxide. A grey residue and a gas **Y** were formed. The gas **Y** has no effect on red litmus paper and does not support combustion. Identity:

(i) Gas **X** (1mk)

(ii) Gas **Y** (1mk)

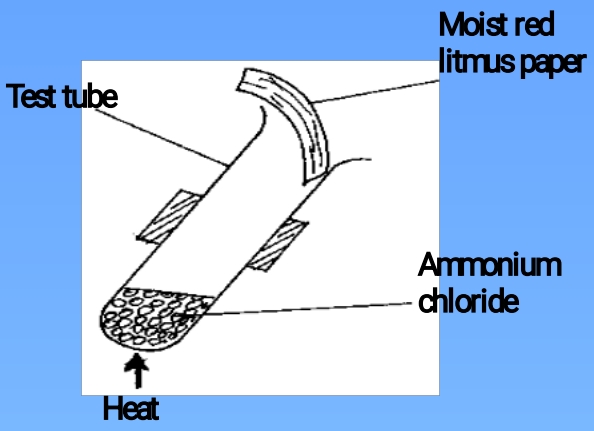
21. The structure below represents a polymer



(a) State the name of the polymer (1mk)

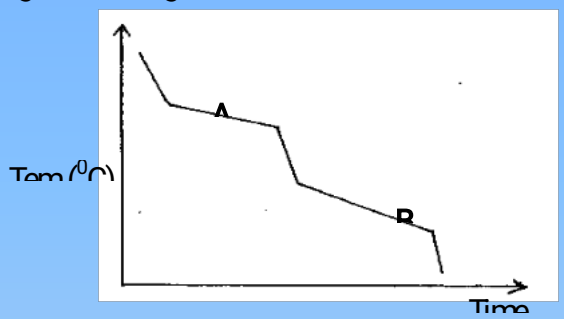
(b) State **one** industrial use of the polymer (1mk)

22. The set up below was used to heat a sample of ammonium chloride. Study it and answer the question that follow.



Explain the observations made in the red litmus paper. (3mks)

23. The following is a cooling curve of a certain substance.



(a) Is this a pure or impure substance? Explain (1mk)

(b) Explain using kinetic theory what happens in region **A** (1mk

24. (a) Distinguishing between weak and strong alkali (1mk)

(b) The following is a list of pH values of some substance:

Substance	M	N	V	X	Z
pH	10.6	7.2	13.2	5.9	1.5

Identify:

(i) Strong acid (1mk)

(ii)Weak base (1mk)

25. Study the following reactions and answer the questions that follow:

$C_{(s)} + O_{2\,(g)} \longrightarrow CO_{2\,(g)}$ $\Delta H = -393kJ/mol$

$H_{2\,(g)} + \frac{1}{2}\,O_{2\,(g)} \longrightarrow H_2O_{(g)}$ $\Delta H = -286kJ/mol$

$C_4H_{10\,(g)} + 13/2\,O_{2\,(g)} \longrightarrow 4CO_{2\,(g)} + 5H_2O_{(g)}$ $\Delta H = -2877kJ/mol$

(a) Construct the energy cycle diagram for the reactions (1mk)

(b) Determine the heat of formation of butane (2mks)

26. (a) Draw the structure of a sulphur molecule (1mk)

(b) When a sample of sulphur is heated in a test tube, it changes into amber liquid which flows easily. On further heating the liquid becomes dark and does not flow easily .Explain these observation (2mks)

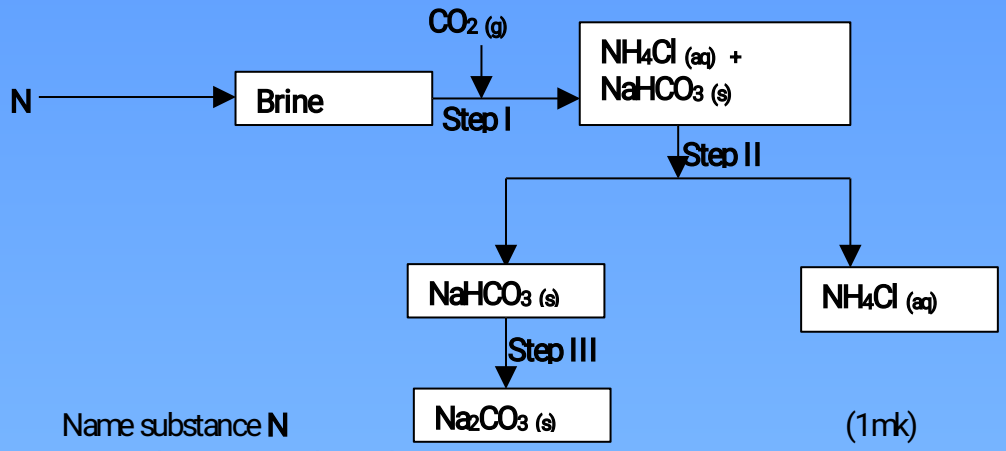
27. Ammonia gas reacts with water according to the equation below.

$NH_{3\,(g)} + H_2O_{(l)} \rightleftharpoons NH_4^{+}{}_{(aq)} + OH^{-}{}_{(aq)}$

(a) Identify the species that acts as a base. Give a reason. (1mk)

(b) What effect does addition of sodium hydroxide solution have on the position of the equilibrium? Explain. (2mks)

28. The flow chart below shows some of the stages in the manufacture of sodium carbonate by the solvary process. Use it to answer the questions that follow:



(a) Name substance **N** (1mk)

(b) Name the process taking place in

(i) Step II (1mk)

(i) Step III (1mk)

(c) Write an equation for the react producing sodium carbonate. (1mk)

NAIROBI SCHOOL KCSE TRIAL AND AND PRACTICE EXAM .

Paper 2

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1. The grid below represents part of the periodic table. Study it and answer the questions that follow. The letters given do not represent the actual symbols of the element

						A		
	B		C		D		E	
F	G							
							H	

(i) Select the element that can form an ion with a charge of -2. Explain your answer. (1mk)

(ii) What type of structure would the oxide of **C** have? Explain your answer. (1mk)

(iii) How does reaction of **H** compare with that of **E**? (2mks)

(iv) 1.3g of **B** reacts completely when heated with 1.21 litres of Cl_2 (g) at STP (*1 mole of gas at STP occupies 22.4 litres*)

(i) Write a balanced equation for the reaction between **B** and Cl_2 (1mk)

(ii) Determine the relative atomic mass of **B.** (2mks)

(v) Explain how you would expect the following to compare.

(a) Atomic radii of **F** and **G** (1mk)

(b) The pH values of aqueous solution of oxides of **B** and **D** (1mk)

(vi) The table below shows some physical properties of some substances. Use the information in the table to answer the questions that follow.

Substances	Melting	Boiling point °C	Electrical conductivity	
			Solid	Solid
U	1083	2595	Good	Good
V	801	1413	Poor	Good
W	5.5	80.1	poor	Poor
X	-114.8	-84.9	Poor	Poor
Y	3550	4827	Poor	Poor

(i) Which substance is likely to be

(i) A metal (1mk)

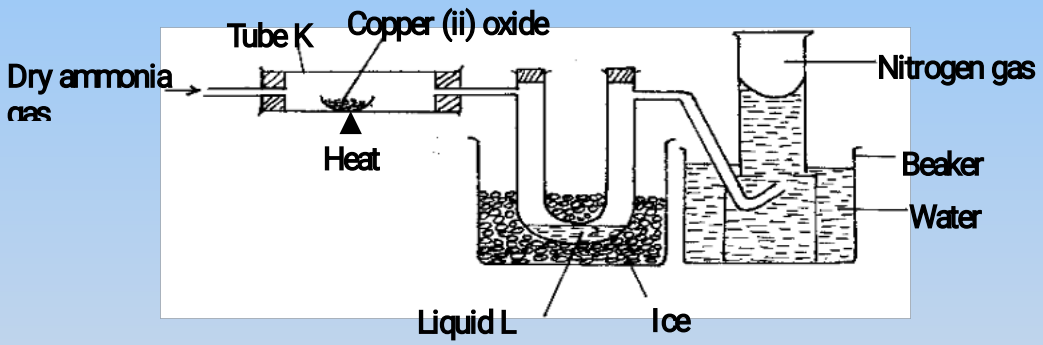
(ii) Liquid at room temperature (1mk)

(ii) Which substance is likely to have the following structures?

(i) Simple molecular (1mk)

(ii) Giant atomic (1mk)

2. The diagram below shows the set up that can be used to obtain nitrogen gas in an experiment carried out by form 3 of Boseti. Sec school.



(i) How is the ammonia gas from this process dried? (1mk)

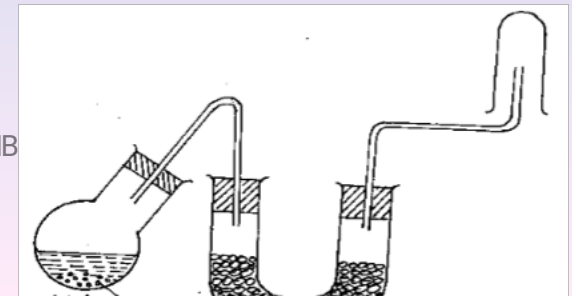
(ii) Name liquid **L**? (1mk)

(iii) What observation would be made at tube **K** at the end of the experiment? (1mk)

(iv) Write an equation for the reaction that took place in the tube **K**. (1mk)

(v) At the end of the experiment the pH of water in the beaker was found to be 10.0. Explain. (1mk)

(b) A student set up the following apparatus for preparing jars of dry ammonia but found that no gas collected in the gas jars, although a reaction occurred in the flask.



(i) Explain why their was no gas collected? (1mk)

(ii) The following alteration were made

- Using a mixture of ammonium chloride and an alkali, $Ca(OH)_2$ instead of NH_4CL
- The flask was made to slope with neck downward.

State the reason for each alteration above (2mks

(iii) When ammonia gas is passed into a jar of hydrogen chloride gas, white fumes are formed. Explain with an aid of equation of reaction. (2mks)

(iv) Ammonia decompose if sparked electrically, what would you expect to be the products of the decomposition? (1mk)

3. (a) Use the information below on standard electrode potentials to answer the questions that follow.

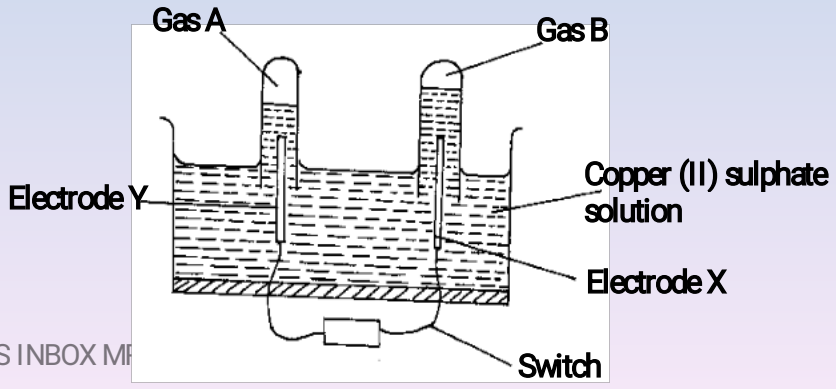
Electrode reaction	*E^{θ} Volts*
$C^{2+}_{(aq)} + 2\bar{e} \rightleftharpoons C_{(s)}$	+ 0.34
$D^{2+}_{(aq)} + 2\bar{e} \rightleftharpoons D_{(s)}$	+ 0.44
$E^{+}_{(aq)} + 2\bar{e} \rightleftharpoons E_{(s)}$	- 2.92
$F2+(aq) + 2e^{-} \rightleftharpoons F(s)$	- 2.71
$G^{2+}_{(aq)} + 2\bar{e} \rightleftharpoons G_{(s)}$	- 0.14
$\frac{1}{2} H_{2(g)} + \bar{e} \rightleftharpoons H^{-}_{(q)}$	+ 2.87
$\frac{1}{2} K_{2(g)} + \bar{e} \rightleftharpoons K^{-}_{(q)}$	+ 1.09
$L^{+}_{(q)} + \bar{e} \rightleftharpoons \frac{1}{2} L_2$	0.00

(i) Identify the strongest reducing agent and the strongest oxidizing agent. Give reason (2mks)

(ii) Calculate the e.m.f of the cell formed by connecting half cells **C** and **D.** (1mk)

(iii) Draw and label a diagram of a cell formed by connecting half cells of **E** and **D**. on the Diagram. Indicate the flow of elections. (3mks)

(b) An aqueous solution of copper (ii) sulphate was electrolysed using platinum electrodes. When a current was passed a gas that relights a glowing splint was produced



(i) Name the electrode which acts as cathode. Give a reason. (1mk)

(ii) Write an equation for the reaction at the anode. (1mk)

(iii) 0.11g of metal **R** deposited by electrolysis when a current of 0.03 amperes flow for 99 minutes (*R = 92, 1F = 96500C*)

I.. Find the number of moles of **R** deposited (1mk)

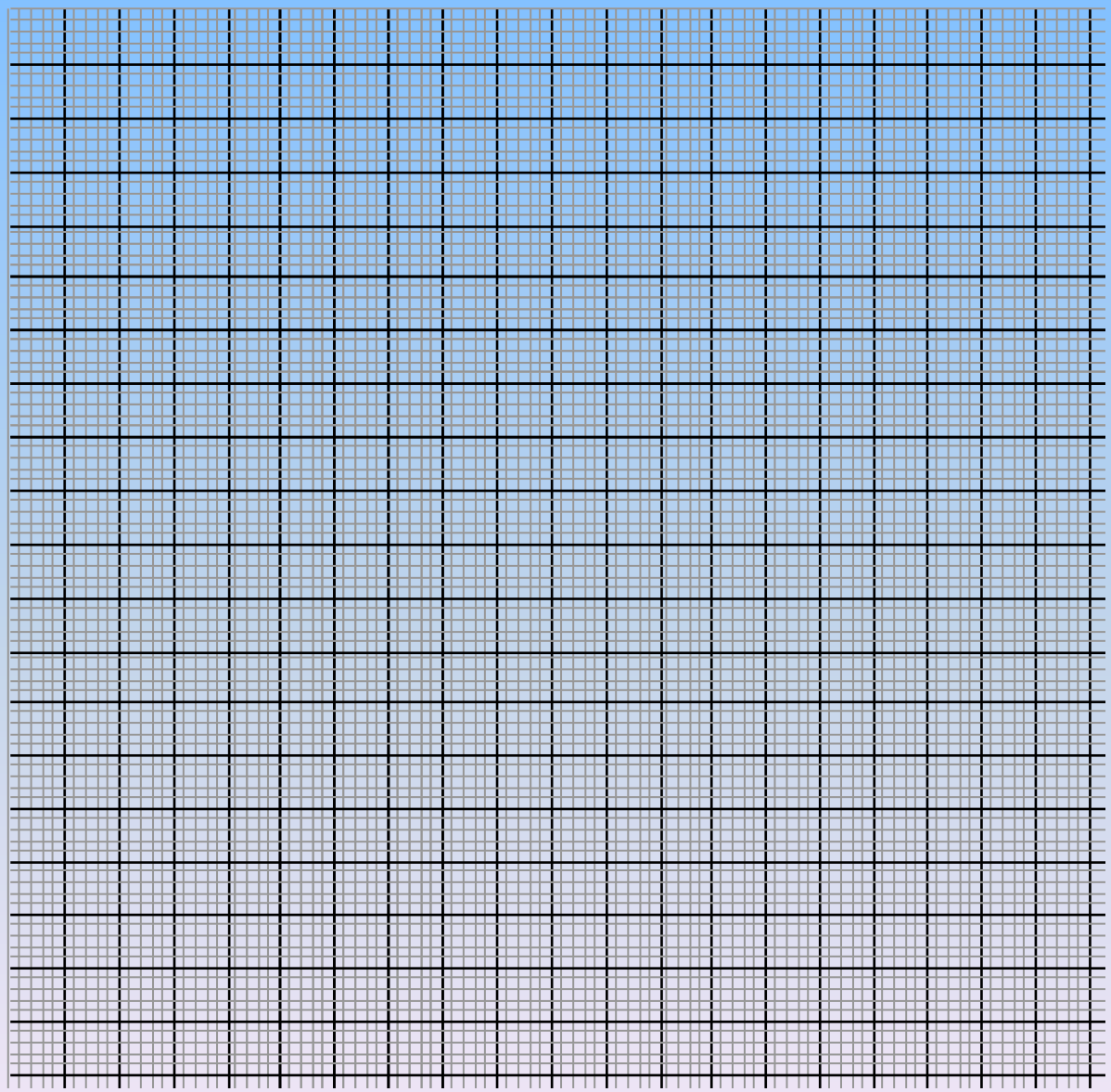
II. Find the number of moles of electrons passed. (1mk)

III. Determine the value of **n** in the metallic ion in R^n (2mks)

4. The table below shows the change in concentration of Bromine liquid against time.

Concentration of $Br_{2\,(l)}$ mol/dm^3	Time in minutes
10.0×10^{-3}	0
8.1×10^{-3}	1
6.6×10^{-3}	2
4.4×10^{-3}	4
3.0×10^{-3}	6
2.0×10^{-3}	8
1.3×10^{-3}	10

Plot a graph of concentration of bromine (vertical axis) against time. (3mks)



(b) From the graph determine

(i) The concentration of bromine at the end of 3 minutes (1mk)

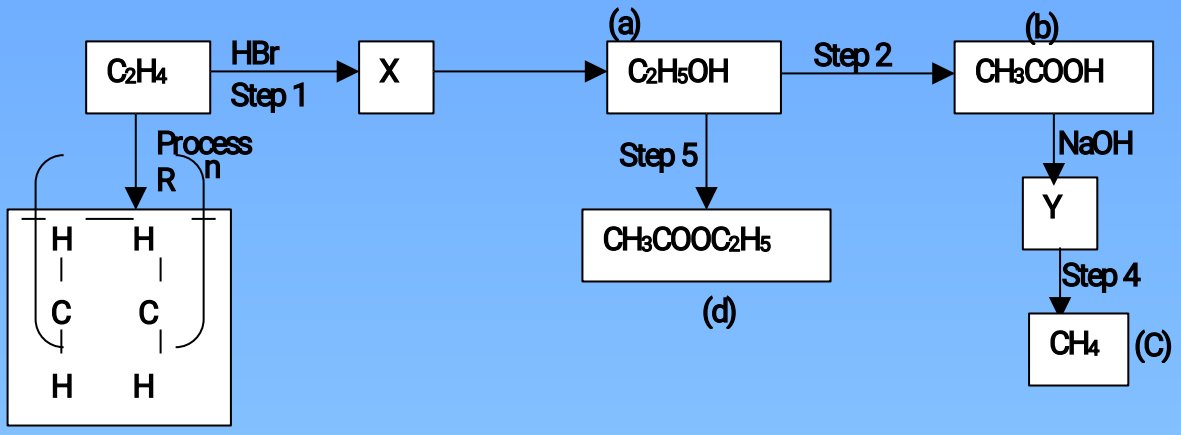
(ii) The rate of reaction at t = 1 ½ minutes. (2mk)

(c) Explain how the concentration of bromine affects the of the reaction 2mks)

(d) On the same axis, sketch the curve that would be obtained if the reaction was carried out at 20^0C and label the curve as curve II.

Give a reason for your answer. (2mks)

5. The scheme show the reaction starting with Ethane



(i) Name the compound **a**, **b**, **c** and **d** (2mks)

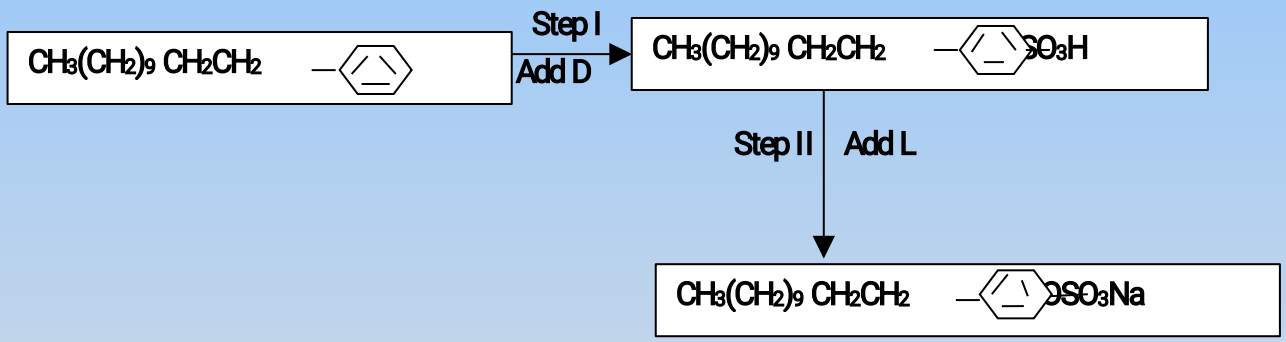
(ii) Give the formulae and name of **X** (1mk)

(iii) Name the reagent and condition needed to carry out steps 2 and 5 . (2mks)

(iv) Write a balanced equation which lead to the formation of substance **Y** (1mk)

(v) Name process **R** in the above schematic diagram. (1mk)

(b) The flow chart below shows the manufacture of a cleansing agent.

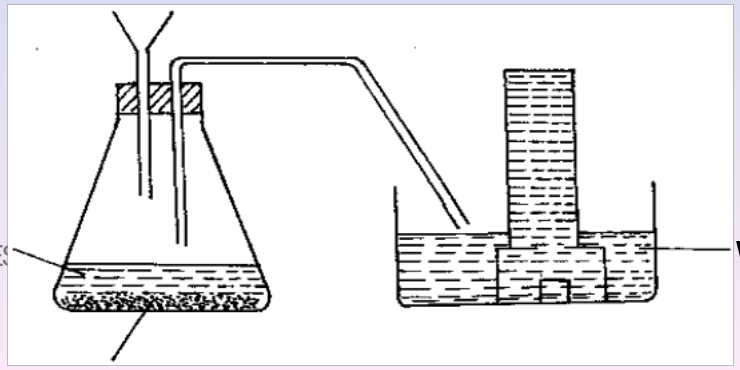


(i) Identify each of the substance **D** and **L** (2mks)

(ii) Give **one** advantage of using this cleansing agent over ordinary soap (1mk)

(iii) What is the effect of the above cleansing agent to the environment. (1mk

6. The diagram below shows a set up used by a student in an attempt to prepare and collect oxygen.



(i) Complete the diagram by correcting the mistakes in it (2mks)

(ii) Identify solid **W**. (1mk)

(b) A piece of phosphorous was burnt in excess air. The amount of hot water to make a solution.

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

(ii) The solution obtained in (b) above was found to have a pH of 2.0. Give reasons for this observation. (2mks)

(c) Explain why cooking pots made of aluminium do not corrode easily when exposed to air. (1mk)

(d) The reaction between sulphur (IV) oxide and oxygen to form sulphur (VI) Oxide per day (*Condition for the reaction a catalyst, 2 atmospheric pressure and temperature between 400^0 - 500^0C*)

$2SO_{(aq)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)}$

Factory manufacturing sulphuric acid by contact process produces 350kg of sulpur trioxide per day (conditions) for the reaction catalyst. 2 atmospheres pressure and temperatures between 400^0-500^0C.

(i) What is meant by an exothermic reaction? (1mk)

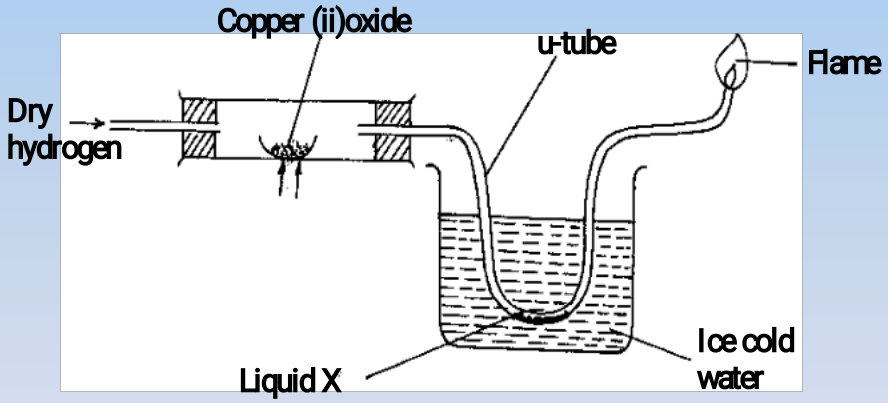
(ii) How would the yield per day of sulphur trioxide be affected if temperatures lower than 400^0C are used? Explain (1mk)

(iii) All the sulphur (VI) oxide produced was absorbed in concentrated sulphuric acid to form oleum.

$SO_{3(g)} + H_4SO_{4(l)} \longrightarrow H_2S_2O_{7(l)}$

Calculate the mass of oleum that was produced per day. (*S = 32.0, O= 16: H= 1.0*) (2mks)

7. Dry hydrogen gas was passed over coated copper (II) oxide in a combustion tube as shown below



(i) State and explain the observation made in the combustion tube. (2mks)

(ii) Write an equation for the reaction that took place in the combustion tube. (1mk)

(iii) Identify liquid **X**. (1mk)

(iv) Give **one** chemical test that can be used to prove the identify of liquid **X** (1mk)

(b) (i) When magnesium oxide is used in place of copper (II) oxide no liquid is formed in the u- tube dipped in ice cold water. Explain. (1mk)

(ii) Write an equation for the reaction at flame point. (1mk)

uclear reactant coolant

- Alloy with lead for anti-knock

Any 2

7 (a) (i) A stable electron configuration of 2

(ii) Intermolecular force in which positive atom of hydrogen is joined to a negative atom of another molecule

(b) (i) Heating

(ii) R – $Ca(OH)_2$

Y – $CO_{2(g)}$

(iii) $CaO_{(s)} + H_2O_{(l)} \longrightarrow Ca(OH)_{2(aq)}$

(c) 0.1MHCl ⟶ ionises completely

0.1M ethanoic ⟶ ionises partially

d) (i) Green colour turns black

(ii) $CuCO_{3\,(s)} \longrightarrow CuO_{(s)} + CO_{2(g)}$

FOR MARKING SCHEMES INBOX

MR CHEPKWONY ON 0724351706