KCSE 2025 TOP SCHOOLS MOCKS

CHEMISTRY

(MOCKS EXAMS 1-10)

To encourage academic excellence, top-performing national schools collaborate on the "National Schools" joint mock exam compilation. The goal of this collaborative effort is to push students and enhance their readiness for national exams through the use of challenging tests. The goal of participating schools' resource and strategy sharing is to raise student achievement and promote an achievement-focused culture.

KEY TO SUCCESS!

For Marking Schemes

Mr Isaboke 0746 222 000 / 0742 999 000

MWALIMU CONSULTANCY

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 1

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your* ***name, admission number, date, index number*** *and school in the spaces provided*

b) *Answer* ***all*** *the questions in the spaces provided*

c) *All working* ***MUST BE*** *clearly shown where necessary*

d) *Scientific calculators may be used*

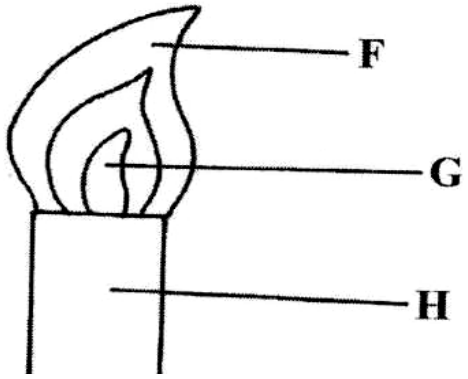
e) *Candidates should answer the questions in English*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 28	80	

QUESTIONS

1. Study the figure below and answer questions that follow.



Name the parts labelled **F** and **G**. **(1mk)**

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

Element	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 **<u>two</u>** elements have similar chemical properties? Explain. **(2mks)**

3. Describe how a solid sample of Lead (II) Chloride can be prepared using the following reagents: Dilute Nitric Acid, Dilute Hydrochloric Acid and Lead Carbonate. **(3mks)**

4. $Na^+_{(g)} + Cl^-_{(g)} \longrightarrow NaCl_{(s)}$ $\Delta H_1 = -781KJmol^{-1}$

$H_2O_{(l)}$

$NaCl_{(s)} \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)}$ $\Delta H_2 = +7KJmol^{-1}$

(a) What is the name of ΔH_1? **(1mk)**

……

(b) Calculate the heat change for the process: **(2mks)**

$H_2O_{(l)}$

$Na^+_{(aq)} + Cl^-_{(aq)} \longrightarrow Na^+_{(aq)} + Cl^-_{(aq)}$

5. The table below gives the solubility of potassium bromide and potassium sulphate at 0^0C and 40^0C.

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

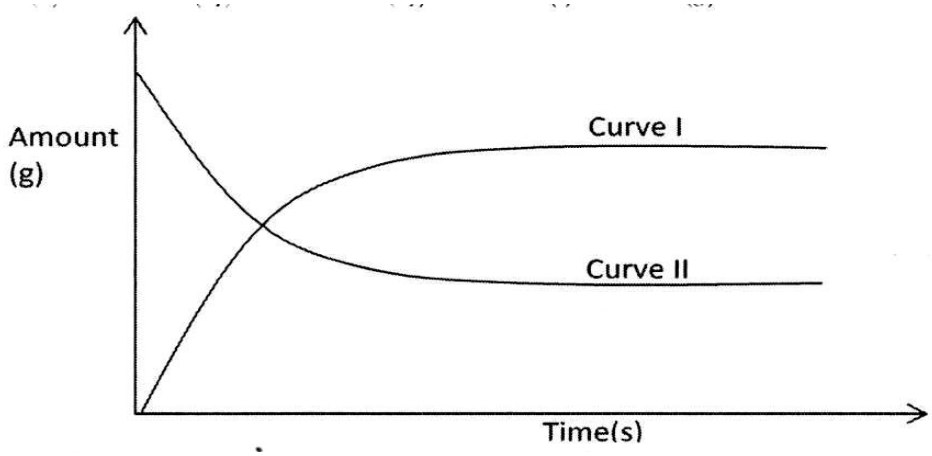
When an aqueous mixture containing 60g of potassium bromide and 7g potassium sulphate in 100g of water at 80^0C was cooled to 0^0C, some crystals were formed.

(a) Identify the crystals. **(1mk)**

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

6. The graph below shows the amount of calcium carbonate and calcium chloride varying with time in the reaction.

$CaCO_{3(s)} + 2HCl_{(aq)} \longrightarrow CaCl_{2(aq)} + H_2O + CO_{2(g)}$



(a) Which curve shows the amount of calcium chloride varying with time? **(1mk)**

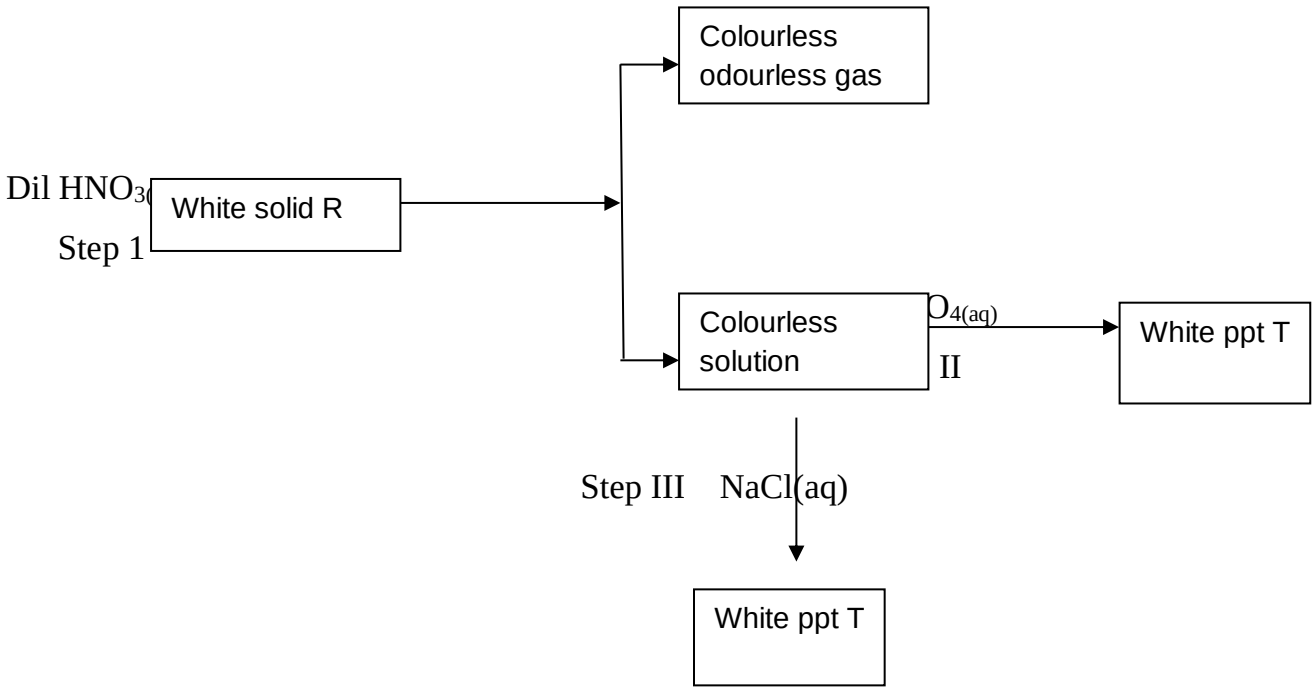
(b) Explain why the two curves become horizontal after a given period of time. **(1mk)**

(c) Sketch on the graph, how curve II would appear if the experiment was repeated using a more dilute hydrochloric acid solution. **(1mk)**

7. $200cm^3$ of Nitrogen (I) Oxide (N_2O) pass through a porous plug in 2 minute 15 seconds. How long will it take the same volume of Sulphur (IV) Oxide (SO_2) gas to diffuse through the same plug under the same conditions? (N = 14, O = 16, S = 32) **(3mks)**

8. An organic compound contains carbon and hydrogen only. When this compound was completely burnt in excess air, it gave 9.6g of Carbon (IV) Oxide and 4.9g of water vapour. The molecular mass of the hydrocarbon is 58. Determine the molecular formula.(C = 12, O = 16, H = 1) **(3mks)**

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



(a) Identify solid R. **(1mk)**

(b) Write a balanced equation for step II and ionic equation for step III.

Step II **……(1mk)**

Step III **…… (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. Both diamond and graphite have giant atomic structures. Explain why diamond is hard while graphite is soft. **(2mks)**

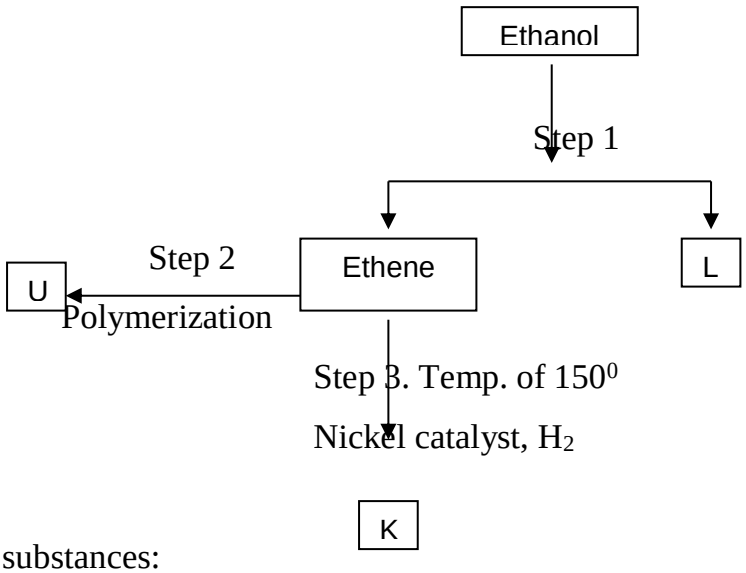
12.(a) Define the term oxidation state. **(1mk)**

(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^-

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



(a) Identify substances:

K:…… **(½mk)**

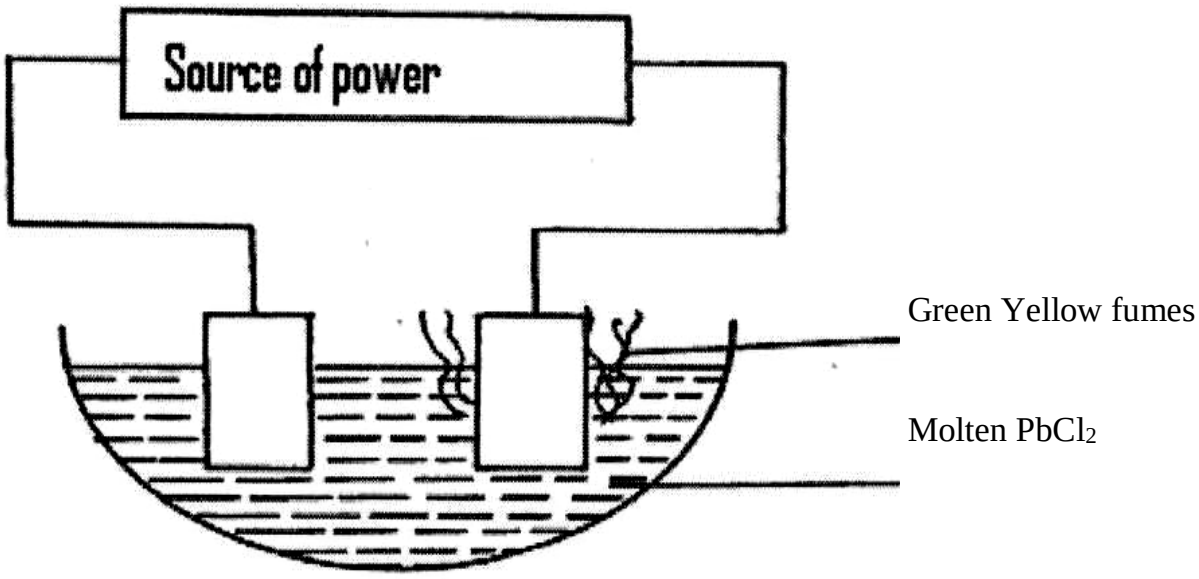
U:…… **(½mk)**

L:…… **(½mk)**

(b) State the conditions for the reaction in step 1 to occur. **(2mks)**

(c) Give **<u>one</u>** disadvantage of continued use of substances such as U. **(½mk)**

14. Use the set up below to answer the questions that follow.



(a) On the diagram, label the cathode. **(1mk)**

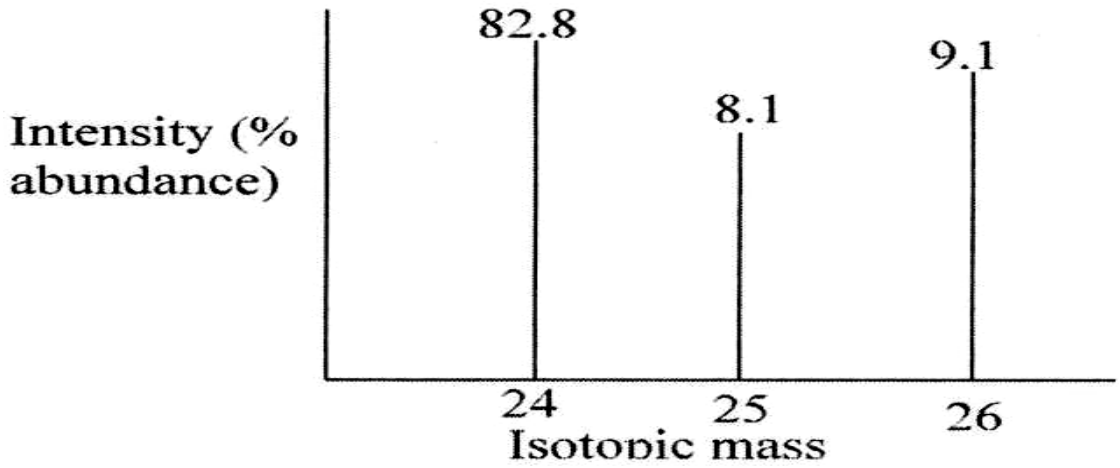
(b) Write the equation for the reaction on the cathode. **(1mk)**

15. Use the bond energy value given below for the question that follows.

Bond	Bond energy ($kJmol^{-1}$)
H – H	432
C = C	610
C – C	346
C – H	413

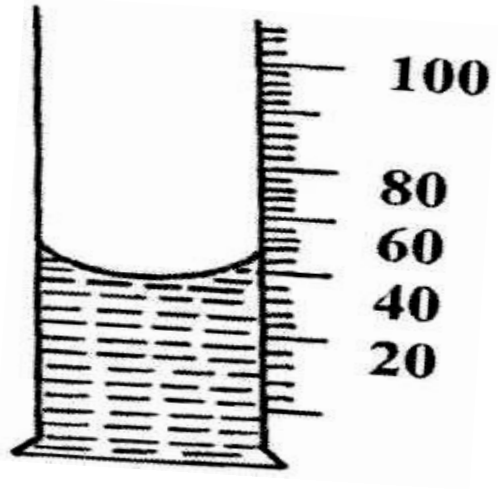
Determine the enthalpy change for the conversion of butene to butane by hydrogen. **(3mks)**

16. The peaks below show the mass spectrum of element X.



Calculate the relative atomic mass of **X.** **(2mks)**

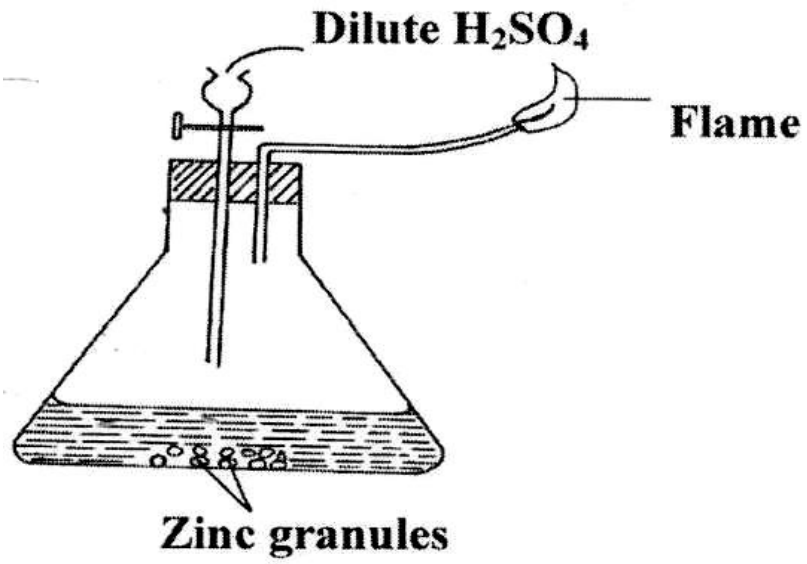
17. In an experiment, concentrated sulphuric (VI) acid was put in a beaker and exposed to air for one week as shown below.



(i) What observation was made after one week? Explain. **(2mks)**

(ii) What property of sulphuric (VI) acid was being investigated in the experiment? **(1mk)**

18. Below is a set-up of apparatus used to prepare hydrogen gas in the laboratory. Study it and answer the questions that follow.

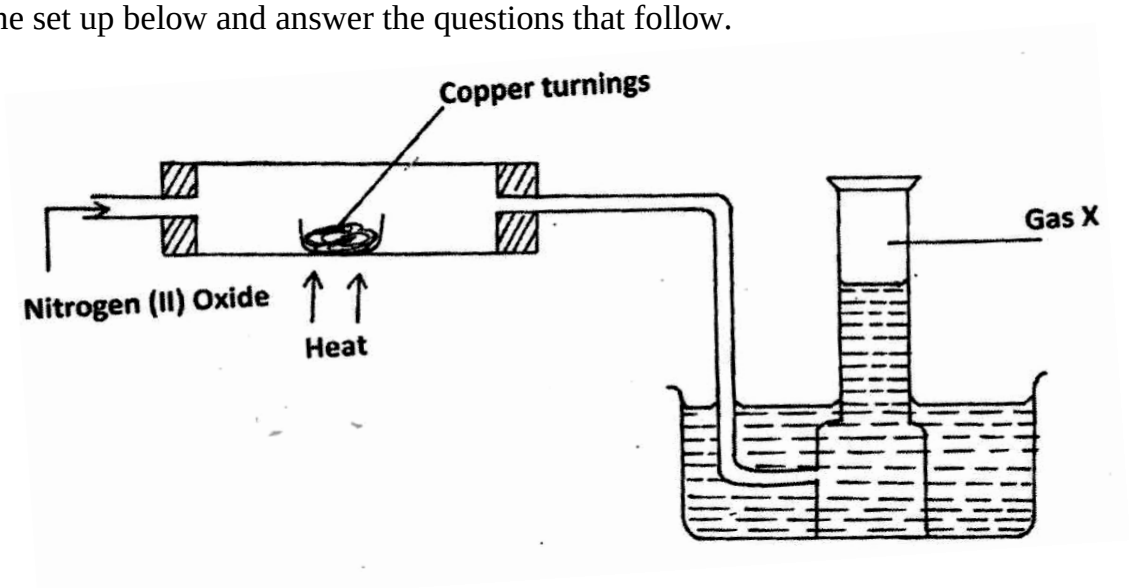


(a) Write a chemical equation for the two reactions taking place in he above set-up. **(2mks)**

(b) State the chemical test for hydrogen gas. **(1mk)**

19. State **three** reasons why air is considered to be a mixture but not a compound. **(3mks)**

20. Study the set up below and answer the questions that follow.

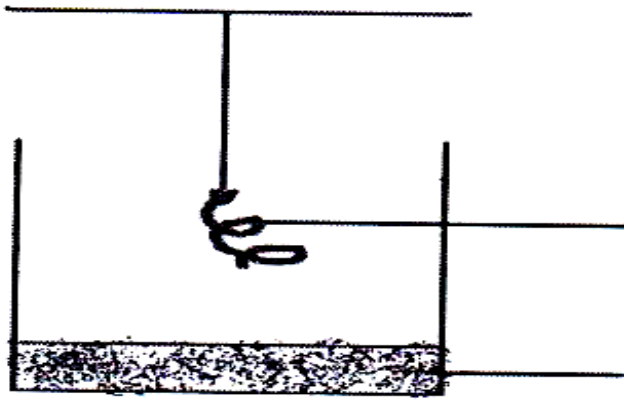


(a) Identify gas X. **(1mk)**

(b) State the observation made in the combustion tube. **(1mk)**

(c) Write equation for the reaction in combustion tube. **(1mk)**

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



(a) State and explain the observation made. **(2mks)**

(b) Write a chemical equation for the first reaction taking place in the beaker. **(1mk)**

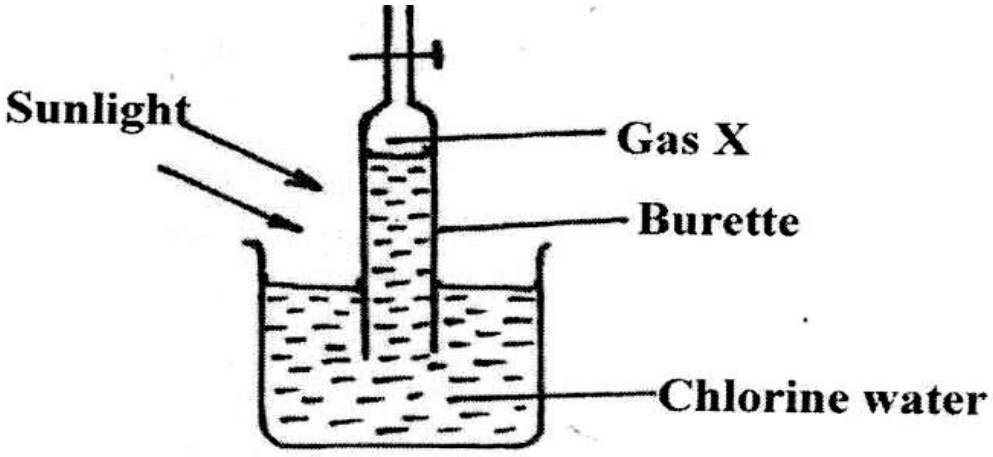
22. When sulphur is heated in a boiling tube in absence of air, the yellow crystals melts into golden yellow mobile liquid at 113^0C. The liquid changes at 180^0C into a dark brown very viscous liquid. More heating to about 400^0C, produces a brownless viscous liquid.

(a) Draw the molecular structure of sulphur in the yellow crystals. **(1mk)**

(b) Explain why the molten liquid becomes viscous. **(1mk)**

(c) If the brown liquid at 400^0C is cooled rapidly by pouring it into cold water, which form of sulphur is produced? **(1mk)**

23. An experiment was set up using chlorine water as shown below.



(i) Identify gas X. **(1mk)**

(ii) Write an equation for the production of gas X. **(2mks)**

24. The 1st, 2nd and 3rd ionization energies in KJ/Mol of elements G and R are given below.

Element	**1st I.E**	**2nd I.E**	**3rd I.E**
G	520	7,300	9,500
R	420	3,100	4,800

(i) Define the term 1st ionization energy. **(1mk)**

(ii) Apart from the decrease in energy levels, explain the big difference between the 1st and 2nd ionization energies. **(1mk)**

(iii) Calculate the amount of energy for the process: **(1mk)**

$R_{(g)} \longrightarrow R^{3+}_{(g)} + 3e^-$

25. A gaseous compound consists of 86% carbon and 14% hydrogen by mass. At s.t.p. 3.2dm^3 of the compound had a mass of 6g. Calculate its molecular formula. (1 mole of a gas at s.t.p. = 22.4dm^3) **(3mks)**

26. 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 **(1mk)**

(ii) Lemon juice **(1mk)**

(b) Explain why a solution of hydrogen chloride gas in methyl benzene was identified as N. **(1mk)**

27. Using dots (•) and crosses (x) to represent electrons, show bonding in the compound formed when the following elements reacts. (N = 14, H = 1).

Nitrogen and Hydrogen. **(1mk)**

28. 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 $MgCO_3.Mg(OH)_2$.

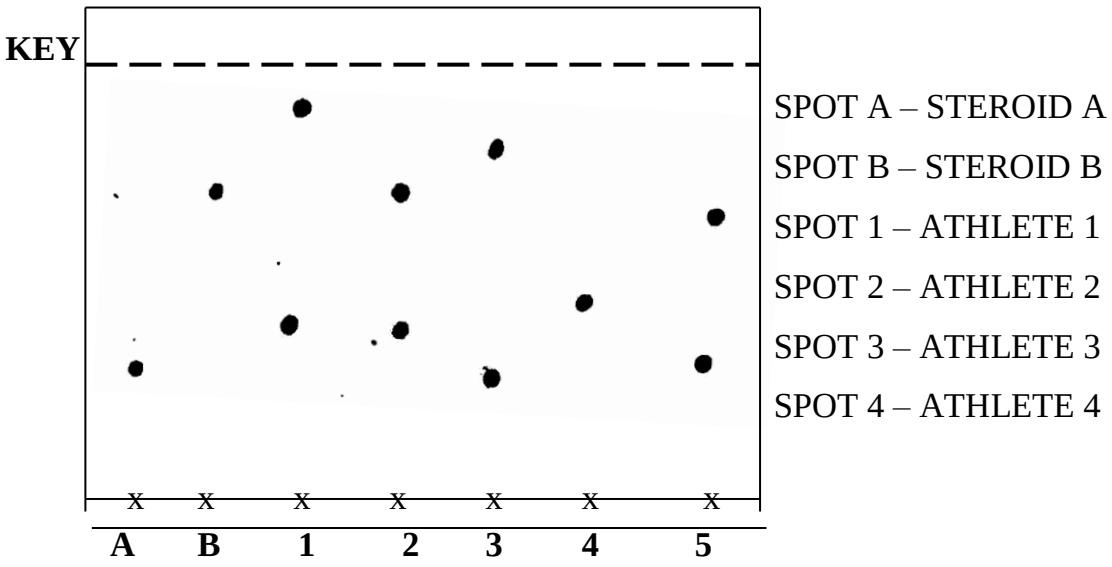
(a) What is meant by a double salt? **(1mk)**

(b) Write equations of reactions that occur when dilute hydrochloric acid is reacted with: **(2mks)**

(i) Trona

(ii) Basic magnesium carbonate.

29. During Olympics, urine sample of five short distance runners were taken and tested for the presence of two illegal steroids by paper chromatography. Methanol was used as the solvent. A chromatogram from the test appeared as shown below. Study the chromatogram and answer the questions that follow.



(a) Which of the two steroids is most likely to be more soluble in methanol? Give a reason**.(1mk)**

(b) Identify the athletes that tested positive for the illegal steroids. **(2mks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 1

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS

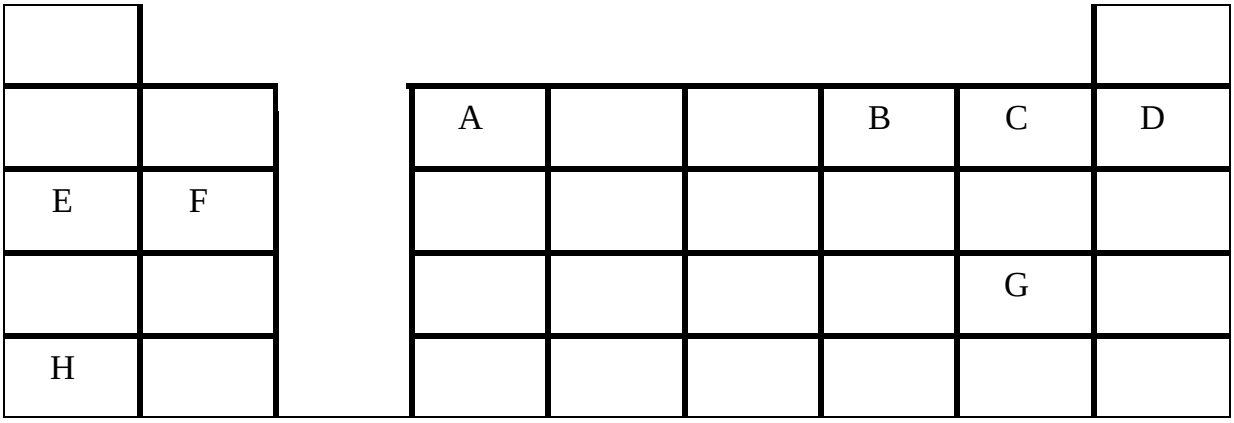
a) *Write your name and index number in the spaces provided above.*
b) *Sign and write the date of examination in the spaces provided above.*
c) *Answer **all** the questions in the spaces provided*
d) *Silent electronic calculators may be used.*
e) *All working **must** be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

Question	Maximum Score	Candidate's Score
1	13	
2	12	
3	12	
4	10	
5	11	
6	10	
7	12	
Total Score	80	

QUESTIONS

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



(a) Give the name of the family to which element F belongs. **(1mk)**

(b) Identify an element which forms a stable divalent anion **(1mk)**

(c) Give the formula of:

(i) The compound formed between A and B **(½mk)**

(ii) The sulphate of H **(½mk)**

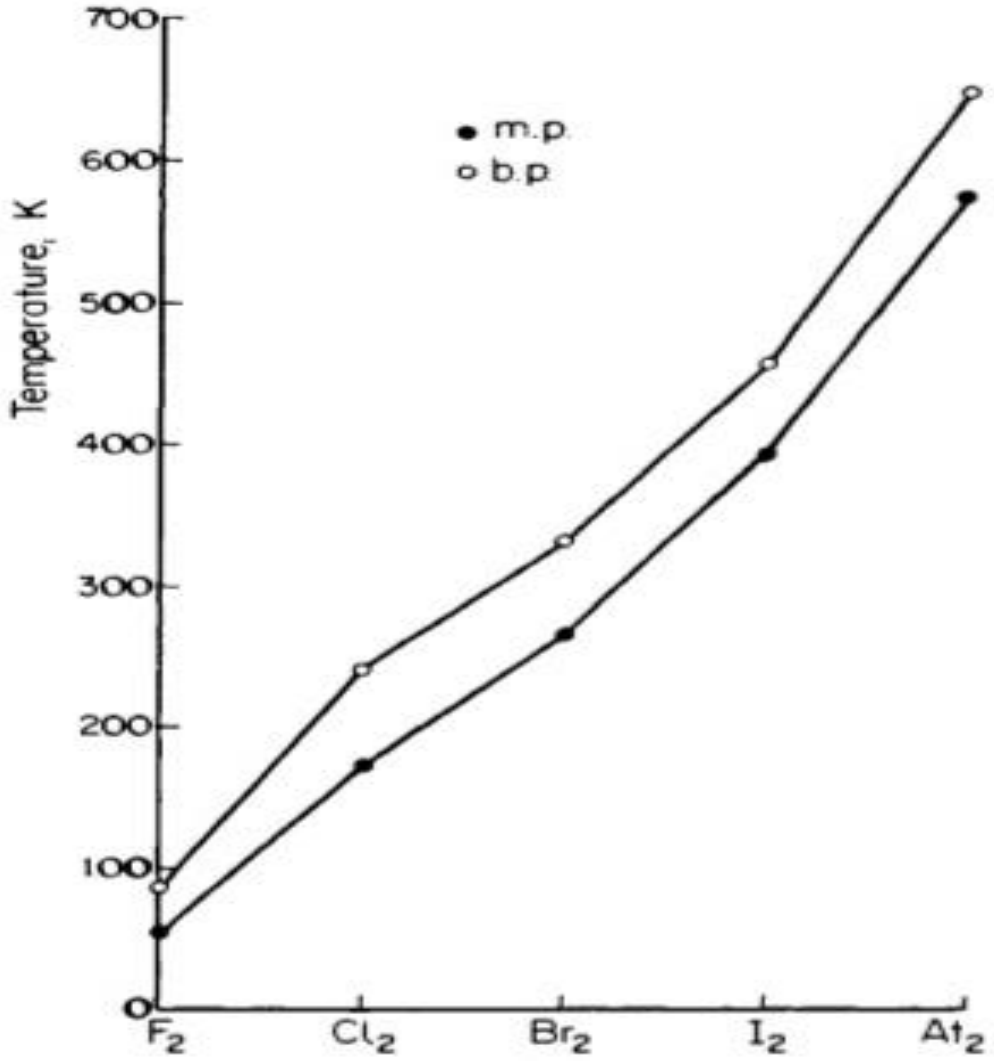
(d) Using dot(.) and cross(x) diagram, show the bonding in the compound formed between E and C. **(2mks)**

(e) Compare the atomic radii of elements C and D. Explain. **(2mks)**

(f) Select the element that has the lowest ionization energy. Explain. **(1mk)**

(g) 0.081g of element A reacts with $20cm^3$ of dilute hydrochloric acid. Calculate the molarity of the hydrochloric acid. (R.A.M = 27) **(3mks)**

(h) The graph below shows the trend of the melting points and the boiling points of the family to which element G belongs. Explain the trend in the melting points. **(2mks)**



2. (**a) (i)** What is a fuel? **(1 mk)**

(ii) Calculate the heating value of propane, C_3H_8, given that its molar enthalpy of combustion is 2200 kJ mol^{-1}. (C=12, H=1) . **(2 mks)**

(b) (i) Define molar enthalpy of combustion**.** **(1 mk)**

(ii) Use the information provided by the thermochemical equations below to calculate the molar enthalpy of combustion of ethyne**.** **(3 mks)**

$C(s) + O_2(g) \longrightarrow CO_2(g)$ $\Delta H = -394$ kJ mol^{-1}

$H_2(g) + \frac{1}{2}O_2(g) \longrightarrow H_2O(g)$ $\Delta H = -286$ kJ mol^{-1}

$2C(s) + H_2(g) \longrightarrow C_2H_2(g)$ $\Delta H = +226$ kJ mol^{-1}

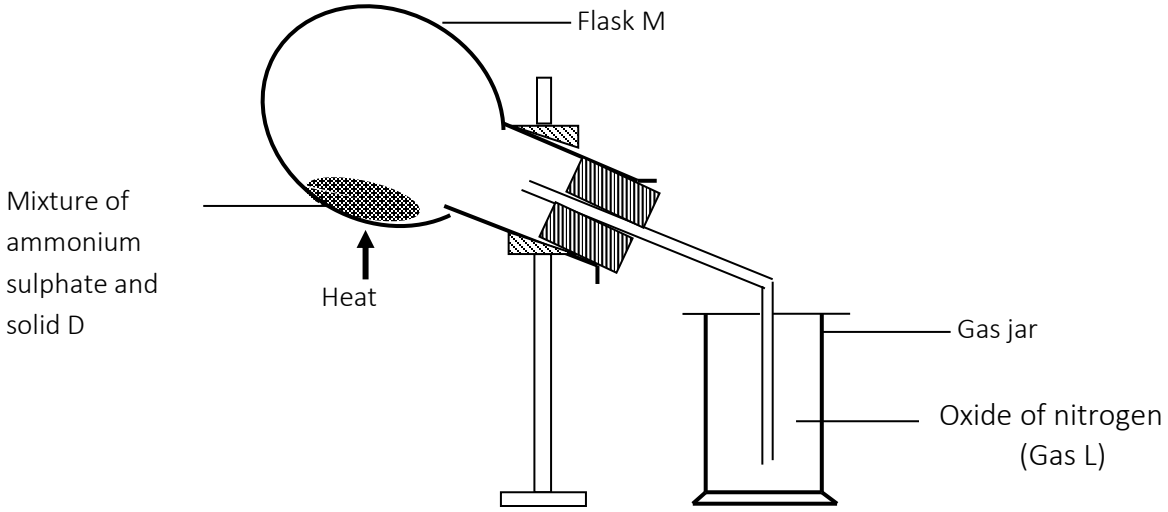
(c) Study the data given below and answer the questions that follow.

Substance/ion	Enthalpy change
$CaCl_2(s)$	Lattice energy = -2237 kJ mol^{-1}
$Ca^{2+}(g)$	Hydration energy = -1650 kJ mol^{-1}
$Cl^-(g)$	Hydration energy = -364 kJ mol^{-1}

(i) Determine the molar enthalpy of solution of calcium chloride in water. **(2 mks)**

(ii) Draw an energy level diagram for the dissolution of calcium chloride in water. **(3 mks)**

3. (a) The diagram below shows the preparation of an oxide of nitrogen. Study the diagram and answer the questions that follow.



(i) Name the solid D. **(1mk)**

(ii) Write the equation for the reaction in the flask M **(1mk)**

(iii) Burning magnesium ribbon was lowered into the gas jar containing gas L. State and explain the observations made. **(2mks)**

(iv) Write the two equations for the reactions taking place in (iii) above. **(2mks)**

I.

II.

(v) A drop of water was added to the product formed in (iii) above. A colourless gas **K** with a choking smell was produced. Write the chemical equation for the production of gas **K** **(1mk)**

(b) (i) Give **two** uses for nitric (V) acid. **(2mks)**

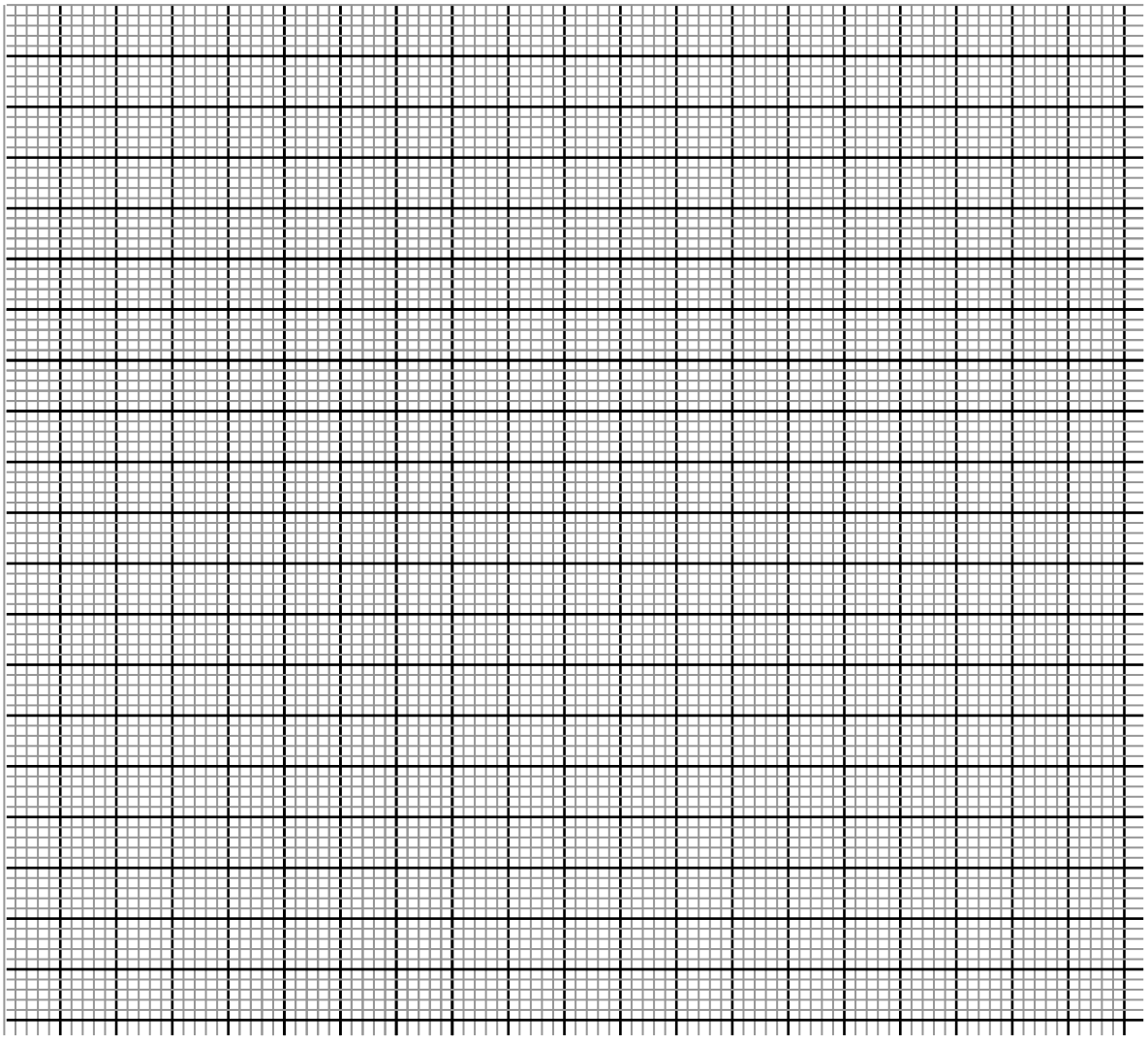
(ii) A factory uses nitric (V) acid and ammonia gas as the only reactants for the preparation of ammonium nitrate. If the daily production of the ammonium nitrate is 4800kg, calculate the mass of ammonia gas used daily in kg. (N=14.0, O = 16.0 H= 1.0) **(3 mks)**

4. A group of form four students of Cockelbet Secondary School carried out an experiment to determine the solubility of potassium chlorate. The table below shows the results obtained.

Total volume of water added(cm^3)	10.0	20.0	30.0	40.0	50.0
Mass of $KClO_3$(g)	5.0	5.0	5.0	5.0	5.0
Temperature at which crystals appear(^0C)	80.0	65.0	55.0	45.0	30.0
Solubility of $KClO_3$(g/100gH_2O)					

(a) Complete the table to show the solubility of $KClO_3$ at different temperatures. **(3mks)**

(b) Plot a graph of mass of $KClO_3$ per 100g water against temperature at which crystals form. **(3mks)**



(c) From the graph, determine ;

(i) The solubility of $KClO_3$ at 40^oC**.** **(1mk)**

(ii) The temperature at which the solubility of $KClO_3$ is 35g/100g water. **(1mk)**

(d) Explain the shape of the graph**.** **(1mk)**

(e) State **one** application of solubility and solubility curves. **(1mk)**

5. (a) Use the standard reduction potentials for elements P, Q, R, S and T given below to answer the questions that follow. (The letters do not represent the actual symbols of the elements).

E^{θ} (Volts)

P^{2+} (aq) + 2e	$\rightleftharpoons$	P (s)	- 2.90
Q^{2+}(aq) + 2e	$\rightleftharpoons$	Q (s)	-2.36
R^{+} (aq) + e	$\rightleftharpoons$	½R_2 (g)	0.00
S^{2+} (aq) + 2e	$\rightleftharpoons$	S (s)	+ 0.33
½ T_2 (g) + e	$\rightleftharpoons$	T^{-} (aq)	+2.86

(i) Which element is likely to be hydrogen? Give a reason for your answer. **(1½mks)**

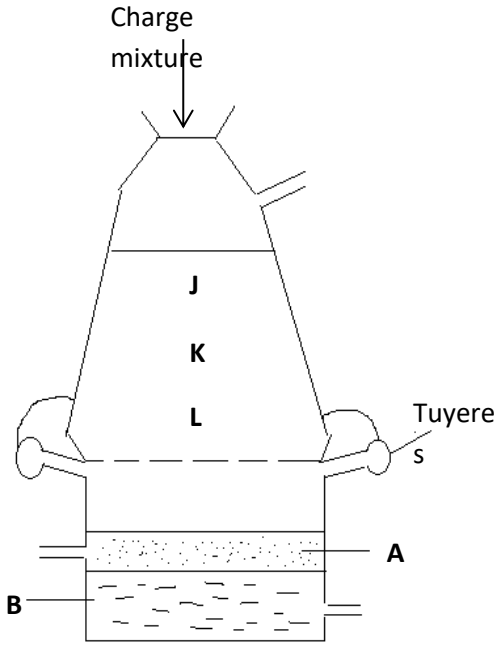
(ii) What is the **E^{θ}** value of the strongest reducing agent? **(1mk)**

(iii) A form four student chose $S^{2+}_{(aq)}$ / $S_{(s)}$ as the reference half-cell. Use the space at the right side of **E^{θ} Volts)** to rewrite the **E^{θ}** values of the above half-cells**.** **(2½mks)**

(iv) In the space provided below draw a labeled diagram of the electrochemical cell that would be obtained when half-cells of elements Q and S are combined. **(3mks)**

(b) An iron spoon is placed in an electrochemical cell with $AuCl_3$ solution to be gold plated. How long must the spoon be in the electrolytic cell if the spoon is to be plated with 0.293 g of Au and the current of the cell is 1.03A. (RAM of Au =197; 1F = *96,485 C*). **(3mks)**

6 The diagram below represents a blast furnace used for the extraction of iron.



(a) Name three substances contained in the charge mixture. **(1½mks)**

(b) Name the substances labeled A and B. **(2mks)**

(c) Arrange regions J, K and L in order of decreasing temperature. **(1mk)**

(d) Write an equation for the reaction that occurs in region L. **(1mk)**

(e) What is the function of the tuyeres? **(1mk)**

(f) Distinguish between cast iron and wrought iron. **(1mk)**

(g) Write an equation for the reaction between heated iron and chlorine. **(1mk)**

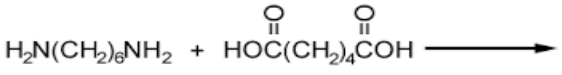
(h) Iron-60 is a radioisotope of iron (half-life 2.6 x 10^6 years). Its ultimate decay product is nickel-60. Write a nuclear equation for this process.

(Atomic numbers: Fe= 26, Ni= 28) **(1mk)**

(i) State one use of stainless steel. **(½mks)**

7. **(**a) Draw and name all the isomers of C_4H_6 **(2mks)**

(b) The following monomers react to form a polymer:



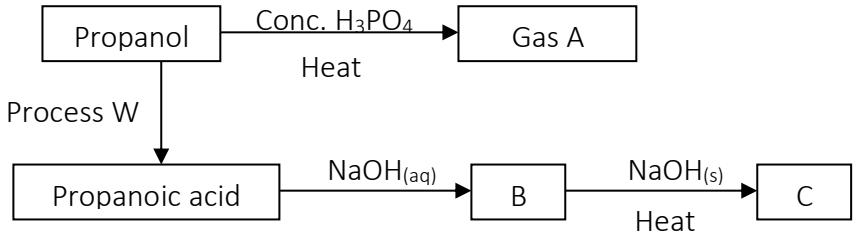
Draw and name the structure of the polymer **(2mks)**

(c) Chlorofluorocarbons have a wide range of uses. However they have been linked to depletion of ozone.

(i) Explain the problem caused by depletion of ozone layer. **(1mk)**

(ii) Give one other environmental problem caused by chlorofluorocarbons. **(1mk)**

(d) Study the flow chart below and use it to answer the questions that follow.



(i) Name:

I: Process W **(½mk)**

II: Substances A, B and C **(1½mks)**

(ii) Write an equation for the combustion of substance C **(1mk)**

(iii) Give one use of gas A **(1mk)**

(e) Explain how a sample of propan-1-ol could be distinguished from a sample of propanoic acid by means of a chemical reaction **(2mks)**

NATIONAL TRIAL 2

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

1. *Write your name and index number in the spaces provided above.*

2. *Answer all the questions in the spaces provided.*

3. *All working must be clearly shown.*

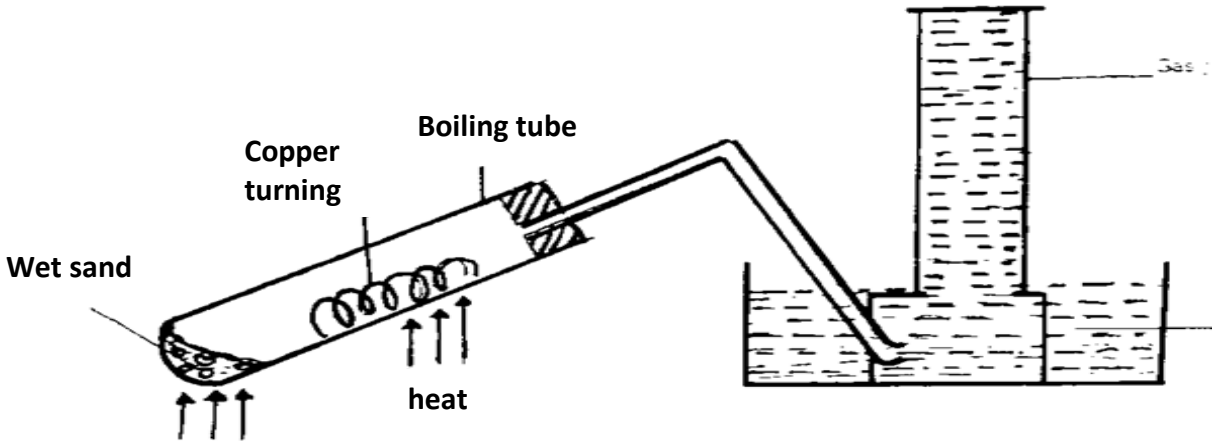
4. *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATES SCORE
1 – 28	80	

QUESTIONS

1. The set-up below was used to investigate the effect of steam on copper turnings.



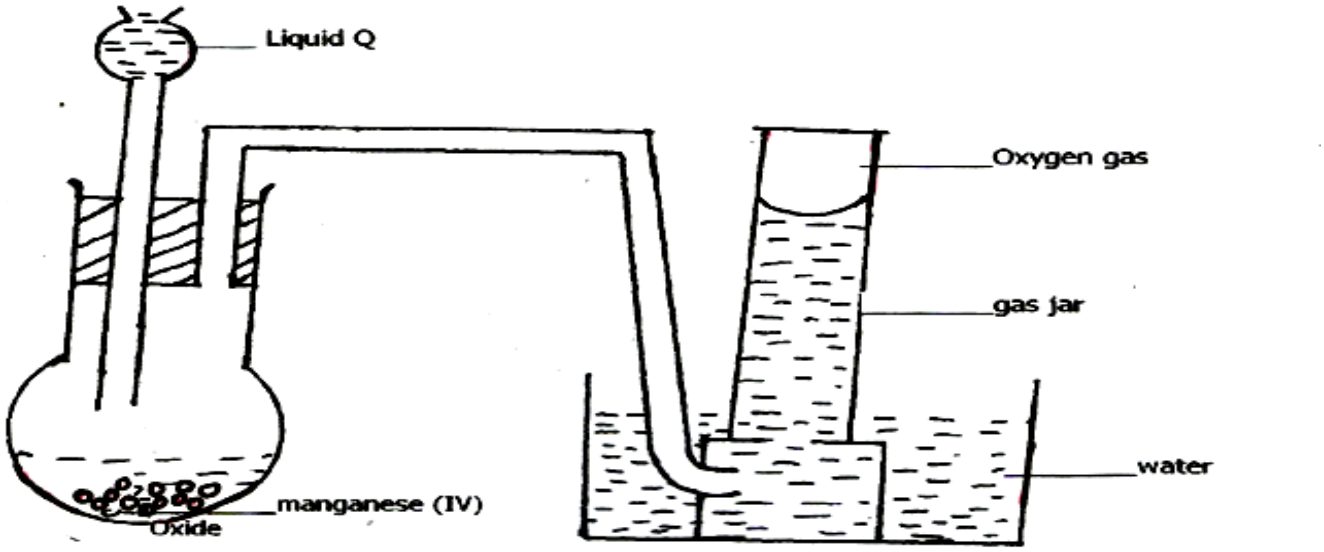
(a) What was observed in the boiling tube? Explain **(2mks)**

(b) Suggest one other metal that would behave as copper turnings in the above set up if used.**(1mk)**

2. (a) State Graham's law of diffusion. **(1 mk)**

(b) A certain volume of gas S takes 180 seconds to diffuse through a porous plug. Molar mass of S is 18. Equal volume of gas Q takes 240 seconds to diffuse through the same plug. Calculate the molar mass of Q. **(2mks)**

3. A student set-up the apparatus shown below attempting to collect oxygen gas.



(a) State one mistake the student made. **(1 mk)**

(b) Identify liquid Q. **(1 mk)**

(c) What property enables the gas to be collected as shown above? **(l mk)**

4. Sodium chloride is accidentally mixed with lead(II) sulphate. Explain how sodium chloride crystals can be obtained from the mixture. **(3mks)**

5. The molecular formula of a hydrocarbon is $C_{11}H_{24}$,

The hydrocarbon can be converted into other hydrocarbons as shown below.

$$C_{11}H_{24} \xrightarrow{\text{Process R}} Y + C_9H_{20}$$

(a)Name process **R** …… **(½ mk)**

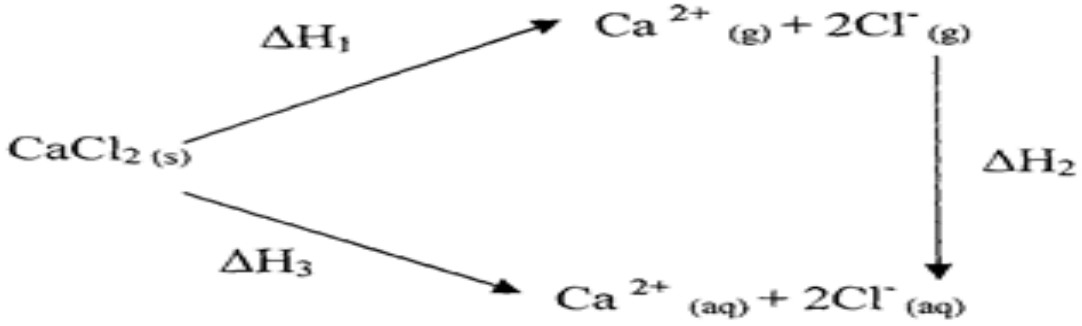
(b) Draw the structural formula of Y and give its name. **(1 ½ mks)**

6. The third number of the alkenes is converted to its corresponding saturated hydrocarbon by hydrogenation. Using the bong energy values given below, answer the questions that follow.

Bond	Bond energy kJ/Mol
H-H	432
C=C	610
C-C	346
C-H	413

Determine the enthalpy change for the conversion of the third member of the alkenes to its corresponding saturated hydrocarbon by hydrogenation. **(3mks)**

7. Use the information in the energy cycle below to answer the questions that follow.



(i) What is the name given to the energy changes? **(3mks)**

H1. ……

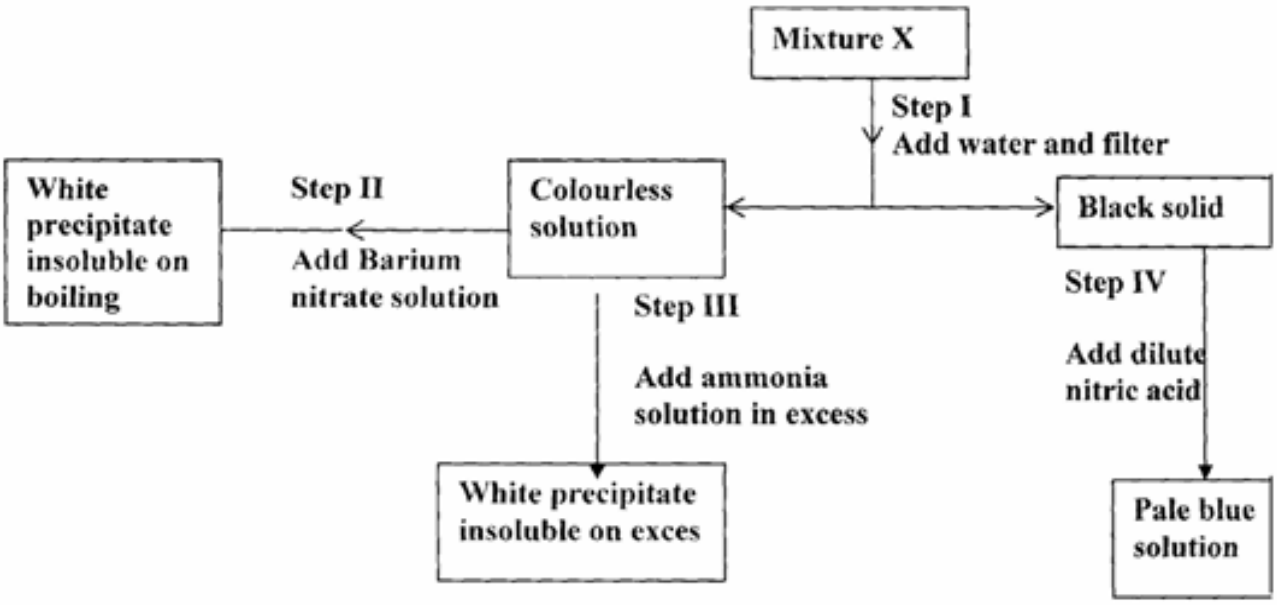
H2. ……

H3. ……

(ii) Given that Δ H1= 2237KJ/Mol and ΔH2=-2378KJ/Mol, calculate the value of ΔH3. **(l mk)**

8. When solid Zinc carbonate was added to a solution of hydrogen chloride in methylbenzene, there was no observable change. On addition of some water to the mixture there was effervescence. Explain these observations. **(2mks)**

9. Study the chart below and answer the questions that follow.



(a) Name:

(i) Cations present in mixture X. **(1mk)**

(ii) Anions present in the solution. **(1mk)**

(b) Write an equation to show how the white precipitate in step III dissolves. **(1mk)**

(c) Name the process outlined in step IV above. **(1mk)**

10. An element X has two naturally occurring isotopes ^{22} X1 and ^{20} X2. If its relative atomic mass is 21.8, calculate the percentage abundance of the more stable isotope. **(2mks)**

11. State two conditions that would make the boiling point of water to be higher than 100^{o}C.

(2 marks)

12. Study the following equilibrium equation.

$2X_2(g) + Y_2(g) \rightleftharpoons 2X_2Y(g) \quad \Delta H = -197kJ/mol$

(a) Suggest two ways of increasing the yield of X_2Y. **(1 mark)**

(b) Draw the energy level diagram for the forward reaction. **(2 marks)**

13. 5.0g of calcium carbonate were allowed to react with 25cm3 of 1.0M hydrochloric acid until there was no further reaction. Calculate the mass of calcium carbonate that remained unreacted.

(3 marks) **(Ca = 40, C = 12, O = 16)**

14. A student fetched water from a river in a limestone area. He used it for washing and realized that it did not lather easily.

(i) Name the two ions that prevent lathering. **(1 mark)**

(ii) Given that the structure of soap is $C_{17}H_{35}COONa$.

Explain by means of ionic equations how the above ions prevent lathering**.** **(2 marks)**

15. M grams of a radioactive isotope decayed to 5 grams in100 days. The half-life of the isotope is 25 days.

(a) What is meant by half life? **(1 Mark)**

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

16. $20cm^3$ of a dibasic acid required $25cm^3$ of 0.1M NaOH for complete neutralization.

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

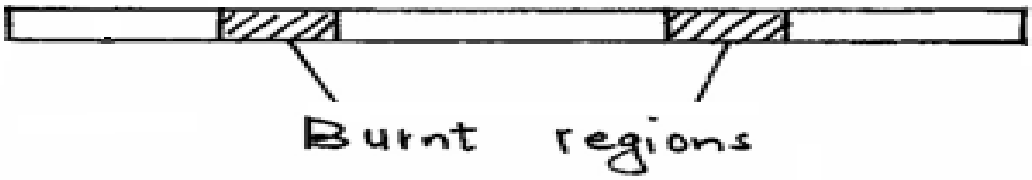
(b) Calculate the concentration of the dibasic acid in moles per litre. **(2 marks)**

17. When $25cm^3$ of 0.5M HCl is added to $25cm^3$ of 0.5M NaOH the temperature of the solution rose from 23 ®C to 26 ®C. Given that the density of the solution is $1gcm^{-3}$ and its specific heat capacity is $4.2Jg^{-1}K^{-1}$.

(a) Determine the amount f heat evolved that caused the temperature rise. **(1 mark)**

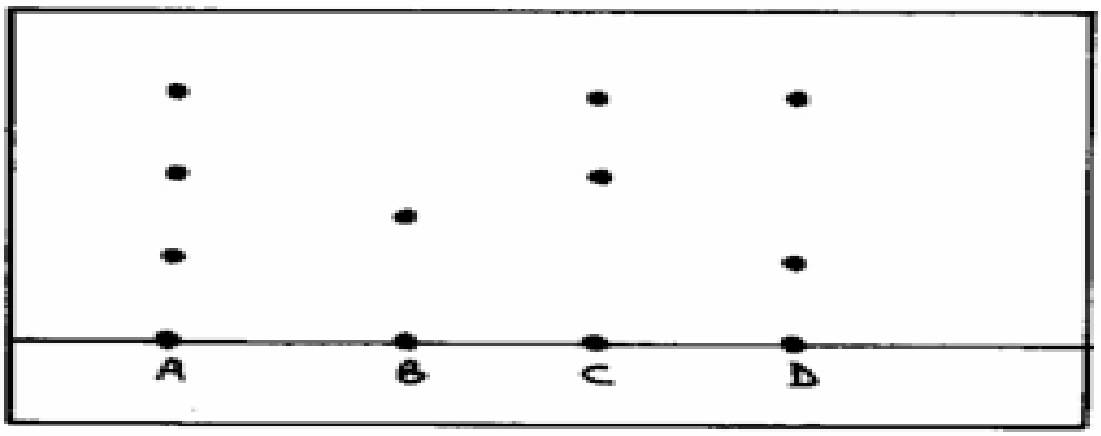
(b) Work out the molar enthalpy of neutralization for this reaction. **(2 marks)**

18. The figure below shows a burning splint that was put across the middle of a non-luminous flame. Explain the results. **(2 marks)**



19. 3.22g of hydrated sodium sulphate, Na2SO4.XH2O were heated to a constant mass of 1.42g. Determine the value of X in the formula. (Na = 23.0, S = 32.0, O = 16.0, H = 1). **(3 marks)**

20. The following chromatogram was obtained in an experiment to investigate the components present in certain dyes.



(a) Which two dyes when mixed would produce A? **(1 mark)**

(b) Which dye is pure? **(1 mark)**

(c) Indicate on the diagram the solvent front. **(1 mark)**

21. The following are electrode potentials of the half cells.

Half-cell	E® volts
M^{2+} (aq)/M(s)	-0.76
C^{2+} (aq)/C(s)	+0.34

a) Calculate the potential difference of the following cell. **(1 mark)**

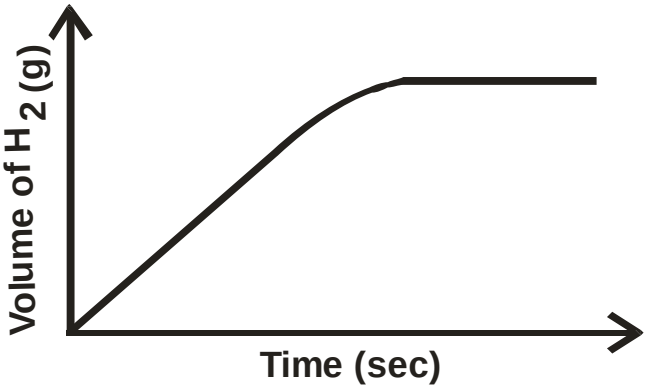
M(s)/M^{2+} (aq) //C^{2+} (aq) /C(s)

b) Draw an electrochemical cell for the cells in (a) above. **(3 marks)**

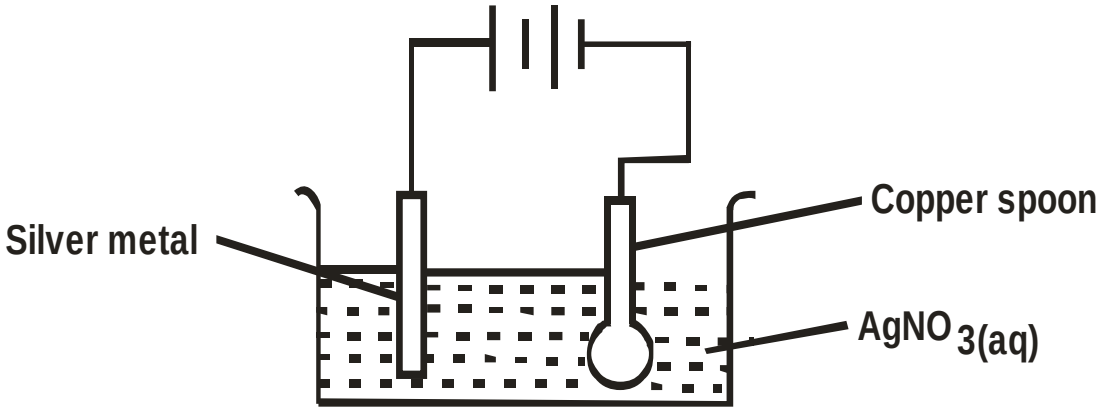
c) Show the electrode which represents the anode. **(1 mark)**

22. The diagram below shows the reaction of zinc granules with hydrochloric acid.

On the diagram sketch the graph that would be obtained if zinc powder of same quantity was used and label it C2. Explain. **(2 marks)**



23. A copper spoon was coated with silver metal as shown below.



i) Write an equation for the reaction that occurs at the copper spoon cathode. **(1 mark)**

ii) How many grams of silver would be deposited on the spoon in two hours using steady current of 0.03A? (1 F = 96500C, Ag = 108.0) **(3 marks)**

24. Copper (II) sulphate solution was electrolyzed using graphite electrodes.

a. State the observations made at the electrodes**.** **(2marks)**

Anode

Cathode

b. Write the equation for the anode reaction**.** **(1mark)**

25. Write down a balanced equation to show the effect of heat on each of the following substances.

i) Anhydrous copper (II) **sulphate** **(1mark)**

ii) Potassium nitrate **salt** **(1mark)**

iii) Silver **nitrate** **(1mark)**

26. A compound with the formula X (OH)3(not its actual chemical formula) reacts as shown below

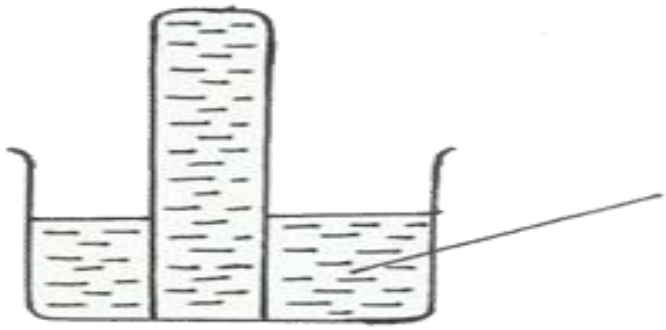
$X(OH)_3(s) + OH^-(aq) \longrightarrow X(OH)_4(aq)$

$X(OH)_3(s) + 3\ H^+(aq) \longrightarrow X^{3+}(aq) + 3H_2O(l)$

a) State the name of compounds that behave like X $(OH)_3$ in the two reactions above**.** **(1mark)**

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

27. Chlorine water was exposed to sunlight for one day using the set up below.



After one day a gas was collected

a) Identify the gas that was collected**.** **(1mark)**

b) State the observations made in the liquid**.** **(2mark)**

c) What will happen to the pH of the solution after one day**?** **(1mark)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 2

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

1) *Write your* ***Name, Admission Number*** *and* ***School*** *in the spaces provided above.*

2) *Answer* ***all*** *the questions in the spaces provided after each question.*

3) *Mathematical tables and non-programmable electronic calculators may be used.*

4) ***ALL*** *working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1	12	
2	10	
3	13	
4	11	
5	13	
6	10	
7	9	
TOTAL	**80**	

Answer all the questions in the spaces provided.

1. Below is a table of oxides of period 3 elements. Use it to answer the questions that follow.

Element	Na	Mg	Al	Si	P	S	Cl
Oxides	Na_2O Na_2O_2	MgO	Al_2O_3	SiO_2	$P2O_3$ P_2O_5	SO_2 SO_3	Cl_2O_7
Nature of oxides	I	II	III	IV	V	VI	VII

(a) Compare the electrical conductivity of oxides of Sodium to those of phosphorus. **(2 mks)**

(b) Which oxides would react with dilute Sulphuric acid. Explain. **(2 mks)**

(c) Write down balanced equation to show how one of the oxides would react with both 2M hydrochloric acid and 2M Sodium hydroxide solution. **(2 mks)**

(d) What structure would be formed by the oxides of silicon? Explain your answer. **(2 mks)**

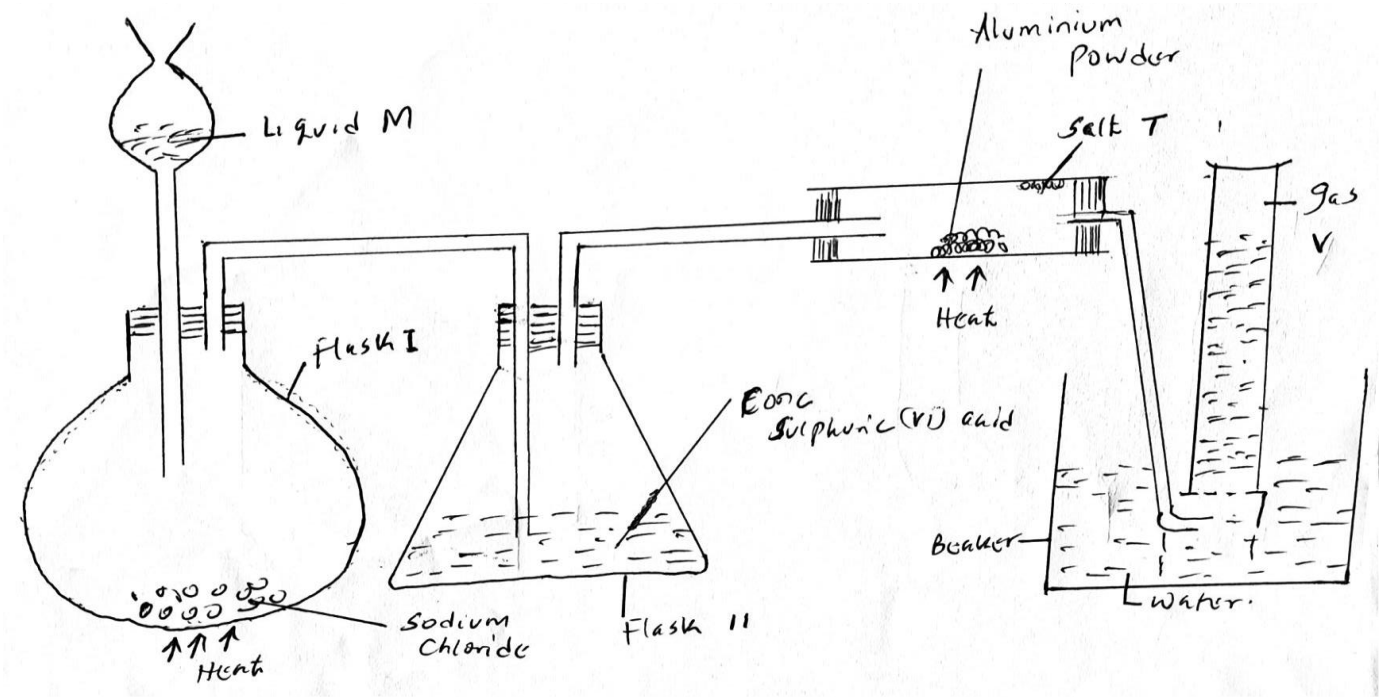
The melting point of SO_2 is lower than that of MgO. MgO has a giant ionic structure while SO_2 has a simple molecular structure.

(e) Describe how you would prepare a dry sample of lead (II) nitrate from the following reagents. Lead (II) oxide and dilute nitric (V) acid. **(3 mks)**

(f) Alum used in treating water is both advantageous and disadvantageous. Explain. **(2 mks)**

(g) When a blue litmus paper is dipped in a solution of aluminium Chloride it turns red. Explain.

2. The set up below was used to prepare hydrogen chloride gas and salt T. **(1 ½ mks)**



(a) Identify the following:

(i) Liquid M.

(ii) Gas V

(iii) Salt T

(b) Write down balanced chemical equations for reactions that occur at: **(2 mks)**

(i) Flask I

(ii) Combustion tube.

(c) Name the process that formed salt T as shown in the diagram. **(½ mks)**

(d) Sulphuric (VI) acid is used as a drying agent in this experiment. Explain why calcium oxide is unsuitable for the same purpose in this reaction. **(1 mk)**

(e) The water in the beaker was found to have a pH of 2.0 at the end of the experiment. Explain. **(1 mk)**

(f) Calculate the mass of salt T formed if $480cm^3$ of hydrogen chloride gas measured at room temperature was reacted with aluminium powder (**Al = 27, Cl = 35.5 MGV = $24dm^3$**) **(2 mks)**

(g) Draw a well labeled diagram showing how you would dissolve hydrogen chloride in water. **(2 mks)**

(h) Explain why hydrogen chloride gas dissolved in methyl benzene does not react with calcium carbonate. **(1 mk)**

(i) Using an equation, state the observation made when a gas jar containing hydrogen chloride gas is opened near an open bottle of liquid ammonia. **(1 mk)**

3. Use the information below to answer the questions that follow.

$Ca_{(s)} + ½\ O_{2(g)} \xrightarrow{} CaO_{(s)}$ ΔH = - 635kj/mol-1

$C_{(s)} + O_{2(g)} \xrightarrow{} CO_{2(g)}$ ΔH = - 394kj/mol

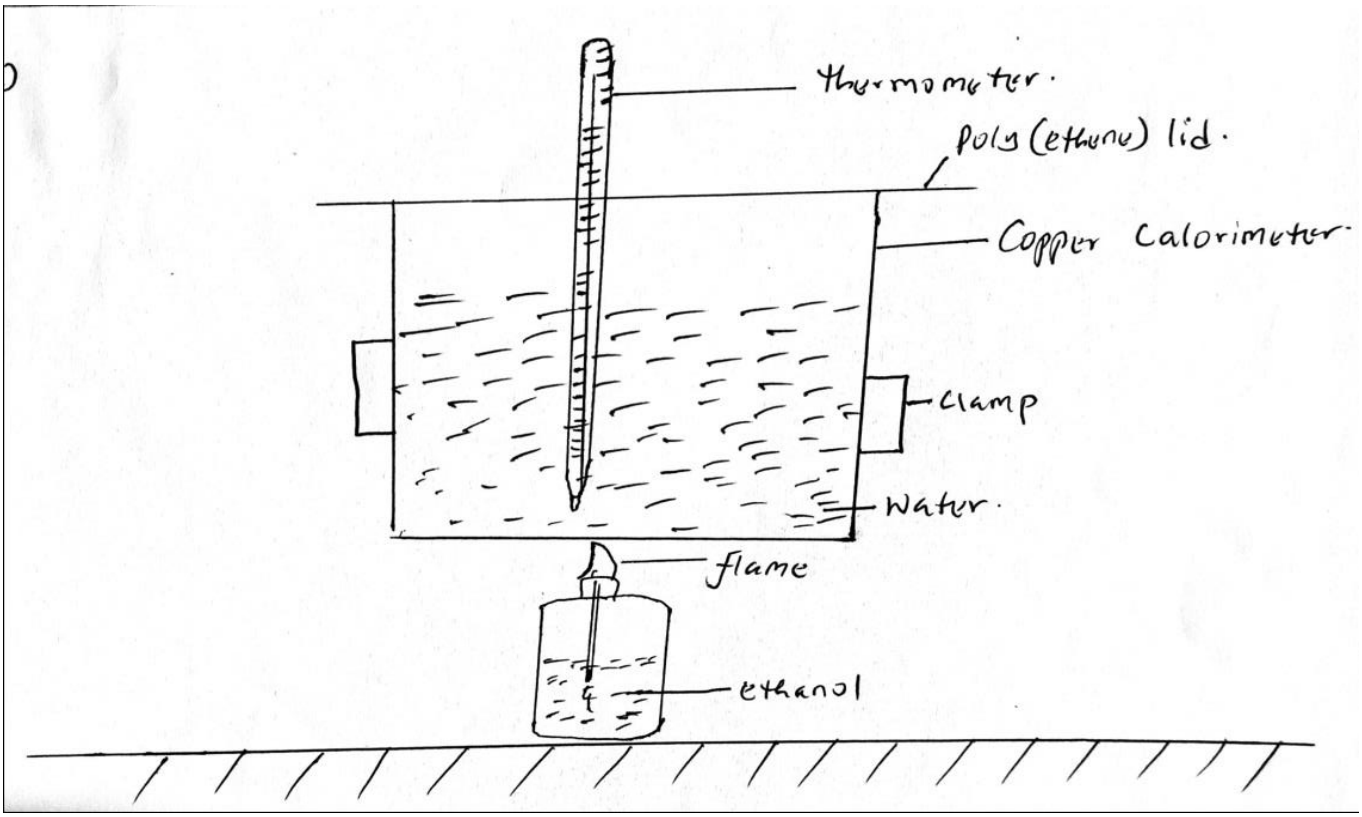
$Ca + C + \frac{3}{2}O_2 \longrightarrow CaCO_{3(s)}$ ΔH = - 1207 kj/mol

(a) Calculate the enthalpy change for the reaction. **(3 mks)**

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

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

(c) A student used the apparatus shown to calculate the energy released when ethanol burns. The energy released by the burning ethanol raises the temperature of the water in the copper colorimeter.



Volume of water used	= 500cm^3
Initial temperature of water	= 25^{o}C
Final temperature of water	= 44.5^{o}C
Mass of ethanol + Lamp before burning	= 121.5g
Mass of ethanol + lamp after burning	= 120.0g

Calculate the:

(i) Heat evolved during the experiment (density of water = 1g/cm^3, specific heat capacity of water = 4.2jg^{-1}K^{-1}) **(3 mks)**

(ii) Molar heat of combustion of ethanol. **(3 mks)**

(C = 12, O = 16, H = 1)

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

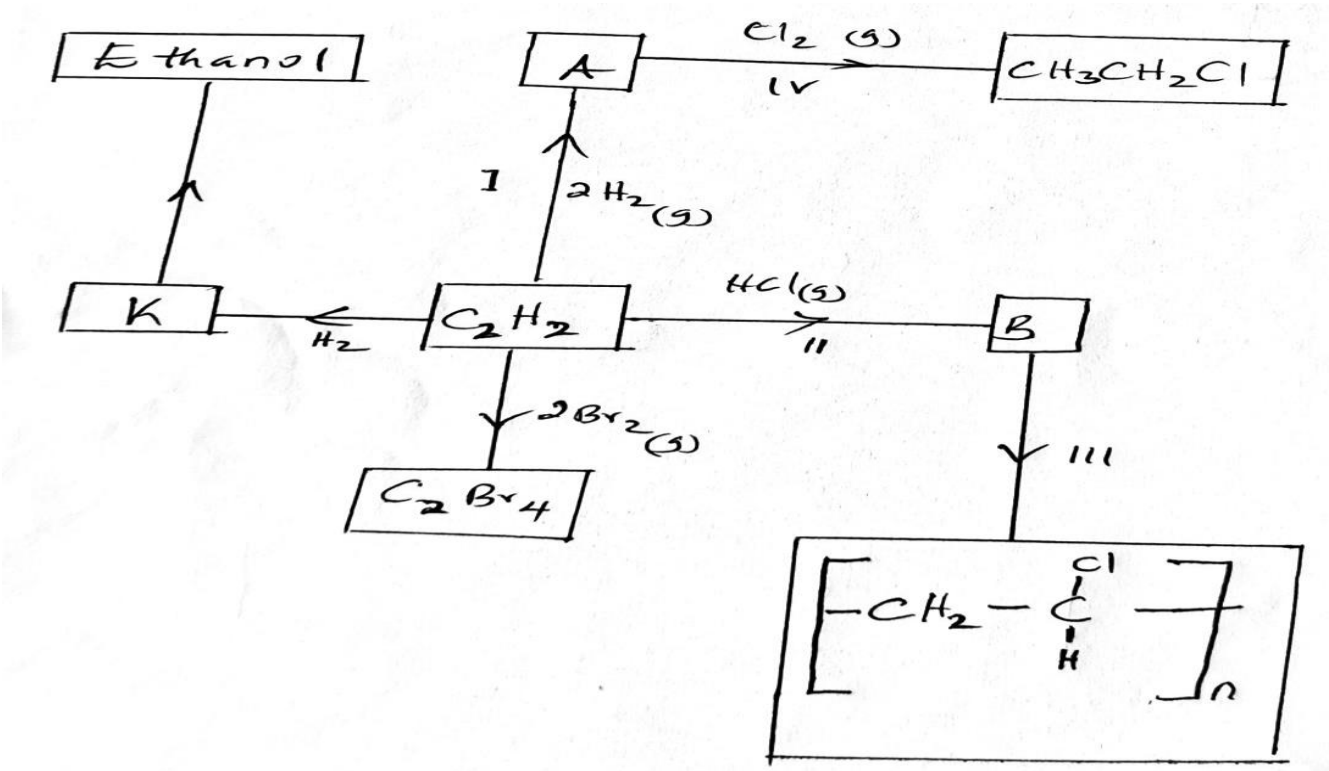
(e) Sketch a simple energy diagram for the reaction of ethanol in air. **(3 mks)**

4. Name the following compounds using the LUPAC system.

(a) (i) $CH_3CH_2COOCH_2CH_3$ **(1 mk)**

(ii) $CH_3CH_2CHC{=}CH$ **(1 mk)**

(b) Study the scheme below and answer the questions that follow.



(i) Identify the catalyst used in step I. **(1 mk)**

(ii) Name the compounds A and B. **(1 mk)**

(iii) Give one disadvantage of compound formed in step III. **(1 mk)**

(iv) Name the reactions taking place at steps. **(2 mks)**

III

IV

(c) Compound A and B have the same molecular formula $C_3H_6O_2$. Compound A liberates Carbon (iv) oxide on addition of aqueous Sodium carbonate while compound B does not. Compound B has a sweet smell. Draw the possible structures of:

(i) Compound A **(1 mk)**

(ii) Compound B. **(1 mk)**

(d) A student mixed equal volumes of ethanol and butanoic acid. He added a few drops of concentrated Sulphuric (vi) acid and warmed the mixture.

(i) Name and write the formula of the main products. **(2 mks)**

(ii) Which homologous series does the product named in (i) above belong**?** **(1 mk)**

5. Use the standard electrode potentials given below to answer the questions that follow.

Element		**Volts(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
$Zn^{2+}_{(s)} + 2e^-$	$\longrightarrow Zn(s)$	- 0.76

(a) Select two half-cells which when combined give the lowest workable cell (lowest e.m.f).

(1 mk)

(b) Calculate the e.m.f of the cell formed by combining the two half-cells in (a) above**.(1 mk)**

(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 down the half equation for the half-cell in which oxidation occurs. **(1 mk)**

(ii) Write down the overall cell equation. **(1 mk)**

(iii) What is the role of the salt bridge **(2 mks)**

(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 electrolyte.

(i) Why was it necessary to clean the metals before dipping them into the electrolyte?

(1 mk)

(ii) A current of 0.75A was passed through the solution for one hour and four minutes. The mass of chromium deposited on the cup was 0.52g (1 Faraday = 96500C, Cr = 52)

I. Calculate the quantity of electricity. **(1 mk)**

II. How many moles of chromium were deposited? **(1 mk)**

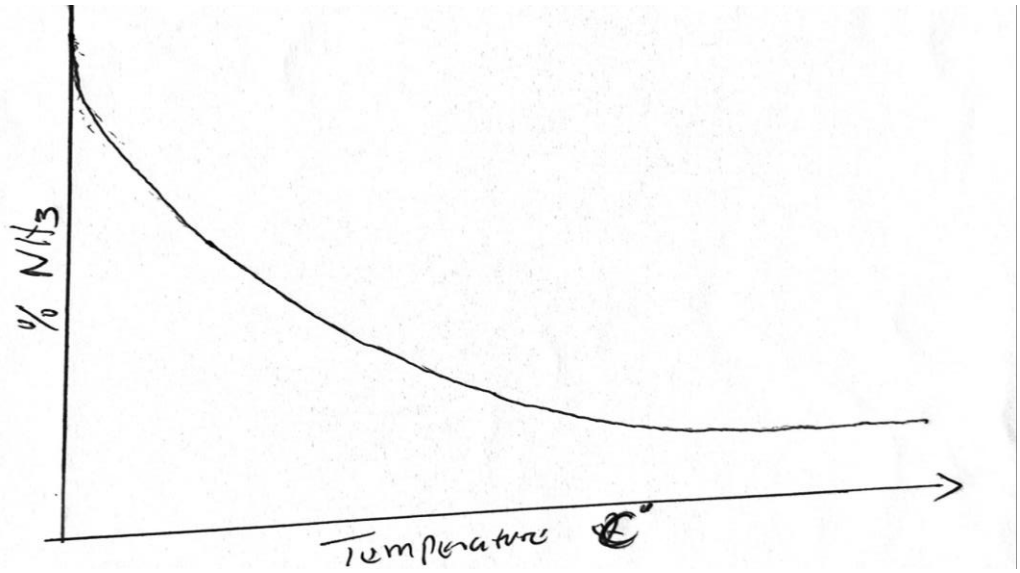
III Calculate the quantity of electricity to deposit one mole of chromium**.** **(2 mks)**

IV. Calculate the number of Faradays required to deposit one mole of chromium and hence deduce the change of ion. **(2 mks)**

6. Nitrogen and hydrogen react to form ammonia gas as shown in the following equation.

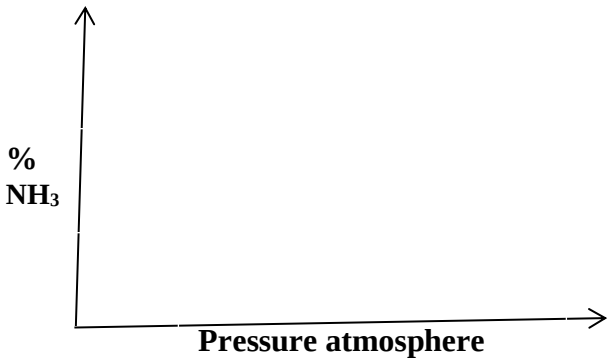
$$\mathbf{N_{2(g)} + 3H_{2(g)} \longrightarrow 2NH_{3(g)} \quad \Delta H = -97\ Kj/mol}$$

The figure below shows how the percentage of ammonia gas in the equilibrium mixture changes with temperature.



(a) Explain why the percentage of ammonia gas changes as shown in the figure above. **(2 mks)**

(b) On the following axis, sketch a graph showing how the percentage of ammonia gas in the equilibrium mixture changes with pressure. **(1 mk)**



(c) Bismuth chloride ($BICl_3$) reacts with water according to the equation given below.

$$BiCl_{3(g)} + H2O_{(l)} \rightleftharpoons BiOCl_{(s)} + 2HCl_{(aq)}$$

(i) State what would happen when a few drops of dilute hydrochloric acid are added to the mixture at equilibrium. **(1 mk)**

(ii) Give a reason for your answer in (a) (i) above. **(1 mk)**

(d) (I) In that harbor process, the industrial manufacture of ammonia is given by the following equation:

$$N_{2(g)} + 3H_2 \rightleftharpoons 2NH_{3(g)} \qquad \Delta H = -97jh/mol$$

(i) Name one source of hydrogen used in the process. **(1 mk)**

(ii) Name the catalyst used in the above reaction. **(1 mk)**

(iii) What is the effect of increasing temperature on yield of ammonia. Explain. **(2 mks)**

(II) The curves below were obtained when equal volumes of 2M HCl were reacted with 3.0g of marble chips ($CaCO_3$). In one of the reactions, the acid was warmed before adding this marble chips.

(i) Write down the equation for the reaction. **(2 mks)**

(ii) Identify the curve representing the reaction where the acid was warmed. **(1 mk)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 3

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

1) *Write your **Name**, **Index Number** and **School** in the spaces provided above.*
2) *Answer **all** the questions in the spaces provided after each question.*
3) ***KNEC** Mathematical tables and **silent non-programmable** electronic calculators may be used.*
4) ***ALL** working **must** be clearly shown where necessary.*
5) *Candidates should answer the questions in **English**.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1 – 29	80	

1. State and explain the change in mass that occur when the following substances are separately heated in open crucibles.

a) Copper metal **(1 $\frac{1}{2}$ marks)**

b) Copper (II) nitrate **(1 $\frac{1}{2}$ marks)**

2. (a) State Graham's law of diffusion **(1 mark)**

(b) A volume of 120 cm^3 of nitrogen gas diffused through a membrane in 40 seconds, how long will 240cm^3 of carbon (IV) oxide defuse through the same membrane? **(2 marks)**

3. A reaction of Propane with chlorine gas gave a compound of formula C_3H_7Cl.

a) What condition is necessary for the above reaction to take place. **(1 mark)**

b) Draw the structural formula of the compound C_3H_7Cl **(2 marks)**

4. Name a gas which is used together with Oxygen in welding. **(1 mark)**

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

(The letters are not the actual symbols of the elements)

Element	B	C	D	E	F
Atomic number	18	5	3	5	20
Mass number	40	10	7	11	40

(i) Which two letters represent the same elements? Give reason. **(2 marks)**

(ii) Give the number of neutrons in an atom of element D. (Show your working) **(1 mark)**

6. A hydrated salt of copper has the formula $CuSO_4.nH2O$. About 25g of the salt was heated until all the water evaporated. If the mass of the anhydrous salt is 16.0g, find the value of n.(Cu = 64.0, S = 32.0, O = 16.0, H = 1) **(3 marks)**

7. The table below shows the pH values of the solutions I, II, III and IV

Solution	**I**	**II**	**III**	**IV**
pH	2	7	11	14

a) Which solution is likely to be that of calcium hydroxide? **(1 mark)**

b) Select the solution in which a sample of aluminum oxide is likely to dissolve. Give a reason for your answer. **(2 marks)**

c) Select a pair of solutions that would likely give a pH of 7 when equal volumes are reacted with each other. **(1 mark)**

8. Sodium chloride has a higher melting point than hydrogen chloride, explain. **(2 marks)**

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

substance	M.pt ^oC	B.pt ^oC	Electrical conductivity in solid state	Electrical conductivity in molten state
J	365	463	Nil	Nil
K	1323	2773	Good	Good
L	1046	1680	Nil	Good
M	2156	2776	Nil	Nil

Place J, K, L and M in the appropriate categories from the following:

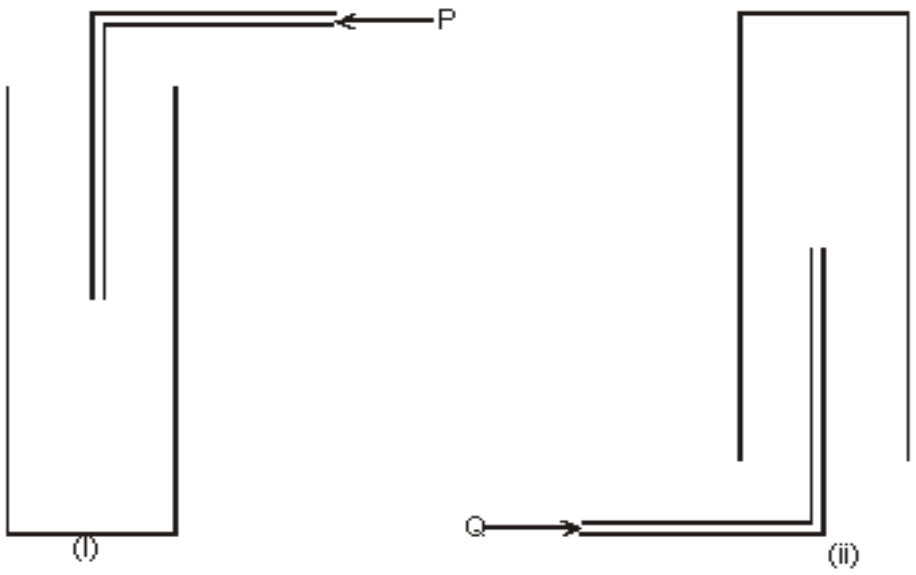
i. Metallic solid _____ **(1 mark)**

ii. Covalent network solid _____ **(1 mark)**

iii. Ionic solid _____ **(1 mark)**

iv. Covalent molecular solid_____ **(1 mark)**

10. The diagram below shows how two gases, P and Q were collected.



a) Name the two methods used. **(2 marks)**

(i)..……(ii) ……....

b) State properties of P and Q that enable them to be collected through the methods shown.

(2 marks)

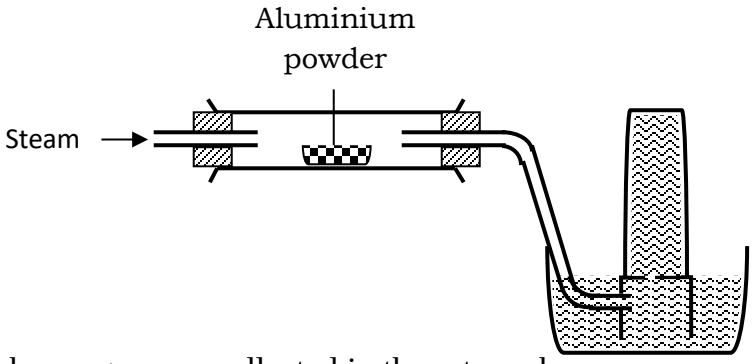
11. Study the information in the table below and answer the questions in the table below and answer the questions below the table

Bond	Bond Energy ($KJmol^{-1}$)
C-H	414
Cl-Cl	244
C-Cl	326
H-Cl	431

Calculate the enthalpy change of the following reaction

$CH_{4\,(g)} + Cl_{2\,(g)} \xrightarrow{\text{U.V. light}} CH_3Cl_{(g)} + HCl_{\,(g)}$ **(3 marks)**

12. Study the diagram below used to investigate the property of steam on aluminium

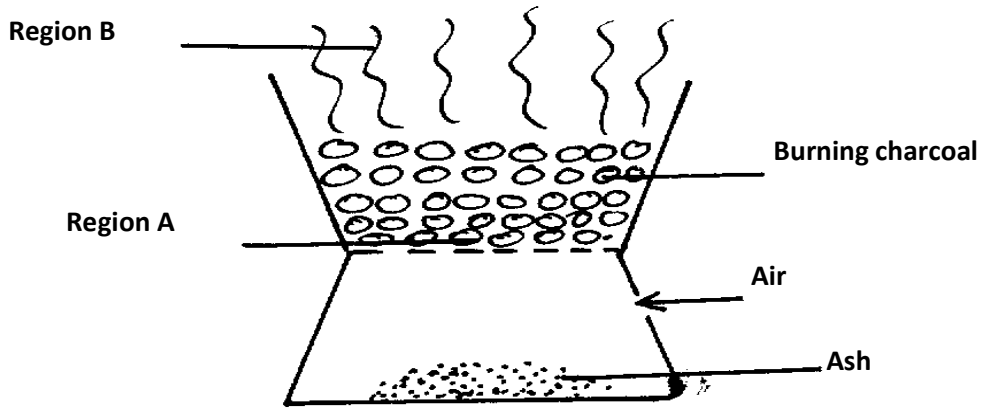


(a) Explain why no gas was collected in the set up above. **(1 mark)**

(b) Explain why the reaction between aluminium and steam stops after a short time. **(2 marks)**

13. A pupil analyzed a commercial vinegar solution by titration and found that $24.5cm^3$ of 0.09 M sodium hydroxide solution was required for titration of $1cm^3$ of vinegar. Calculate the molarity of ethanoic acid CH_3COOH in vinegar. **(3 marks)**

14. The diagram below shows a 'jiko' when in use. Study it and answer the questions that follow



(a) Identify the gas formed at region **B** **(1 mark)**

(b) Using an equation, explain what happens at region **A** **(2 marks)**

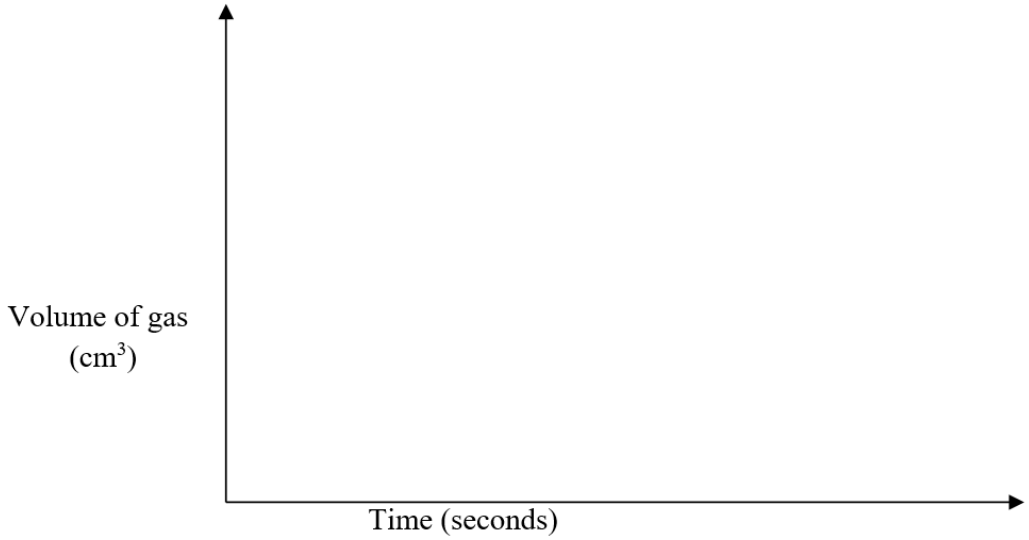
15. Sodium chloride is contaminated with copper (II) oxide. Explain how pure sodium chloride can be obtained from the mixture. **(3 marks)**

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

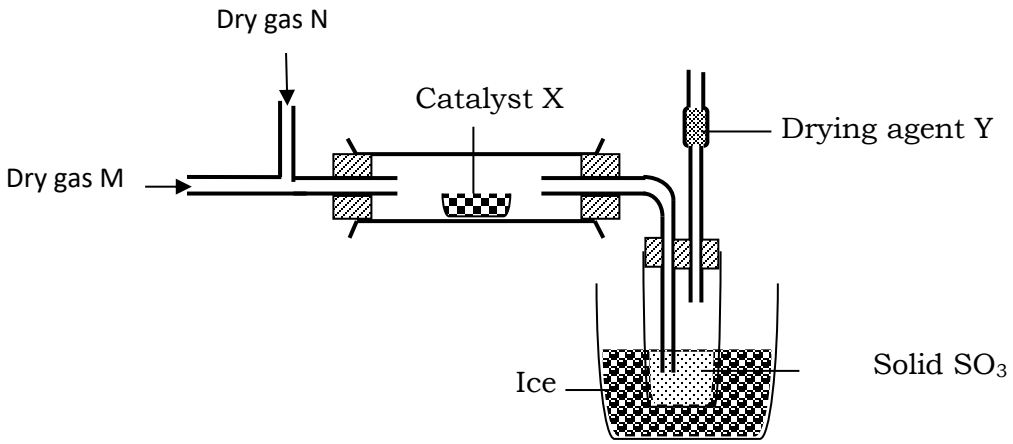
Experiment	Form of zinc	Sulphuric (VI) acid solution
I	Powder	0.8M
II	Powder	1.0M
III	Granules	0.8M

On the axis below, draw and label the **three curves** that could be obtained from such results.

(3 marks)



17. The set-up of apparatus below used to prepare sulphur (VI) oxide:



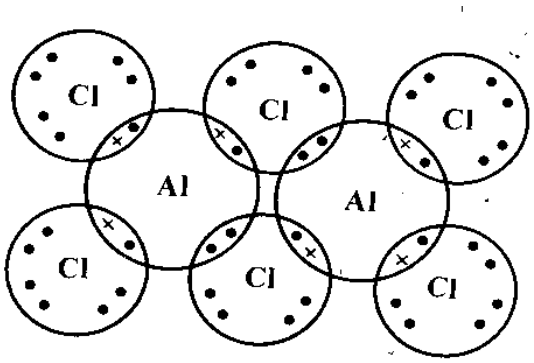
(i) Name Gas N…… and Gas M…….. **(1 mark)**

(ii) Catalyst X ……... **(1 mark)**

(iii) Why is it necessary to use drying agent Y? **(1 mark)**

18. State and explain the observation made when chlorine gas is bubbled into potassium iodide solution. **(2 marks)**

19. The diagram below shows an arrangement of electrons in Aluminium chloride dimer.



(i) Write down the structural formula of the above molecule. **(1 mark)**

(ii) On the diagram, indicate using an arrow the dative bond. **(1 mark)**

20. When Magnesium metal is burnt in air, it reacts with both oxygen and nitrogen gases giving a white solid with black specs. Write two equations for the reactions that take place. **(2 marks)**

21. Below is a representation of an electrochemical cell.

$$Pb_{(s)}|Pb^{2+}_{(aq)}||Ag^{+}_{(aq)}|Ag_{(s)}$$

a) What does || represent? **(1 mark)**

b) Given the following:

E^{θ} (volts)

$Pb^{2+}_{(aq)} + 2e^{-} \longrightarrow Pb_{(s)}$ -0.13

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

Calculate the E.M.F of the electrochemical cell **(2 marks)**

22. When hot concentrated nitric (V) acid is added to sulphur, a red – brown gas and a colourless liquid are formed.

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

(ii) Identify the oxidizing agent in the reaction above. **(1 mark)**

(iii) State **one** environmental hazard of the nitrogen compounds. **(1 mark)**

23. Draw the dot (.) and cross (x) structure of:

a) Carbon (II) oxide - CO **(2 marks)**

b) Ammonium ion - NH_4^+ **(2 marks)**

24. Using sodium hydroxide solution, describe a chemical test that can be used to distinguish between copper (II) ions and iron (II) ions. **(3 marks)**

25. State and explain what would be observed if concentrated sulphuric (VI) acid is added to:

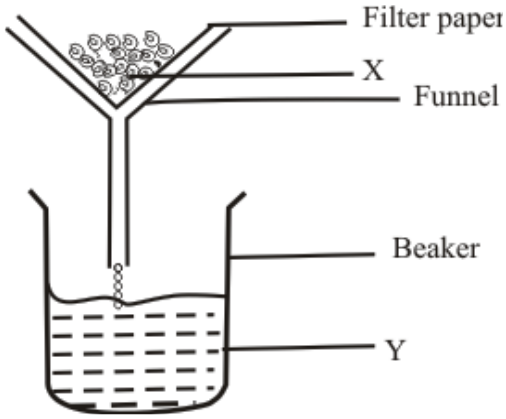
(a) Sugar crystals **(1 ½ marks)**

(b) Copper (II) sulphate crystals **(1 ½ marks)**

26. When 100 cm^3 of 0.5 M sulphuric acid solution, H_2SO_4, react with 100 cm^3 of 1 M sodium hydroxide solution, NaOH, the temperature rises by 6.85 Kelvins. Calculate the molar heat of neutralization described by the equation: **(3 marks)**

$H_2SO_{4(aq)} + 2NaOH_{(aq)} \rightarrow Na_2SO_{4(aq)} + 2H_2O_{(l)}$

27. Filtration is carried out in the apparatus shown



a) Name **X** …… **($\frac{1}{2}$ mark)**

b) State **one** property that makes it possible to separate mixtures using filtration. **($\frac{1}{2}$ mark)**

28. Calculate the oxidation numbers of Sulphur in the following species: **(3 marks)**

a) SO_3^{2-}

b) SO_3

c) $S_2O_3^{2-}$

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 3

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

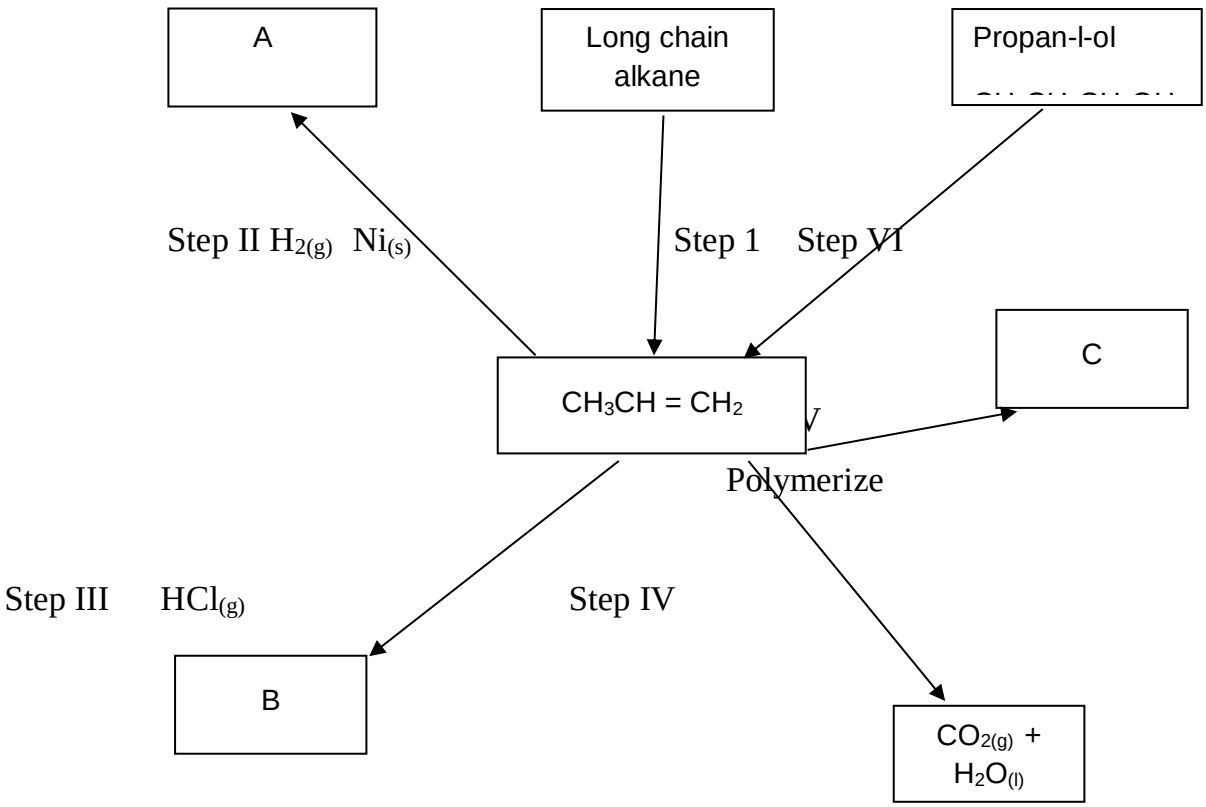
INSTRUCTIONS TO CANDIDATES

1) *Write your **Name, Index Number** and **School** in the spaces provided above.*
2) *Answer **all** the questions in the spaces provided after each question.*
3) *Mathematical tables and non-programmable electronic calculators may be used.*
4) ***ALL** working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1	10	
2	12	
3	12	
4	13	
5	11	
6	10	
7	12	
TOTAL	**80**	

1. (a) Study the flow chart below and answer the questions that follow.



(i) Name the process taking place in step (I). **(1mk)**

(ii) Describe chemical test that can be carried out to show the identity of organic compound A.

(2mks)

(iii) Give the name of the following: **(2mks)**

I. A:……

II. B:……

(iv) Give the structural formulae of substance C. **(1mk)**

(v) Name the type of reaction that occurs in:

I. Step IV **(1mk)**

II. Step **VI:……**

(vi) Give the reagent and the condition necessary for step VI. **(1mk)**

Reagent:……

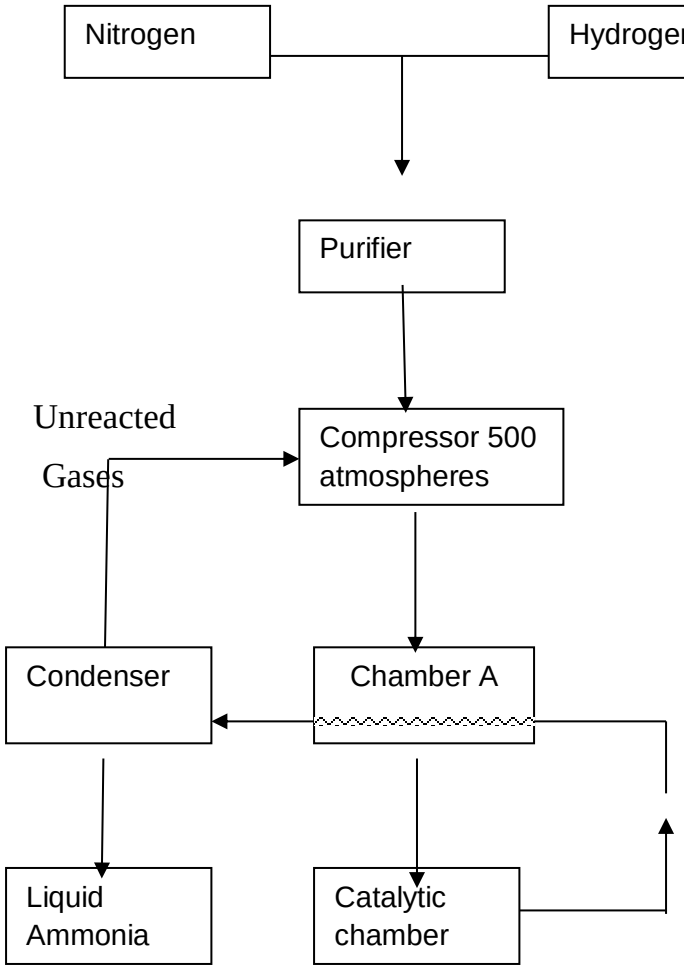
Condition:……

(b) Give the systematic names of the following compounds:

I. $CH_2CHCHCH_2CH_3$ **(1mk)**

II. CH C C H_3 **(1mk)**

2. The flow chart below shows the Haber process in the large scale manufacture of Ammonia gas. Use it to answer the questions that follow.



(a) Describe how nitrogen is obtained from air on a large scale. **(3mks)**

(b) (i) Name **one** source of hydrogen gas used as a raw material in the above process. **(1mk)**

(ii) Name chamber A. **(1mk)**

(iii) Write an equation for the reaction taking place in the catalytic chamber. **(1mk)**

(iv) In the Haber process optimum temperature of 500^0C and 200 atmospheres of pressure are used to get optimum yield of Ammonia. Why can't lower temperatures and higher pressure be used? **(2mks)**

(c) Give **two** reasons why finely divided iron is the commonly used catalyst. **(1mk)**

(d) State and explain the observation made when dry ammonia gas is passed over heated copper (II) Oxide in a combustion tube. **(2mks)**

(e) Give **two** uses of ammonia gas. **(1mk)**

3. (a) In a reaction to determine the rate of a reaction between magnesium ribbon and dilute hydrochloric acid 2g of magnesium ribbon were reacted with excess 2M hydrochloric acid. The volume of hydrogen gas evolved was recorded at regular intervals of one minute for eight minutes. The results are as shown in the table below.

Time (minutes)	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0
Volume of Hydrogen gas (cm^3)	95	160	210	237.5	260	272.5	275	275

(i) Plot the graph of time in minutes on the horizontal axis against volume of hydrogen gas on the vertical axis. **(3mks)**

(ii) Name the factor that was investigated in this experiment. **(1mk)**

(iii) Use the graph to determine the volume of hydrogen gas that was produced between 2¾ minute and 5.0 minutes. **(2mks)**

(iv) Explain the shape of the graph between minutes 7.0 and 8.0. **(2mks)**

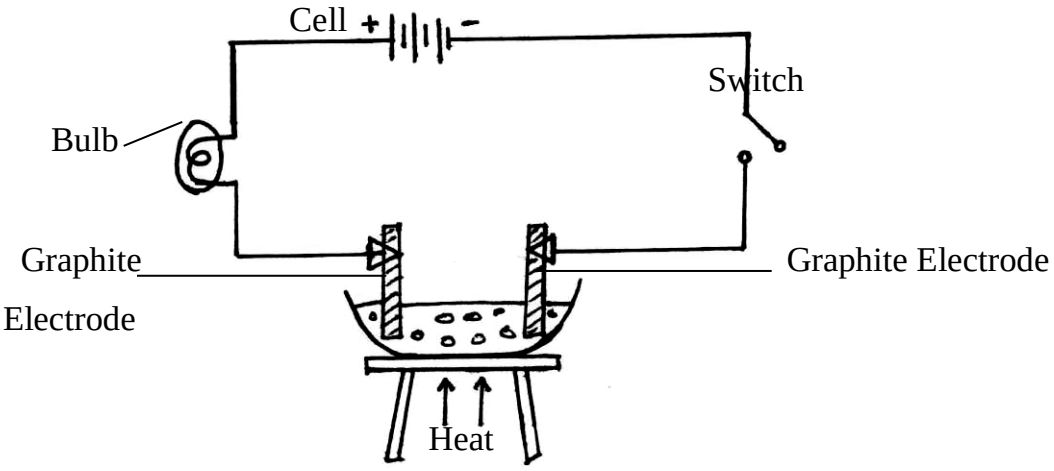
(b) Hydrogen gas reacts with chlorine gas to form hydrogen chloride gas as shown in the equation below.

$$H_{2(g)} + Cl_{(g)} \rightleftharpoons 2HCl_{(g)}$$

(i) Explain the effect on the yield of $HCl_{(g)}$ by lowering the pressure for this reaction. **(2mks)**

(ii) Using a well labeled diagram, describe how a solution of hydrogen chloride can be prepared in the laboratory. **(2mks)**

4. The diagram below shows a set up which was used by student to investigate effect of electricity on solid Molten Lead (II) Bromide. Study it and answer the questions that follow.



(a) (i) State and explain the observation at the anode when the switch is switched on. **(2mks)**

(ii) What precaution should be taken when carrying out this experiment? **(1mk)**

(iii) Write the equation of the reaction taking place at the Anode. **(1mk)**

(iv) Why are graphite electrodes used in the experiment? **(1mk)**

(v) On the diagram, indicate the direction of flow of electrons.

(vi) The students noted that the bulb only produced light after the Lead (II) Bromide had melted. Explain this observation. **(2mks)**

(b) State the difference in conduction of electric current between Molten Lead (II) Bromide and Lead Metal. **(1mk)**

(c) Explain why it is not advisable to store Copper (II) Sulphate solution in a can made of Zinc metal **(2mks)**

(d) State **two** applications of electrolysis. **(1mk)**

5. (a) What is meant by molar heat of solution? **(1mk)**

(b) The enthalpies of combustion of carbon, and carbon (II) oxide are indicated below.

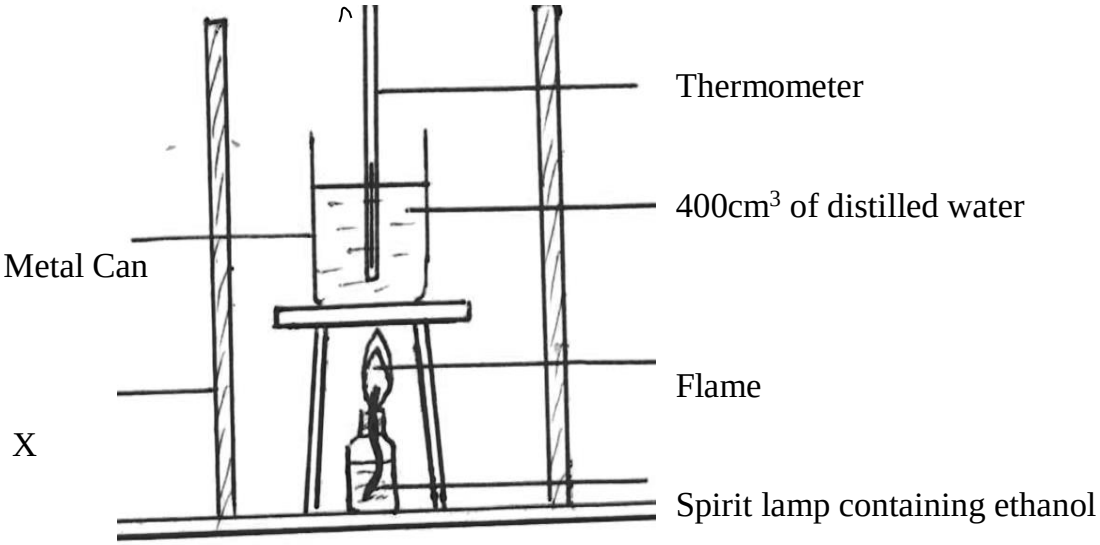
$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$: DH = 393 KJ mol^{-1}

$CO_{(g)} + O_{2(g)} \longrightarrow CO_{2(g)}$: DH = 283 KJ mol^{-1}

(i) Draw an energy level diagram that links the enthalpy of formation of Carbon (II) Oxide to enthalpies of combustion of carbon and Carbon (II) Oxide. **(2mks)**

(ii) Determine the enthalpy of formation of Carbon (II) Oxide. **(2mks)**

(c) The set up below was used by a student to determine the enthalpy of combustion of ethanol (CH_3CH_2OH). Study it and answer the questions that follow.



The following data was collected from the experiment:

Initial temperature of water	12^0C
Final temperature of water	22^0C
Initial mass of spirit lamp	11.42g
Final mass of spirit lamp	10.50g
Specific heat capacity of water	$4.20Jg^{-1}k^{-1}$

(i) What is the function of the part labeled X. **(1mk)**

(ii) Using the data above, calculate the change in heat of combustion of ethanol, assuming density of water is $1g/cm^3$. **(2mks)**

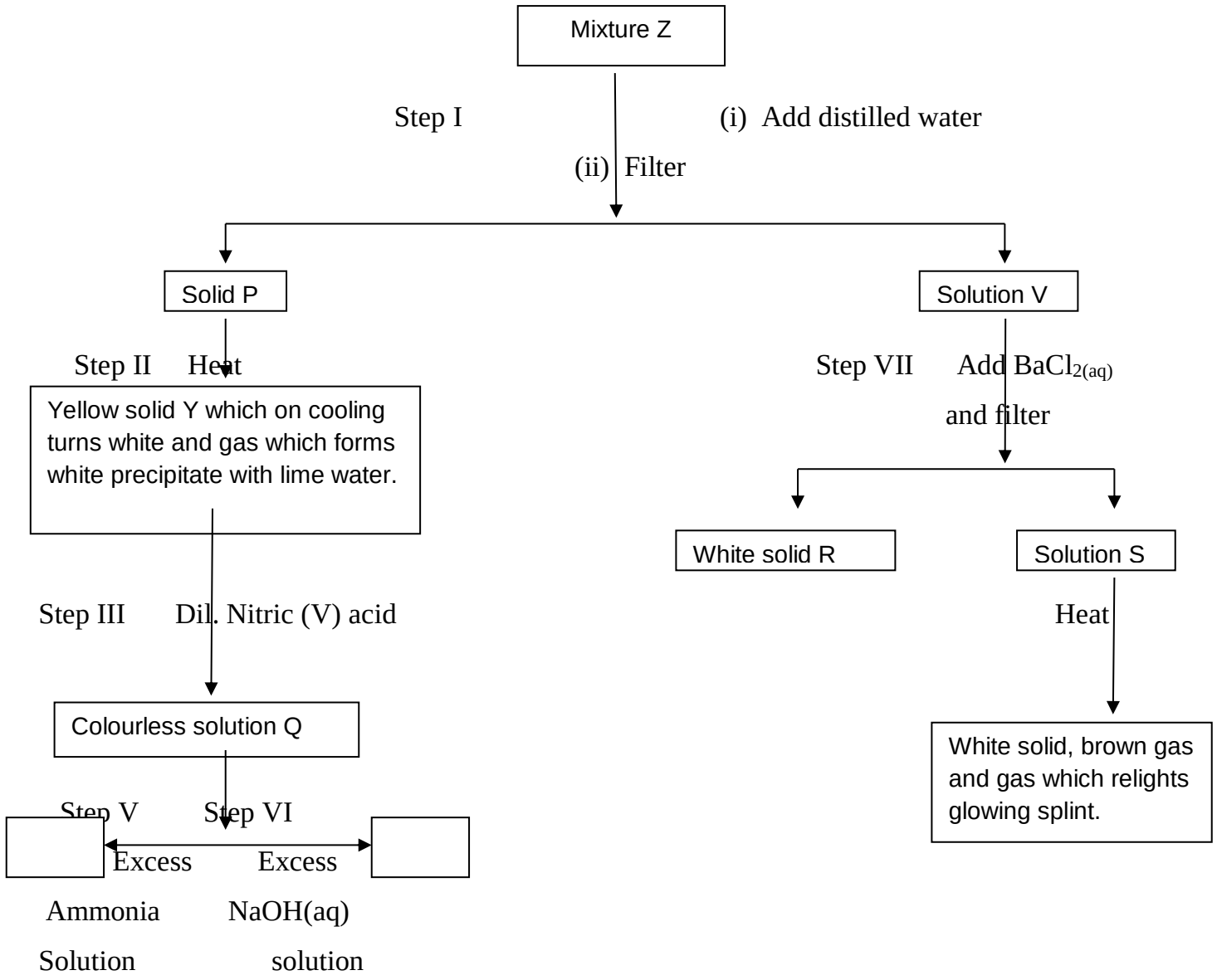
(iii) Calculate the molar heat of combustion of Ethanol (C = 12, O = 16, H = 1) **(2mks)**

(iv) Find the heating value of ethanol. **(2mks)**

(d) Give **<u>two</u>** precautions necessary when using fuels. **(1mk)**

6. (a) Starting with a solid sample of calcium carbonate, describe how a pure dry sample of calcium sulphate can be prepared in the laboratory. **(3mks)**

(b) The flow chart below shows a sequence of reactions involving a mixture of two salts, mixture **Z.** Study it and answer the questions that follow.



Write the formulae of the two salts present in mixture Z. **(2mks)**

(c) Write an ionic equation for the reaction in step VII. **(1mk)**

(d) State and explain the observation in Step (V) and (VI). **(3mks)**

(i) Step (V)

(ii) Step (VI)

(e) Write an equation showing the effect of heating a sample of anhydrous copper (II) suphate in a test tube. **(1mk)**

7. The grid below forms part of the Periodic Table. Use it to answer the questions that follow.

The letters do not represent the actual symbols of element.

A				**C**	**M**	**D**	**E**	**F**
	B		**H**	**I**		**J**	**K**	
	G							

(a) (i) What name is given to the group of elements where B and G belong? **(1mk)**

(ii) Select a letter which represents an element that gain electrons most readily. Give a reason for your answer. **(2mks)**

Explain why the atomic radius of K is smaller than its ionic radius. **(2mks)**

(iii) Using dots (•) and crosses(x) show the bonding between element G and M. **(2mks)**

(iv) A carbonate of element G react with dilute sulphuric (VI) acid at s.t.p to produce $0.4dm^3$ of gas. Determine the mass of G which was reacted with the acid. (Molar gas volume at s.t.p is $22.4dm^3$. (Relative atomic mass of G = 24 and C = 12, O = 16) **(2mks)**

(b) Explain why sodium chloride has melting point of 1074^0C whereas silicon tetrachloride has a melting point of 203^0C under the same conditions. **(2mks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 4

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

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

(ii) ***Sign*** *and write the* ***date*** *of examination in the spaces provided* ***above****.*

(iii) *Answer* ***ALL*** *the questions in the spaces provided.*

(iv) *Mathematical tables and silent electronic calculators* ***may be*** *used.*

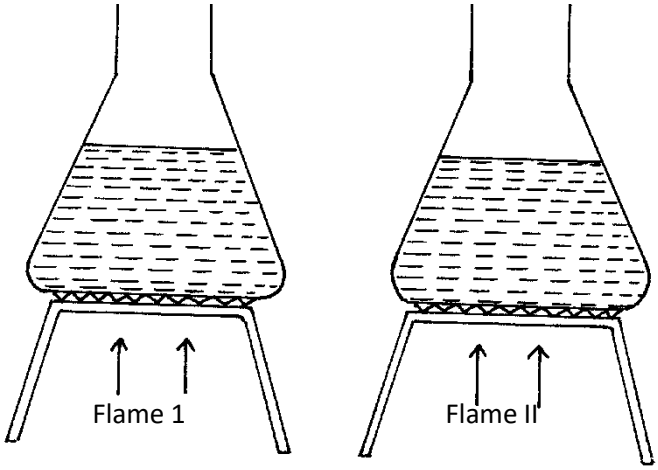
(v) *All working* ***must be*** *clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 –30	80	

*Answer **ALL** the questions in the spaces provided*

1. The samples of equal volumes of water were put in 100cm^3 conical flasks and heated for 5 minutes on a Bunsen flame. It was observed that sample 1 registered a low temperature than sample II

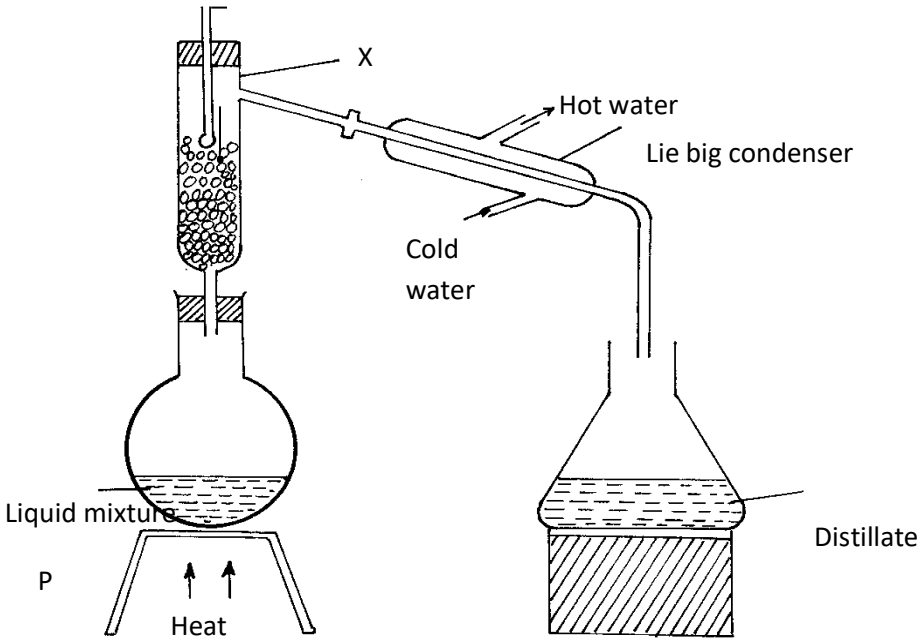


(a) Name flame I **(1mk)**

(b) State one disadvantage of using flame I for heating **(1mk)**

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

The diagram shows the method used to separate component of mixture P



(a) Name X **(1mk)**

(b) What is the name given to the method used in separation of mixture P **(½mk)**

(c) What would happen if the inlet and outlet of water were interchanged **(½mk)**

(d) Which physical property is used to separate mixture P **(1mk)**

3. The table below shows the solubility of three solids P, Q, and R.

Solid	Cold Water	Hot Water
P	soluble	soluble
Q	insoluble	insoluble
R	insoluble	soluble

How would you obtain pure samples of R,P and Q **(2mks)**

4. State why a water molecule H_2O can combine with H^+ ion to form H_3O^+ ion **(1mk)**

5. The P^H values of some solutions are given below

P^H	14.0	1.0	8.0	6.5	7.0
Solution	M	L	N	P	Z

(a) Identify the solution with the lowest concentration of hydrogen ion. Give reason for your answer **(1mk)**

(b) Which solution would be used as an anti-acid for treating stomach upset. Give for your answer **(1mk)**

6. The data below gives the electronic configuration of some selected atoms and ions

Atom/ion	A^{2+}	B	C^{2-}	D^{2+}	E	F^-	G^+	H
Electronic configuration	2	2.4	2.8	2.8.8	2.8	2.8.8	0	2.8.2

(a) Select an atom that is a noble gas **(1mk)**

(b) What is the atomic number of C and A **(1mk)**

(c) Select an element that belong to group 2 and period four **(1mk)**

(d) Write the formula of the compound formed when D and F react **(1mk)**

7. Helium is used instead of hydrogen in balloons for metrological research. Explain **(1mk)**

8. Zinc metal and hydrochloric acid reacts according to the following equation

$$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2\,(aq)} + H_{2\,(g)}$$

1.96g of Zinc metal were reacted with $100cm^3$ of 0.2M hydrochloric acid

a) Determine the reagent that was in excess **(2mks)**

Zn=65.2; Molar gas volume at s.t.p 22.4 liters

(b) Calculate the total volume of hydrogen gas that was liberated at s.t.p **(1mk)**

9. Give the IUPAC names of the following compounds **(1mk)**

(i) $CH_3CH_2CH_2CH(CH_3)CH_3$ ……

(ii) $CH_3CH=CHCl$…… **(1mk)**

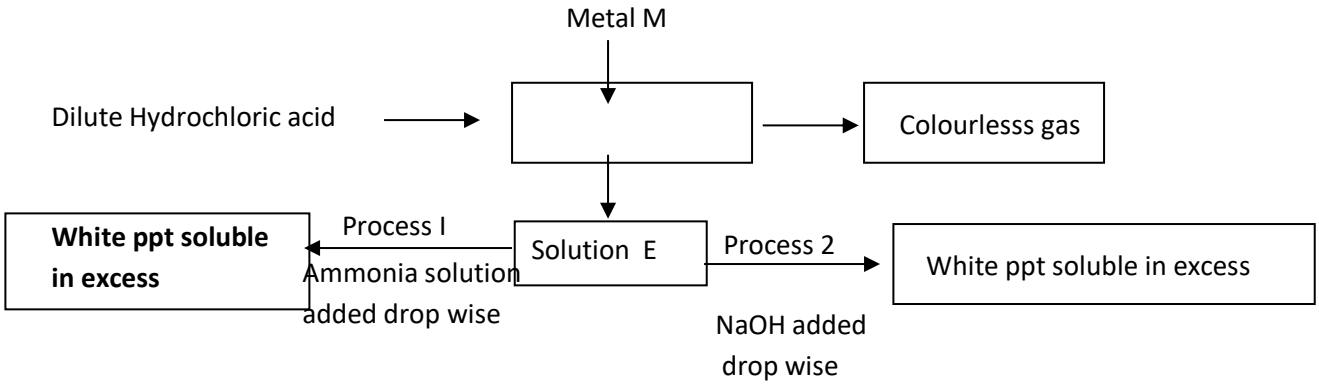
10. 0.9g of potassium chloride and potassium carbonate mixture completely reacted with 25cm^3 of 0.2M hydrochloric acid

(i) Write an equation of the reaction which takes place **(1mk)**

(ii) Determine the number of moles of the acid used **(1mk)**

(iii) Calculate the mass of potassium chloride in the mixture(**K=39.0; C=12.0; O=16.0**) **(2mks)**

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



(i) Identify metal **M:** …… **(1mk)**

(ii) Colourless gas: …… **(1mk)**

(iii) Write an equation that leads to the formation of white precipitate in process **(1mk)**

12. a) Define the term dynamic equilibrium **(1mk)**

b) A reaction at equilibrium can be represented as

$2CrO^{2-}_{4[aq]} + 2H^{+}[aq] \rightleftharpoons Cr_2O7\ ^{2}{}_{[}{}^{-}{}_{aq]} + H_2O_{\{l\}}$

Yellow **orange**

State and explain the observation made when NaOH is added to the equilibrium mixture **(2mks)**

13. Few drops of hydrochloric acid were added into a test tube containing lead {II} Nitrate solution

a) State one observation made **(1mk)**

b) Write an ionic equation of the reaction that occurred in the test tube **(1mk)**

14. A compound of carbon, hydrogen and oxygen contains 57.15% carbon, 4.76% hydrogen and the rest oxy gen. If its relative molecular mass is 126, find its molecular formula. **(C = 12, H = 1, O = 16)** **(3mks)**

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

Salt	Solubility g/100g of water	
	At 40°C	At 60°C
$CuSO_4$	28	38
$Pb(NO_3)_2$	79	98

A mixture containing 35g of $CuSO_4$ and 78g of $Pb(NO_3)_2$ in 100g of water at 60°C was cooled to 40°C.

i) Which salt crystallized out? Give a reason. **(2 marks)**

ii) Calculate the mass of the salt that crystallized out. **(1 mark)**

16. a)Distinguish between strong and concentrated acid **(1mk)**

b). A solution of ammonia in methylbenzene has no effects on red litmus paper while a solution of ammonia in water turns red litmus paper blue. Explain **(2mks)**

17. Name the process which takes place when

i. Iodine changes directly from solid to **gas** **(1mk)**

ii. $Fe^{2+}_{(aq)}$ changes to $Fe^{3+}_{(aq)}$ **(1mk)**

iii. White sugar changes to black when mixed with concentrated sulphuric (VI) acid **(1mk)**

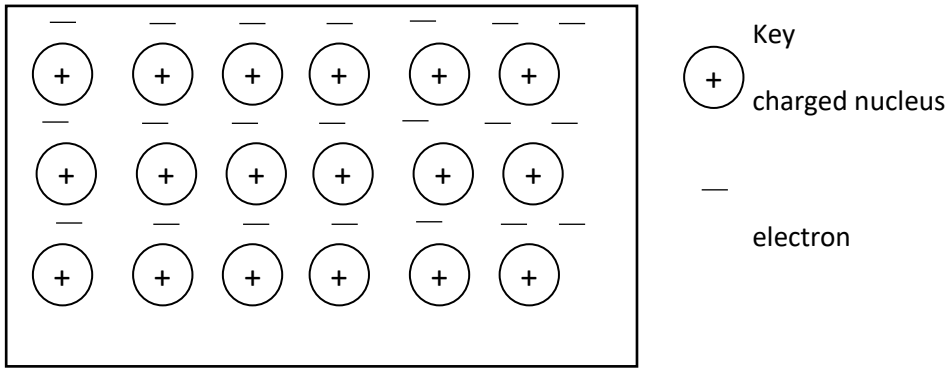
18. In the last stage of the solvay process, a mixture of sodium hydrogen carbonate and ammonium chloride is formed

a) State the method of separation **used** **(1mk)**

b) Write an equation showing how lime is **slaked** **(1mk)**

c) Name the by- product recycled in the above **process** **(1mk)**

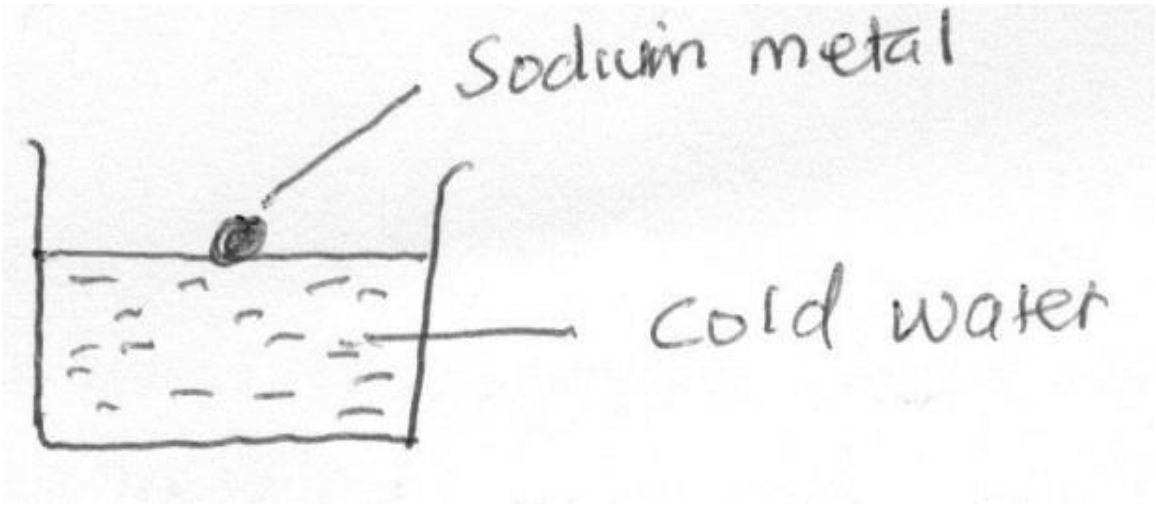
19. The diagram below is a section of a model of the structure of element K



a) State the type of bonding that exist in **K** **(1mk)**

b) In which group of the periodic table does element K belong. Give a **reason** **(2mks)**

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



a) State two observations made in the above experiment when sodium react with wate**r (2 mks)**

b) Write a chemical equation for the reaction that takes **place** **(1mk)**

21. (a)Explain why permanent hardness in water cannot be removed by boiling **(2mks)**

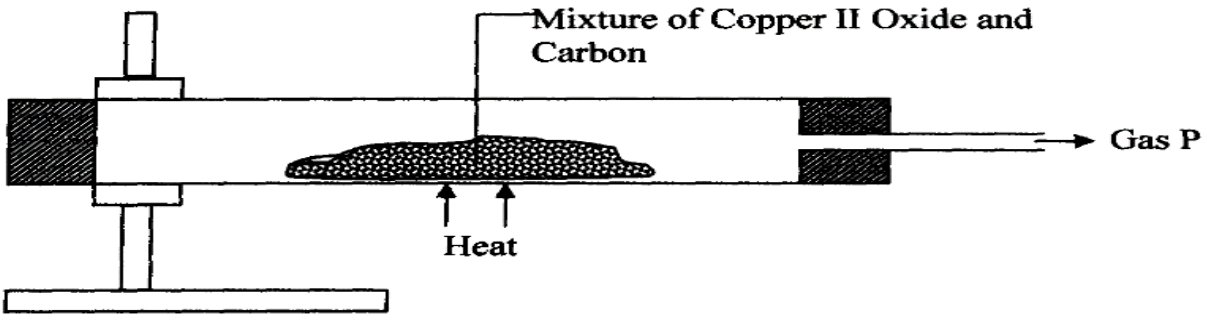
(b) Name two methods that can be used to remove permanent hardness from **water** **(1mk)**

22. Write an equation to show the effect of heat on the nitrate of: - **(2mks)**

i) Potassium

(ii) Silver

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



(a) State the observation made in the combustion tube. **(1mk)**

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

(c) Name gas **P** **(1mk)**

24. Sulphur exists in two crystalline forms.

a) Name **one** crystalline form of Sulphur. **(1mk)**

b) State **two** uses of Sulphur. **(2mks)**

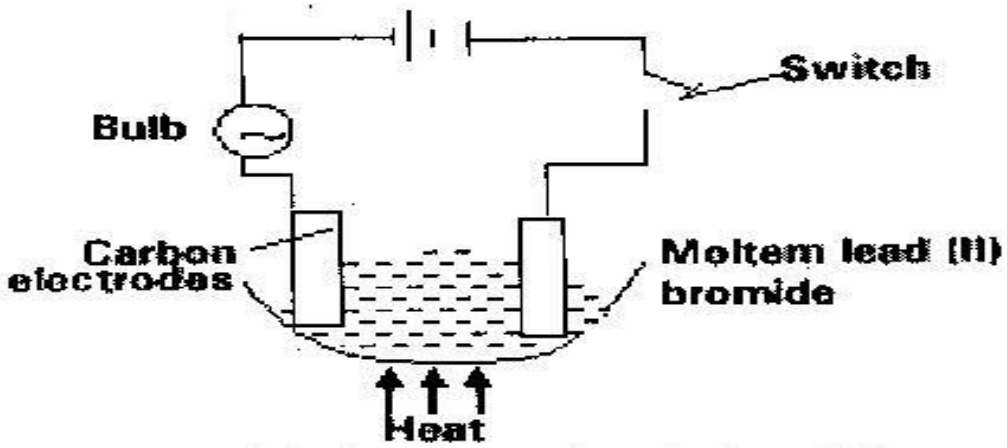
25. Bond energies for some bonds are tabulated below: -

BOND	BOND ENERGY KJ/mol
H – H	436
C = C	610
C- H	410
C – C	345

Use the bond energies to estimate the enthalpy for the reaction. **(3mks)**

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

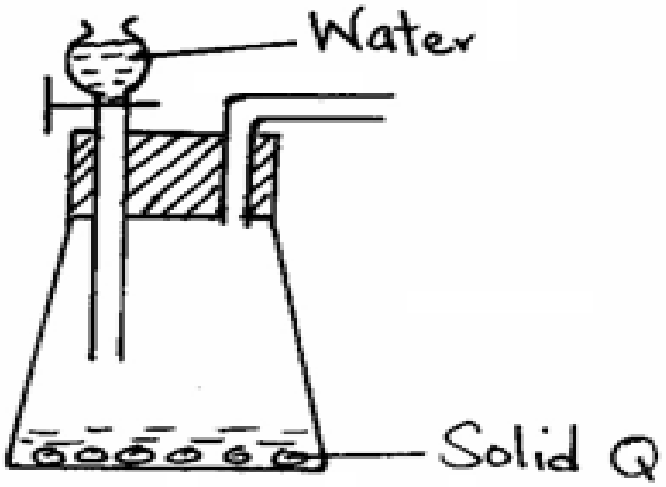
26. Study the set up below and answer the questions that flows



State all the observations that would be made when the circuit is **completed** **(3mks)**

27. Describe how solid samples of salts can be obtained from a mixture of lead (II) chloride, sodium chloride and ammonium chloride. **(3mks)**

28. The diagram below represents a set-up used to prepare oxygen gas.



(a) Name substance Q. **(1mk)**

(b) Complete the set-up to show how oxygen gas is collected. **(1mk)**

(c) Write the equation for the reaction that occur. **(1mk)**

29. Two reagents that can be used to prepare chlorine gas are potassium manganate (VII) and hydrochloric acid.

(a) Write an equation for the reaction. **(1mk)**

b) Give the formula of another reagent that can be used instead of potassium manganate (VII). **(1mk**

(c) Using an equation illustrate how chlorine bleach coloured substances. **(2mks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 4

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

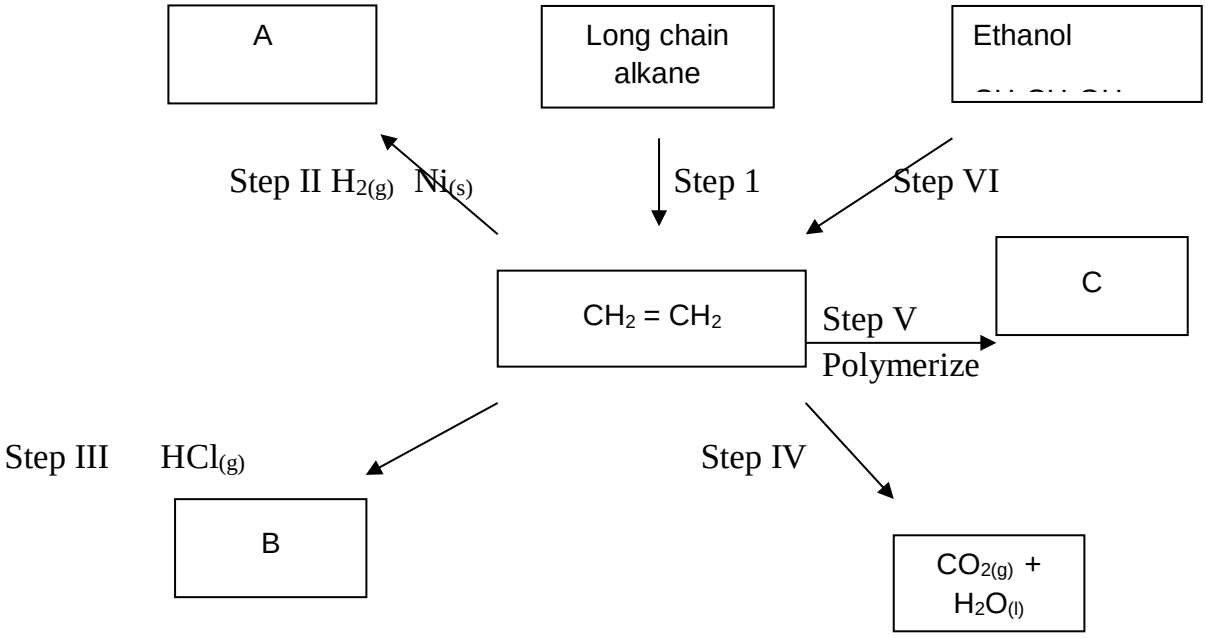
1) *Write your **Name, Admission Number** and **School** in the spaces provided above.*
2) *Answer **all** the questions in the spaces provided after each question.*
3) *Mathematical tables and non-programmable electronic calculators may be used.*
4) ***ALL** working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1	12	
2	12	
3	10	
4	11	
5	14	
6	10	
7	11	
TOTAL	**80**	

*Answer **all** the questions*

1. (a) Study the flow chart below and answer the questions that follow.



(i) Name the process taking place in step (I). **(1mark)**

(ii) Describe a chemical test that can be carried out to show the identity of organic compound A.

(2marks)

(iii) Give the name of the following: **(2marks)**

I. A:……

II. B:……

(iv) Give the structural formulae of substance C. **(1mark)**

(v) Name the type of reaction that occurs in:

I. Step IV **(2marks)**

II. Step VI:

(vi) Give the reagent and the condition necessary for step VI. **(2marks)**

Reagent:……

Condition:……

(c) Give the systematic names of the following compounds:

I. $CH_2CHCHCH_2CH_3$ **(1mark)**

II. $CH\ C\ CH_3$ **(1mark)**

2. a) The results below were obtained in an experiment conducted by form 3 students from Tigityo Secondary school using Magnesium.

- Mass of the crucible + lid = 19.52g
- Mass of the crucible + lid + Magnesium Ribbon = 20.36g
- Mass of the crucible + lid + Magnesium oxide = 20.92g

(i) Use the results to find the percentage mass of Magnesium & Oxygen in Magnesium oxide **(2 marks)**

(ii) Determine the empirical formula of magnesium oxide. (Mg=24.0,O=16.0) **(3 marks)**

b) Sodium hydroxide pellets were accidentally mixed with sodium chloride 8.8g of the mixture were dissolved in water to make one litre of solution. 50cm^3 of the solution was neutralised by 20cm^3 of 0.25M sulphuric acid.

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

(ii) Calculate the:

I. number of moles of the substance that reacted with sulphuric acid. **(2 marks)**

II. number of moles of the substance that would react with sulphuric acid in the one litre solution **(2 marks)**

(iii) the percentage of sodium chloride in the mixture. **(2 marks)**

(H=1.0; Na=23.0; Cl=35.5; O=16.0)

3. a) Study the table below and answer the questions that follow

Bond type	bond energy $kJmol^{-1}$
C-C	346
C = C	610
C-H	413
C-Br	280
Br-Br	193

i) Calculate the enthalpy change for the following reaction **(3 marks)**

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

ii) Name the type of reaction that took place in (a) above **(1mark)**

b) Butane C_4H_{10} cannot be prepared directly from its elements but its standard heat of formation (ΔH_f^θ) can be obtained indirectly.

The following heats of combustion are given.

ΔH_C^θ (Carbon) = -393kJ/mol

ΔH_C^θ (Hydrogen) = -286kJ/mol

ΔH_C^θ (Butane) =-2877kJ/mol

i. Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion and the heat of combustion of its constituents elements. **(1mark)**

ii. Calculate the heat of formation of butane ΔH_f^θ (C_4H_{10}) **(2marks)**

c) Given that the lattice enthalpy of potassium chloride is +690kJ/mol and hydration enthalpies of K^+ and Cl^- are -322kJ and -364kJ respectively. Calculate the enthalpy of solution of potassium chloride. **(3 marks)**

4. (a) Name two apparatuses that can be used for determining accurate volume in a laboratory **(2marks)**

(b) One of the flames produced by Bunsen burner is the luminous flame

i) Explain why this flame is very bright **(1mark)**

ii) State two disadvantages of the luminous flame **(2marks)**

(c) Air is usually one of the substances that is considered as a mixture

(i) Identify the two most abundant component of air **(2marks)**

(ii) Give two reasons why the air is considered as a mixture **(2marks)**

(iii) One of the components of air is carbon (iv) oxide. Describe an experiment that can be used to prove the presence of carbon (iv) oxide in the air **(2marks)**

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

P				T	V	W	Y	M
	Q		S	U		X		
	R						Z	

a) Write the general name given to the element P belong. **(1mark)**

b) An element N has an atomic number of 15. Write down its electronic arrangement and hence fix it in its right position on the grid above. **(2marks)**

Electronic arrangement **……**

c) Compare the size of the atom of R and that of its ion. Explain your answer. **(2marks)**

d) Give the formula of the compound formed between **(1mark)**

i. P and W ……

ii. T and Y ……..

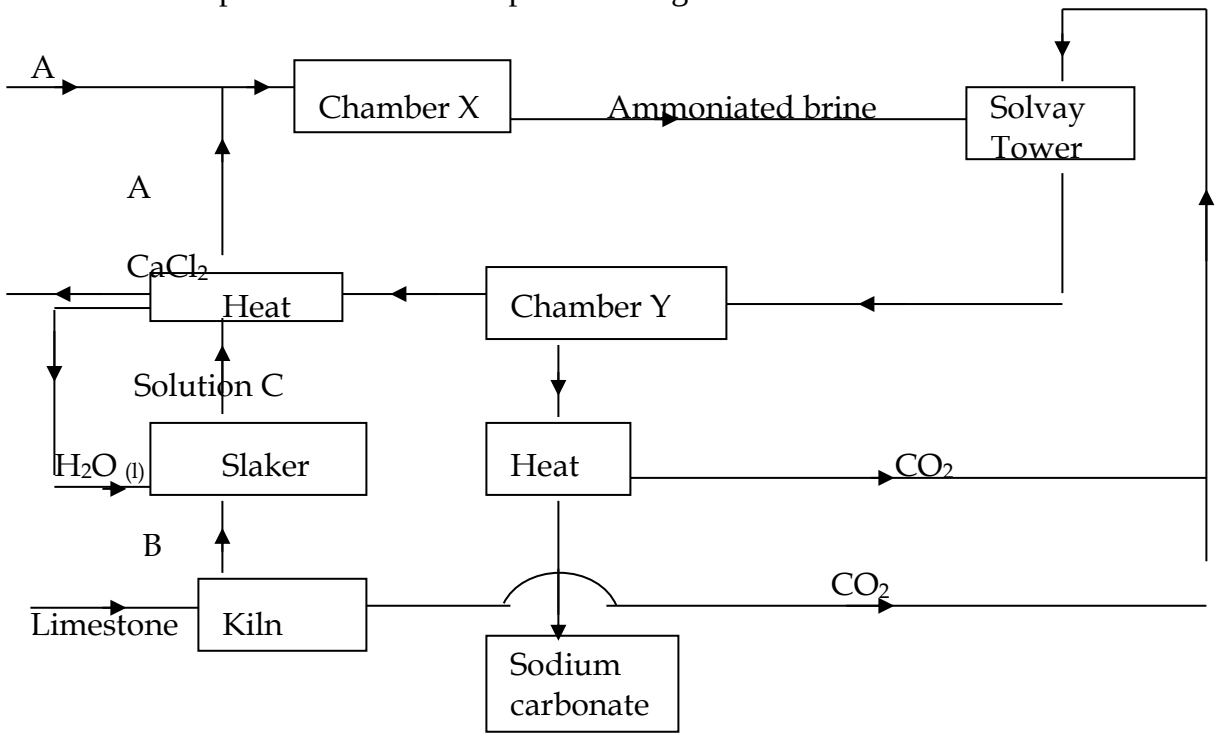
e) Compare the melting points of element Q and S. Explain **(2marks)**

f) State the least reactive element in the grid. Give a reason for your answer **(2marks)**

g) Give two advantages that element S has over element Q in making electric cables **(2mks)**

h) Draw (a) dot (.) and cross (x) diagram to represent the bonding in compound formed between T and Y **(2 marks)**

6. The chart below represents the main steps in the large-scale manufacture of sodium carbonate.



(a) Name substances A and B.

A …… **(1 mark)**

B …… **(1 mark)**

(b) Write down the chemical equation leading to formation of C. **(1 mark)**

(c) A stream of cold water is made to circulate around chamber X. What does this suggest about the reaction taking place. **(1 mark)**

(d) Name the process that takes place in chamber Y. **(1 mark)**

(e) State any 2 by-products recycled in the process. **(2 marks)**

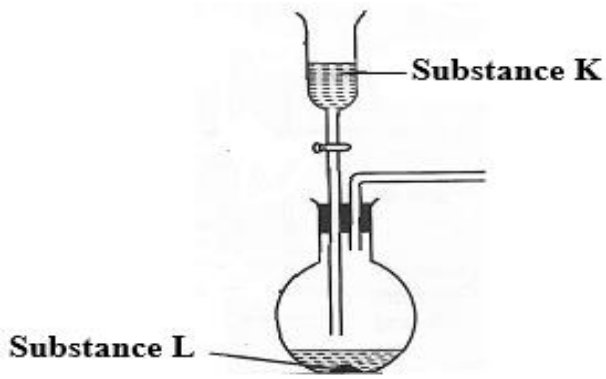
(f) In an experiment, wood charcoal was mixed with concentrated sulhuric (VI) acid in a test-tube. The mixture was then placed over a Bunsen-burner flame for sometime.

(i) Write down the chemical equation of the reaction that takes place. **(1 mark)**

(ii) State the property of concentrated sulphuric (VI) acid investigated in (i) above. **(1 mark)**

(g) Mention any 2 uses of sodium carbonate. **(1 mark)**

7. The set-up below can be used to generate a gas.



(a) (i) Complete the table below giving the names of substance **K** and **L** if the gases generated are carbon (IV) oxide and carbon (II) oxide. **(2marks)**

Substance	Carbon (IV) oxide	Carbon (II) oxide
K		
L		

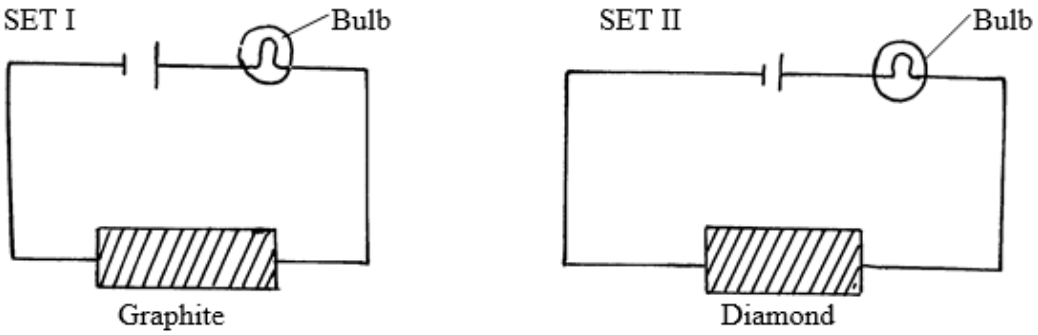
(ii) Complete the diagram to show how a sample of carbon (II) oxide can be collected. **(2marks)**

(iii) State two ways that can be used to distinguish carbon (IV) oxide from carbon (II) oxide? **(2 marks)**

(b) (i) In an experiment, carbon (IV) oxide gas was passed over heated charcoal held in a combustion tube. Write a chemical equation for the reaction that took place in the combustion tube. **(1 mark)**

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

(c) The following set ups were used by Form Two students. Study and use them to answer the questions that follow.



State and explain the difference in observation made in set up I and II above. **(3 marks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 5

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

- *Write your name, admission number, date and school in the spaces provided.*
- *Answer all the questions in the spaces provided.*
- *All working must be clearly shown where necessary.*
- *Scientific calculators may be used.*

FOR EXAMINERS' USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 29	80	

1. State **two** laboratory rules that should be followed to avoid contamination and wastage of chemicals. **(2 marks)**

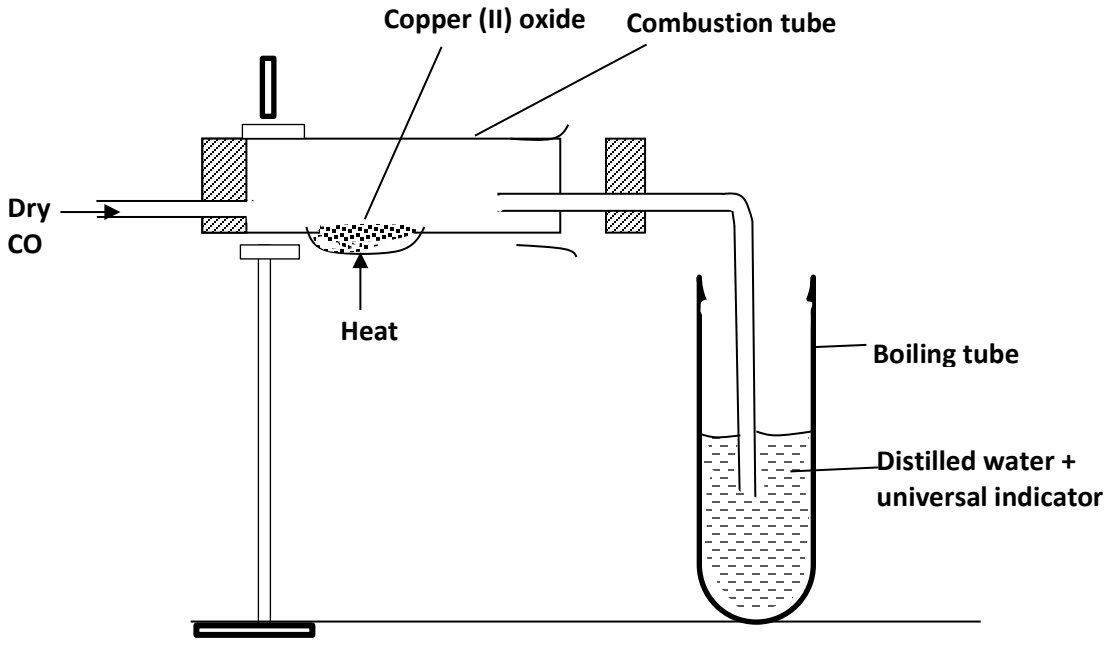
2. **(a)**Give **one** reason some of the laboratory apparatus are made of ceramics. **(1 mark)**

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

3. Draw the procedural set-ups that can be used to separate a mixture of sand and calcium chloride to obtain crystals of calcium chloride. **(3 marks)**

4. State **two** applications of chromatography. **(2 marks)**

5.



The above set-up was used to determine the chemical properties of carbon (II) oxide.

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

(b) State and explain the observation made in the boiling tube. **(2 marks)**

6. A student placed some hydrogen peroxide in a test tube then added a small amount of manganese (IV) oxide. A glowing splint was then brought near the mouth of the tube.

(a) State the observation made on the glowing splint. **(1 mark)**

(b) What is the role of the manganese (IV) oxide? **(1 mark)**

(c) Give **one** use of the gas produced. **(1 mark)**

7. **An** organic compound with formular C_4H_8 , has isomers. Draw and name two possible structural isomers of the compound. **(3 marks)**

8. Explain how the compound C_4H_8 and C_4H_{10} can be distinguished using bromine water. **(2 mks)**

9. (a) Chlorine can be prepared in the laboratory by using the following reagents and chemicals. Concentrated sulphuric (VI) acid, water, manganese (IV) oxide, concentrated hydrochloric acid.

(i) State the role of concentrated sulphuric (VI) acid. **(1 mark)**

(ii) Write the equation for formation of chlorine. **(1 mark)**

(iii) What is the role of manganese (IV) oxide? **(1 mark)**

10.(a) State Boyle's law. **(1 mark)**

(b) A gas occupies 270cm^3 at a pressure of 660mmHg at 37^{0}C. What is the new volume if pressure is changed to 810 mmHg at 63^0 C? **(2 marks)**

11. An organic compound contains 24.24% carbon, 4.04% hydrogen and the rest chlorine. If its relative molecular mass is 99, what is its molecular formula? **(3 marks)**
(C = 12, H = 1, Cl = 35.5)

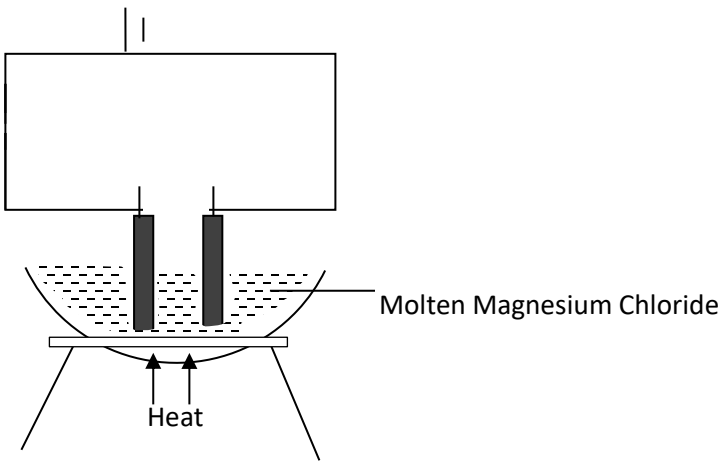
12. A given mass of sodium nitrate was heated completely and 320 cm^3 of the gas was produced at s.t.p. Determine the mass of the sodium nitrate heated. (Na = 23. N = 14, O = 16, molar gas volume = 22.4L) **(3 marks)**

13.(a) Give **one** advantage of using methyl orange over phenolphthalein as an indicator. **(1 mark)**

(b) Three drops of litmus solution was added to 20 cm^3 of 2M hydrochloric acid in a beaker followed by 20 cm^3 of 2M ammonium hydroxide. State and explain the observation made. **(2 marks)**

14. A tea farmer suspects that her farm had turned acidic. She obtained a soil sample to analyze for pH. Give her the procedure to follow in order to verify this. **(2 marks)**

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



(a) Define electrolysis. **(1 mark)**

(b) On the diagram, label the Anode and Cathode. **(2 marks)**

(c) Write the equation at the anode. **(1 mark)**

16. In order to find the proportion by volume of gases in air, a sample of air was passed through two wash bottles, the first containing sodium hydroxide solution and the second containing concentrated sulphuric (VI) acid. The remaining gas was then collected in a syringe.

(a) Why was the air passed through;

(i) sodium hydroxide solution? **(1 mark)**

(ii) concentrated sulphuric (VI) acid? **(1 mark)**

(b) Name the major gas collected in the syringe. **(1 mark)**

17. During the manufacture of sodium carbonate in the industry.

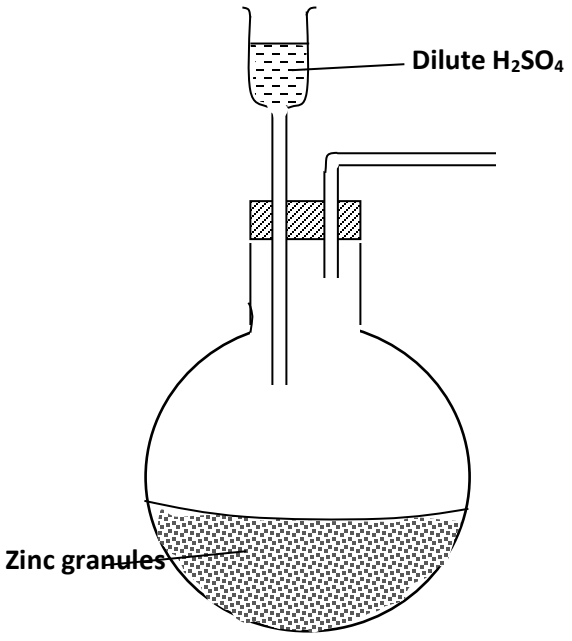
(a) Give the name of the process to manufacture sodium carbonate. **(1 mark)**

(b) Write the final equation for the formation of sodium carbonate during the process. **(1 mark)**

(c) Give **one** use of sodium carbonate. **(1 mark)**

18. Describe how to prepare crystal of magnesium sulphate starting with magnesium powder. **(3 marks)**

19.(a) Complete the diagram below to show how dry sample of hydrogen gas is prepared in the laboratory. **(2 marks)**



(b) Name the catalyst which could be used to increase the reaction rate of production of hydrogen gas in the set up drawn above. **(1 mark)**

20. An element consists of two isotopes with atomic masses 59 and 61 in the ratio of 3 : 2 respectively.

(a) What are isotopes? **(1 mark)**

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

21. An element: $^{24}_{12}R$

(a) To which chemical family does it belong? **(1 mark)**

(b) Write the electron arrangement of the atom. **(1 mark)**

(c) Draw the structure of its ion. **(1 mark)**

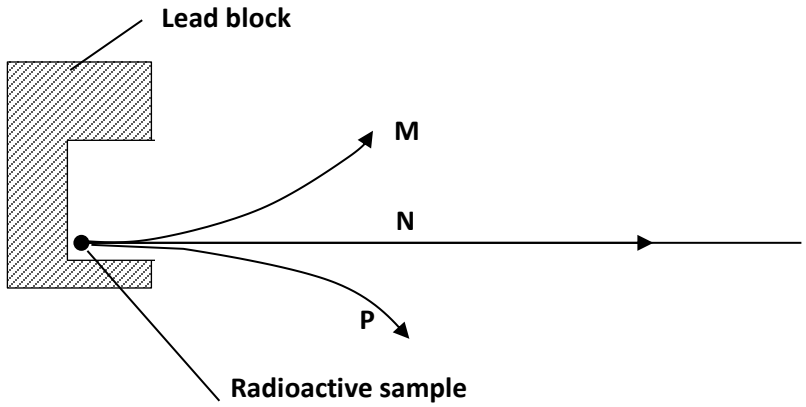
22. Given the bond energies.

H – Cl	431kJ/mole
H – H	435kJ/mole
Cl – Cl	243kJ/mole

(a) Calculate the enthalpy change for the formation of hydrogen chloride gas when chlorine and hydrogen react. **(2 marks)**

(b) Sketch the energy level diagram for the reaction. **(1 mark)**

23. The diagram below shows the radiations emitted by a radioactive sample.



Name the radiations; **(3 marks)**

P - ……

M - ……

N - ……

24. Calculate the enthalpy of formation of ethanol given the enthalpies of;

combustion of ethanol = -1369 kJ/mole

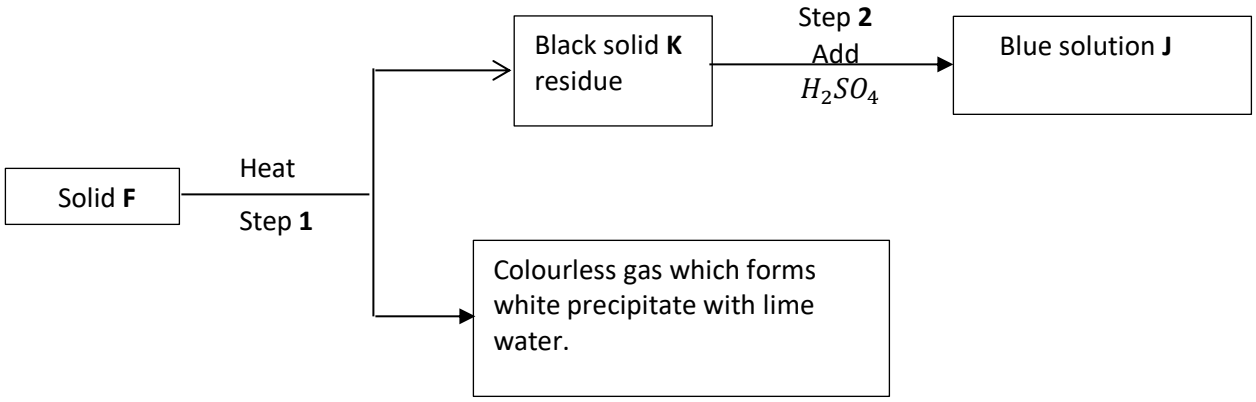
combustion of carbon = -394kJ/mole

combustion of hydrogen = -286kJ/mole **(3 marks)**

25.(a) State what is observed when sodium hydroxide pellets are left in air overnight. **(1 mark)**

(b) What name is given the process shown by the salt in (a) above? **(1 mark)**

26. Given;



(a) Identify;

Solid **F** - **…….(1 mark)**

Solid **J** - **…….. (1 mark)**

(b) Write equation for step **1**. **(1 mark)**

27. A saturated solution of sodium nitrate in water was made at 30^0C. Use the information below to answer the questions that follow.

Mass of evaporating dish = 52.5g

Mass of evaporating dish + salt solution = 119.6g

Mass of evaporating dish + dry salt = 59.3g

(a) What is solubility? **(1 mark)**

(b) Determine the solubility of sodium nitrate at 30^0C. **(2 marks)**

28. Use dot (•) and cross (**X**) to show the bonding in Lithium oxide. **(1 mark)**

29. Excess magnesium ribbon was burnt in air to form a white solid mixture. Write two equations to show the formation of the white solid mixture. **(2 marks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 5

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

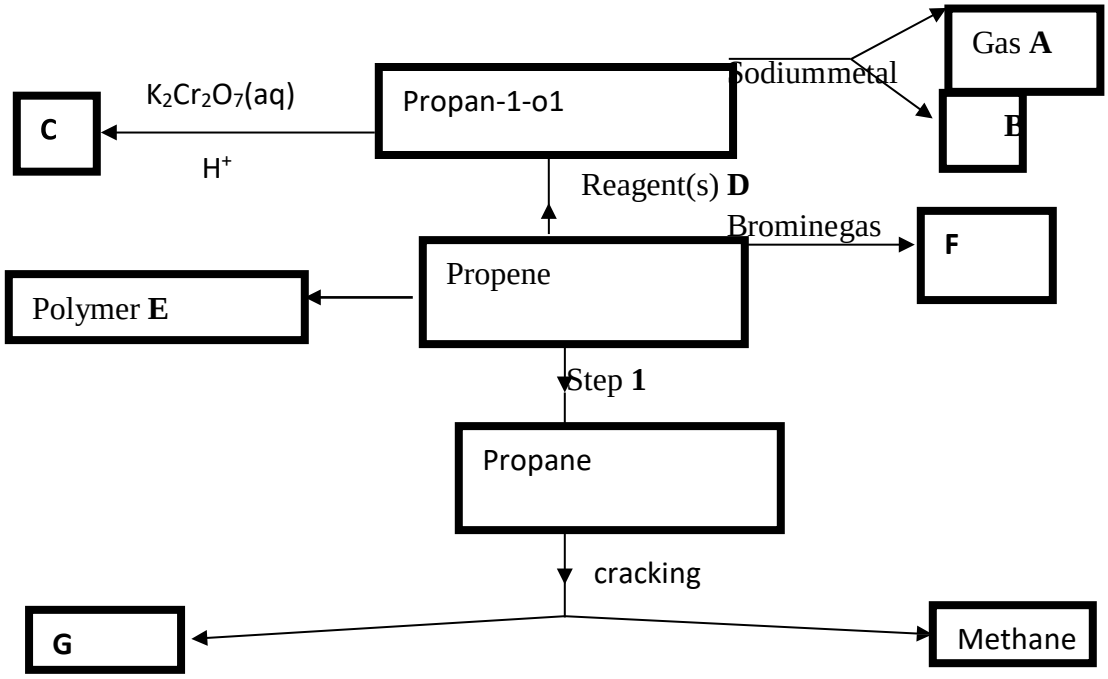
INSTRUCTIONS TO CANDIDATES

a) *Write your name, school and index number in the spaces provided above.*
b) *Sign and write date of examination in the spaces provided above.*
c) *Answer **ALL** questions in the spaces provided.*
d) *Mathematical tables and silent electronic calculators may be used.*
e) *All workings **MUST** be clearly shown where necessary.*

Questions	Maximum Score	andidate's Score
1	14	
2	14	
3	11	
4	14	
5	16	
6	11	
TOTAL	80	

QUESTIONS

1. The scheme below shows a series of reactions and compounds. Study it and use it to answer the questions that follow.



(a) Identify the following compounds and products **(6marks)**

A……

B……

C……

E……

F……

G……

(b) State 2 conditions for **step 1** to occur. **(1 mark)**

(c) Write an equation for the formation compound **F.** **(1 mark)**

(d) Identify reagent(s) **D.** **(1 mark)**

(e) State one industrial use of methane. **(1 mark)**

(f) Name the following organic compounds**.** **(3 marks)**

(i) **C_3H_4**

(ii) **$CH_3CH_2\ CH_2\ CH\ CH_2\ CH_3$**

OH

(iii) **$CH_2 = C – CH_3$**

| |

CH_3

(g) Draw the structure of a section of polymer E showing three repeat units. **(1 mark).**

2. The table below shows the elements in perid 3 of the periodic table. Study it and answer the questions that follow.

Element	Na	Mg	Al	Si	P	S	Cl	Ar

(a) Write the formulae of two oxides for each of the following**:** **(2 marks)**

(i) **Sodium: Oxide I ……………………………………….**

(ii) Oxide II …………………………..

(ii) Sulphur: Oxide I ……………………………………. Oxide II …………………………..

(b) The products of the reaction between phosphorus and chlorine depend on the conditions used. Write the equation for the reaction when phosphorus reacts with limited phosphorus. **(1 mark)**

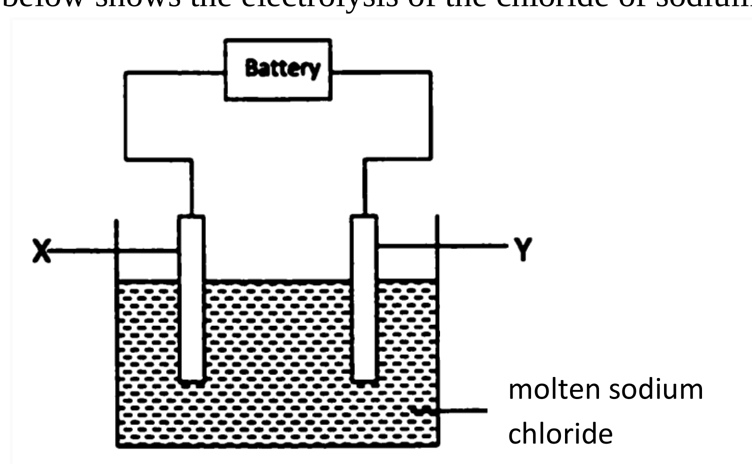
(c) Identify the most electronegative element. Give a reason. **(2 marks)**

(d) State and explain the differences in the boiling points of:

(i) Magnesium oxide and sulphur (IV) oxide**.** **(2 marks)**

(ii) Sulphur and phosphorus. **(2 marks)**

(e) The diagram below shows the electrolysis of the chloride of sodium.



(a) On the diagram, indicate the missing condition. **(1 mark)**

(b) During the electrolysis, chlorine gas was formed at electrode Y. Identify the:

(i) Anode**…………………………………………………………………….** **(1 mark)**

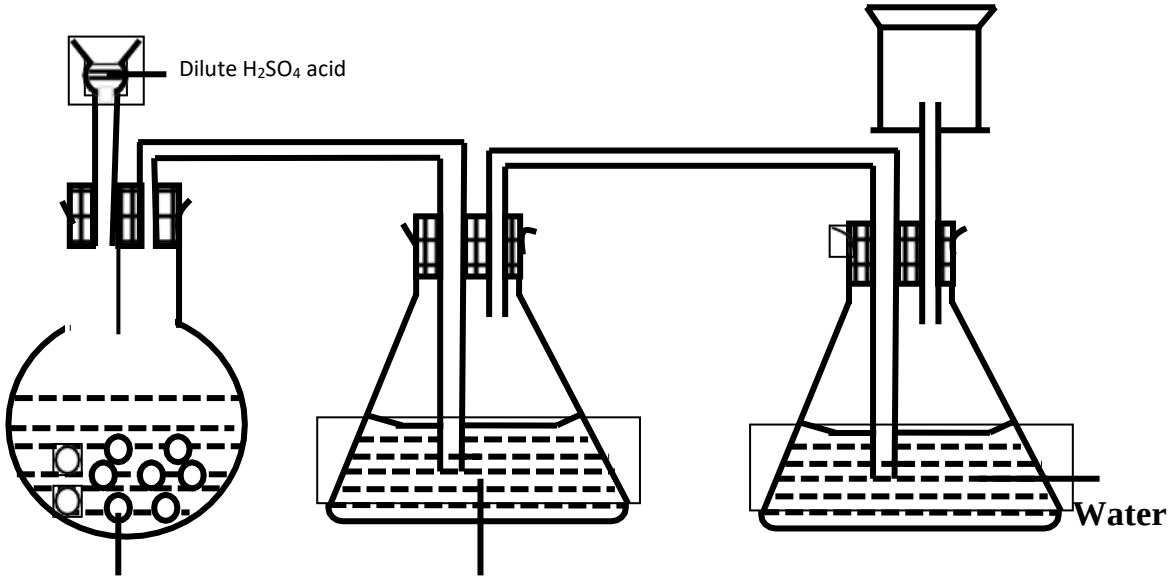
(ii)Cathode………………………………………………………………….. (1 mark)

(c) Write the half equation for the reaction taking place at the:

(i) Anode. **(1 mark)**

(ii) Cathode. **(1 mark)**

3. A student set up the apparatus shown below to prepare and collect dry carbon (IV) oxide gas.

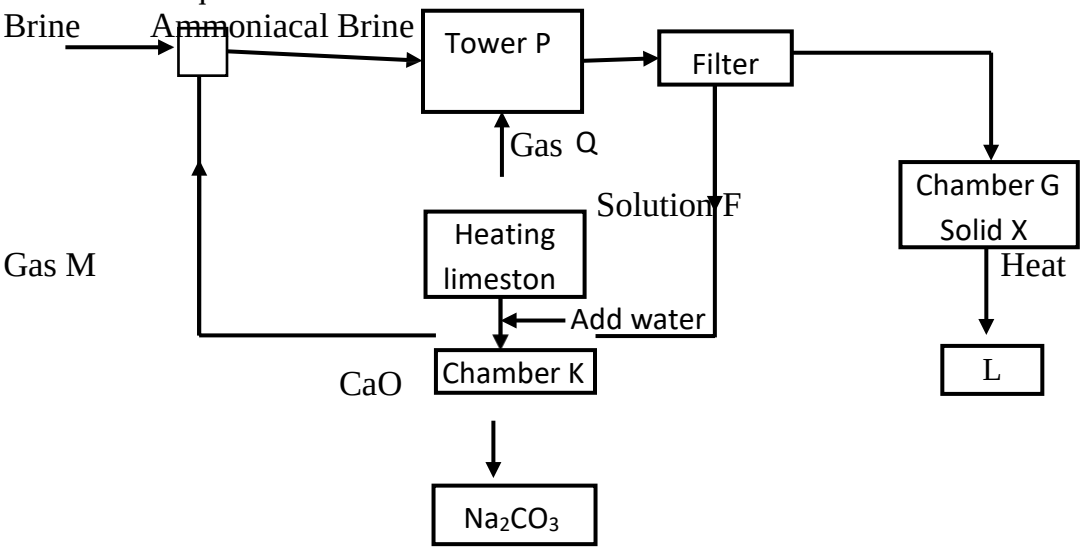


Calcium carbonate ***Concentrated sulphuric (VI) acid***

(a) State a correction for three mistakes in the set up above **(3 marks)**

(b) Give two reasons why carbon (IV) oxide is used as a fire extinguisher **(1 mark)**

(c) The flow chart below is for the manufacture of sodium carbonate by the Solvay process. Use it toanswer the questions that follow



(i) Name:

Gas M …… Gas Q……(1 mark)

Solution F …… Solid X……(1 mark)

(ii) Name the product L formed and give one of its uses. **(2 marks)**

Name: ……

Use: ……

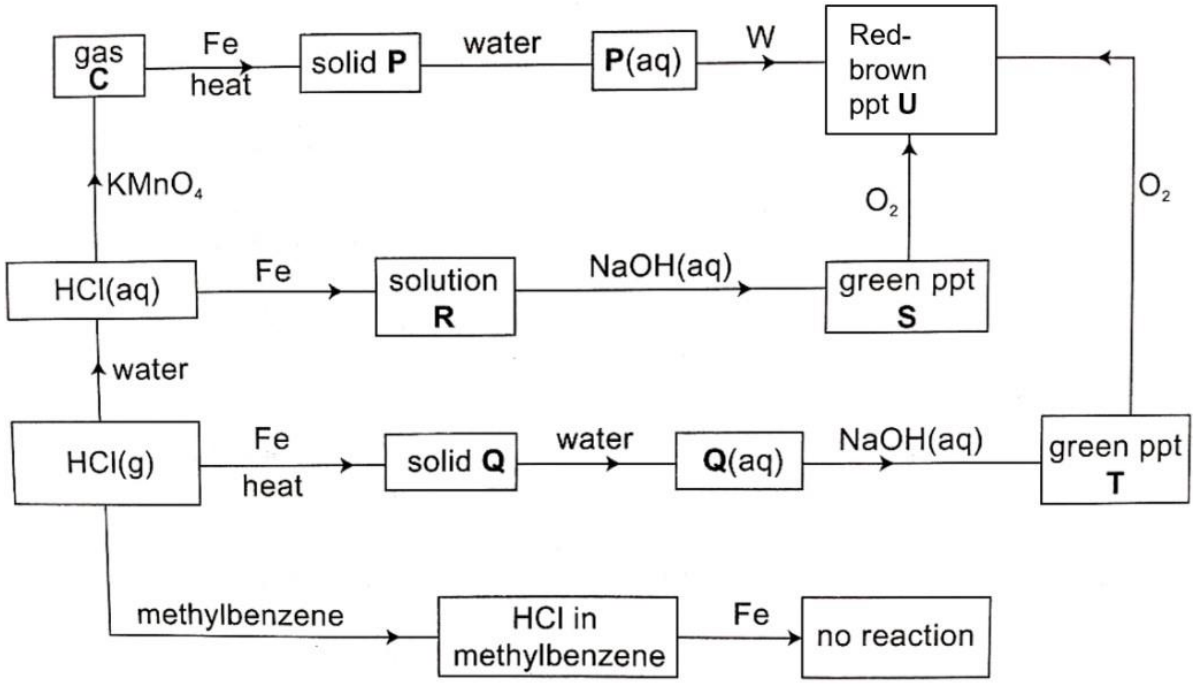
(iii) Write equations of the reactions in**:** **(2 marks)**

Tower P (Overall equation)

Chamber K

(v) Name the two raw materials required in the manufacture of sodium carbonate **(1 mark)**

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



(a) Identify:

(i) Gas C …… (½ mark)

(ii) Solid Q …….. (½ mark)

(iii) Solid P …… (½ mark)

(b) From the flow chart, give two solutions that contain the same metallic ions**.** **(1 mark)**

(c) Give two precipitates in the flow chart that are the same and name them**.** **(3 marks)**

Precipitates: **Name:**

(d) Explain the difference between HCl (g) in water and in methylbenzene as shown in the flow chart. **(2 marks)**

(e) Name reagent W. **(½ mark)**

(f) Write the equations for:

(i) The formation of solid P**.** **(1 mark)**

(ii) The formation of solid Q. **(1 mark)**

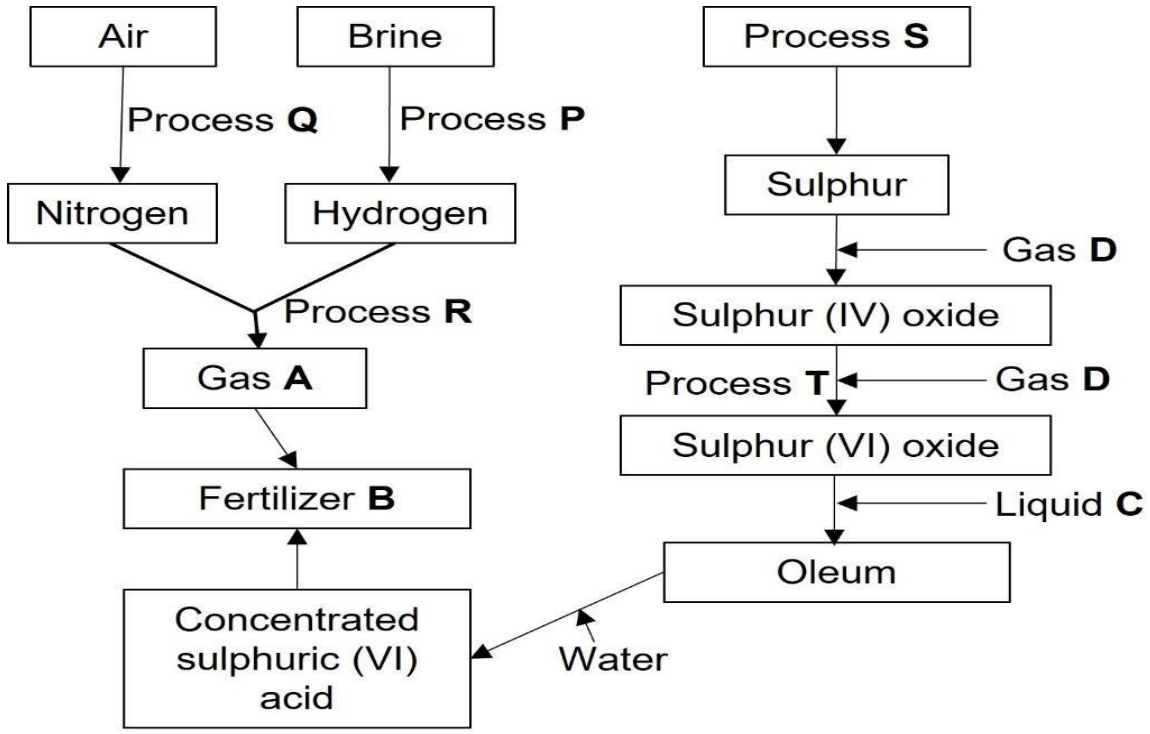
(g) In the preparation of a bleaching agent (sodium hypochlorite), excess chlorine gas was bubbled into15 litres of cold 2M sodium hydroxide.

(i) Write the equation for the reaction between chlorine gas and cold dilute sodium hydroxide.

(1 mark)

(ii) Calculate the mass in **kilograms** of sodium hypochlorite produced. (Na = 23.0, Cl = 35.5, O = 16.0) **(3 marks)**

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



(a) Name the following: **(3 marks)**

(i) Process **Q** …….

(ii) Process **R** ……..

(iii) Process **S** ……..

(iv) Process **T** ……..

(v) Gas **A** ……

(vi)Fertilizer **B** ……

(b) Why is liquid C used instead of water **(1 mark)**

(c) Write the formula of oleum. **(1 mark)**

(d) Write the equation for the formation of:

(i) fertilizer **B**. **(1 mark)**

(ii) gas **A**. **(1 mark)**

(e) Name the **catalyst** and give the **conditions** for:

(i) Process **R**. **(3 marks)**

Catalyst ……

Conditions ……

(ii) Process **T**. **(3 marks)**

Catalyst ……

Conditions ……

(h) Explain how nitrogen is obtained from air using process **Q**. **(3 marks)**

6. The following is a procedure that was used to obtain the solubility of a salt **Q** in water at 25^0C. Studyit and answer the questions that follow.

Salt **Q** was dissolved in warm distilled water until no more could dissolve. The mixture was then cooled to 25^0C and allowed to settle. A dry evaporating dish and dry watch glass were weighed. Some of the solution was decanted into the dish, covered with the watch glass, and then weighed.

The solution was evaporated to dryness over a small flame. This residue, the dish and the watch glasswere weighed. The residue was then heated repeatedly until a constant mass was obtained.

The results below were obtained.

Mass of dish + Watch glass = 50.60g

Mass of solution + dish + watch glass = 80.6gMass of residue + dish + watch glass = 62.60g

(a) Use the data to answer the questions that follow.

(i) What is the purpose of the watch glass in such an experiment**?** **(1 mark)**

(ii) Why should the heating be continued until a constant mass is obtained? **(1 mark)**

(iii) Calculate the mass of the solution. **(1 mark)**

(iv) Calculate the mass of the residue. **(1 mark)**

(v) Calculate the mass of the water**.** **(1 mark)**

(vi) Calculate the solubility of salt **Q** in g per 100g of water at 25^0C**.** **(2 marks)**

(b) Hard water has both advantages and disadvantages. Give one advantage and one disadvantage of using hard water**.** **(2 marks)**

Advantage

Disadvantage

(c) Using an equation, explain how addition of sodium carbonate is used to remove water hardness. **(2 marks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 6

233/1

CHEMISTRY

PAPER 1 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS

1. *Write your name and index no. in the spaces provided above.*
2. *Sign and write the date of examination in the space provided above.*
3. *Answer **ALL** the questions in the spaces provided.*
4. *Mathematical tables and silent electronic calculators may be used.*
5. *All working **MUST** be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 29	80 marks	

1. The table below shows the pH values of some solutions.

Solutions	J	K	L	M	N
pH	6	13	2	10	7

a) Which solution is likely to be:

i) Potassium hydroxide. **(1 mark)**

ii) Lemon juice. **(1 mark)**

b) Explain why a solution of hydrogen chloride gas in methylbenzene was identified as N.

(1 mark)

c) Compare the electrical conductivity of solution J and L. **(1 mark)**

2. Name the process that takes place when:

i) Sulphur is heated with natural rubber. **(1 mark)**

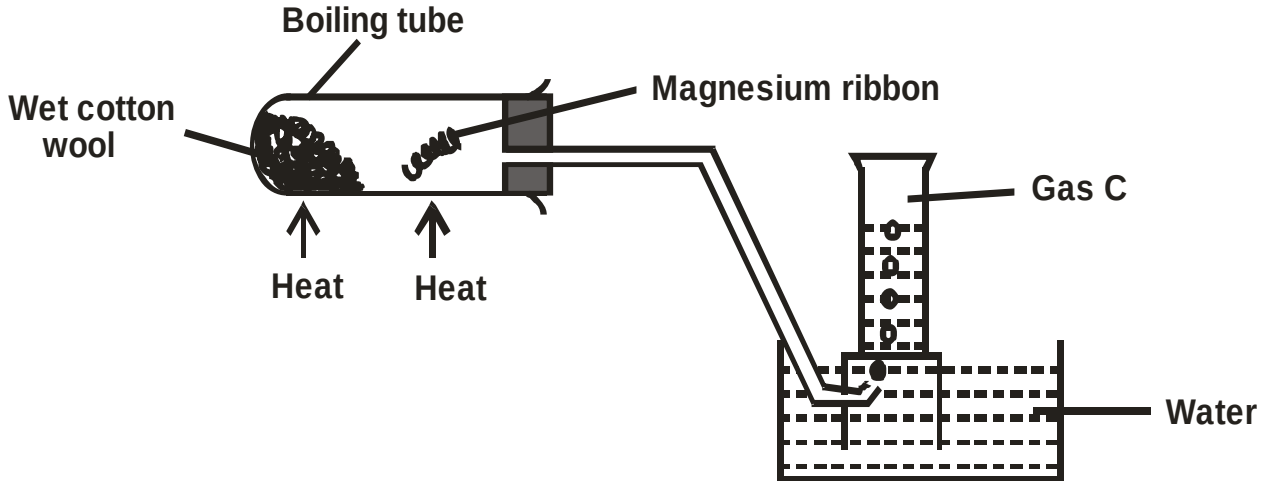
ii) Fats or oils are hydrolysed using an alkali. **(1 mark)**

3. a) Oxygen is obtained by fractional distillation of liquid air.

Name **two** other gases which are obtained from this process during distillation. **(1 mark)**

b) Give **two** industrial uses of oxygen gas. **(2 marks)**

4. The diagram below represents the apparatus used to react steam with magnesium.



a) State an observation made in the boiling tube. **(1 mark)**

b) Write an equation for the reaction that takes place in the boiling tube. **(1 mark)**

c) State and explain **one** precaution required before the heating is stopped. **(2 marks)**

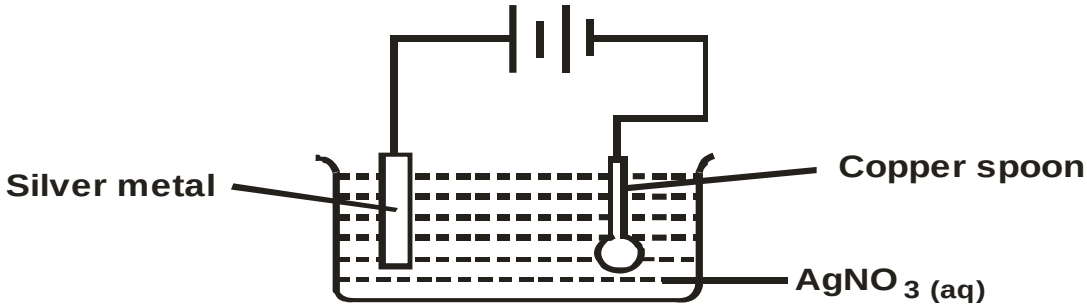
5. State and explain how an increase in pressure will affect the equilibrium position in the following reactions.

a) $2SO_{2\,(g)} + O_{2\,(g)} \rightleftharpoons 2SO_{3\,(g)}$ **(1 mark)**

b) $H_{2\,(g)} + Cl_{2\,(g)} \rightleftharpoons 2HCl_{(g)}$ **(1 mark)**

6. Given a mixture of sodium chloride, silver chloride and ammonium chloride, describe how each component can be obtained. **(2 marks)**

7. A copper spoon was coated with silver metal as shown below.



i) Write an equation for the reaction that occurs at the copper spoon (cathode). **(1 mark)**

ii) How many grams of silver would be deposited on the spoon in two hours using steady current of 0.03A? (IF = 96500C, Ag = 108.0) **(3 marks)**

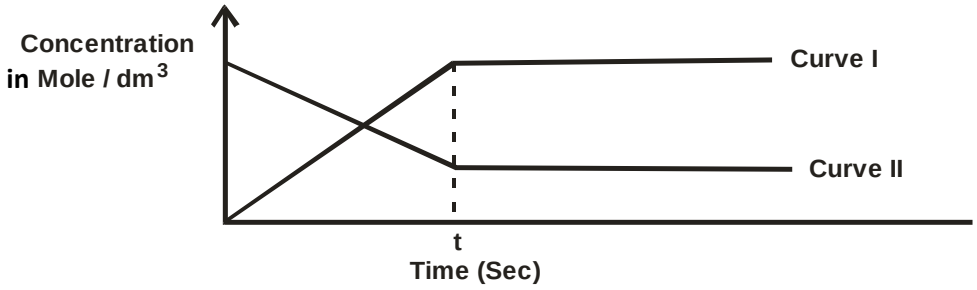
8. Using dost (•) and crosses (**X**) to represent electrons, show bonding in

a) Ammonia molecule. **(1 mark)**

b) Calcium oxide. **(1 mark)**

9. The curve below represents the changes in the concentration of substances E and F with time in the equation.

$E_{(g)} \rightleftharpoons F_{(g)}$



a) Which curve represents the changes in the concentration of substance F? Give a reason. **(2 marks)**

b) Give a reason for the shapes of the curves after time (t) seconds. **(1 mark)**

10. The following two tests were carried out on chlorine water contained in two test-tubes.

a) A piece of blue flower was dropped into the first test-tube. Explain why the flower bleached. **(2 marks)**

b) The second test-tube was corked and exposed to sunlight.

After a few days, it was found to contain a gas that rekindled a glowing splint.

Write an equation for the reaction which produced the gas. **(1 mark)**

11. State any **two** differences between a luminous and a non-luminous flame. **(2 marks)**

12. Potassium hydroxide of mass Yg was dissolved in distilled water to make 200cm^3 of solution. 100cm^3 of the solution required 100cm^3 of 2M nitric acid for complete neutralization.

Calculate the value of Y. (K = 39, O = 16, H = 1) **(3 marks)**

13. Explain how electrical conductivity may be used to distinguish between magnesium oxide and silicon (IV) oxide. **(3 marks)**

14. In the nuclear reaction below:

$$^{235}_{92}U + {}^{1}_{0}n \longrightarrow {}^{90}_{42}Sr + {}^{x}_{y}Xe + 3\,{}^{1}_{0}n + \text{Energy}$$

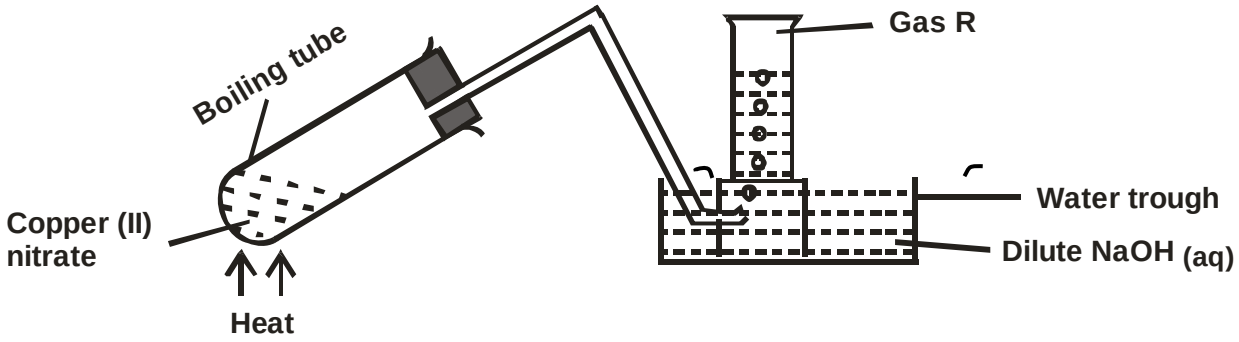
a) Identify the value of x and y.

x **(½ mark)**

y **(½ mark)**

b) State **two** applications for radioisotopes. **(1 mark)**

15. The diagram below shows the effect of heat on copper (II) nitrate.

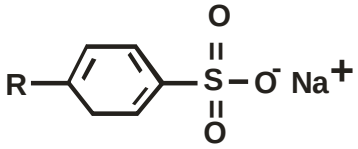


a) State **two** observations made in the boiling tube. **(1 mark)**

b) Write the equation for the reaction that takes place in the water trough. **(1 mark)**

c) How would you confirm the identity of gas R? **(1 mark)**

16. The structure below represents a cleaning agent which is said to have both an advantage and a disadvantage.



a) Which type of cleaning agent does the structure above represent? **(1 mark)**

b) State:

i) **one** advantage **(1 mark)**

ii) **one** disadvantage **(1 mark)**

17. a) State and explain Boyle's law on the behavior of gases. **(2 marks)**

b) State **two** conditions under which gases are likely to behave as ideal. **(1 mark)**

18. Both diamond and graphite have giant atomic structures.

Explain why diamond is hard while graphite is soft. **(2 marks)**

19. a) What is meant by the terms

i) Element **(1 mark)**

ii) Atomic number **(1 mark)**

b) The formula for a chloride of Titanium is $TiCl_3$. What is the formula for its sulphate?

(1 mark)

20. A student investigated the effect of an electric current by passing it through some substances.

The student used inert electrodes and connected a bulb to the circuit.

The table below shows the substances used and their states.

Experiment	Substance	State
1	Potassium carbonate	Solid
2	Copper (II) Sulphate	Solution
3	Sugar	Solution
4	Lead (II) Iodide	Molten

a) In which experiment did the bulb not light? **(1 mark)**

b) Explain your answer in (a) above. **(2 marks)**

21. a) Name **one** natural polymer. **(1 mark)**

b) Give **one** advantage of synthetic fibres over natural fibres. **(1 mark)**

22. The table below gives the atomic numbers of elements, W, X, Y and Z. the letters do not represent the actual symbols of the elements.

Element	**W**	**X**	**Y**	**Z**
Atomic number	9	10	11	12

a) Which one of the elements is least reactive? Explain. **(1 mark)**

b) i) Which **two** elements would react most vigorously with each other? **(1 mark)**

ii) Give formula of the compound formed when the elements in b (i) react. **(1 mark)**

23. a) Name **two** ores from which copper is extracted? **(1 mark)**

b) During extraction of copper metal, the ore is subjected to froth flotation.

Give a reason why this process is necessary. **(1 mark)**

c) Name **one** alloy of copper and state its use. **(1 mark)**

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

					C	D	E	F
G	H						I	

a) Select an element which is stored in paraffin in the laboratory. **(1 mark)**

b) How do the Ionic radii of E and I compare? Explain. **(2 marks)**

25. Use the information below to answer the questions that follow.

Equation	Enthalpy of formation
$H_{2\,(g)} + \frac{1}{2}O_{2\,(g)} \rightarrow H_2O_{(l)}$	$\Delta H_1 = -286\ KJmol^{-1}$
$C_{(s)} + O_{2\,(g)} \rightarrow CO_{2\,(g)}$	$\Delta H_2 = -394\ KJmol^{-1}$
$2C_{(s)} + 3H_{2\,(g)} + \frac{1}{2}O_{2\,(g)} \rightarrow C_2H_5OH_{(l)}$	$\Delta H_3 = -277\ KJmol^{-1}$

a) Define the term enthalpy of formation of a compound. **(1 mark)**

b) Calculate the molar enthalpy of combustion ΔH_4 of ethanol.

$C_2H_5OH_{(l)} + 3O_{2\,(g)} \rightarrow 2CO_{2\,(g)} + 3H_2O_{(l)}$ **(2 marks**

26. Nitrogen forms many compounds in which its oxidation state varies.

a) What is meant by oxidation state? **(1 mark)**

b) What is the oxidation state of nitrogen in Mg_3N_2? **(1 mark)**

c) Explain why high temperature is required for nitrogen to react with oxygen. **(1 mark)**

27. Draw and name the isomers of pentane. **(3 marks)**

28. When a student was stung by a nettle plant a teacher applied an aqueous solution of ammonia to the affected area of the skin and the student was relieved of pain. Explain. **(2 marks)**

29. Distinguish between ionization energy and electron affinity of an element. **(2 marks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 6

233/2

CHEMISTRY

PAPER 2 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS:

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

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

(c) *Answer **ALL** the questions in the spaces provided.*

(d) *Mathematical tables and silent electronic calculators may be used.*

FOR EXAMINER'S USE ONLY

Question	Maximum score	Candidate's score
1	12	
2	12	
3	8	
4	12	
5	15	
6	12	
7	9	
Total score	**80**	

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

Element	Atomic number	Relative atomic mass	Melting point (°C)
Aluminum	13	27.0	
Calcium	20	40.0	850
Carbon	__	12.0	3730
Hydrogen	__	1.0	- 259
Magnesium	12	24.0	650
Neon	__	20.0	- 249
Phosphorous	15	31.0	44.2 white 590 red
sodium	__	23	97.8

a) Complete the table by filling in the missing atomic numbers. **(2 marks)**

b) Write the electron arrangement for the following ion. **(2 marks)**

i) Ca^{2+}

ii) P^{3-}

c) What is the melting point of hydrogen in Kelvin? **(1 mark)**

d) Which of the allotropes of phosphorous has a higher density? Explain. **(2 marks)**

e) The mass numbers of three isotopes of magnesium are 24, 25 and 26.

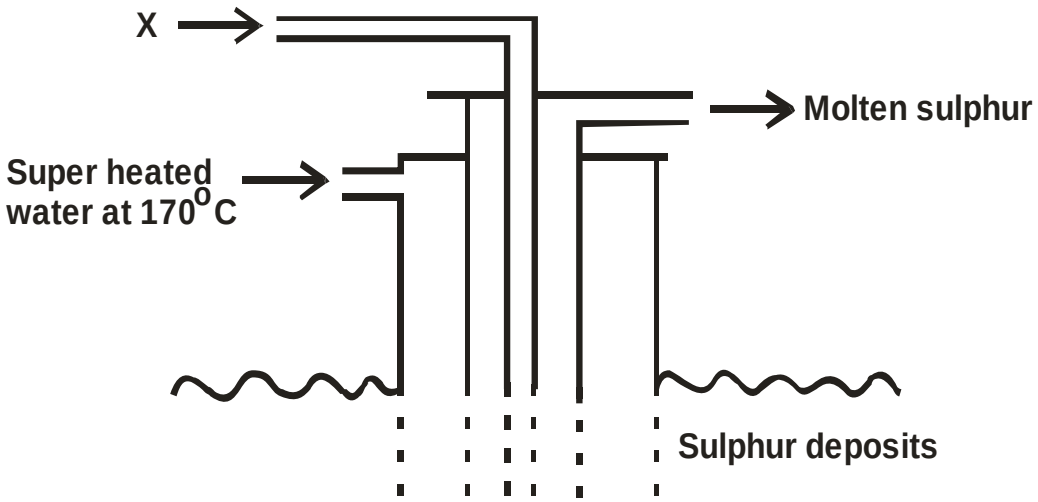
What is the mass number of the most abundant isotope of magnesium? Explain. **(2 marks)**

f) Give the formula of the compound formed between aluminum and carbon. **(1 mark)**

g) Explain the difference in the melting points of magnesium and sodium. **(2 marks)**

2. a) The diagram below shows the Frasch process used for extraction of sulphur.

Use it to answer to answer the questions that follow.

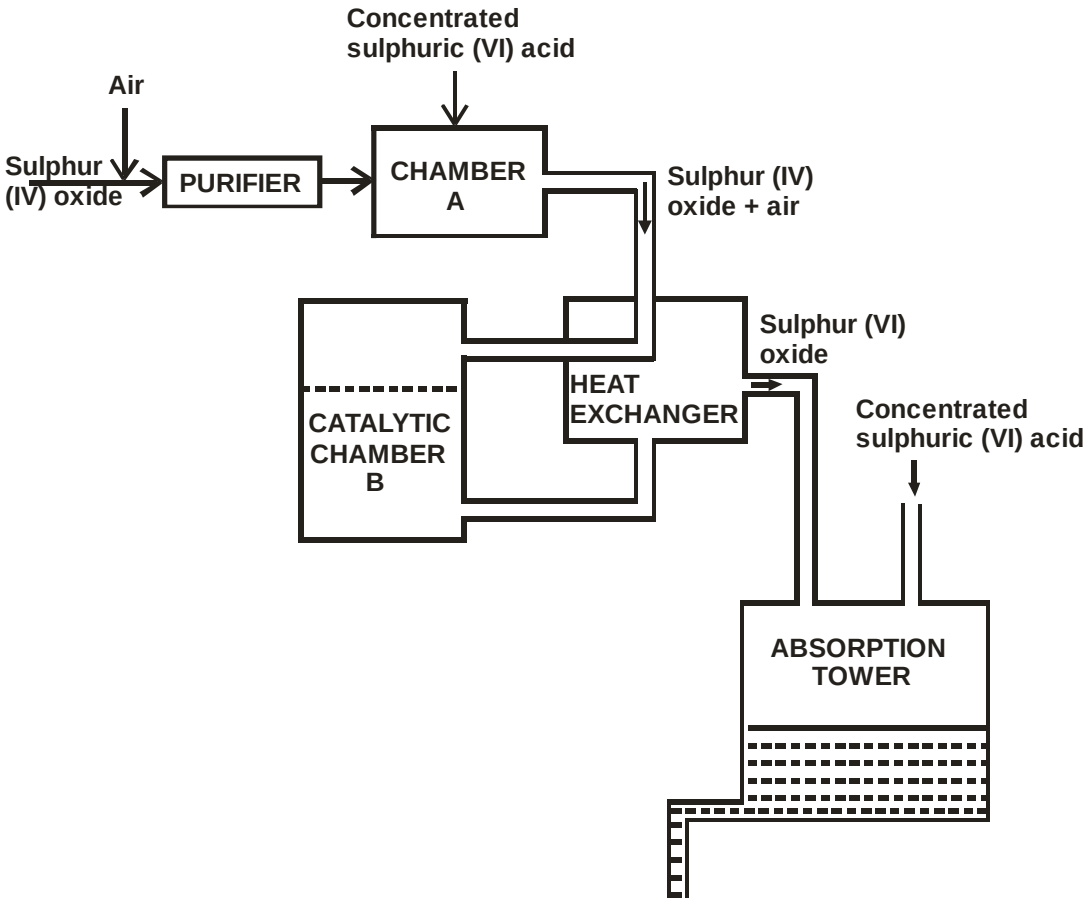


i) Identify **X**. **(1 mark)**

ii) Why is it necessary to use super-heated water in this process? **(1 mark)**

iii) State **two** physical properties of sulphur that makes it possible for it to be extracted by this method. **(2 marks)**

b) The diagram below shows part of the process in the manufacture of suphuric (VI) acid. Study it and answer the questions that follow.



i) Write an equation for the formation of sulphur (IV) oxide from sulphur. **(1 mark)**

ii) What it the role of concentrated sulphuric (VI) acid in chamber A? **(1 mark)**

iii) Name **two** catalysts that can be used in the catalytic chamber B. **(1 mark)**

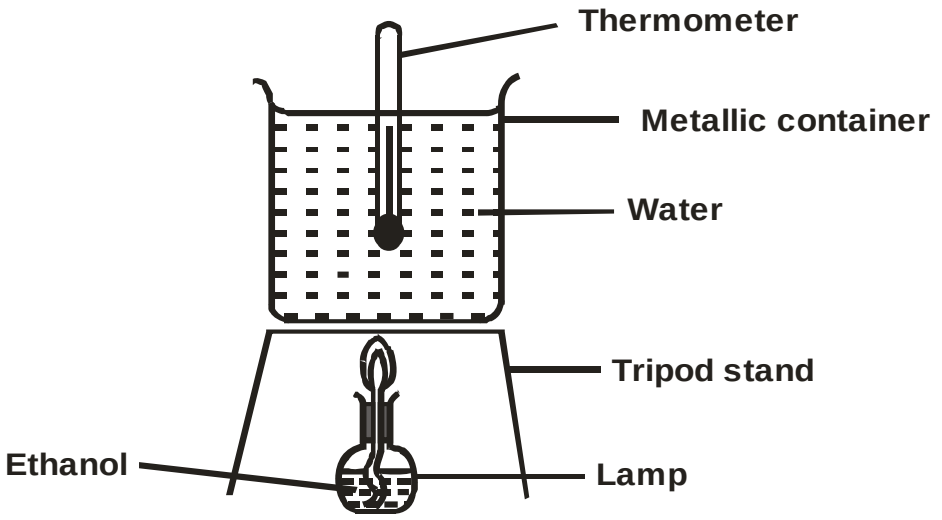
iv) State **two** roles of the heat exchanger. **(2 marks)**

c) Explain **one** way in which sulphur (IV) oxide is a pollutant. **(1 mark)**

d) What observation will be made when a few drops of concentrated sulphuric (VI) acid are added to crystals of sugar? Explain your answer. **(2 marks)**

3. a) State **two** factors that should be considered when choosing a fuel for cooking. **(2 marks)**

b) The diagram below represents a set-up that was used to determine the molar heat of combustion of ethanol.



During the experiment the data given below was recorded.
Volume of water = $450cm^3$
Initial temperature of water = 25^oC
Final temperature of water = 46.5^oC
Mass of ethanol + lamp before burning = 125.5g
Mass of ethanol + lamp after burning = 124.0g

Calculate the:

i) Heat evolved during the experiment.
(Density of water = $1g/cm^3$ specific heat capacity of water = $4.2Jg^{-1}K^{-1}$). (2 marks)

ii) Molar heat of combustion of ethanol **(2 marks)**

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

d) The value of the molar heat of combustion of ethanol obtained in b (ii) above is lower than the theoretical value. State **one** source of error in the **(1 mark)**

4. a) Crude oil is a source of many compounds that contain carbon and hydrogen only.

i) Name the process used to separate the components of crude oil. **(1 mark)**

ii) State **two** physical properties of the above components that determine the separation. **(2 marks)**

b) Under certain conditions, Heptane can be converted to two products.
The formula of one of the products is C_3H_8.

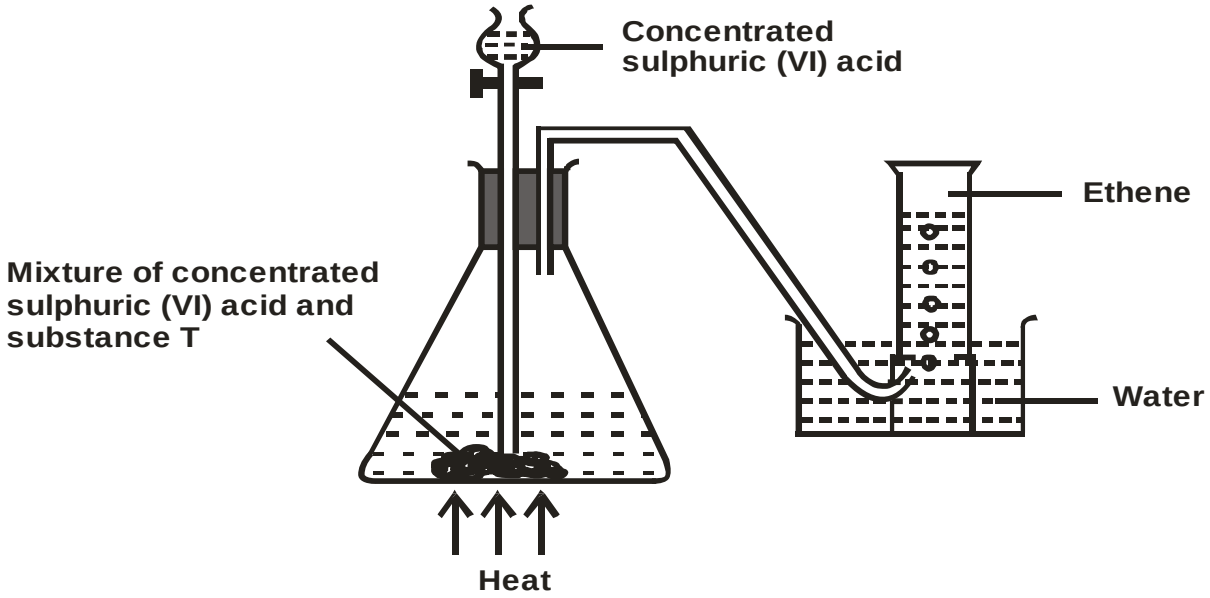
i) Write the formula of the other product. **(1 mark)**

ii) Determine a simple chemical reaction to show the difference between the two products formed in **b(i)** above. **(2 marks)**

c) Butyne C_4H_6 is another compound found in crude oil. One mole of butyne was reacted with one mole of hydrogen chloride gas and a product P1 was formed. P1 was then reacted with excess hydrogen gas to form P2. Draw the structure of P1 and P2. **(2 marks)**

d) The set up below was used to prepare and collect ethene gas.

Study it and answer the questions that follow.



i) Name substance T. **(1 mark)**

ii) Give the property of ethene that allows it to be collected as shown in the set-up.**(1 mark)**

e) One of the reactions undergone by ethene is addition polymerization.

Give the name of the polymer and **one** disadvantage of the polymer it forms.**(2 marks)**

Name

Disadvantage

5. a) The standard electrode potentials for the elements chloride and magnesium are:

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

$Mg^{2+}_{(aq)} + 2e^- \rightarrow Mg_{(s)}$ $\quad E^\theta = -2.36V$

i) Which one for the two elements will act as an oxidizing agent? Explain your choice.

(2 marks)

ii) Calculate the electromotive force of a cell where the overall reaction is:

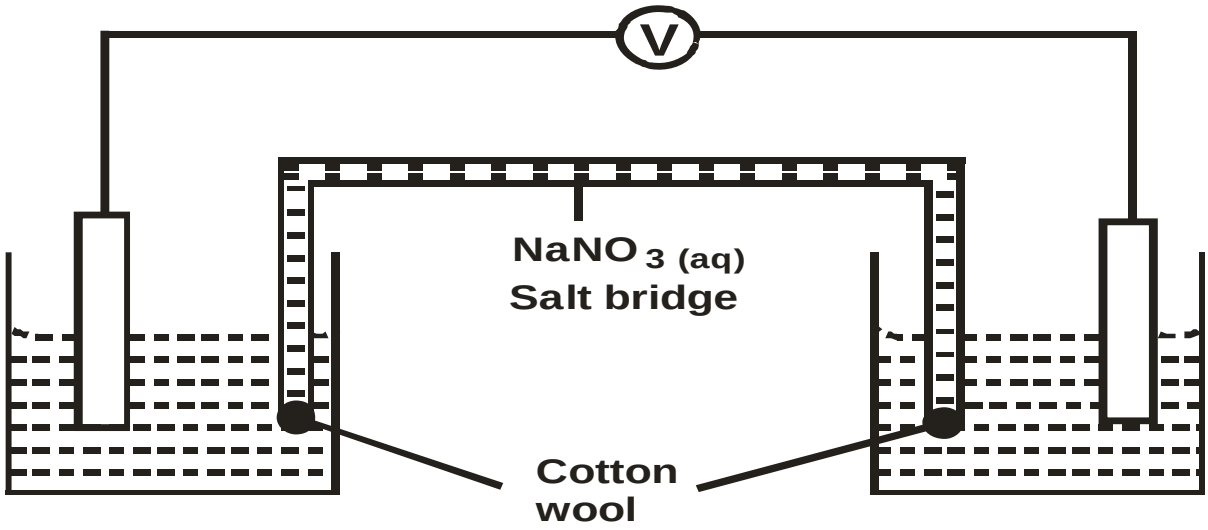
$Cl_{2\,(aq)} + Mg_{\,(s)} \rightarrow MgCl_{2\,(aq)}$ **(1 mark)**

b) The table below gives the standard electrode potentials for divalent metals represented by the letters P, Q, R and S (not their symbols of elements). Use it to answer the question that follow.

Metal	E^{θ} (volts)
P	+1.50
Q	+0.44
R	+0.34
S	–0.76

i) Which one of the metals cannot be displaced from a solution of its ions by any other metals in the table? Explain. **(2 marks)**

ii) Metals P and Q were connected to from a cell as shown in the diagram below.



I. On the diagram label the metals P and Q and indicate the ions in solution. **(2 marks)**

II. Write equations (half equations) of the reactions taking place at the electrodes.

Electrode P **(1 mark)**

Electrode Q **(1 mark)**

III. State **two** functions of the salt bridge. **(2 marks)**

IV. What must be observed about the choice of a salt bridge? **(1 mark)**

iii) A metallic couple of the metal S and Z produced a voltage of +1.71volts.

(Assume that S has the higher negative electrode potential)

I. Calculate the standard electrode potential (S.E.P) for metal Z. **(1 mark)**

II. Arrange the metals P, Q, R and Z in their decreasing order of reactivity. **(2 marks)**

6. a) Define the term solubility. **(1 mark)**

b) In an experiment to determine the solubility of two salts X and Y at different temperatures, a candidate recorded her observations as shown below.

Temperature (°C)	0	10	20	30	40	50	60	70	80	90
Solubility of X in g/100g of H_2O	14.3	17.4	20.7	25.0	28.5	33.3	40.0	47.0	55.0	64.0
Solubility of Y in g/100g of H_2O	25.0	27.5	30.0	32.5	35.0	37.6	40.1	42.4	45.0	48.0

On the same axes plot the solubility curves of X and Y against temperature. **(5 marks)**

c) From the graph determine;

i) Solubility of X and Y at 47°C.

Solubility of X. **(½ mark)**

Solubility of Y. **(½ mark)**

ii) The temperature at which the two salts have the same solubility in water. **(1 mark)**

d) If 60g of X is dissolved in 100g of water and heated to 90°C, calculate the amount of salt that crystallized out if cooled to 20°C. **(1 mark)**

e) State what would happen if a mixture of salt X in 100g of water and 30g of Y in 100g of water were cooled from 90°C to 70°C. **(2 marks)**

f) State **one** application of solubility. **(1 mark)**

7. In an experiment, a piece of magnesium ribbon was cleaned with steel wool. 2.4g of the clean magnesium ribbon was placed in crucible and completely burnt in oxygen.

After cooling, the product weighed 4.0g.

a) Explain why it is necessary to clean the magnesium ribbon. **(1 mark)**

b) What observation was made in the crucible after burning? **(1 mark)**

c) Why was there an increase in mass? **(1 mark)**

d) Write the equation for the reaction which took place in the crucible. **(1 mark)**

e) The product in the crucible was shaken with water and filtered.

Explain the observation which was made when blue and red litmus papers were dropped into the filtrate. **(2 marks)**

f) Calculate the volume of oxygen gas used during the burning.

(O = 16, molar volume of gas = 24000cm^3 at room temperature) **(3 marks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 7

233/1

CHEMISTRY

PAPER 1 (THEORY)
TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

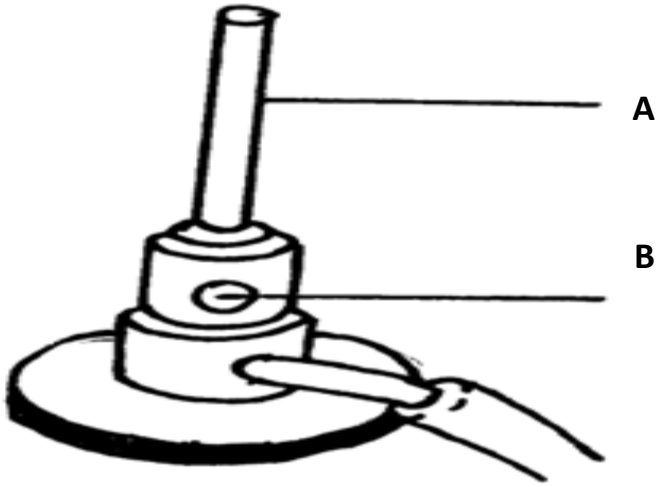
INSTRUCTIONS TO CANDIDATES

1. *Write your name and index number in the spaces provided above.*
2. *Sign and write the date of examination in the spaces provided above.*
3. *Answer all the questions in the spaces provided.*
4. *Mathematical tables and silent electronic calculators many be used.*
5. *All working must be clearly shown where necessary.*

FOR EXAMINER'SUSE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1 – 27	80	

1. The diagram below shows a Bunsen burner which is used as a source of heat in the laboratory.



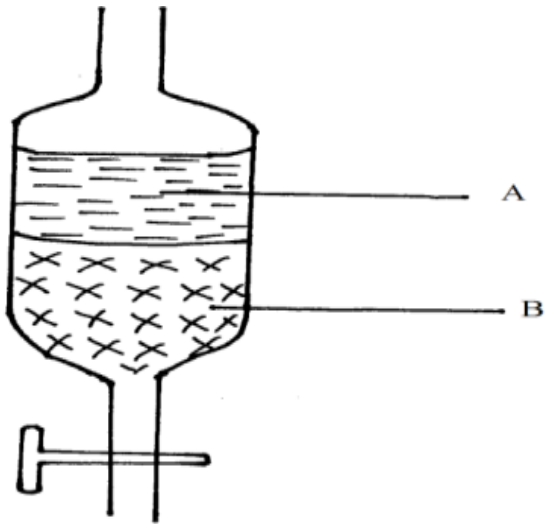
a) Name the parts labeled: **(2 marks)**

A_____

B_____

b) Explain how the hotness of a non-luminous flame can be increased. **(1 mark)**

2. In an experiment to separate a mixture of two immiscible liquids A and B, a form four student set the apparatus as shown below.

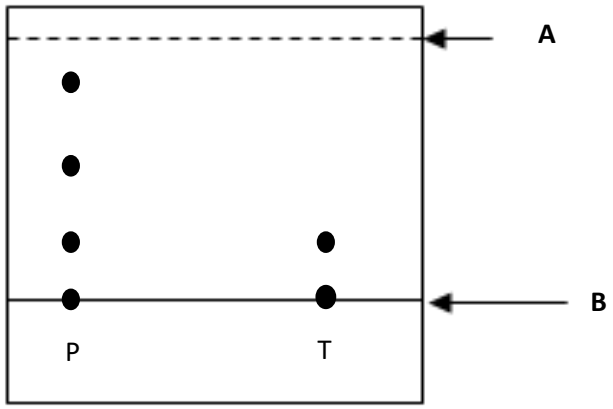


a) Name the above apparatus._____ **(1 mark)**

b) Which liquid is denser? _____ **(1 mark)**

c) Name one other method that can be used to separate the above mixture**.** **(1 mark)**

3. The following chromatogram shows the results obtained after separating substances P and T.



a) Name lines; **(1 mark)**

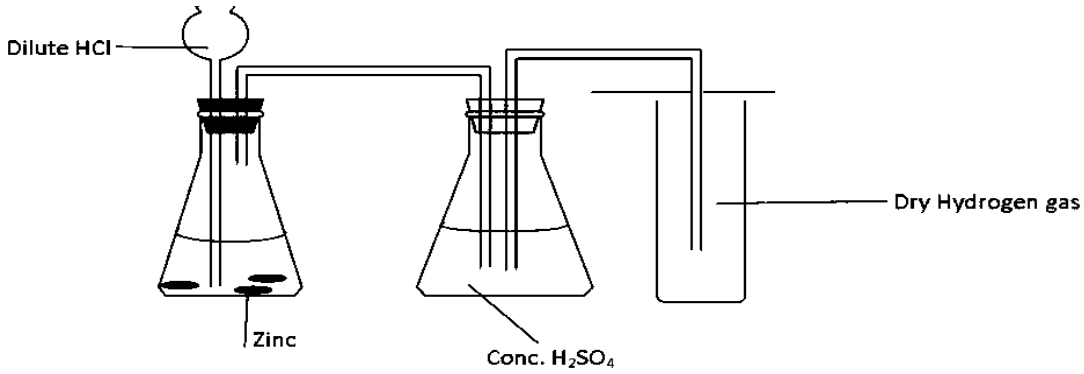
A_____

B_____

b) Name the possible solvent that can be used in the above process**.** **(1 mark)**

c) Which of the two substances is pure? **(1 mark)**

4. A form four student arranged the apparatus as shown below with the aim of collecting dry hydrogen gas.



Identify with reasons two mistakes in the above set-up. **(3 marks)**

5. The table below shows elements and their atomic numbers. The letters do not represent the actual symbols of the elements.

Element	A	B	C	D	E	F	G
Atomic number	11	10	20	13	14	6	8

a) From the given letters, select two elements with the same chemical properties**.** **(1 mark)**

b) Write the formula of the compound formed when element E reacts with element G. **(1 mark)**

c) Identify the most stable element and give a reason for your answer. **(1 mark)**

6. When magnesium burns in air, it forms two products. When one of the products dissolves in water, a colorless gas that turns red litmus paper blue is formed.

a) Name the product that dissolves in water to produce a colorless ga**s.** **(1 mark)**

b) Write an equation for the formation of the colorless gas. **(1 mark)**

c) State any one use of the colorless gas. **(1 mark)**

7. A student was given a mixture ammonium chloride, copper (II) oxide and sodium chloride. Describe how the student would separate the mixture. **(3 marks)**

8. When small amount of carbon (IV) oxide is passed through lime water, a white precipitate is formed. When excess carbon (IV) oxide is bubbled through, the white precipitate dissolves to form a colorless solution.

a) Name the white precipitate. **(1 mark)**

b) Explain using chemical equations why the white precipitate dissolves in excess of carbon(IV) oxide. **(1 mark)**

c) What will happen of the above colorless solution is boiled. **(1 mark)**

9. Write equations to show the effect of heat on each of the following.

(a) Sodium hydrogen carbonate. **(1 mark)**

(b) Silver nitrate **(1 mark)**

(c) Sodium nitrate **(1 mark)**

10. a) State the Graham's law of diffusion. **(1 mark)**

(b) A sample of unknown gas Z was shown by analysis to contain sulphur and oxygen. The gas requires 28.3 seconds to diffuse through an aperture into a vacuum. An identical amount of oxygen gas passes through the same aperture in 20 seconds. Determine the molar mass of gas Z. **(O=16, S=32).** **(2 marks)**

11. When a hydrated sample of $CaSO_4 .XH_2O$ was heated until there all the water was lost, the following data was obtained.

Mass of the crucible = 30.296g

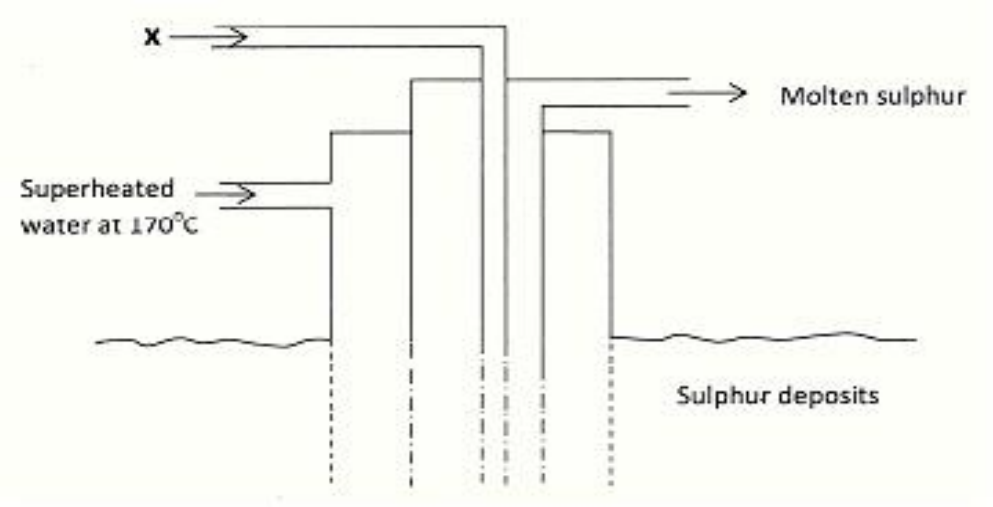
Mass of crucible + hydrated salt = 33.111g

Mass of crucible + anhydrous salt = 32.781g

Determine the empirical formula of the hydrated salt. (Ca=40, S=32, O=16, H=1) **(3 marks)**

12. The empirical formula of a compound is C_2H_5. When 11.6g of the compound was allowed to evaporate; it occupied 4.8 dm^3 at room temperature and pressure. What is its molecular formula? (MGV = 24dm^3) **(3marks)**

13. The diagram below shows an industrial process that is used in extraction of sulphur.



a) What is the name given to the above industrial process? **(1 mark)**

b) Identify substance X. **(1mark)**

c) What is the role of super-heated water? **(1mark)**

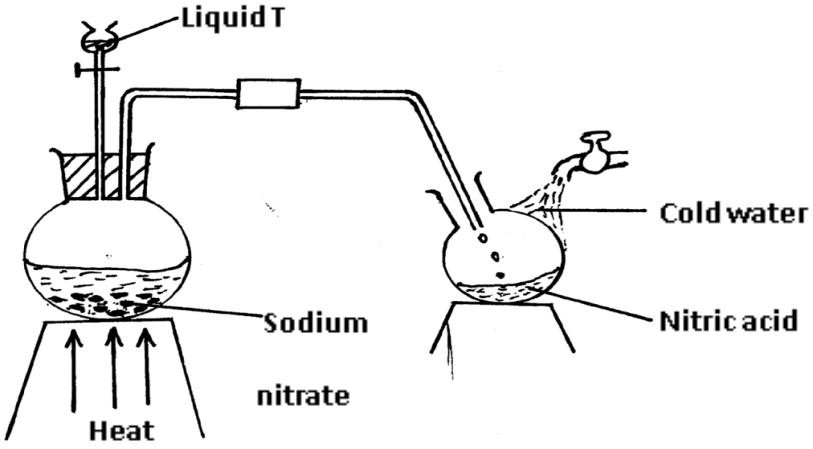
14. a) Give the systematic names for the following compounds.

i) $CH_3CH_2CHCH_2$ _____ **($^1/_2$ mark)**

ii) $CH_3CH_2CH_3$ _____ **($^1/_2$ mark)**

b) Describe one chemical process that can be used to distinguish between the substances named in (a) above. **(2 marks)**

15. The set-up below was used to prepare Nitric(V) acid in the laboratory.

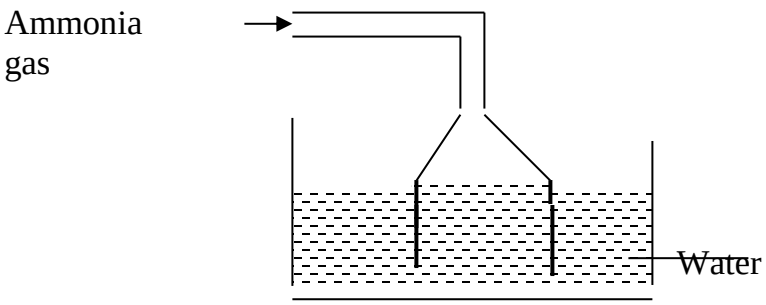


a) Name liquid T. **(1 mark)**

b) Write an equation for th reaction taking place in the flask. **(1 mark)**

c) State the reason why nitric(V) acid collected is brown in colour and explain how the brown colour can be removed. **(1 mark)**

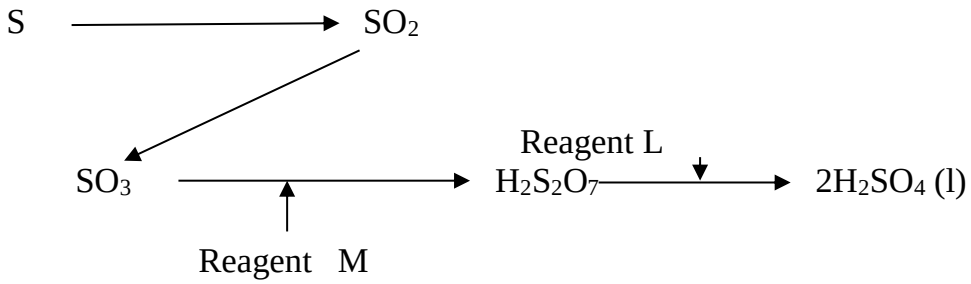
16. Ammonia gas was passed into water as shown below.



a) What is the use of the inverted funnel? **(1 mark)**

b) State and explain the observation made when a red litmus paper is dipped into the above solution. **(1 mark)**

17. Study the flow chart below showing the reaction involved in the preparation of sulphuric (IV) acid and answer the questions that follow.



a) Name the reagents.

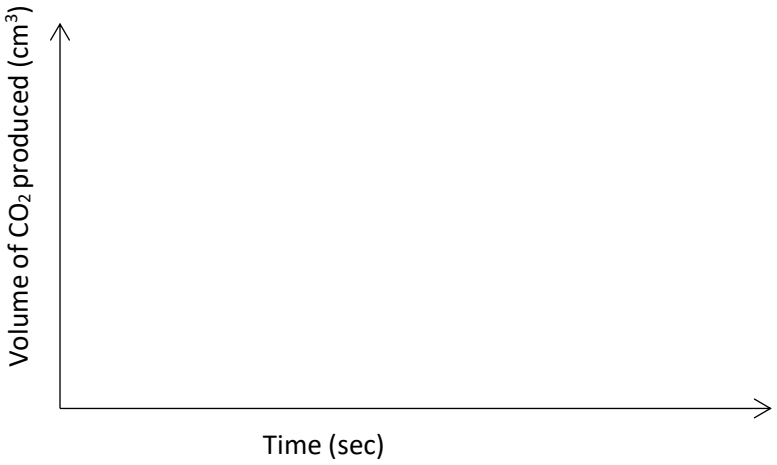
L_____ **(1/2mk)** **M**_____ **(1/2mk)**

b) Write the equation for the reaction between reagent M and $H_2S_2O_7$ **(1mk)**

c) State one industrial use of sulphuric(VI) acid. **(1 mark)**

18. a) What is meant by the term strong acid? **(1 mark)**

b) In an experiment, $40cm^3$ of 0.5M sulphuric (VI) acid was reacted with excess sodium carbonate and the volume of cabon (IV) oxide produced recorded with time. In another experiment, $40cm^3$ of 0.5M ethanioc acid was reacted with excess sodium carbonate and the volume of carbon (IV) oxide produced recorded with time. On the grid below, sketch and label the curves if the volumes of carbon (IV) oxide were plotted against time on the same axis. **(2 marks)**

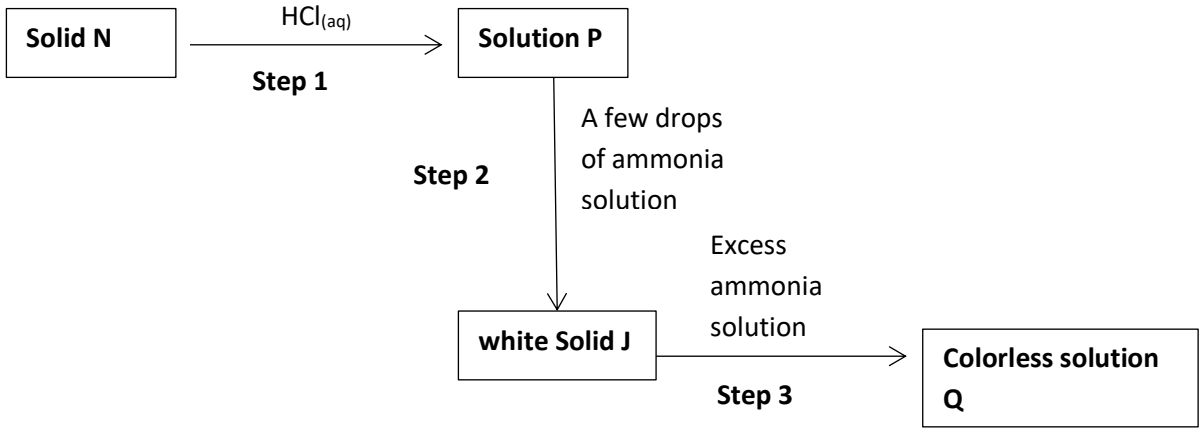


19. Hydrogen chloride gas is soluble in both water and methylbenzene. State and explain the observation made when a small piece of magnesium ribbon is placed in each of the solutions.

a) Solution of HCl(g) in methylbenzene **($1\frac{1}{2}$ marks)**

b) Solution of HCl(g) in water. **($1\frac{1}{2}$ marks)**

20. The scheme below shows a reaction sequence starting with solid N. study it and answer the questions that follows.



a) Name the cation present in solid N. **(1 mark)**

b) Write the formula of the complex ion in the colorless solution Q. **(1 mark)**

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

21. Reagent bottles labelled H_2SO_4 solution, K_2CO_3 solution and NaCl solution had labels accidentally removed. A packet of blue litmus paper is lying near a long with a rack of test-tubes, without using any other material explain how you would go about labeling the bottles correctly. **(3marks)**

22. Some bond energies are given below;

Bond	Energy ($kJmol^{-1}$)
C-C	348
C-H	414
Cl-Cl	243
C-Cl	432
H-Cl	340

Calculate the energy change for the reaction below. **(3 marks)**

$$C_2H_{6(g)} + Cl_{2(g)} \longrightarrow CH_3CH_2Cl_{(g)} + HCl_{(g)}$$

23. a) What is fractional crystallization? **(1 mark)**

(b) The solubility of copper (II) sulphate is 55g/100g of water at 75°C and 19g/100g of water at 15°C. What mass of crystals would be deposited, if 150g of a saturated solution is cooled from 75°C to 15°C. **(2 marks)**

24. Study the equation below and answer the question that follows.

$$NH_{3(g)} + H_20_{(l)} \rightleftharpoons NH_4^+{}_{(aq)} + OH^-{}_{(aq)}$$

Identify two species that acts as an acid. Give a reason for your answer. **(3 marks)**

25. Using well labeled diagrams, explain how water hardness can be removed by ion exchange method. **(3 marks)**

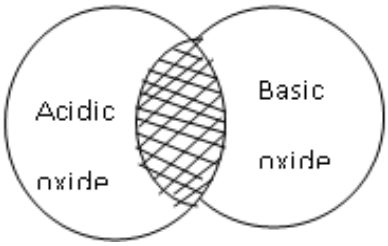
26. Substances X and Y consists of molecules X_2 and Y_2 respectively. When the two elements react, they form a molecule of XY. The X-X bonds are as strong as Y-Y bonds. But the X-Y bond is stronger than both X-X and Y-Y bonds.

$$X_{2(g)} + Y_{2(g)} \longrightarrow 2\,XY_{(g)}$$

a) Is the above reaction exothermic or endothermic? Give a reason for your answer. **(2 marks)**

b) Draw an energy level diagram for the reaction in (a) above. **(1 mark)**

27. The diagram below shows acidic and basic oxides fit in a general family of oxides.



a) State the name given to the type of oxides that would be placed in the shaded region. **(1 mark)**

b) Name two oxides that could be placed on the shaded region. **(2 marks)**

NATIONAL TRIAL 7

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

a) *Write your name and index number in spaces provided.*
b) *Sign and write date of examination in spaces provided above*
c) *Answer all the questions in the section*
d) *Mathematical tables and electronic calculators may be used.*
e) *All working MUST be clearly shown where necessary.*

FOR EXAMINERS USE ONLY

Question	Maximum score	Candidates score
1	14	
2	13	
3	11	
4	10	
5	11	
6	11	
7	10	
Total	80	

1. The table below shows part of the Periodic table. The letter of the elements do not represent the actual symbols of the elements: -

X			Y					Z
U						W		

(i) How do the electrical conductivities of elements X and Y compare? Explain. **(2mks)**

(ii) Element W has two melting points. Explain this observation. **(1mk)**

(iii) When 1.15g of element U was reacted with cold water 0.6dm^3 of hydrogen was produced at r.t.p. Calculate the relative atomic mas of U. (Molar gas volume = 24dm^s at r.t.p) **(3mks)**

(iv) Element V has atomic number 15. Show its position in the grid. **(1mk)**

(v) State **one** use of element Z. **(1mk)**

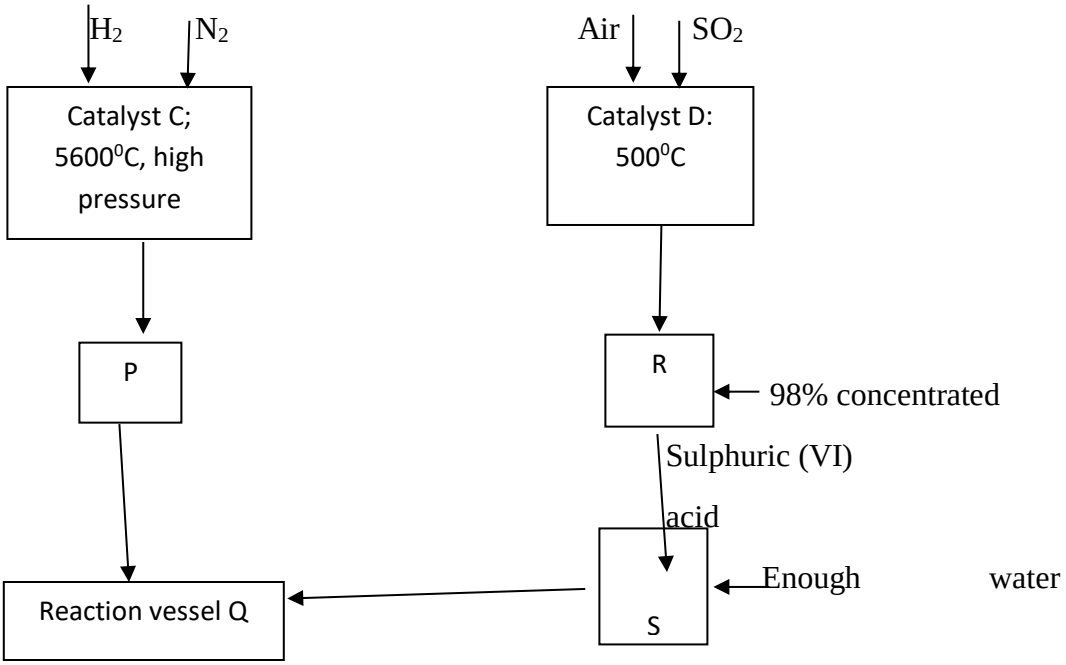
(vi) Oxide of element Y react with both acids and bases. What property is shown by element Y? **(1mk)**

(vii) Explain (vi) above using chemical equations. **(2mks)**

(viii) Write down the equation for the reaction between element Y and Oxygen. **(1mk)**

(ix) Explain how the reactivity of elements X and U with chlorine compare. **(2mks)**

2. The flow chart below shows how a fertilizer can be manufactured. Use it to answer the questions that follow.



I. (a) Name catalyst C and catalyst D

C …….. **(1mk)**

D ……. **(1mk)**

(b) Give the identities of substance: **(1 ½ mks)**

P ……

S ……

R ……

(c) Give the identity of the fertilizer formed. **(½ mk)**

(d) Write an equation for the reaction at vessel Q. **(1 mk)**

(e) Explain why substance R is absorbed in 98% sulphuric (VI) acid first before adding water. **(1 mk)**

(f) Name two methods by which pollution is controlled in contact **process** **(1mk)**

(g) Which industry can be set next to the plant **(1mk)**

II. (a) When hydrogen sulphide gas was bubbled into an aqueous solution of Iron (III) chloride, a yellow precipitate was deposited.

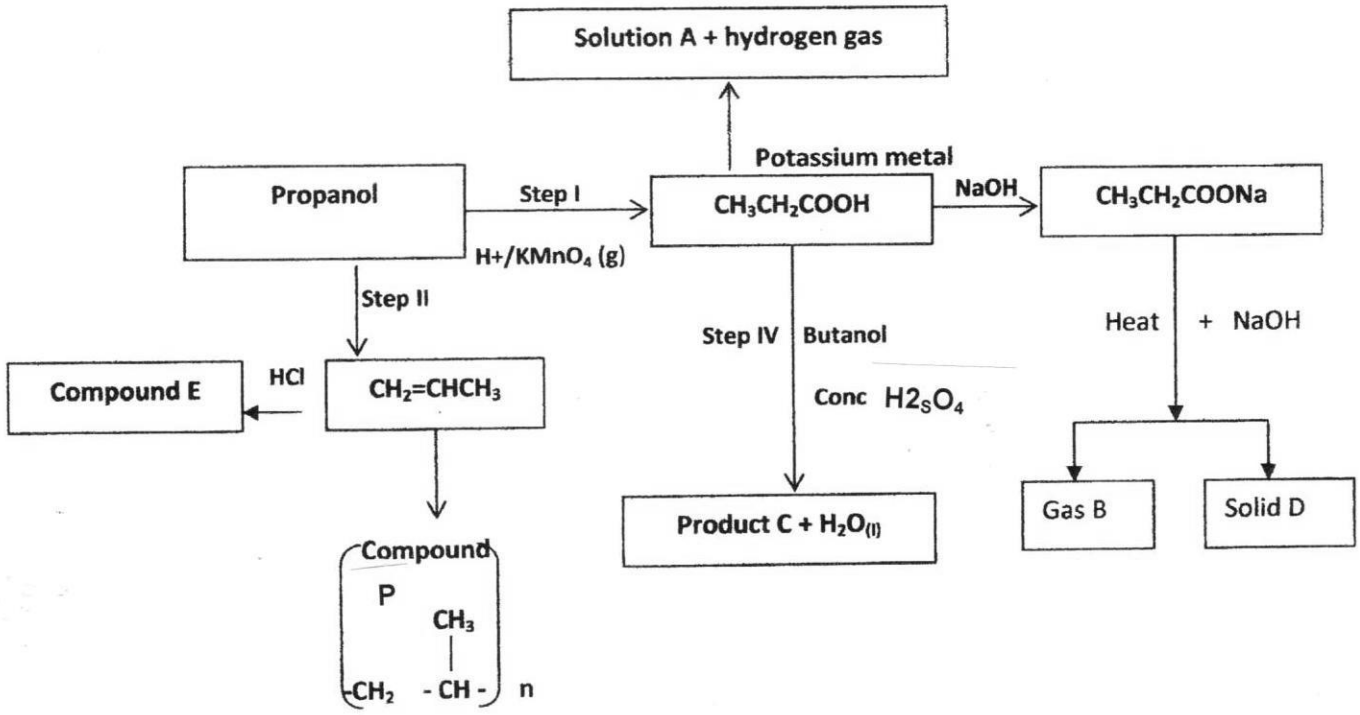
(i) State another observation that was made. **(1 mk)**

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

III. (a) Explain why old newspapers slowly turn brownish when exposed to air and sunlight. **(1 mk)**

(b) Describe a chemical test that can be used to distinguish sodium sulphate and sodium sulphite. **(2 mks)**

3. The scheme below shows a series of reactions starting with Propanol. Study it and answer the questions that follow:-



a. Name the type of reaction in steps I and II.

Step I ……..... **(1mk)**

Step II ……. **(1mk)**

b. Identify :-

gas B **(1mk)**

solid D. **(1mk)**

c. Name the substances labeled A and E.

A …… **(1mk)**

E …… **(1mk)**

d. Draw the structural formula of product C. **(1mk)**

e. Name the process in Step (IV) **(1mk)**

f. Name compound P and state the type of reaction involved in its formation. **(1mk)**

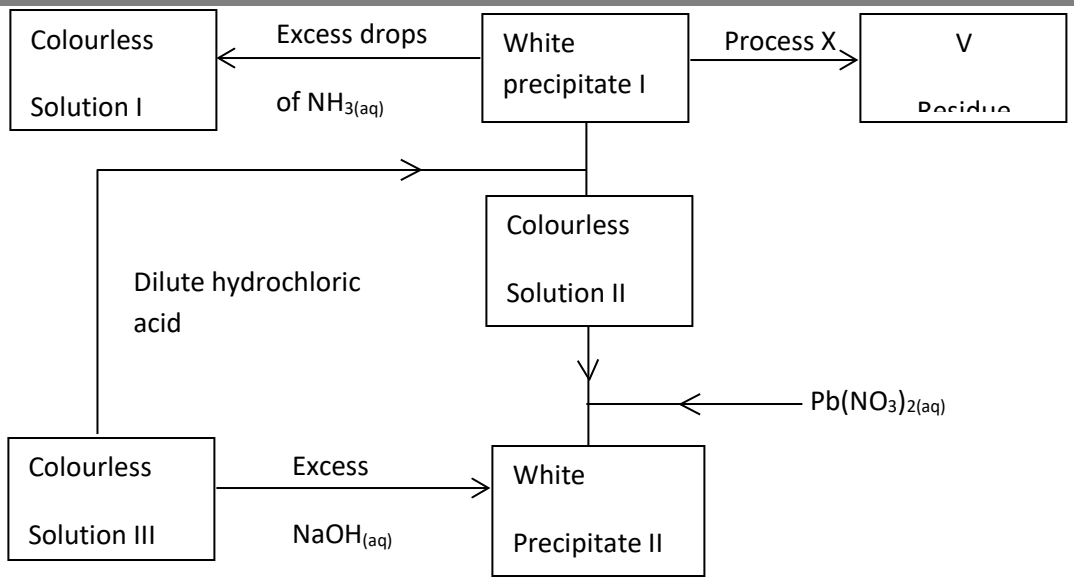
Name of compound P: ……

Type of reaction: ……

g. If the relative molecular mass of P is 35,700 determine the value of n. **(2mks)**

(C = 12, H = 1)

4. (a) Study the flow chart **below** and answer the questions that follow.



Residue **V** was yellow when hot and white when cold.

(i) Identify :-

I White Precipitate **I**. **(½ mk)**

II Solution **II**. **(½ mk)**

III Residue **V**. **(½ mk)**

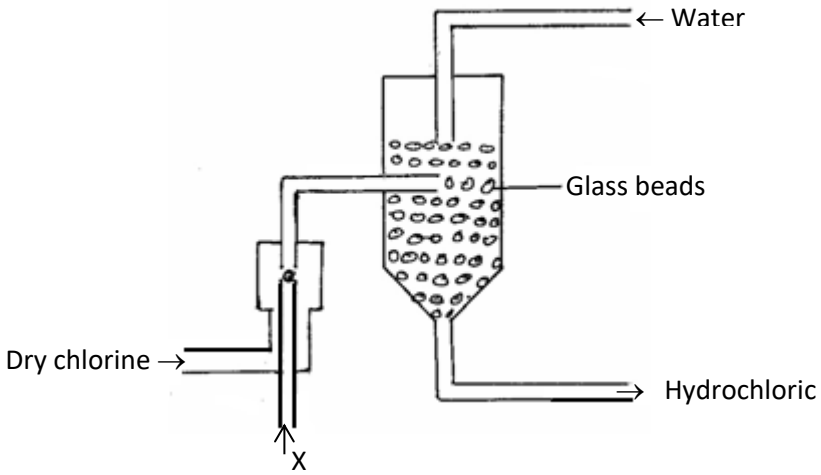
(ii) Write an ionic equation for the reaction of solution **II** with $Pb(NO_3)_{2(aq)}$. **(1mk)**

(iii) Write observations that would be made when ammonia solution is added drop wise till in excess to the colourless solution II. **(1mk)**

(iv) Identify process **X** **(½ mk)**

(v) Write an equation for the formation of solid **V** **(1mk)**

(b) The diagram **below** represents a set-up for large scale manufacture of hydrochloric acid. Study it and answer the questions that follow:



(i) Name substance **X**. **(1mk)**

(ii) What is the purpose of glass beads? **(1mk)**

(iii) Give **two** sources of substance X used in the above process. **(1mk)**

(iv) Give **two** use of hydrochloric acid. **(2mks)**

5. Sodium thiosulphate solution reacts with dilute hydrochloric acid according to the following equation.

$$S_2O_3^{2-}{}_{(aq)} + 2H^+{}_{(aq)} \longrightarrow H_2O_{(l)} + SO_2 + S_{(s)}$$

In an experiment to study how the rate of reaction varies with concentration, $10cm^3$ of 0.4M sodium thiosulphate was mixed with $10cm^3$ of 2M hydrochloric acid in a flask. The flask was placed in a white paper marked with across X. The time taken for the cross X to become invisible when viewed from above was noted and recorded in the table below. The experiment was repeated three times at the same temperature using the volumes in the table and the results recorded as shown in the table below.

Experiment	Volume of 0.4M thiosulphate (cm3)	Volume of water (cm3)	Volume of 2M HCl(cm3)	Time (Sec)
1	10	0	10	16
2	7.5	2.5	10	23
3	5.0	5.0	10	32
4	2.5	7.5	10	72

a) i) On the grid below, plot a graph of the volume of thiosulphate (Vertical axis) against time taken for the cross (X) to become invisible**)** **(3mks)**

ii) From the graph determine how long it would take for the cross to become invisible if the experiment was done.

i) Using 6cm3 of the 0.4M thiosulphate **(1mk)**

ii) Using 6cm3 of 0.2M thiosulphate solution **(1mk)**

b) Using values for experiment I Calculate

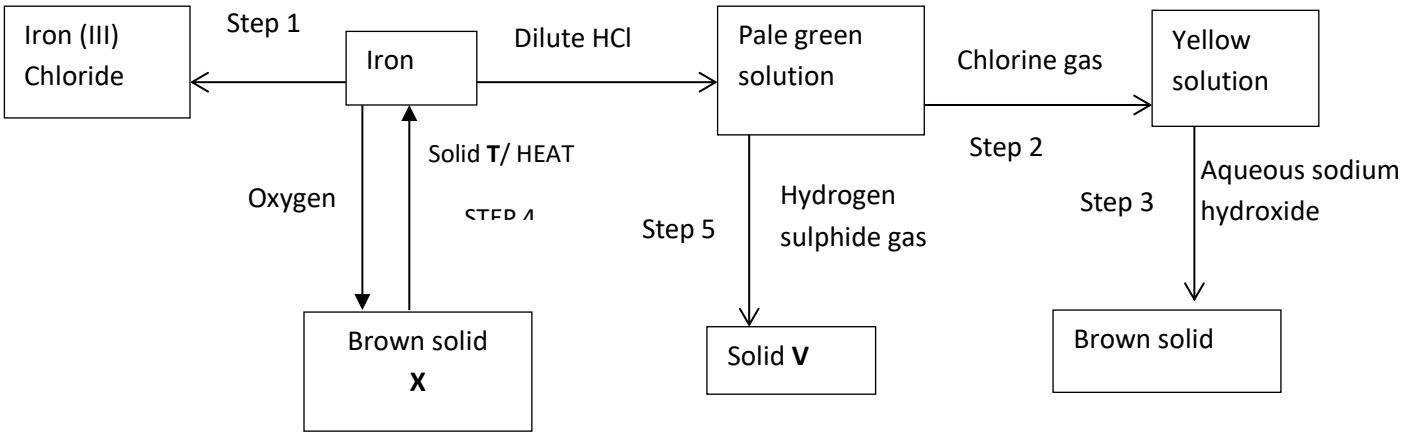
i) Moles of thiosulphate used **(1mk)**

ii) Moles of hydrochloric acid used **(1mk)**

iii) which of the two reactants in experiment I controlled the rate of the reaction? Explain **(2mk)**

c) Give two precautions which should be taken in experiment I controlled the rate of the reaction? **Explain** **(2mks)**

6. The flow chart below shows a sequence of reactions starting with iron. Study it and answer the questions that follow.



(a)Write balanced chemical equations and conditions where necessary for the reaction that takes place; **(i) Step 1** **(1mk)**

(ii) Step 2 **(1mk)**

(iii) Step 3 **(1mk)**

(b) State the observation that will be made in step 5 **(1mk)**

(c) Give a reason for the color change in Step 2. **(1mk)**

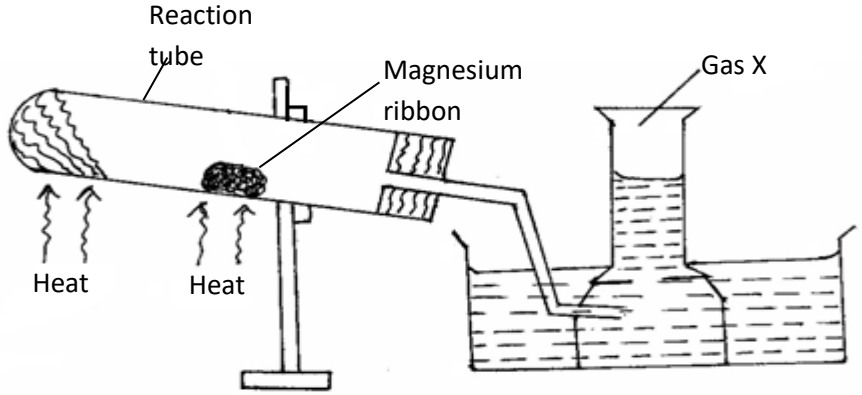
(d) Identify **X** ……..…… **(1mk)**

V …… **(1mk)**

T …….. **(1mk)**

(e) The mass of the product formed in step 1 was 2.0g. Calculate the volume of the gas used at r.t.p. (Fe =56. Cl = 35.5 and molar gas volume at r.t.p is 24 dm^3) **(3mks)**

7. The set-up **below** was used to prepare and collect gas **X.** During the experiment cleaned magnesium ribbon was strongly heated before heating the wet glass wool.



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

(b) Why is magnesium ribbon cleaned before it is used? **(1 mk)**

(c) State **one** observation that would be noted in the reaction tube. **(1 mk)**

(d) Write the equation for the reaction in the reaction tube. **(1 mk)**

(e) State **one** industrial use of the solid product formed in the reaction tube. **(1 mk)**

(f) What precaution should be taken at the end of experiment? Explain. **(2 mks)**

(g) At the end of the experiment 96.0cm³ of gas X were collected at 10°C and 1 atmosphere pressure. (Mg = 24, M.G.V = 22.4, T = O°C at stp, P = 1 atmosphere at stp).

(i) Determine the volume gas X would occupy at s.t.p? **(2 mks)**

(ii) Calculate the mass of magnesium ribbon used Mg = 24. **(2 mks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 8

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES:

1. *Write your name and index number in the spaces provided above.*

2. *Answer all the questions in the spaces provided.*

3. *All working must be clearly shown.*

4. *Non-programmable silent electronic calculators and KNEC mathematical tables may be used.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAXIMUM SCORE	CANDIDATES SCORE
1 – 28	80	

1. Metal **Q** displaces metals **T** and **U** from their oxides but does not displaces metal **R.** Metal **T** displaces **U** form its oxide. Arrange the metals according to their reactivity starting with the strongest reducing agent**.** **(1 mark)**

2. Chlorine gas can be prepared in the laboratory using the following two methods;

Solid substance X and concentrated Hydrochloric acid

Solid substance X, concentrated sulphuric (VI) acid and solid Sodium Chloride.

a) Name the solid substance X **(1 mark)**

b) What is role of concentrated sulphuric acid in the reaction**?** **(1 mark)**

c) State how dry chlorine gas is collected**.** **(1 mark)**

3. A white crystalline solid Q when heated to forms a brown gas, colourless gas that relights a glowing wooden splint and a yellow residue which turns white on cooling. Aqueous solution of Q forms white precipitate which dissolves excess aqueous ammonia solution to form a colourless solution P.

a) Write the name and chemical formulae of complex ion in solution **P.** **(2 marks)**

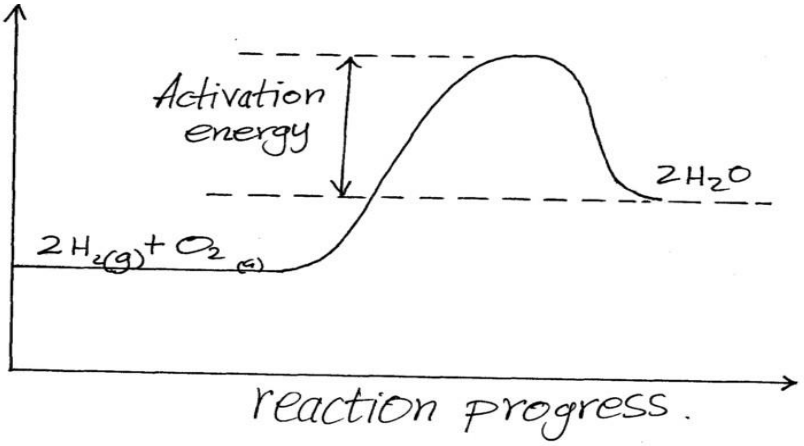
Name;

Chemical formula;

b) State the observation made when the aqueous solution of P is reacted with few drops of sodium hydroxide**.** **(1 mark)**

4(a) Define term Lattice energy **(1 mark)**

b) The reaction between hydrogen gas and oxygen releases energy. A student drew the reaction profile for the reaction between hydrogen gas and oxygen gas.



State two errors made when drawing the reaction profile. **(2mks)**

5. Ammonia gas is one of the substances recycled in the Solvay process.

a) Other than water name another substance that is recycled in the process. **(1 marks)**

b) Write a balanced chemical equation for the reaction that regenerates Ammonia gas in the process. **(1 mark)**

c) State an industrial use of the only waste product in the Solvay process**.** **(1 mark)**

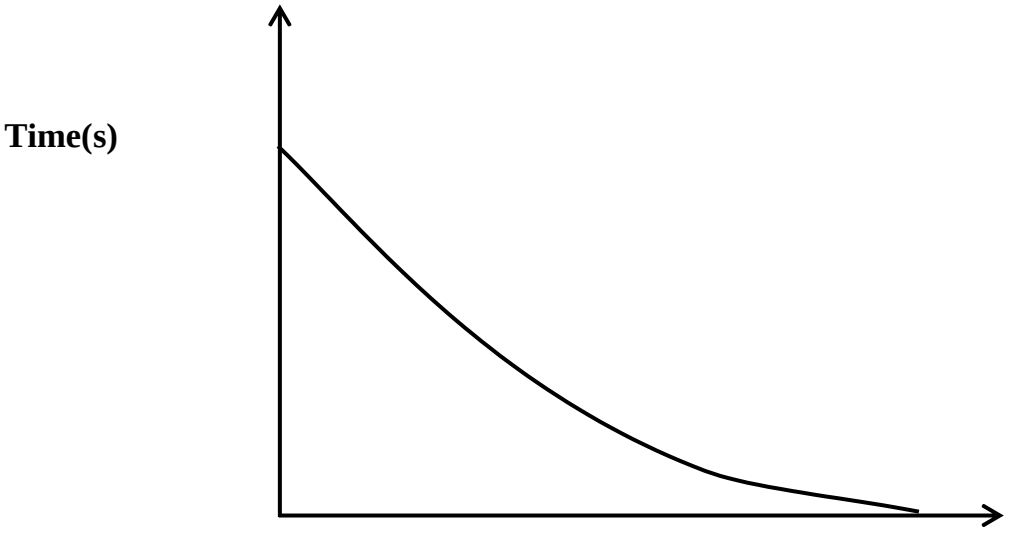
6. Lead (II) iodide is a toxic bright yellow solid which was used as a paint pigment known as 'iodine yellow'. Describe briefly how you would prepare lead (II) iodide in the laboratory starting with lead (II) oxide. **(3 marks)**

7. 5.0g of zinc carbonate were allowed to react with $25cm^3$ of 1M hydrochloric acid until there was no further reaction. Calculate the volume of gas that was formed at s.t.p. **(Zn = 65.4, O = 16, C = 12, molar gas volume at s.t.p = 22400 cm^3)** **(3 marks)**

8. Atoms of element P can be represented $^{23}_{11}P$. Element P reacts with sulphur to form a yellow as solid.

Using dots (•) and crosses (**X**) to represent electrons, draw the structure of the yellow solid. (S=16). **(2 marks)**

9. The curve shown below shows the variation of time against temperature for the reaction between sodium thiosulphate and hydrochloric acid.



(a) Explain the shape of the curve**.** ***(2 marks)***

(b) Other than temperature name **one** factor that affects the rate of reaction**.** ***(1 mark)***

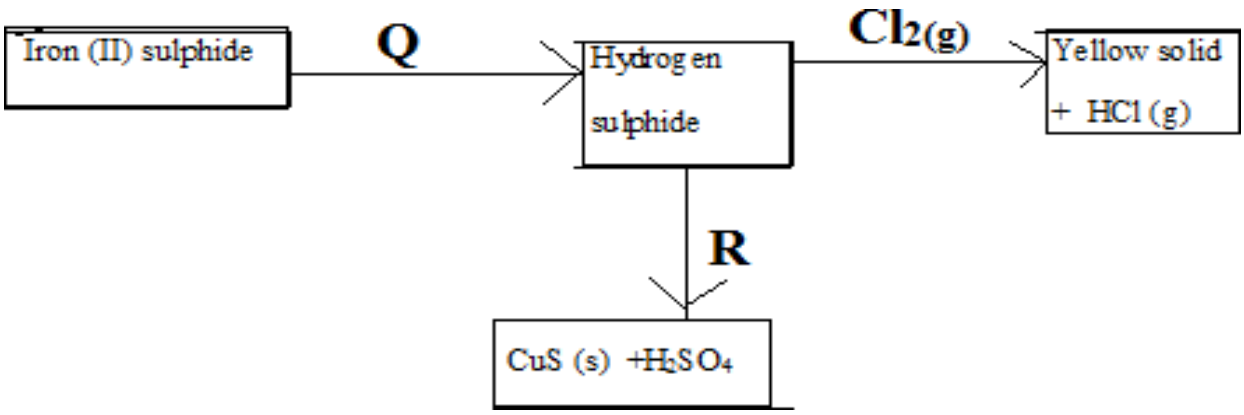
10 .Magnesium ribbon was added to a solution of hydrogen chloride in methylbenzene. Another piece of Magnesium ribbon was added to hydrogen chloride in distilled water. State and explain observations made. **(2 marks)**

11 State **two** differences between luminous and non luminous flame of the Bunsen burner**.**

(2 marks)

12 A fuel gas contains 50% of hydrogen gas and 44% of carbon (II) oxide by volume. The rest of is incombustible. Calculate the volume of gas that remains at room temperature when the 100 cm^3 fuel gas was ignited. **(3 marks)**

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



a) Name substances; Q and R **(1 mark)**

b) Write the equation for the reaction that leads to the formation of the yellow solid. **(1 mark)**

c) Using a chemical test, describe how you would distinguish between hydrogen sulphide and sulphur (IV) oxide. **(1 mark)**

14. A gas occupies a volume of 400cm^3 at 227^{o}C and 760mmHg.What will be the temperature of the gas when the volume and pressure of the gas is 100cm^3 and 380mmHg respectively**. 2 mks**

15. For each of the following experiments, give the observations, and the type of change that occurs (Physical or chemical) **(3 marks)**

Experiment	Observation	Type of change
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.		

16. (a)Define solubility of a solute. **(1 mark)**

b) The solubility of potassium nitrate is 120g/100g of water at 80 ^{o}C and 70g/100g of water at 20^{o}C.What mass of the salt would crystallize if 80g of potassium nitrate solution saturated at 80 ^{o}C was cooled to 20 ^{o}C **(2 Marks)**

17. Zinc metal reacted with dilute hydrochloric acid. The gas produced was then passed over heated copper

(II) oxide in a combustion tube.

a) State two precautions that must be considered when the gas reacts with copper (II) Oxide in the combustion tube. **(2 marks)**

b) Write a balanced chemical equation between zinc and dilute hydrochloric acid. **(1 mark)**

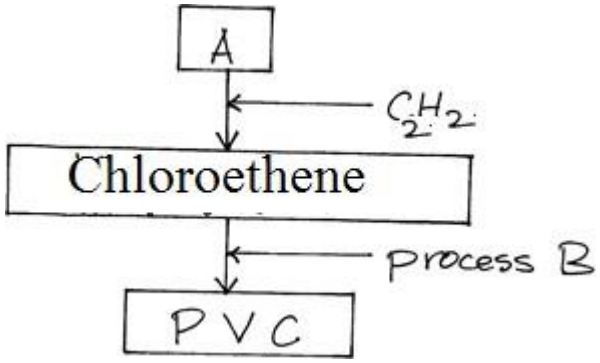
18. The table below shows ammeter readings recorded when two equimolar solutions were tested separately.

Electrolyte	Current (A)
Dilute Sulphuric (VI) Acid	7.210
Ethanoic Acid	4.011

a) Explain the difference in the ammeter readings. **(2marks)**

b) Compare the reactivity of equal length of magnesium ribbon with each of the electrolytes. **(1 mark)**

19. Study the scheme below and answer questions that follow



a) Identify reagent A.***(1mk)***

b) Name process B***(1mk)***

c) What does PVC stand for?***(1mk)***

20. One of the disadvantages of hard water is wastage of soap.

a) State one other disadvantage **(1mk)**

b) The table below shows tests carried out in a sample of water and the results obtained.

Sample	Results	observations
A	Addition of sodium hydroxide drop wise until excess	Whit precipitate which dissolves in excess
B	Addition of excess ammonia solution	White precipitate
C	Addition of dilute nitric (V) acid followed by barium chloride	White precipitate

(i) Identify the **anion** present in the water sample ***(1 Mark)***

(ii) Write an ionic equation for the reaction in **C** ***(1 Mark)***

21. A piece of sodium was burnt in excess oxygen gas. The product obtained was shaken with water to make a solution.

(a) Write a balanced equation for reaction between the product formed and water. **(1 mark)**

(b) State and explain the observation made when red and blue litmus papers are dipped into the solution. **(2 marks)**

22. Aluminium chloride and sodium chloride are both chlorides of period 3 elements in the periodic table. Use this information to explain the following observations.

a) A solution of Al_2Cl_6 in water turns blue litmus paper red while that of sodium Chloride does not.**(1½ marks)**

b) Sodium chloride has a melting point 801^oC is while Al_2Cl_6 sublimes 183^oC.**(1½ marks)**

23. The ionization energies of elements A and B are 495.9kJ/mol and 739.9kJ/ mol respectively. Both elements are in the same group of the periodic table.

a) What is ionization energy**?(1 mark)**

b) Compare the reactivity of elements A and B . Explain your answer**.(2 marks)**

24. Study the information given in the table below and answer the questions below.

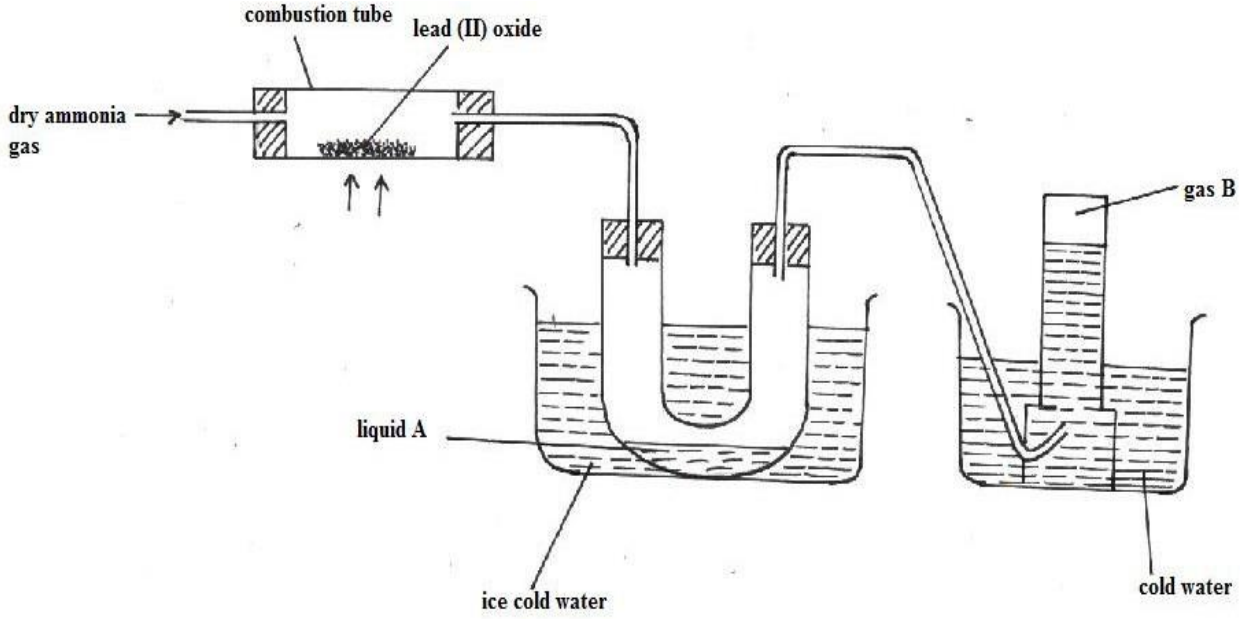
Bond	Bond energy(kJ/mol)
C-H	413
H-Cl	431
C-Cl	346
Cl-Cl	244
C – C	347

a) Calculate the enthalpy change for the reaction below.

$C_2H_6 (g) + Cl_2 (g) \rightarrow CH_3CH_2Cl (g) + HCl (g)$ **(2 marks)**

b) State a condition required for the reaction in (a) above to take place. (**1 mark)**

25. 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) Describe the chemical test for liquid **A.** **(1 mark)**

(b) What observation is made in the combustion tube during the reaction? (**1 mark)**

(c) State two uses of gas B. (**1 mark)**

26. a) State Graham's law of diffusion.***(1mk)***

b) 50cm³ of nitrogen (ii) oxide was allowed to diffuse through a porous membrane in 20 seconds. Calculate the time taken by equal volume of carbon (ii) oxide to diffuse through the same membrane. (C=12, N=14, O=16).***(2mks)***

27. Nitrogen (IV) oxide dissolves and reacts with Sodium hydroxide solution to form two salts and water.

a) What is the nature of Nitrogen (IV) oxide?**{1 mark}**

b) Write the Ionic equation for the reaction that takes place.**{1 mark}**

28. When powdered brass was reacted with excess dilute sulphuric (VI) acid, a solid residue was left.

(i) Name the residu**e.(1 mark)**

(ii) Explain why the residue was left**.(1 mark)**

(iii) State another observation made(**1 mark)**

29. During manufacture of sulphuric (vi) acid, sulphur (iv) oxide is oxidised to sulphur (vi) oxide in the presence of vanadium oxide catalyst as shown below:

$$2SO_{2(g)} + O_{2(g)} \rightleftharpoons 2SO_{3(g)} \quad \triangle H = -197kJ/mol$$

The reaction is carried out at a pressure of 3 atmospheres and a temperature of 450^0C. State and explain the effect on the yield of sulphur (vi) oxide if the reaction is:

a) Carried out at 3 atmospheres and 600^0C ***(2mks)***

b) In absence of a catalyst ***(2mks)***

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 8

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

1) *Write your **Name, Admission Number** and **School** in the spaces provided above.*
2) *Answer **all** the questions in the spaces provided after each question.*
3) *Mathematical tables and non-programmable electronic calculators may be used.*
4) ***ALL** working must be clearly shown where necessary.*

FOR EXAMINER'S USE ONLY

QUESTIONS	MAX SCORE	CANDIDATE'S SCORE
1	12	
2	10	
3	13	
4	11	
5	13	
6	10	
7	9	
TOTAL	**80**	

8. The grid below forms part of the periodic table. Study it and answer the questions that follow.

The letters do not represent the actual symbols of the elements

P				T	V	W	Y	M	
	Q		S	U		X			
	R						Z		

a) Write the general name given to the element P belong. **(1mark)**

b) An element N has an atomic number of 15. Write down its electronic arrangement and hence fix it in its right position on the grid above. **(1mark)**

Electronic arrangement

c) Compare the size of the atom of R and that of its ion. Explain your answer. **(2mks)**

d) Give the formula of the compound formed between **(1mark)**

i. P and W **……**

ii. T and Y **……..**

e) Compare the melting points of element Q and S. Explain **(2Mks)**

f) State the least reactive element in the grid. Give a reason for your answer **(1mk)**

g) Give two advantages that element S has over element Q in making electric cables **(2mks)**

h) Draw (a) dot (.) and cross (x) diagram to represent the bonding in compound formed between T and Y **(2 marks)**

9. a) Study the table below and answer the questions that follow

Bond type	bond energy $kJmol^{-1}$
C-C	346
C = C	610
C-H	413
C-Br	280
Br-Br	193

i) Calculate the enthalpy change for the following reaction **(3 marks)**

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

ii) Name the type of reaction that took place in (a) above **(1mark)**

b) Butane C_4H_{10} cannot be prepared directly from its elements but its standard heat of formation (ΔH_f^θ) can be obtained indirectly.

The following heats of combustion are given.

ΔH_C^θ (Carbon) = -393kJ/mol

ΔH_C^θ (Hydrogen) = -286kJ/mol

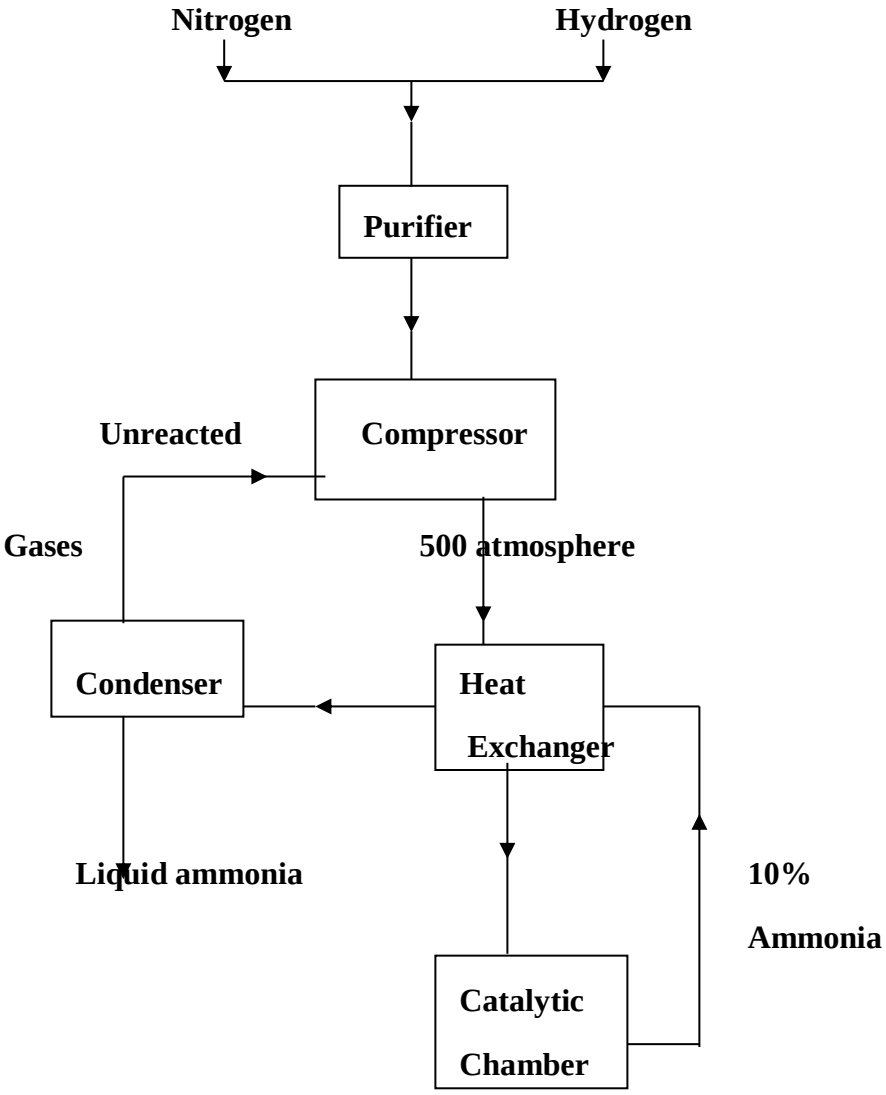
ΔH_C^θ (Butane) =-2877kJ/mol

i. Draw an energy cycle diagram linking the heat of formation of butane with its heat of combustion and the heat of combustion of its constituents elements. **(2mk)**

ii. Calculate the heat of formation of butane ΔH_f^θ (C_4H_{10}) **(2mks)**

c) Given that the lattice enthalpy of potassium chloride is +690kJ/mol and hydration enthalpies of K^+ and Cl^- are -322kJ and -364kJ respectively. Calculate the enthalpy of solution of potassium chloride. **(3 mks)**

10. The diagram below represents the Haber process for the manufacture of ammonia. Study it and answer the questions that follow.



a) **Name** any two impurities removed by the purifier. **(1mark)**

b) The catalyst used in the process is finely divided iron. Why iron is finely divided? **(1mk)**

c) In the Haber process the conversion of nitrogen and hydrogen into ammonia is only 10%. The remaining unreacted gases are recycled. What is the advantage of this? **(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, ammonia is catalytically oxidized to nitrogen (ii) oxide

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

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. **(1mark)**

(ii) State and explain what would be observed when dry litmus papers are dipped in a gas jar of chlorine. **(1mark)**

(iii) Freshly prepared chlorine water bleaches but chlorine water exposed to sunlight for sometime does not bleach. Explain. **(2marks)**

(iv) When preparing hydrogen chloride gas from sodium chloride and sulphuric (VI) acid, two conditions are necessary. State the conditions. **(1mark)**

11. A label on the bottle containing Sulphuric (IV) acid has the following information

- Density = 1.836 g/cm3
- Percentage purity = 98%
- Relative formula mass = 98

(a) Calculate:

i. The concentration of the **acid** **(3 mks)**

ii) The volume of concentrated sulphuric (IV) acid that should be diluted to produce 2 litres of 2 M Sulphiric (IV) **acid** **(2 mks)**

(b) A solution of sodium hydroxide was found to contain 12.4g/dm^3 of sodium hydroxide. 25cm^3 of this solution reacted with 15cm^3 of a solution of sulphuric (VI) acid. (Na=23.0, H=1.0, S=32.0, O=16.0)

(i) Find the molarity of the sodium hydroxide solution. **(1 mark)**

(ii) Calculate the number of moles of sodium hydroxide solution used. **(1 mark)**

(iii) Calculate the number of moles of the acid used. **(1 mark**

(iv) Determine the concentration of the sulphuric (VI) acid solution in g/dm^3.. **(3mrks)**

12. Define a saturated solution. **(1 mark)**

(b) The table below represent the solubilities of sodium nitrate and Sulphur (IV) oxide at different temperatures.

Temp (^oC)	10	18	26	34	42
Solubility of Sodium Nitrate (g/ 100g of water)	20	29	40	53	68
Solubility of Sulphur (IV) Oxide (g/ 100g of water)	78	55	45	40	36

On the grid provided below, plot a graph of solubilities of sodium nitrate and Sulphur (IV) oxide against temperature. **(4 marks)**

Using the graph;

i. Determine the solubility of Sulphur (IV) oxide at 16^{o}C. **(1 mark)**

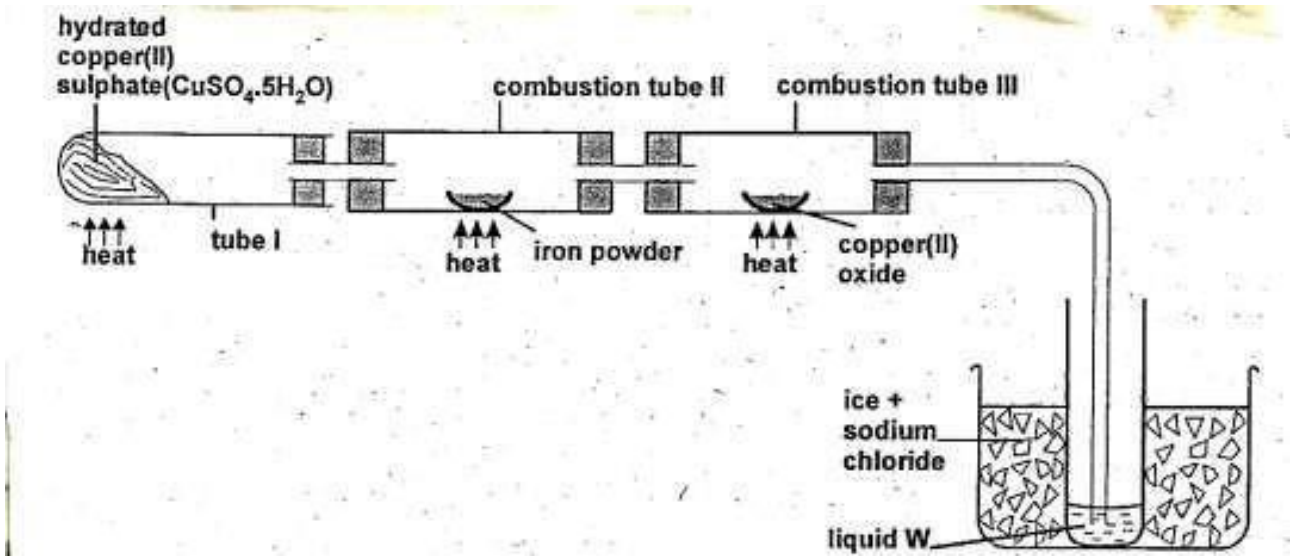
ii. The concentration, in moles per litre, of sodium nitrate at 16 ^{o}C. (assume density of solution is 1 g/cm^3) (**Na=23, 0=16, N=14).** **(3 marks)**

iii. Mass of crystals formed when a solution of sodium hydroxide is cooled from 40^{o}C to 26^{o}C. **(2 marks)**

iv. What is the relationship between solubility of sodium nitrate and temperature? **(1 mark)**

(c) Give one advantage of hard water. **(1 mark)**

6. The diagram below shows the apparatus for the preparation of gas A and investigate on its properties . Study it and answer thequestions that follow.



a) (i) Name gas A. **(1 mark)**

(ii)suggest property of gas A under investigation **(1mark)**

(iii) Write chemical equations for the reactions in the;

Boiling tube I **(1 mark)**

Combustion tube II **(1 mark)**

b) (i) State and explain the observation made in

Tube I. **(1 mark)**

Combustion tube II **(1 mark)**

c) (i)What is the use of hydrated copper (II) sulphate in the experiment**?** **(1 mark)**

(ii)Name one other substance that comes out of tube III. **(1 mark)**

(iii)Name liquid W. **(1 mark)**

(iv) What is the role of sodium chloride in the ice (freezing mixture) **(1 mark)**

7. Study the condensed formulae below and answer the questions that follow

(a) I $CH_3CH\ (CH_3)\ CH_2CHCH_2$

II $CH_3CHCH(CH_3)CH_3$

i. Draw the structural formula of each of the compounds I and II **(2mks)**

I. .

II.

ii. Give the systematic name of each of the compounds represented by the formulae above **(2mks)**

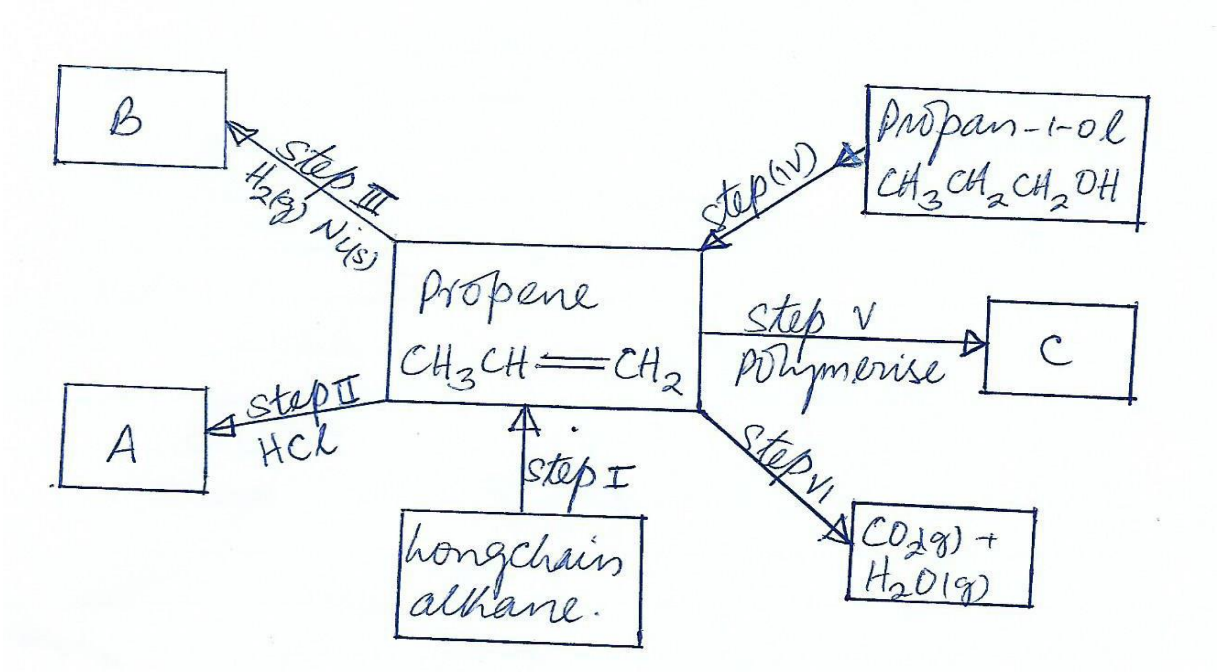
I_____

II_____

iii. To which homologous series does the compound represented by I belong **(1/2 mk)**

……

(b) The flow chart below shows some reactions starting with a long chain alkane. Study it and answer the questions that follows.



i. Name substance **(1 1/2 mks)**

A_____

B_____

C_____

ii. What is the name given to the process represented by

Step I_____ **(½ mk)**

Step III_____ **(½ mk)**

Step IV_____ **(½ mk)**

Step VI_____ **(½ mk)**

iii. Write down the chemical equation represented by the reaction in step **VI** **(1mk)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 9

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

(a) *Write your name and index number in the spaces provided here*

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

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

(d) *KNEC Mathematical tables and silent non – programmable electronic calculators may be used.*

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

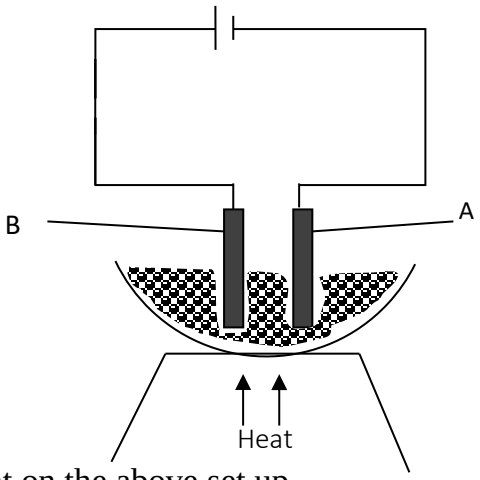
FOR EXAMINERS' USE ONLY.

QUESTIONS	MAXIMUM SCORE	CANDIDATES SCORE
1 - 29	80	

Answer ALL questions

1. A luminous flame produces more light than a non-luminous flame. Explain. **(2 marks)**

2. The diagram below was used to electrolyze molten copper (II) chloride using graphite electrodes at s.t.p.



(a) Explain the role of heat on the above set up. **(1 mark)**

(b) Write equations at electrode A and B. **(2mark)**

3. Dry ammonia was passed over heated copper (II) oxide in a combustion tube.

(a) State and explain the observation that was made. **(2 marks)**

(b) Write a balanced chemical equation for the reaction above**.** **(1 mark)**

4. (a) Use dots (•) or crosses (x) to show bonding in the silicon chloride **(1mark)**

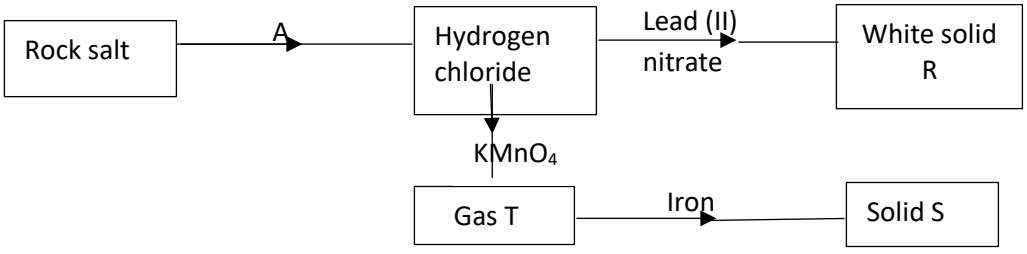
b) Ethanol and dimethylether have both molecular formulae C_2H_6O. Explain why ethanol C_2H_6OH boils at 78.2^{0}C and dimethyl ether CH_3OCH_3 has a boiling point -24^{0}C. **(2 marks)**

5. When 17.2 g of hydrated calcium sulphate was heated to a constant mass, 13.6g of the residue was obtain. Find the value of n in $C_aSO_4 \bullet nH_2O$. **(3 marks)**

(Ca = 40, S = 32, O = 16, H = 1)

6. **In** an experiment, ammonium chloride was heated in a boiling tube with a moist red and blue litmus paper at the mouth of test tube. State and explain the observation made. **(3 marks)**

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

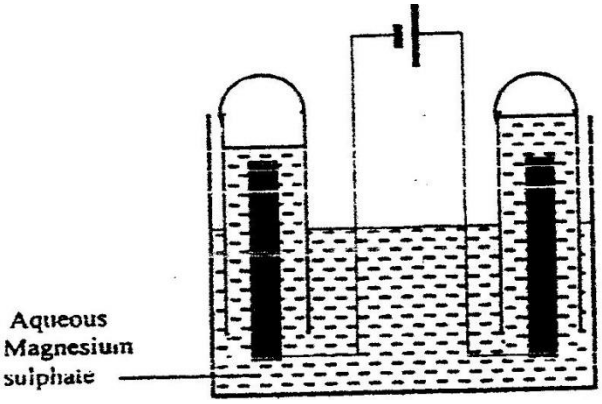


(a) Name reagent used in step A. **(1 mark)**

(b) Write the ionic equation for formation of white solid R. **(1 mark)**

(c) Write an equation for formation of solid S. **(1 mark)**

8. The set-up below was used during the electrolysis of aqueous magnesium sulphate using inert electrodes.



i) On the diagram label the cathode. **(½mark)**

ii) Write an equation for the reaction that took place at the cathode**.** **(1 mark)**

iii) Explain the change that occurred to the concentration of magnesium sulphate solution during the experiment. **(1½ marks)**

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

$$2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3(g)} \qquad \Delta H = -196kJ/mol^{-}$$

State and explain the effect on the yield of Sulphur (IV) oxide when:

a) the temperature increased. **(1½ marks)**

b) the amount of oxygen is increased. **(1½marks)**

10. Dry carbon (II) oxide is passed over heated iron (III) oxide.

a) Name the type of reaction between carbon (II) oxide and iron (III) oxide. **(1mark)**

b) Write an equation for the reaction between carbon (II) oxide and iron (III) oxide **(1mark)**

c) Name a suitable drying agent for carbon (II) oxide **(1mark)**

11. Thermochemical equation for combustion of ethanol is shown below;

$C_2H_5OH\ (l) + 3\ O_2\ (g) \longrightarrow 2\ CO_2\ (g) + 3\ H_2O\ (I),\ AH = -1337kJmol$

(a) Determine the heating value for ethanol? **(2 mark)**

(C= 12, H = 1, O = 16)

(c) Draw the structural formula for 2-methylprop-l-ene **{1 mark)**

12. a) Define oxidation in terms of electrons **(1mark)**

b) Determine the oxidation state of **(1mark)**

i) Suphur in SO_3^{-2} ion

ii) Phosphorous in PO_4^{3-} ion **(1mark)**

13. Labels on acid solutions indicated the following:-

Acid 1 :0.1M, 6.5% ionized

Acid 2 :0. 2M, 1.3% ionized

(a) Identify the strong acid **(1 mark)**

(b) If $25cm^3$ of distilled water are added to $50cm^3$ of acid 2, what is its new concentration? **(2 mark)**

14. When 0.05 mole of magnesium were added to $100cm^3$ of dilute hydrochloric acid at 25°C, 25kJ of heat energy were released. The acid was in excess.

(a) Calculate the highest temperature of the reaction mixture. **(2mark)**

(specific heat capacity for water is 4.2J/g/ °*C*, density of the solution is lg/cm^3)

(b) Calculate the molar heat of reaction for the reaction below **(1 mark}**

$Mg(s) + 2HCl(aq) \longrightarrow MgCl_2(aq) + H_2(g)$

15. Hydrogen sulphide is a highly toxic and flammable gas and is usually prepared in the fume chamber.

a) Name any two reagents that can be used to prepare hydrogen sulphide in the laboratory. **(1mk)**

b) Hydrogen sulphide could be used to produce sulphur as shown in the equation below:

$$2H_2S_{(g)} + SO2_{(g)} \longrightarrow 3S_{(s)} + 2H_2O_{(l)}$$

In the equation above, identify the reducing agent and give a reason for your answer**.** **(1mk)**

c) Other than Vulcanization of rubber, identify any other uses of Sulphur**.** **(1mk)**

16. The following table shows the P^H values of solutions A ,B and C

Solution	**A**	**B**	**C**
pH	2	**7**	11

(a) Which solution is likely to be magnesium chloride? Give a reason. **(1mk)**

(b) Identify the solution in which a sample of aluminium chloride is likely to be when dissolved in water. Explain **(2mks)**

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

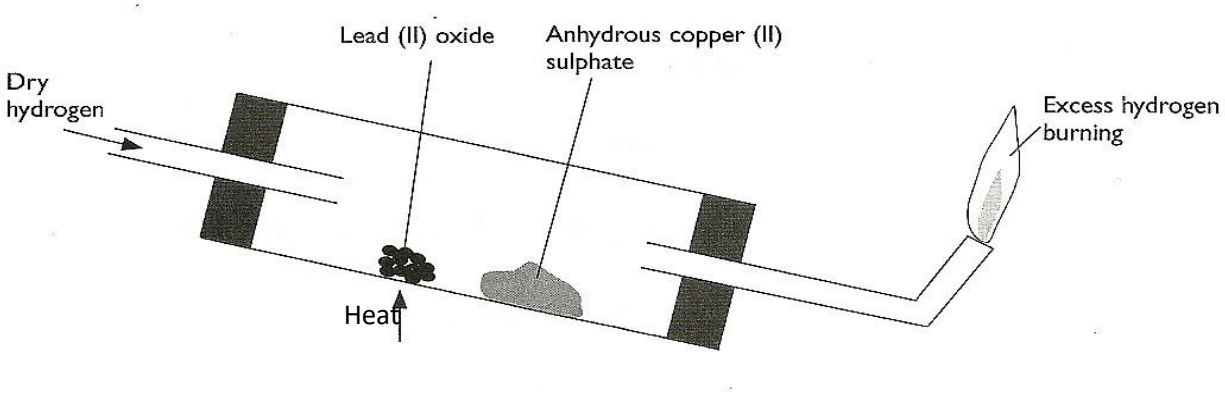
		Ionization Energy_kJ/Mole $^{-1}$	
Element	**Electronic configuration**	**1st ionization energy**	**2nd ionization energy**
A	2.2	900	1800
B	2.8.2	736	1450
C	2.8.8.2	590	1150

a) What is ionization energy **(1mk)**

b) Explain why the 2nd ionization energy is higher than the 1st ionization energy. **(1mk)**

18. An element K has relative atomic mass of 40.2. It has two isotopes of masses 39 and 42. Calculate the relative abundance of each isotope. **(3mks)**

19. Use the diagram below to answer the questions that follow.



a) After the experiment has been running for some time, record two major observations made in the tube. **(2mks)**

b) Write an equation for the reaction that takes place in the dish containing lead (II) oxide. **(1mk)**

20. a) Name two ores of iron. **(1mks)**

b) Give the name of the suitable method used in extracting iron from the ore. **(1mk)**

21. Name one impurity present in pig iron and state one effect of the impurity in the physical property of iron. **(1mks)**

22. The table below gives two samples of mixtures. Study the table and answer the questions that follow

Mixture 1 components	**Mixture 2 components**
Silver Chloride	Iron (III) Chloride
Lead Chloride	1ron (III) Oxide
water	-

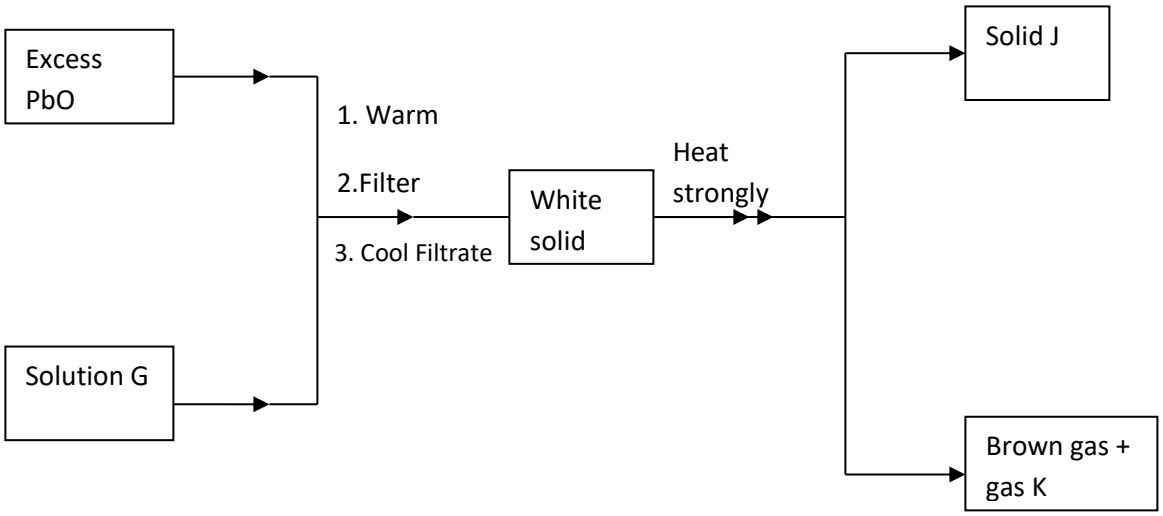
a) State the main property that makes components of **Mixture 1** separable **(1mk)**

b) Draw a well labeled diagram of a simple laboratory set up which can be used to separate the components of **Mixture 2** **(2mks)**

23. a) What name is given to group one elements ? **(1mk)**

b) Explain why there is a general increase in the atomic radii of the elements down a group of the periodic table. **(2 mks)**

24. Study the flow chart below and answer the question that follows.



Identify: **(3mks)**

a) Solution G

b) Solid J

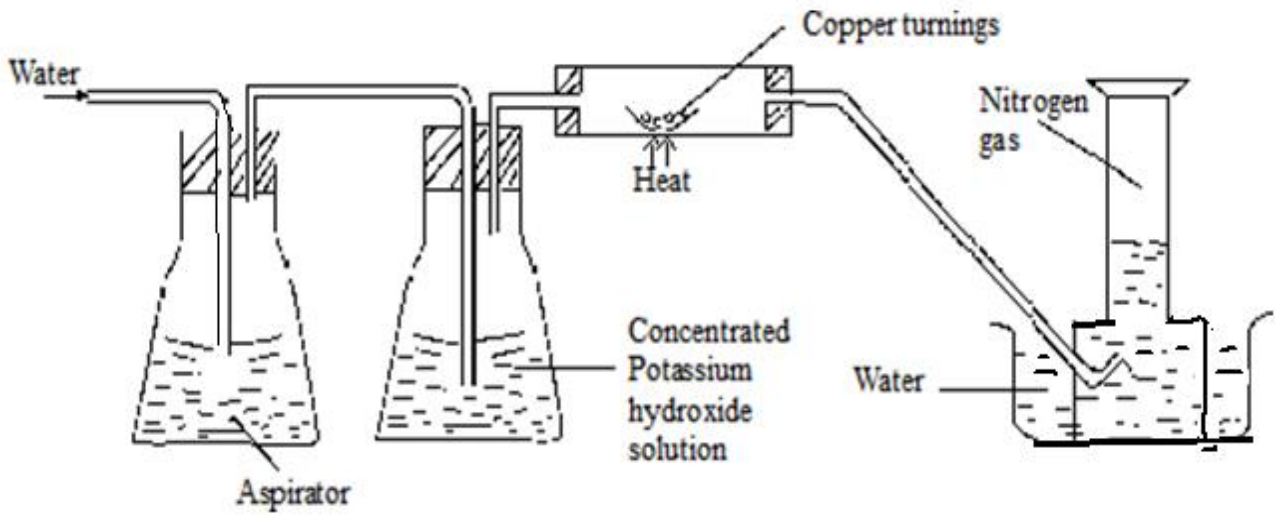
c) Gas K

25. Draw and name structural formulae of two isomers whose molecular formula is C_4H_{10}. **(3mks)**

26. The concentration of a solution of aluminium sulphate is 0.02M. How many sulphate ions are contained in 150 cm^3 of the solution**?** (Avogadro's constant= 6.0×10^{23}) **(3 mks)**

27. Explain why a solution of hydrogen chloride gas in methylbenzene does not conduct electricity but solution of the gas in water conduct electricity**.** **(2mks)**

28. Nitrogen gas can be obtained from air as shown below.



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

b) write the equation for the reaction that takes place in the chamber containing copper turnings **(1 mk)**

c) The nitrogen gas obtained above is not pure. Identify one gaseous impurity in the gas. **(1mk)**

29. Radioactive, polonium, $^{216}_{84}Po$, decays as shown below:-

$$^{216}_{84}Po \longrightarrow {}^{208}_{82}Pb + M\,\alpha + n\,\beta$$

Determine the values of M and N**.** **(2 marks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 9

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

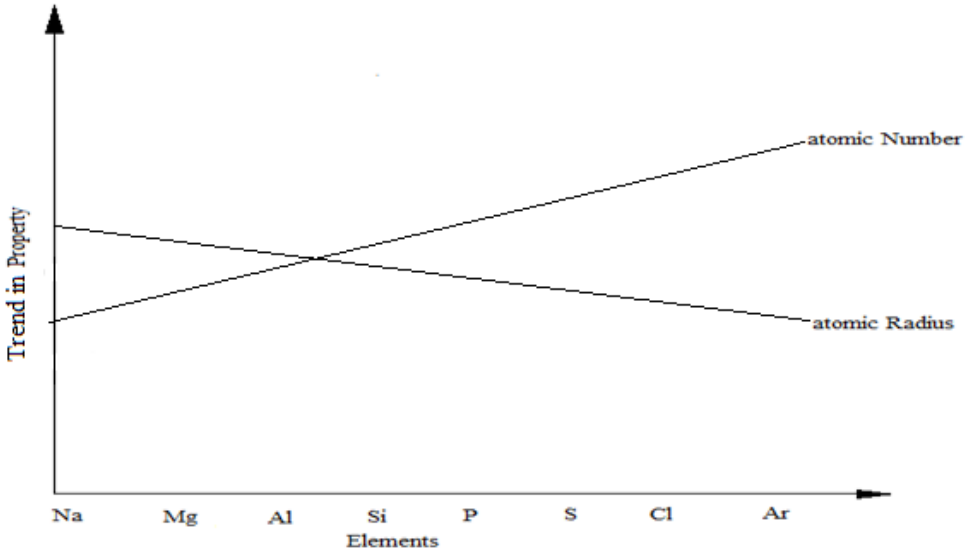
1. *Write your name, class and admission number in the spaces provided above.*
2. *Answer all the questions in the spaces provided in the questions paper.*
3. *Mathematical tables and silent electronic calculators may be used.*
4. *All working must be shown where necessary.*

For Examiners Use Only

Question	Maximum score	Candidates score
1	10	
2	11	
3	14	
4	10	
5	12	
6	11	
7	12	
TOTAL	80	

QUESTIONS

1. The figure below represents trends of some properties of period three elements. Study it answer the questions that follow.



a). Explain the trends shown by the atomic numbers and the atomic radii

i). Atomic number **(1 mark)**

ii). Atomic radii **(2 marks)**

b). On the same axes, sketch the trend of reactivity across the period **(1mark)**

c). Write down the electronic configuration of phosphorous and sulphur in the following compounds

i). H_3PO_4 (P=15) **(1 mark)**

ii). $Na_2S_2O_3$ (S=16) **(1 mark)**

d). i). One of the elements given in the figure above is stored under water.

Identify the element and give a reason as to why it is stored under water **(1 mark)**

ii). State one use of aluminium that can be associated with its malleability. **(1mark)**

e). Explain the observation that would be made if the chloride of Phosphorous is exposed to moist air. **(2 marks)**

2.a). Sulphur is extracted from sulphur beds below the earth's surface. Super-heated water is pumped down a pipe into the sulphur beds.

i. What is super-heated water and how is it obtained**?** **(2marks)**

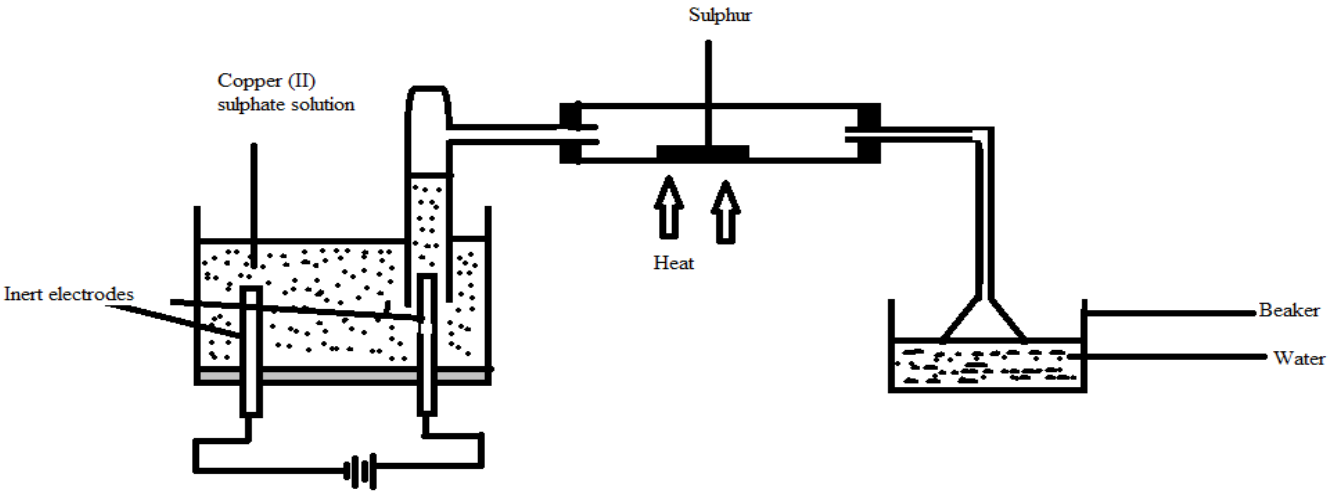
ii. Why does the water used here have to be **superheated**, and **not use boiling** water? **(1mark)**

iii. When molten sulphur is pumped to the surface, it solidifies. Which allotrope of sulphur forms first? **(1mark)**

iv. Name the form of sulphur obtained when liquid sulphur is poured into a beaker of cold water

(1mark)

b) The diagram below represents a set up that can be used for electrolysis of aqueous copper (II) sulphate. Use it to answer the questions that follow.



i. What do you understand by the term inert electrode**?** **(1mark)**

ii. What is the purpose of the filter funnel? **(1mark)**

iii. Explain what happens to the pH of the:

I. Water in the beaker**.** **(1mark)**

II. Copper (II) sulphate **solution** **(1mark)**

iv. Write ionic equation for the:

I. Oxidation **reaction** **(1mark)**

II. Reduction reaction, in above set up. **(1mark)**

3. a). (i) Define the term 'molar enthalpy of formation of a compound; **(1mark)**

(ii) Calculate the molar enthalpy of formation of ethane using the following information:

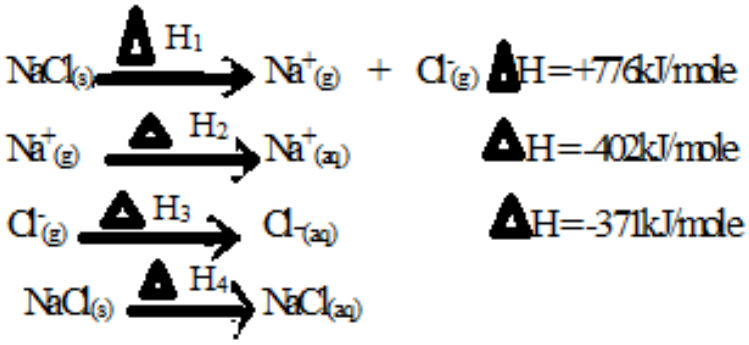
$$C_2H_{6(g)} + \frac{7}{2}O_{2(g)} \longrightarrow 2CO_{2(g)} + 3H_2O_{(l)},\ \Delta H_f^{\Theta} = -1561\ kJ/mole$$

$$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)},\quad \Delta H_f^{\Theta} = -394\ kJ/mole$$

$$H_{2(g)} + \frac{1}{2}O_{2(g)} \longrightarrow H_2O_{(l)},\quad \Delta H_f^{\Theta} = -286\ kJ/mole$$

(3marks)

b) Study the reactions below and answer the questions that follow:



I. State the name given to :

a) ΔH_1 **…….(1mark)**

b) ΔH_2 **……(1mark)**

II. Draw an energy cycle diagram illustrating the reactions above. **(2marks)**

III. Determine the value of H_4 **(2marks)**

IV. Joy placed 100cm^3 of 0.1M $CuSO_{4(aq)}$ in a plastic beaker , covered it with some cotton wool and recorded its initial temperature. She then added excess zinc powder to the solution and stirred it using a stirrer. She noted down the following data:

Initial temperature 20.5^{o}C

Final temperature 30.0^{o}C

Density of solution 1.0g/cm^3

Specific heat capacity of water 4200J/kg/k

i. Apart from the temperature rise, state one other observation made while she was stirring. **(1mk)**

ii. Calculate the heat change for the reaction above **(1mark)**

iii. Determine the number of moles of ions of copper reacting **(1mark)**

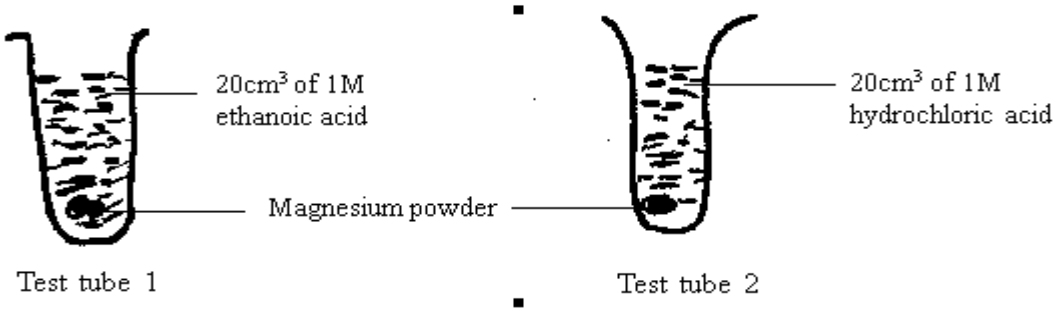
iv. Hence, determine the molar enthalpy of the reaction**.** **(1mark)**

4. a) An experiment was set up to investigate the effect of temperature on the rate of reaction between 1.0g calcium carbonate and excess hydrochloric acid. The temperature was varied from15^{0}C, 20^{0}C and 25^{0}C; and data obtained for the 3 sets of reagents.

i) Sketch a graph of volume of carbon (IV) oxide gas produced against time for each temperature on the axes below. Label each graph with corresponding temperature. Consider all gas volumes measured at same temperature and pressure. **(2 marks)**

ii) Explain the shape of graphs you've drawn in (a) above. **(2marks)**

b) In an experiment, equal amounts of magnesium powder were placed into test tube 1 and 2 as shown below.



i) Explain why the magnesium powder in test tube 2 gets used up faster than that in test tube 1. **(3 mks)**

ii) Other than concentration, state one factor that affects the rate of a reaction. **(1 mark)**

c) Consider the equilibrium of the reaction below

$$A_{(g)} + B_{(g)} \rightleftharpoons D_{(I)} + E_{(g)};\ DH = -ve.$$

In which direction will the equilibrium position shift as a result of each of the following changes? Explain.

i) Raising the temperature **(1 mark)**

ii) Reducing the volume of the container. **(1mark)**

5.(a) Work out the oxidation number of nitrogen in NO_3^- ? **(1 mark)**

(b) Study the standard electrode potentials below and answer the questions that follow. (The letters do not represent the actual symbols of the elements.

$A^+_{(aq)} + e^- \rightarrow A_{(s)} \quad E^\vartheta = -2.92V$

$B^+_{(aq)} + e^- \rightarrow B_{(s)} \quad E^\vartheta = +0.52V$

$C^+_{(aq)} + e^- \rightarrow \frac{1}{2}C_{2(g)} \quad E^\vartheta = 0.00V$

$\frac{1}{2}D_{2(g)} + e^- \rightarrow D^-_{(aq)} \quad E^\vartheta = +1.36V$

$E^{2+}_{(aq)} + 2e^- \rightarrow E_{(s)} \quad E^\vartheta = -0.44V$

(i) With reasons, identify the;

I Strongest reducing agent. **(1 mark)**

II the reference electrode. **(1 mark)**

(ii) Write the overall equation for the reaction that will be obtained when half cells of B and E are connected. **(1 mark)**

(iv) Explain whether the reaction represented below can take place. **(2 marks)**

$$2A^{+}_{(aq)} + E_{(s)} \longrightarrow 2A_{(s)} + E^{2+}_{(aq)}$$

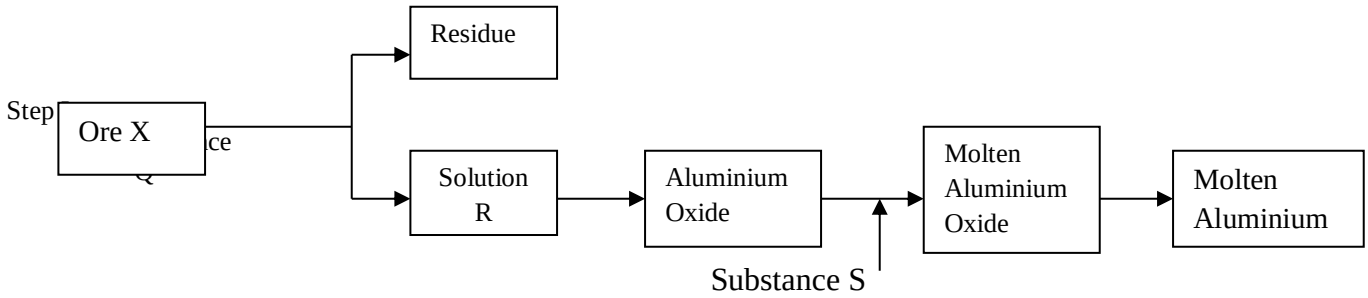
(v) Draw the cell diagram obtained when the half cells in (ii) are combined. **(2 marks)**

(c) In an experiment to electroplate a copper spoon with silver, a current of 0.5A was passed for 18 minutes.

(i) Sketch a diagram to show how the experiment was carried out. **(2 marks)**

(ii) Calculate the amount of silver deposited on the spoon. (IF = 96500C, Ag = 108)**(2 marks)**

6. The process of extraction of Aluminium is summarized as below:



(a) (i) Write the formula of the main Ore X which is used in extraction of Aluminium. **(1 mark)**

(iii) Name:

(a) The main residue formed after filtration in step I. **(1 mark)**

(b) Substance Q. **(1 mark)**

(iv) How is the sodium Aluminate in Solution R separated from the impurity silicon (iv) oxide. **(2 marks)**

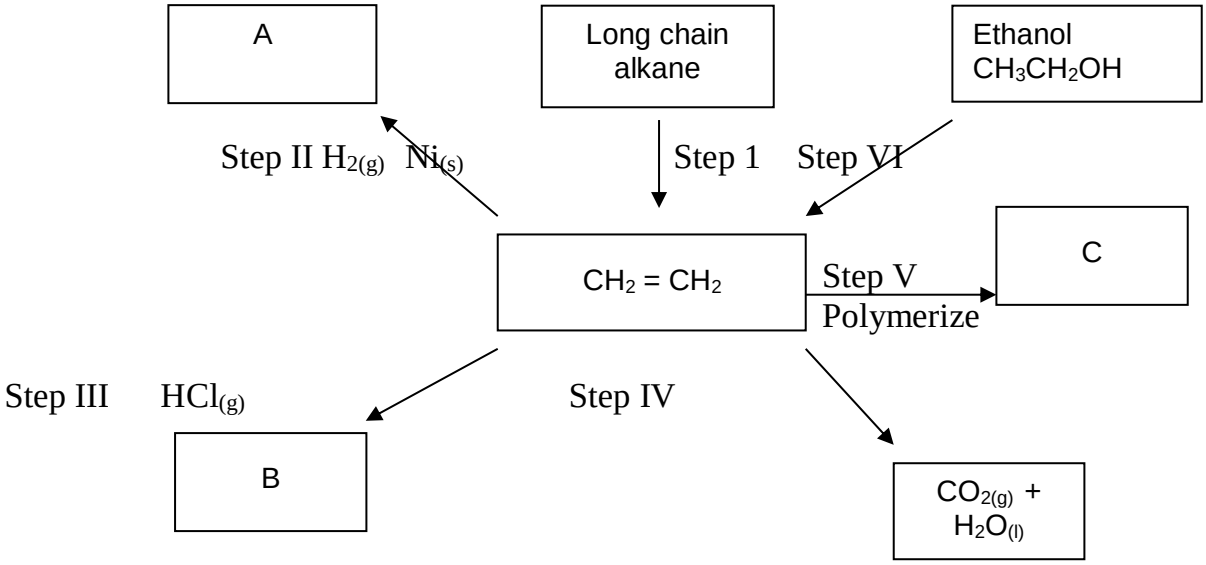
(v) What is the purpose of addition of substance S in step III. Explain. **(2 marks)**

(b) (iExplain why the Anode in extraction of Aluminium is replaced periodically.**(2 marks)**

(ii) Write an equation for the formation of Aluminium at the cathode. **(1 mark)**

(c) Explain why Duralum an alloy of Aluminium is used in construction of aircraft parts and car window frames. **(1 mark)**

7.(a) Study the flow chart below and answer the questions that follow.



(i) Name the process taking place in step (I). **(1mark)**

(ii) Describe a chemical test that can be carried out to show the identity of organic compound A. **(2marks)**

(iii) Give the name of the following: **(2marks)**

I. A:……

II. B:……

(iv) Give the structural formulae of substance C. **(1mark)**

(v) Name the type of reaction that occurs in:

I. Step IV **(2marks)**

II. Step VI:

(vi) Give the reagent and the condition necessary for step VI. **(2marks)**

Reagent: **……**

Condition**: ……**

(b) Give the systematic names of the following compounds:

I. $CH_2CHCHCH_2CH_3$ **(1mark)**

II. CH C CH_3 **(1mark)**

This is the last printed page

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 10

233/1

CHEMISTRY

PAPER 1 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

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

FOR EXAMINERS USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1-30	80	

QUESTIONS

1. State **two** reasons why most apparatus in the laboratory are made of glass **(2mks)**

2. The following is an organic compound represented as $CH_3CH_2COOCH_2CH_3$

(i) Name the organic acid and the alkanol used in making the compound **(2mks)**

(ii) Name the organic compound and the gas formed when the alkanol in (i) above is reacted with Potassium **(1mk)**

3. Use the information below to answer the question that follows

$Ca_{(s)} + ½\ O_{2(g)} \longrightarrow CaO_{(s)}$; ΔH=-635KJmol$^-$

$C_{(s)} + O_{2(g)} \longrightarrow CO_{2(g)}$; Δ H= -394KJmol$^-$

$Ca_{(s)} + C_{(s)} + {}^3/_2O_{2(g)} \longrightarrow CaCO_{3(s)}\Delta H$= -1207 KJmol$^-$

Calculate the enthalpy change for the reaction

4. (a) What is the role of the following parts during fractional distillation of a mixture of water and ethanol

(i) Fractionating column **(1mk)**

(ii) Glass beads in the fractionating column **(1mk)**

(b) State any one application of fractional distillation process **(1mk)**

5. Name the process which takes place when:

(i) Iodine changes directly from solid to gas **(1mk)**

(ii) $Fe^{2+}_{(aq)}$ changes to $Fe^{3+}_{(aq)}$ **(1mk)**

(iii) White sugar changes to black solid when mixed with excess concentrated sulphuric (VI) acid **(1mk)**

6. The melting point of phosphorous trichloride is -91^{o}C while that of sodium chloride is 801^{o}C. In terms of structure and bonding. Explain the difference in their melting point **(3mks)**

7. (a) Name a suitable drying agent to be used to dry chlorine gas **(1mk)**

(b) Chlorine reacts with red hot powder to give iron (III) chloride but not iron (II) chloride. Explain? **(1mk)**

(c) Sodium hydroxide reacts with chlorine to form bleaching powder. Write a balanced equation for the reaction **(1mk)**

8. The electronic arrangement of elements are represented by letters A to D are as follows

A:2.8.6 **B:2.8.2** **C:2,8,1** **D2:8.8**

(a) Select the element which forms

(i) Double charged cation **(1mk)**

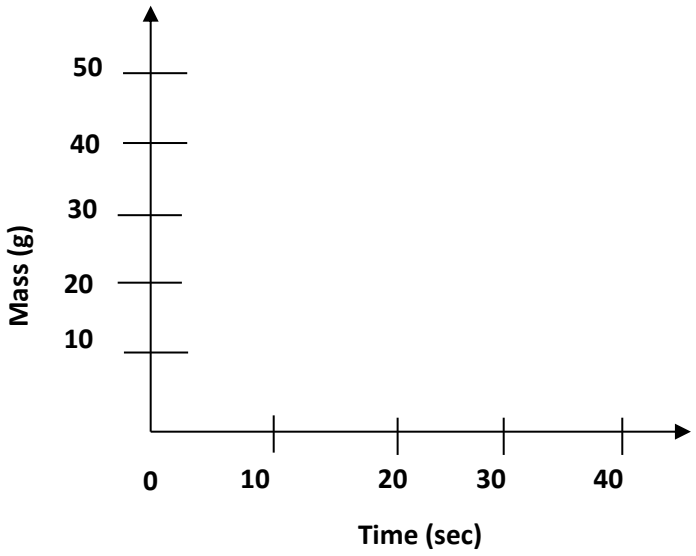
(ii) A soluble carbonate. **(1mk)**

(b) Which element has the shortest atomic radius? **(1mk)**

9. Describe how a sample of Lead (II) chloride can be prepared using the following reagents dilute nitric (V) acid; dilute hydrochloric acid and lead carbonate **(3mks)**

10. A radioactive element of mass 50g has a half-life of 10 seconds

(a) Sketch a graph of mass against time to show how the element mass varies with time **(2mks)**



(b) Give **one** use of radioactive in industries **(1mk)**

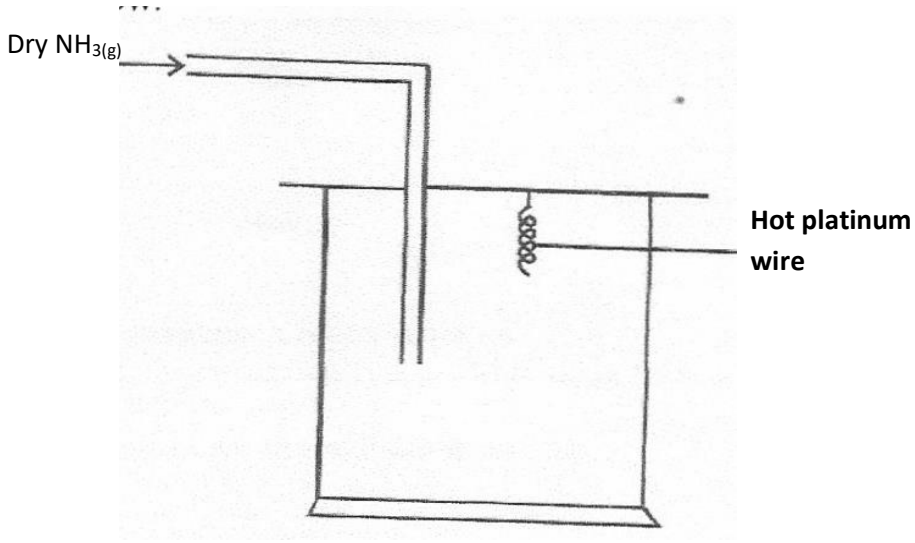
11. **State** and explain **one** disadvantage of using hard water in boilers **(2mks)**

12. **Hydrogen** sulphide gas was passed through a solution of iron(III) chloride

(i) State and explain the observations made **(2mks)**

(ii) Write an ionic equation for the reaction taking place in (i) above **(1mk)**

13. The apparatus below was set up to show the catalytic oxidation of ammonia. Study the diagram and answer the questions that follow



(i) Write an equation for the reaction that takes place in the gas jar **(1mk)**

(ii) What is the role of hot platinum wire? **(1mk)**

(iii) Write the formula of the complex ion formed when excess ammonia gas is passed through a solution containing Zn^{2+} ions. **(1mk)**

14. A solution of silver nitrate was put in a container made of metal Q for 1 day. Given that:

$Q^{2+}_{(aq)} + 2e^- \rightleftharpoons Q_{(s)} : E^{\theta} = 0.130v$

$Ag^{+}_{(aq)} + e \rightleftharpoons Ag_{(s)} : E^{\theta} = +0.80v$

Determine whether or not a reaction occurred between silver nitrate and metal Q **(2mks)**

15. The table below shows the solubility of salt at various temperatures

Temperature	Solubility g/100g of water
0	36
40	30
80	25
110	20

What would happen if a sample of a saturated solution of the salt 40°C is heated to 80°C? Explain **(2mks)**

16. The equation given below represents a redox reaction

$Mg_{(s)} + 2HCl_{(aq)} \longrightarrow MgCl_{2(aq)} + H_{2(g)}$

(i) Write the equation of the reduction process **(1mk)**

(ii) Which substances is oxidized? **(1mk)**

17. **When** a current of 1.5 amperes was passed through cell containing M^{2+} ions on metal M for 15 minutes the mass of the cathode increased by 0.26g. (1F=96500C)

(i) Calculate the quantity of electricity used **(1mk)**

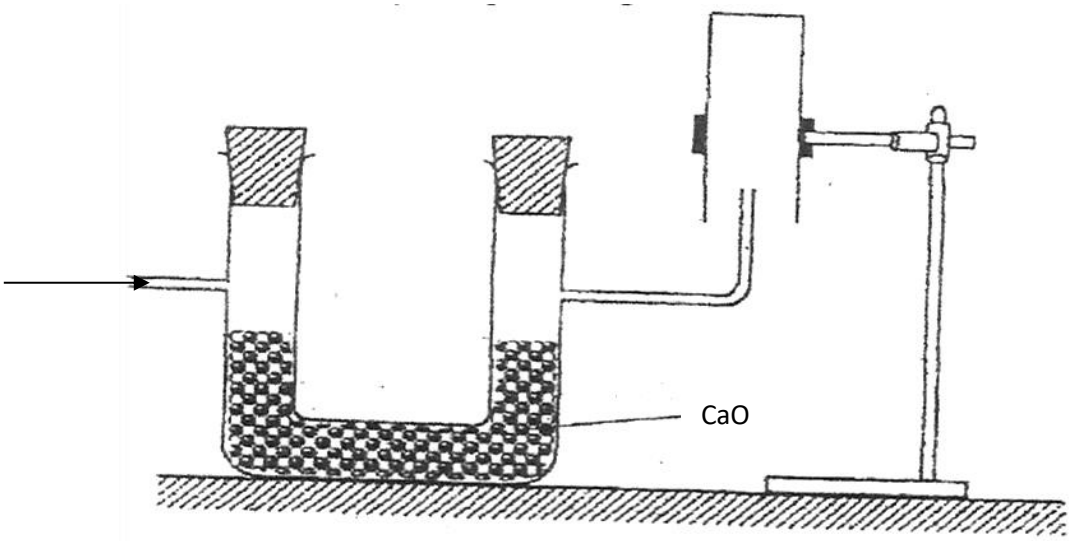
(ii) Determined the relative atomic mass of metal M **(2mks)**

18. State any **two** differences between luminous and non-luminous flames **(2mks)**

19. **(a)** State Graham's law of diffusion **(1mk)**

(b) The molar masses of gas **U** and **V** are 16.0 and 44.0 respectively. If the rate of diffusion of **U** through the porous materials is $12cm^{3-1}$. Calculate the rate of diffusion of V through the same materials **(2mks)**

20. The set up below was used to collect a dry sample of a gas



Give **two** reasons why the set-up cannot be used to collect carbon (IV) oxide gas **(2mks)**

21. Dilute sulphuric (VI) acid does not react fully with calcium carbonate while dilute hydrochloric acid reacts fully with calcium carbonate liberating carbon (IV) oxide. Explain **(2mks)**

22. On complete combustion of 0.5g of a hydro carbon; 1.257g of carbon (IV) oxide and 0.514g of water were produced. If the relative molecular mass of the hydrocarbon is 84, determine the molecular formula (*C=12,H=1,O=16)* **(3mks)**

21. The conversion of SO_2 to SO_3 in the contact process is shown by the equation

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

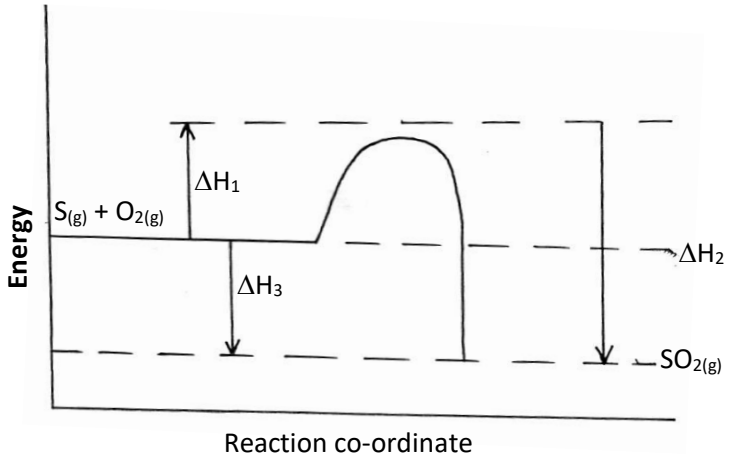
(a) What would be the effect of?

(i) Increasing the concentration of Oxygen **(1mk)**

(ii) Increasing the temperature **(1mk)**

(b) Write an equation for the sulphuric (VI) acid from Oleum **(1mk)**

24. Sulphur burns in air to form sulpur (IV) oxide. A simple energy level energy level diagram for the reaction is given below. Study the diagram and answer the questions that follow:



(a) What do the following represents?ΔH_1 and ΔH_3 **(2mks)**

(b) Write an expression for ΔH_3in terms of $\Delta H_1$and ΔH_2 **(1mk)**

25. Given the reaction below

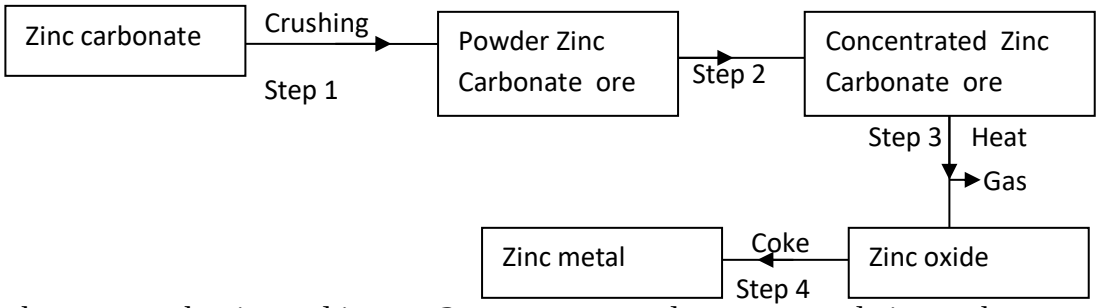
$Zn_{(s)} + 2HCl_{(aq)} \longrightarrow ZnCl_{2(aq)} + H_{2(g)}$

State how the following factors affect the rate of reaction giving explanation

(a) Using Zinc powder instead of granules **(1mk)**

(b) Heating the reactants **(1mk)**

26. The flow chart below shows steps used in the extraction of zinc from one of its ores

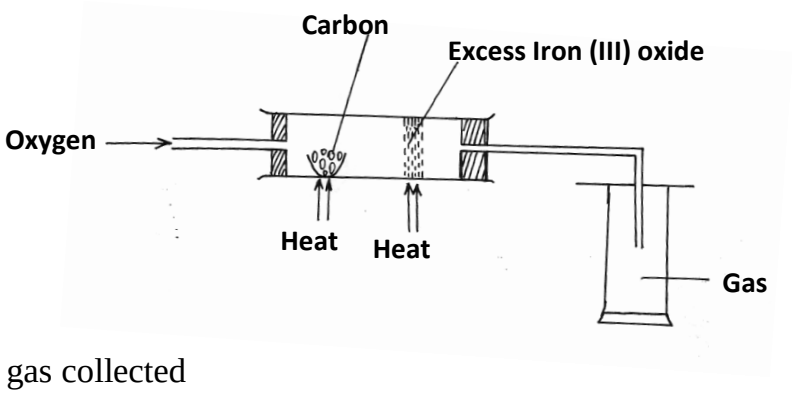


(a) Name the process that is used in step 2 to concentrated concentrated zinc carbonate ore. **(1mk)**

(b) Write an equation for the reaction which takes place in step 3 **(1mk)**

(c) Name one use of zinc other than galvanizing **(1mk)**

27. The set up below used to obtain a sample of iron



(a) Identify the gas collected **(½ mk)**

(b) What observation is made on the excess iron (III) oxide? **(½ mk)**

(c) Write equations for the two reactions that take place in the combustion tube **(2mks)**

28. The table below shows PH values of some solutions

Solution	A	B	C	D
PH values	13	7	1	6.5

(a) What solution reacts vigorously with Magnesium metal? **(1mk)**

(b) Which solution is likely to be that of Lemon juice? **(1mk)**

(c) Which solution forms complex ions with zinc (II) oxide? **(1mk)**

29. 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 substances responsible for the:

(a) Light blue precipitate **(1mk)**

(b) Deep blue solution **(1mk)**

30. Explain why there is general increase in the first ionization energies of the elements in period 3 of the periodic table from left to right **(2mks)**

KCSE 2025 TOP SCHOOLS MOCKS

NATIONAL TRIAL 10

233/2

CHEMISTRY

PAPER 2 (THEORY)

TIME: 2 HOURS

NAME……

SCHOOL…… **SIGN**……

INDEX NO…… **ADM NO**……

Kenya Certificate of Secondary Education.

INSTRUCTIONS TO CANDIDATES

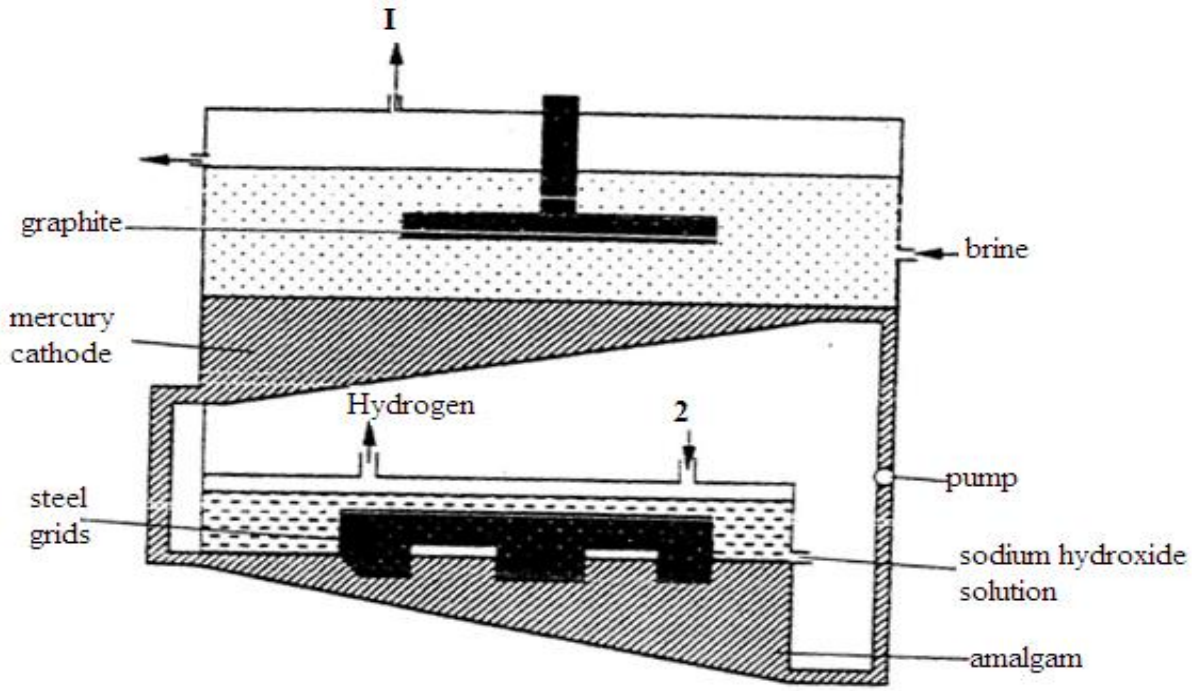
1. *Write your name and admission number in the spaces provided above.*
2. *Sign and write the date of the examination in space provided.*
3. *Answer ALL the questions in the spaces provided in the question paper.*
4. *All working MUST be clearly shown where necessary.*
5. *Mathematical tables and silent electronic calculators may be used.*

FOR EXAMINER'S USE ONLY

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	10	
2	14	
3	8	
4	11	
5	13	
6	12	
7	12	
TOTAL SCORE	80	

QUESTIONS

1. The diagram below represents a mercury cell that can be used in the industrial manufacture of sodium hydroxide. Study it and answer the questions that follow



(a) (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) Identify the by – product that comes out at I. **(1mk)**

(iii) Give

I. One use of sodium hydroxide**.** **(1mk)**

II. Two reasons why mercury is recycled**.** **(2mks)**

(b) A current of 100 amperes was passed through the cell for five (5) hours

(i) Write the equation for the reaction that occurred at the mercury cathode**.** **(1mk)**

(ii) Calculate the mass of sodium hydroxide that was produced**.** **(3mks)**

(Na = 23.0, O = 16.0, H = 1.0, 1 Faraday = 96500 Coulombs)

2. In an experiment to study the rate for reaction between duralumin (an alloy of aluminium, magnesium and copper) and hydrochloric acid, 0.5g of the alloy were reacted with excess 4M hydrochloric acid. The data in the table below was recorded.

Use it to answer the questions that follow.

Time (minutes)	Total volume of gas (cm^3)

0	0
1	220
2	410
3	540
4	620
5	640
6	640

i) On the grid provided, plot a graph of total volume of gas produced (vertical axis) against time. **(3mks)**

ii) **From** the graph, determine the volume of gas produced at the end of 2 ½ minutes. **(1mk)**

a) Determine the rate of reaction between the 3rd and 4th minute**.** **(2mks)**

b) Give a reason why some solid remained at the end of the experiment. **(1mk)**

c) Given that 2.5cm^3 of the total volume of the gas was from the reaction between magnesium and aqueous hydrochloric acid,

(Al = 27.0 and Molar gas volume = 24,000cm^3 at 298K).

(i) Determine the volume of gas produced when hydrochloric acid reacted with aluminium metal. **(1mk)**

(ii) Write a chemical equation of the reaction in (i) above**.** **(1mk)**

(iii) Determine the percentage mass of aluminium present in 0.5g of the alloy. **(3mks)**

e) State two properties of duralumin that make it more suitable than aluminium in aeroplane construction**.** **(2mks)**

3. (a) What method can be used to separate a mixture of ethanol and propanol**?** **(1mk)**

(b) Explain how a solid mixture of sulphur and sodium chloride can be separated into solid sulphur and sodium chloride crystals**.** **(3mks)**

(c) The table below gives the solubilities of potassium bromide and potassium sulphate at 0^{0}C and 40^{0}C

Substance	Solubility g/100g water at	
	40^{0}C	80^{0}C
Potassium bromide	55	75
Potassium sulphate	85	95

When an aqueous mixture containing 60g of potassium bromide and 70 g of potassium sulphate in 100g of water at 80^0C was cooled to 40^0C some crystals were formed

(**i**) Identify the crystals. **(1mk)**

(ii) Determine the mass of the crystals formed. **(1mk)**

(iii) Name the method used to obtain the crystals. **(1mk)**

(iv) Suggest one industrial application of the method named in (iii) above**.** **(1mk)**

4. a)Give the name of the basic raw material for extraction of aluminium metal**.** **(1mk)**

b) Name the method that is used to extract aluminium from the basic raw material in (i) above. **(1mk)**

c) Write the chemical formula of the major component in the raw material in (i) above. **(1mk)**

d) i) Name two major impurities in the raw material in (i) above**.** **(2mks**)

ii) Explain how the impurities in named in (i) above are removed **(3mks)**

e)Cryolite is used in the extraction of aluminium from the basic raw material.

State its function **(1mk)**

f) Aluminium is a reactive metal yet utensils made of aluminium do not corrode easily. Explain this observation**.** **(2mks)**

5. a) The table below shows properties of chlorine, bromine and iodine.

Element	Formula	Colour and state room temperature	Solubility in water
Chlorine	Cl_2	i……	Soluble
Bromine	Br_2	Brown liquid	ii…….
Iodine	l_2	iii……	Slight soluble

Complete the table by giving the missing information in **(i),(ii) and (iii).** **(3mks)**

b)Chlorine gas is prepared by reacting concentrated hydrochloric acids with manganese (iv) oxide.

i) Write the equation for reaction between concentrated hydrochloric acid and manganese (iv) oxide**.** **(1mk)**

ii) What is the role of manganese (IV) oxide in this reaction**.** **(1mk)**

c) i)Iron (II) chloride reacts with chlorine gas to form substance E. Identify substance E. **(1mk)**

ii) During the reaction in c(i) above,6.30g of iron(II) chloride were converted to substance E. Calculate the volume of chlorine used**.** **(3mks)**

(Cl = 35.5, Molar gas volume at room temperature = 24000cm^3, Fe =56)

d) Draw and name the structure of the compound formed when excess chlorine gas is reacted with ethane gas. **(2mks)**

e) Give two industrial uses of chlorine. **(2mks)**

6. (a) The list below shows the formulae of some organic compounds. Use it to answer the questions that follow.

V_1. $CH_3CH_2CH_2OH$

V_2. $CH_3CH_2CH_3$

V_3. $CH_3CH_2CH_2C(=O)-OH$

V_4. $CH_3CH_2CH=CH_2$

V_5. $CH_3CH_2CH_2CH_3$

(i) Select two compounds which

I are not hydrocarbons **(1mk)**

II Belong to the same homologous series **(1mk)**

(ii) Identify the compound that is likely to undergo polymerization. Give a reason for your answer. **(2mks)**

(b) The structures below represent two cleansing agents:

$R - COO^- Na^+$

$R - OSO_3^- Na^{+C}$

In the table below, give one advantage and one disadvantage of using each one of them**.** **(2mks)**

	Advantage	Disadvantage
$R - COO^- Na^+$		
$R - OSO_3^- Na^+$		

Under certain, ethanoic acid ($C_2H_4O_2$) and ethanol (C_2H_5OH) react to form a pleasant smelling compound.

(i) What is the general name of compound to which the pleasant compound belong? **(1mk)**

(ii) Write the formula of the pleasant smelling compound. **(1mk)**

(iii) Give one use of ethanoic acid other than the formation of the pleasant smelling compounds. **(1mk)**

(iv) Write the equation for the reaction between dilute ethanoic acid and solid potassium carbonate **(1mk)**

(c) Fibres are either synthetic or natural. Give one:

(i) Example of a natural fibre **(1mk)**

(ii) Advantage of synthetic fibres have over natural fibres **(1mk)**

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

								A
B				**G**		**H**	**E**	**C**
	J		**I**	**L**				
D							**M**	

I (a) Indicate on the grid the position of an element represented by letter N whose electronic configuration of a divalent cation is 2:8:8. **(1 mark)**

(b) Name the bond formed when **D** and **H** react. Explain your answer. **(2 marks)**

(c) Write an equation for the reaction between **B** and water. **(1 mark)**

(d) How do the atomic radii of **I** and **L** compare. Explain. **(2 marks)**

(e) In terms of structure and bonding explain why the oxide of **G** has lower melting point than oxide of **L**. **(2 marks)**

II Study the information given below and answer the questions that follow:

Formula compound	NaCl	$MgCl_2$	Al_2C1_6	$SiC1_4$	$PC1_3$	$SC1_2$
B.P(°C)	1470	1420	Sublimes	60	75	60
M.P(°C)	800	710	At 800°C	-70	-90	-80

(a) Why is the formula of aluminium chloride given as Al_2Cl_6 and not $AlCl_3$? **(1 mark)**

(b) Give **two** chlorides that are liquid at room temperature(25°c). Give a reason. (**2 marks)**

(c Give a reason why Al_2Cl_6 has a lower melting point than M_gCl_2 although both Al and Mg are metals. **(1 mark)**

THE END

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