

NAME .....cls..... DATE.....

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233/2

**CHEMISTRY****PAPER 2****(THEORY)****TIME: 2 Hours****MURANG'A EXTRA COUNTY SCHOOLS EXAMINATION****FORM 4****TERM 2 – AUGUST 2022****Instructions to Candidates**

- (a) Write your name and index number in the spaces provided above
- (b) Sign and write the date of examination in the spaces provided.
- (c) Answer all the questions in the spaces provided
- (d) KNEC Mathematical tables and silent electronic calculator may be used.
- (e) All the working must be shown clearly where necessary
- (f) Candidates should answer questions in English.

**For Examiner's Use Only**

Questions	Maximum Score	Candidate's Score
1	12	
2	12	
3	8	
4	10	
5	14	
6	14	
7	10	
<b>TOTAL SCORE</b>	<b>80</b>	

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

M								
							B	
G	T		H			J	L	R
							V	
S								

- a. An element X forms a divalent cation with the electron configuration 2.8.8. Place element X in its position on the grid (1 mark)

- b. Element G was put in a trough with cold water containing phenolphthalein indicator

- i. State two observations made during the reaction (2 marks)

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- ii. Write a chemical equation for the reaction (1 mark)

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- iii. Compare the reactivity of G and S with cold water. Explain (2 marks)

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- c. Draw dot(o) and cross (x) diagram showing bonding when element T and element L combine to form a compound. (1 mark)

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d. Kamau accidentally mixed a chloride of S, iron (III) chloride and an oxide of H. Describe how he obtained a solid sample of each. (3 marks)

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e. Explain why at room temperature, an oxide of G is a solid while an oxide of J is gaseous. (1 mark)

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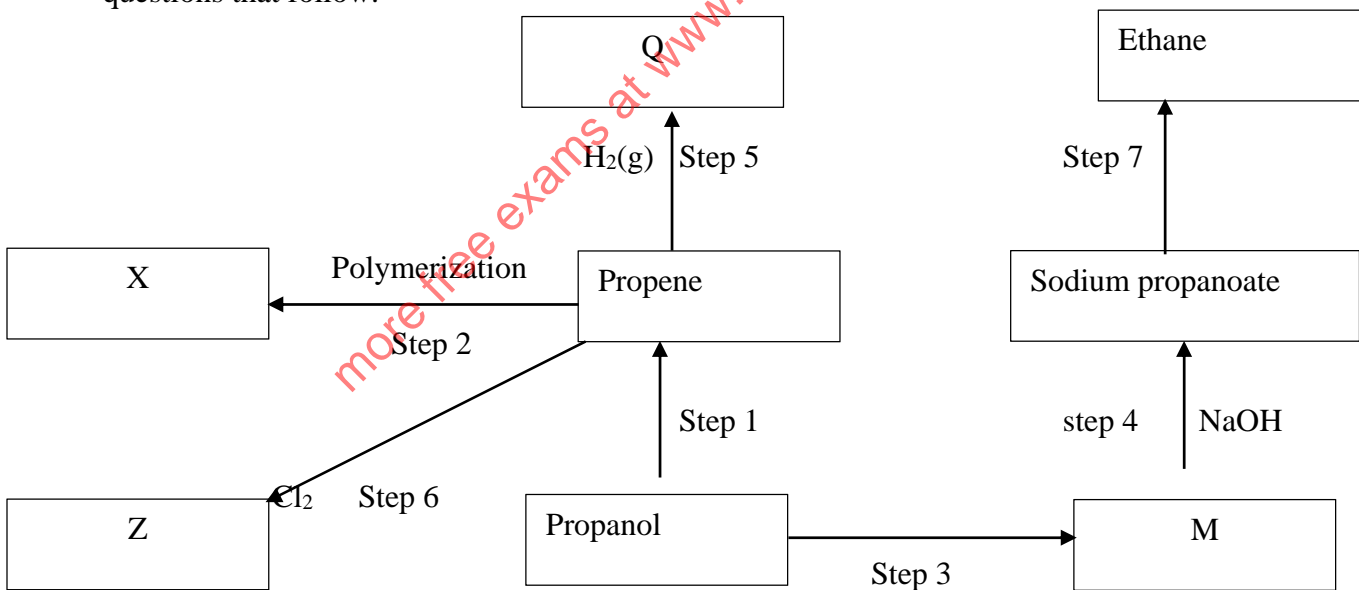
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f. State one use of element R (1 mark)

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2. The flow diagram below shows reactions starting with propanol. Study it and use it to answer the questions that follow.



a. Name the process in (1 mark)

- i. Step 1 .....
- ii. Step 3 .....

b. State the condition in (2 marks)

i. Step 1 .....

ii. Step 5 .....

c. Draw the structure of substance (2 marks)

i. X

ii. Z

d. Name the reagent used in (2 marks)

i. Step 7 .....

ii. Step 3 .....

e. Identify substance (1 mark)

i. M .....

ii. Q .....

f. Describe an experiment used to distinguish between the product in step 1 and step 7 (2 marks)

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g. Write an equation for the reaction of

i) Propanol with potassium (1 mark)

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ii) Propene with oxygen (1 mark)

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3. A student reacted 6g of magnesium ribbon with 50 cm<sup>3</sup> of 0.1M Hydrochloric acid and measured volume of hydrogen gas given off every 10 seconds for 60 seconds. The table below gives the results obtained.

Volume of hydrogen gas (cm <sup>3</sup> )	0	9	15	19	20	20	20
Time taken (seconds)	0	10	20	30	40	50	60

- a. On the grid below, plot a graph of Volume of hydrogen gas (y – axis) against time (x – axis) (3 marks)



- b. From the graph determine:
- i) Volume of gas produced at time 25 seconds ..... (1 mark)

ii) Time taken for 12 cm<sup>3</sup> of hydrogen gas produced ..... (1 mark)

c. Explain the shape of the curve between 40 – 60 seconds (1 mark)

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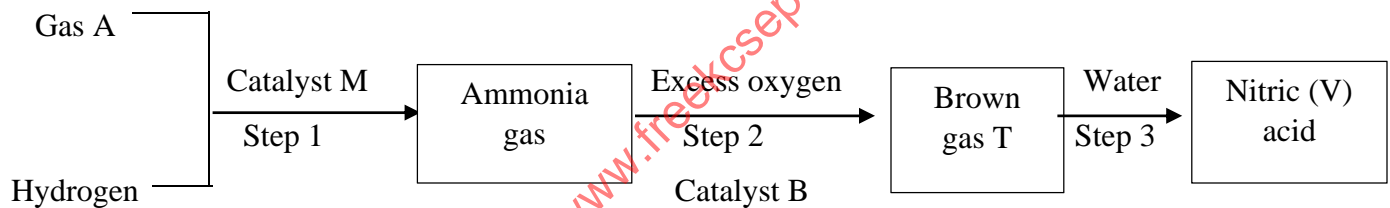
d. The experiment was repeated using 1M Hydrochloric acid.

i) On the same axes sketch the curve that would be obtained (1 mark)

ii) Explain your answer in d(i) above (1 mark)

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



a. Name; (2 marks)

iii. Gas A .....

iv. Catalyst M .....

v. Catalyst B .....

vi. Gas T .....

b. Write an equation for: (2 marks)

i) Step 1

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ii) Step 3

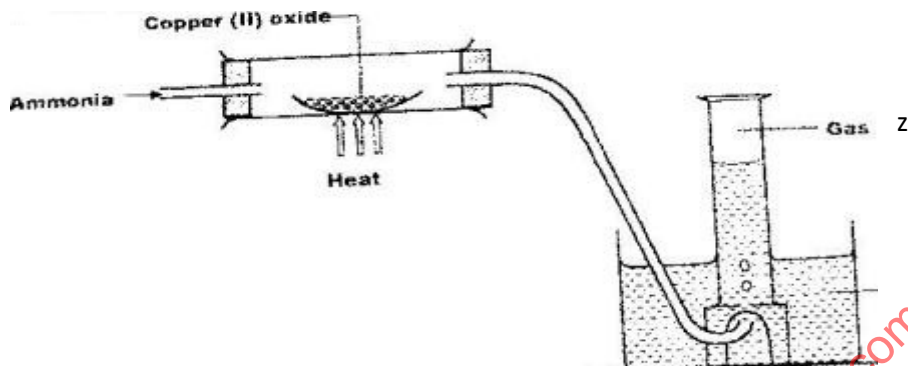
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c. Name the main source of gas A

(1 mark)

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d. Ammonia gas was passed through a combustion tube containing heated copper (II) oxide as shown in the diagram below.



i) State and explain one observation made in the combustion tube

(2 marks)

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Identify gas Z

(1 mark)

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ii) What property of ammonia is being investigated?

(1 mark)

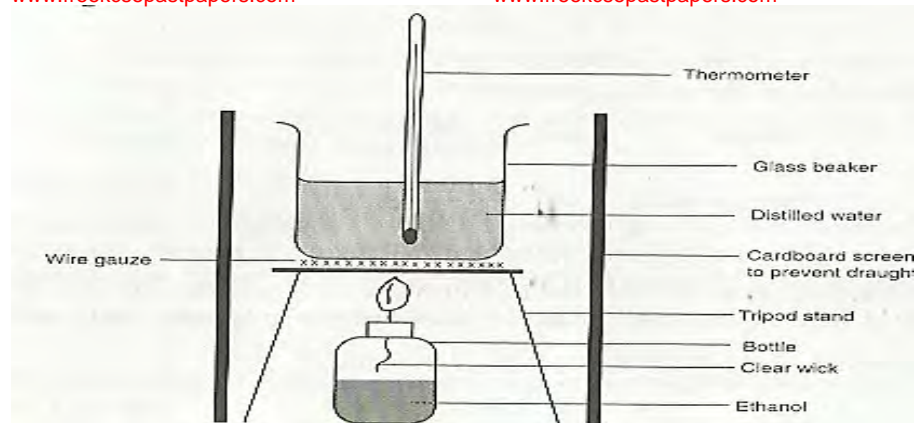
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iii) Name a suitable drying agent for ammonia gas

(1 mark)

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5. The diagram below shows the set – up used to investigate enthalpy of combustion of ethanol when  $450\text{cm}^3$  of water was heated



The data below was obtained during the experiment

Volume of water	= 450 cm <sup>3</sup>
Initial temperature of water	= 23.0 °C
Final temperature of water	= 41.0 °C
Mass of the lamp + ethanol before heating	= 141.7g
Mass of the lamp + ethanol after heating	= 140.2 g
Density of water	= 1g/cm <sup>3</sup>
Specific heat capacity	= 4.2 KJ Kg <sup>-1</sup> K <sup>-1</sup>

a. Calculate;

i) Heat evolved during the experiment (2 marks)

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ii) Moles of ethanol that reacted (C=12.0, H= 1.0, O=16.0) (1 mark)

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iii) Molar heat of combustion of ethanol (2 marks)

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b. Write a thermochemical equation for the reaction (1 mark)

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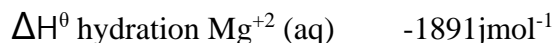
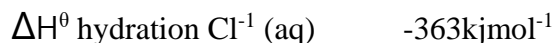
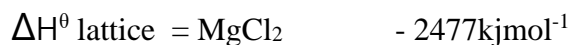
- c. The theoretical molar enthalpy of combustion of ethanol is – 1260 kJ/Mol. Give two reasons why the experimental value is less (2 marks)

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- d. Name two factors to consider before choosing a fuel (2 marks)

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- e. Study the information below and use it to answer the questions that follow



- i) Define the molar enthalpy of solution combustion of a substance? (1 mark)

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- ii) Using the above information Draw an energy level diagram to represent the heat of solution of Magnesium Chloride (1 mark)

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- iii) Calculate the heat of solution of Magnesium Chloride (2 marks)

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6. Use the reduction potentials below for P, Q, R, S and T to answer the questions that follow.

Reaction	$E^\circ$ value (V)
$P^{2+}(\text{aq}) + 2e^- \rightarrow P(\text{s})$	-0.79
$2Q^+(\text{aq}) + 2e^- \rightarrow Q_2(\text{s})$	0.00
$R^{2+}(\text{aq}) + 2e^- \rightarrow R(\text{s})$	+0.45
$S^{2+}(\text{aq}) + 2e^- \rightarrow S(\text{s})$	-0.21
$\frac{1}{2} T_2(\text{g}) + 2e^- \rightarrow T^-(\text{aq})$	+2.91

a. Identify;

i) The element that is likely to be hydrogen (1 mark)

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ii) The strongest reducing agent (1 mark)

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b. The half cells of P and R were combined

i) Draw the electrochemical cell formed (3 marks)

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

c. During the extraction of sodium using the Down's cell, molten sodium chloride is electrolyzed.

i) State the role of the following in the cell (2 marks)

Calcium chloride

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Steel diaphragm

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ii) State the observation made at the anode (1 mark)

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iii) Write an equation for the reaction at the cathode (1 mark)

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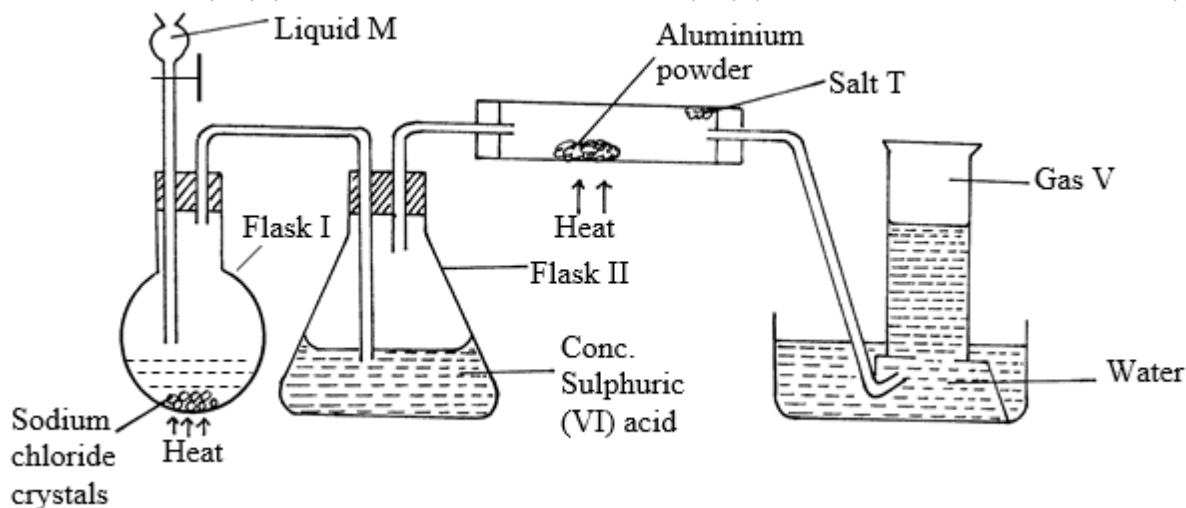
iv) 2A was passed through molten sodium chloride for 2 hours and 35 minutes. Calculate the mass of sodium metal formed (1F= 96,500C, Na=23, Cl=35.5) (2 marks)

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d. State two applications of electrolysis (2 marks)

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7. The set up below was used to prepare hydrogen chloride gas and salt T.



a. Identify the following

- i) Liquid M..... (1 mark)
- ii) Gas V..... (1 mark)
- iii) Salt T..... (1 mark)

b. Write balanced chemical equations for reactions that occur at:

- i. Flask I (1 mark)

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- ii. Combustion tube. (1 mark)

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c. Name the process that formed salt T as shown in the diagram. (1 mark)

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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 mark)

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

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- f. In the space provided below, draw a well labelled diagram showing how you would dissolve hydrogen chloride gas in water. (1 mark)

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- g. Explain why hydrogen chloride gas dissolved in methylbenzene does not react with calcium carbonate. (1 mark)

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