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Index No. Candidate's sign. Date.

233/2
CHEMISTRY
PAPER 2
2 HRS

**KABRAS WEST SUB-COUNTY
JOINT EXAM 2026**

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

INSTRUCTIONS TO CANDIDATES

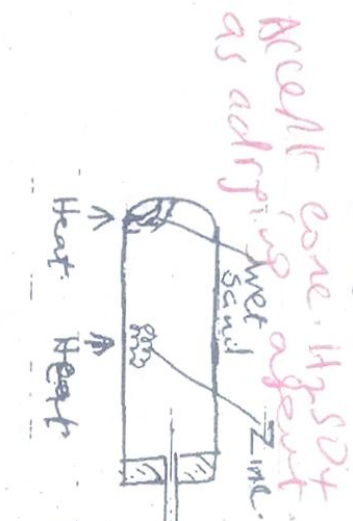
- Write your name and index number in the spaces provided.
- Answer all questions in the spaces provided
- KNEC' mathematical tables and silent electronic calculators may be used for calculations.
- All workings **must** be clearly shown where necessary.
- Candidates should check the question paper to ascertain all the pages are printed as indicated and no questions are missing.

For Examiners Use Only

Questions	Maximum Score	Score
1	11	
2	11	
3	11	
4	11	
5	12	
6	15	
7	9	
TOTAL	80	

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

1. Wakhisi set-up the experiment as shown below to collect a gas. The wet sand was heated before heating zinc granules.

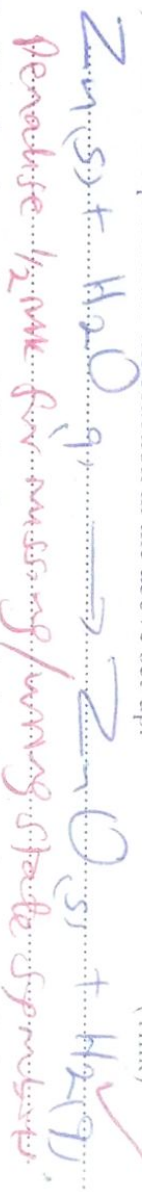


Drying agent - 1 mark
method of collection - 1 mark
wet sand - 1 mark

- a) Complete the diagram for the laboratory preparation of the dry gas. (3mks)

- b) Why was it necessary to heat the wet sand before heating zinc granules? (1mk)
To drive away air initially in the flask which would otherwise oxidise the zinc.

- c) Write an equation for the reaction in the above set-up. (1mk)



- d) State the observation made in the above set-up during the experiment. (1mk)

Wet sand changed to yellow

- e) The gas produced in the above set-up burns in air to form an oxide. Write an equation for the reaction. (1mk)



- f) Sodium hydroxide can be prepared by the following methods, I and II.



- i. Name one precaution that needs to be taken in method I (1mk)

Use a small piece of sodium metal.

ii. Give the name of process A.

Electrolysis

(1mk)

iii. Give two industrial uses of:-

I. Chlorine.

(1mk)

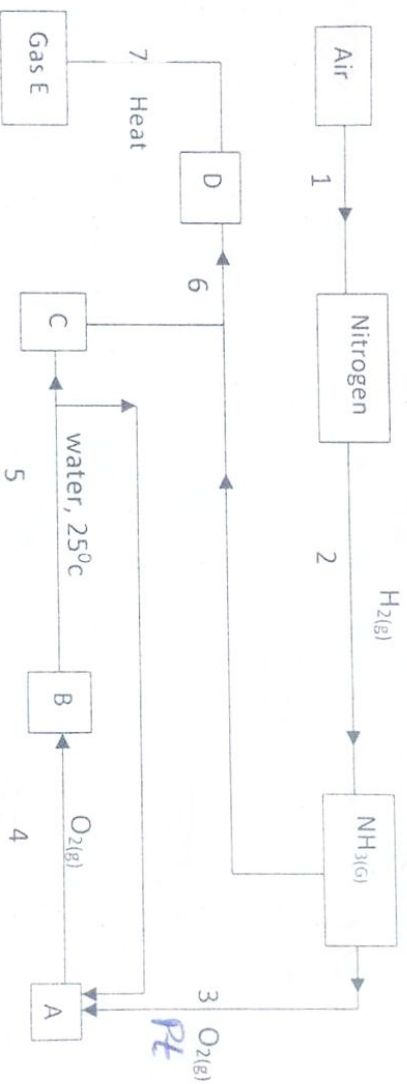
- Manufacture of HCl acid ✓
- Manufacture of bleaches ✓
- treatment of water ✓

II. Hydrogen.

(1mk)

- Manufacture of HCl acid ✓
- Hardening of oil ✓
- oxyacetylene flame welding ✓

2. The following is a summary of reactions involving nitrogen. Study it and answer the questions below



a) The process labelled (1) is usually carried out at industrial scales. What process is it? (1mk)

Fractional distillation of liquid air.

b) Name the substances indicated by the following labels. (4mks)

i. A Nitrogen (II) Oxide

ii. B Nitrogen (IV) Oxide

iii. D Ammonium nitrate

iv. E Nitrogen (I) Oxide

c) Write the equation for the reactions taking place at steps 3 and 5



d) State one application of C apart from any shown in the summary above. (1mk)

- Making explosives ✓
- Manufacturing of dyes ✓
- Manufacturing of plastics ✓ Any 1x1 ✓

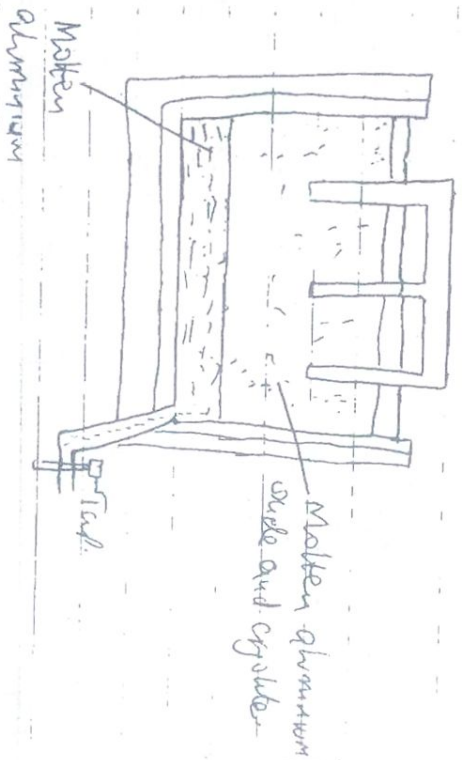
e) Write an equation for the reaction in step 7. (1mk)



f) Describe a chemical test that can be used to differentiate gas E and Oxygen gas?

- Pass NO gas over E and Oxygen ✓ (2mks)
- Separate containers ✓
- Brown fumes ✓ in case of Oxygen and ✓
✓ No brown fumes in case of E ✓

3. The diagram below represents the second stage in extraction of aluminium metal



a) Aluminium oxide is heated first before it is electrolyzed. Explain. (2mks)

to melt it ✓

b) Aluminium is used in making overhead cables. State two properties of aluminium that

makes it suitable for this use.

Light, ductile, good conductor of electricity, ✓
resistant to corrosion. ✓ Any 2x1/2 ✓

c) In the extraction of aluminium from its ore by electrolysis, explain the following observations.

i. graphite anode is replaced from time to time.

(1mk)

oxygen evolved at anode reacts with the graphite anode to form CO₂ gas which escapes.

ii. the steel tank which can also serve as an electrode is also lined with graphite cathode.

(1mk)

graphite acts as heat sink

d) Sodium and aluminium metals both conduct electricity; but aluminium is a better conductor of electricity than sodium. Explain.

(1mk)

Aluminium has more number of delocalised electrons than sodium.

e) A current of 3A was passed through fused aluminium oxide for 10 minutes. Calculate the mass of aluminium obtained at one electrode ($Al = 27.0$, $1F = 96500C$)

(3mks)



$$Q = It = 3 \times 10 \times 60 = 1800C$$



$$27g \rightarrow 3 \times 96500 = 289500C$$

$$Mass = \frac{27 \times 1800}{289500} = 0.1679g$$

f) Aluminium is both malleable and ductile. What is meant by:

i. malleable?

(1mk)

Can be hammered/pressed into thin sheets

ii. ductile

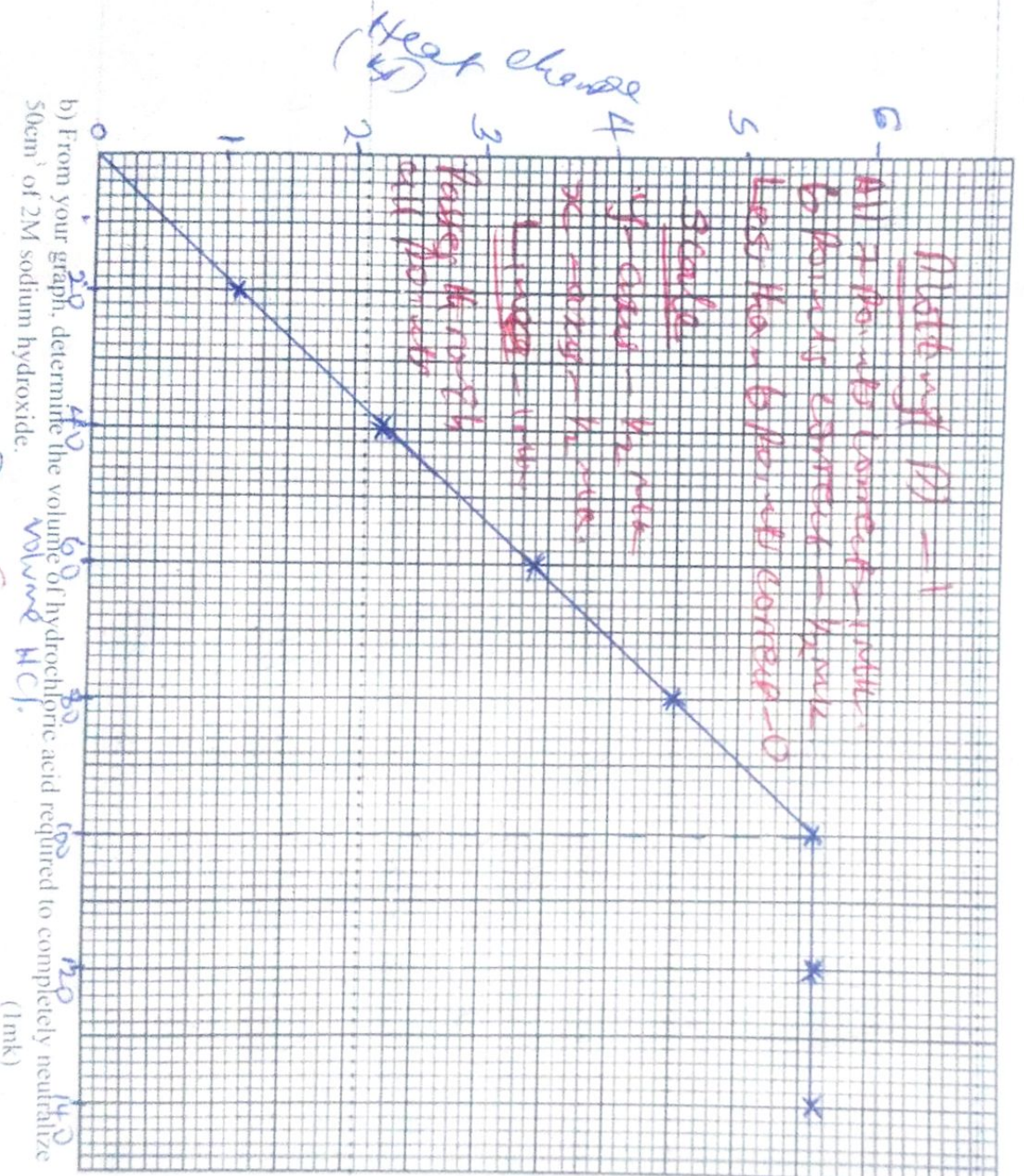
(1mk)

Can be drawn out into thin wire.

4. 50cm³ of 2M sodium hydroxide solution were each placed in an insulate beaker. 20cm³ of hydrochloric acid was added to one of the beaker and the heat change was calculated. The experiment was repeated with other sets of hydrochloric acid. The result was recorded in the table below.

Volume of NaOH (cm ³)	50	50	50	50	50	50	50
Volume of HCl (cm ³)	20	40	60	80	100	120	140
Heat change evolved (kJ)	1.1	2.2	3.4	4.5	5.6	5.6	5.6

- a) Plot a graph of heat change against volume of hydrochloric acid. (3mks)



- b) From your graph, determine the volume of hydrochloric acid required to completely neutralize 50cm³ of 2M sodium hydroxide. (1mk)

100cm³ (from student's graph.)

c) What is the concentration in moles per litre of hydrochloric acid?

moles of NaOH = 50×2
 $\frac{1000}{1000} \times 2 = 2 \text{ moles}$
 $\frac{2}{2} = 1 \text{ M}$

Alternatively
 $\frac{2 \text{ moles}}{2 \text{ M}} = 1 \text{ M}$

moles of HCl in 100 cm³ of 2 M HCl = $2 \times 100 \times 2 = 4 \text{ moles}$
 $\frac{4}{2} = 2 \text{ M}$

Alternatively
 $\frac{2 \text{ M}}{2} = 1 \text{ M}$

d) Calculate the molar heat of neutralization for the reaction.

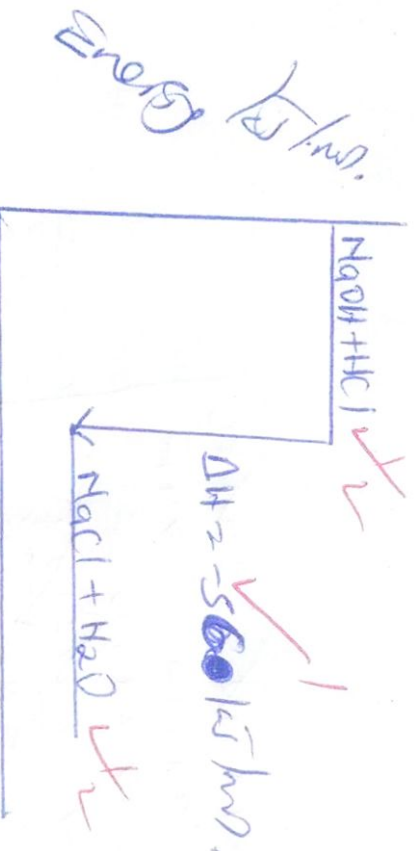


$\frac{2.1}{2} = 1.05 \text{ kJ/mole}$

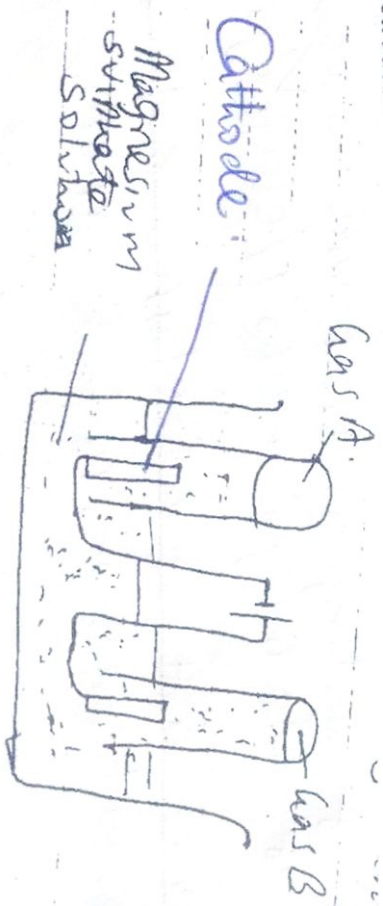
Per mole $\frac{1}{2}$ mole for molar heat

e) Sketch an energy level diagram for this reaction.

(2mks)



5. The set-up below was used to electrolyze aqueous magnesium sulphate using inert electrodes.



a) Name a suitable pair of electrodes for this experiment. (1mk)

inert white electrode, or Platinum electrodes

b) Identify the anions and cations in the solution. (1mk)

Anions: OH^- , SO_4^{2-} ✓ $\frac{1}{2}$ for both correct

Cations: H^+ , Mg^{2+} ✓ $\frac{1}{2}$ for both correct

c) On the diagram, label the cathode. (1mk)

$4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$ ✓

d) Write ionic equation for the reaction at the anode. (1mk)

e) Explain the change that occurred to the concentration of magnesium sulphate solution during the experiment. (2mks)

Concentration increases, since H^+ and OH^- ions which form water are removed, ✓

f) During electrolysis, a current of 2A was passed through the solution for 4 hours. Calculate the volume of the gas produced at the anode. (If = 96500C, molar gas volume = 24000cm³) (3mks)

$$\begin{aligned} Q &= It = 2 \times 4 \times 3600 = 28800 \text{ C} \\ 4 \text{ mole } \text{e}^- &\rightarrow 24000 \text{ cm}^3 \rightarrow 4 \text{ F} \\ \Rightarrow 4 \times 96500 \text{ C} &\rightarrow 24000 \text{ cm}^3 \\ \text{Vol, } 28800 \text{ C} &\rightarrow \frac{28800 \times 24000}{4 \times 96500} \end{aligned}$$

$$= 1290.67 \text{ cm}^3$$

g) One of the uses of electrolysis is electroplating. What is meant by electroplating? (2mks)

Process of coating a metal with another metal by use of electrolytic method/electrolysis ✓

h) Give two reasons why electroplating is necessary. (2mks)

— improve aesthetic value/appearance/make it attractive ✓

— prevent corrosion/reduce corrosion ✓

6. (a) Study the information in the table below and answer the questions that follow

Number of carbon atoms per molecule	Relative molecular mass of hydrogen
2	28
3	42
4	56

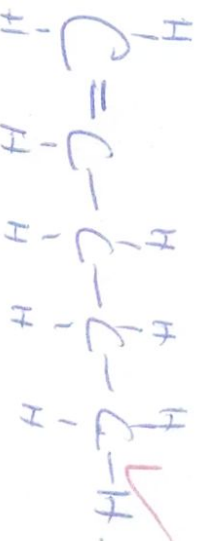
i. Write the general formula of the hydrocarbons in the table below. (1mk)



ii. Predict the relative molecular mass of hydrocarbon with 5 carbon atoms.

~~C_5H_{10}~~ 70

iii. Determine the molecular formula of the hydrocarbon in (ii) and draw its structural formula (2mks)



Acetyl and isomer of C_5H_{10} for structure,

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

I. CH_3CH_2COOH - Propanoic acid ✓ 1/2

II. $CH_3CH_2CH_2CH_2OH$ Butan-1-ol ✓ 1/2

i. Give the systematic name of each compound. (1mk)

ii. Write the molecular formula of each compound. (2mks)

I. $C_3H_6O_2$ ✓ II. $C_4H_{10}O$ ✓ 1 (2mks)

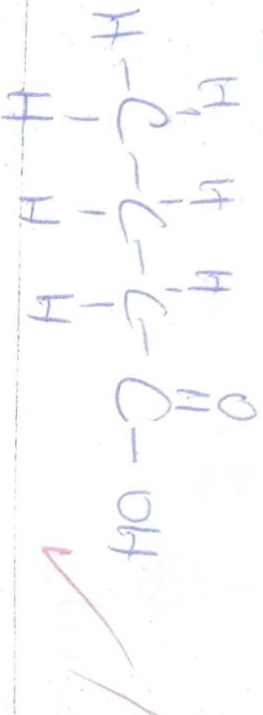
iii. How does the boiling point of I compare to that of II? (1mk)

I has higher boiling point than II, because I has more and stronger ~~van der Waals~~ ~~hydrogen~~ ~~bonding~~ than II.

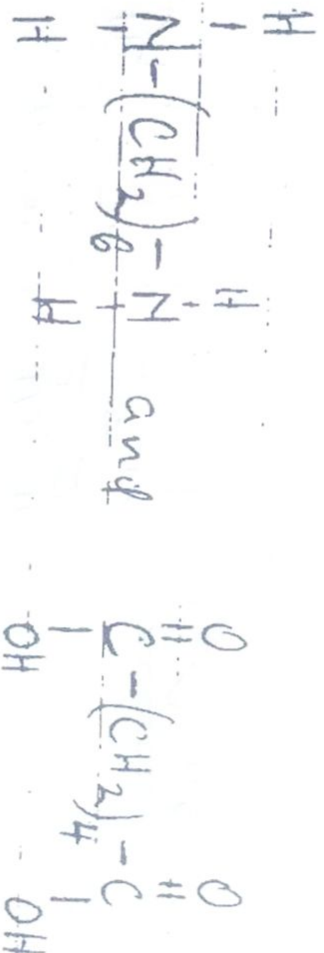
- iv. A gas J is bubbled into concentrated sulphuric (vi) acid. Water is added to the mixture then boiled to yield compound II. Name gas J (1mk)

but-1-ene ✓

- v. Draw the structural formula of the compound immediately after compound I in the homologous series. (1mk)



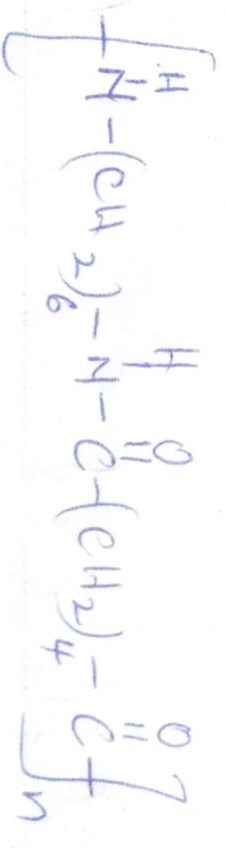
- (c) Study the structural formula of the two monomers below and answer the questions that follow.



- i. Name the type of polymerization these monomers would undergo to form a polymer. (1mk)

Condensation Polymerisation

- ii. Draw the structural formula to represent the polymer formed. (1mk)



- iii. Element Y is found to be in group IV. Write the formula when it reacts with oxygen gas. (1mk)

YO_2 ✓
Relevant O_2 ✓

- iv. Which of the two elements named in (i) above is more reactive? Explain. (2mks)

✓ Z, has lower first ionization energy / is more electropositive ✓

- v. Which of the five elements in the table above is the best conductor of electricity?

Explain

(2mks)

✓ X, has highest number of delocalised electrons ✓