

NAME: CLASS:

ADMISSION NUMBER: SIGNATURE:

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233/2
CHEMISTRY
PAPER 2
(THEORY)
JULY 2024
TIME: 2 HOURS

MUSLIM SCHOOLS JOINT EXAMINATION TEST

Kenya certificate of secondary education

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CHEMISTRY
PAPER 2
JULY 2024
TIME: 2 HOURS

INSTRUCTIONS TO STUDENTS

- Write your name and index number in the space provided above.
- Sign and write the date of exam in the spaces provided.
- Mathematical tables and silent electronic calculators may be used.
- All working must be clearly shown where necessary.
- All working must be clearly shown.

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	10	
2	11	
3	12	
4	11	
5	11	
6	13	
7	12	
TOTAL SCORE	80	

This paper consists of 10 printed pages. Candidates should check to ensure that all the pages are printed as indicated and no questions are missing.

1. The table below represents elements across period three of the periodic table. Study it and answer the questions that follow.

Element	Na	Mg	Al	Si	P	S	Cl
Atomic numbers	11	12	13	14	15	16	17
Atomic Radius(nm)	0.156	0.136	0.125	0.118	0.110	0.104	0.099
Ionic Radius (nm)	0.095	0.065	0.050	-	-	0.184	0.181
Melting Point(0°C)	97.8	650	660	1410	44.2	11.9	-101

- (a) (i) Explain why the atomic radius of Na is bigger than its ionic radius (2mks)

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- (ii) Compare the atomic radius of Mg with that of Al (2mks)

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- (iii) Explain the trend in the melting points from Na to Al (2mks)

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- (iv) Write the formula of the compound formed when Mg combines with Si. (1mk)

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- (v) Name the type of bond formed in (iv) above. (1mk)

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- (b) The melting and boiling points of sodium chloride are 801°C and 1430°C respectively. Explain why sodium chloride does not conduct electricity at 25°C, but does so at temperature 801°C and 1430°C. (2mks)

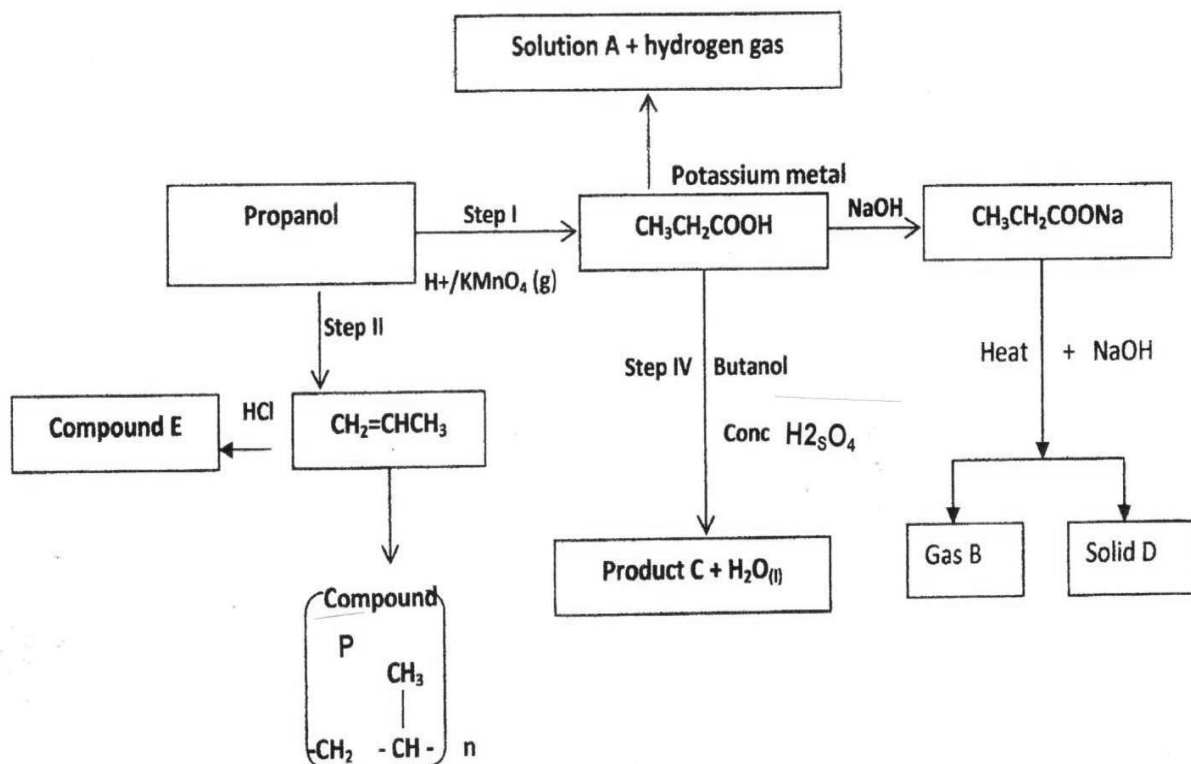
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2. The scheme below shows a series of reactions starting with Propanol. Study it and answer the questions that follow:-



- a. Name the type of reaction in steps I and II.

Step I (1mk)

Step II (1mk)

- b. Write a balanced chemical equation for the reaction that produces:

(i) Gas B (1mk)

.....

(ii) Solution A. (1mk)

.....

- c. Name the substances labelled A, D and E. (3 mks)

A

D

E

- d. Draw the structural formula of product C. (1mk)

e. Name the process in Step (IV)

(1mk)

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.....

f. If the relative molecular mass of P is 35,700, determine the value of n.

(C = 12, H = 1)

(2mks)

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3. (a) State the Hess' law.

(1 mark)

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(b). Use the standard enthalpies of combustion of graphite, hydrogen and enthalpy of formation of propane to answer the questions that follow.

$\Delta H^\circ_{\text{combustion}} (\text{Graphite}) = -393 \text{ kJ mol}^{-1}$

$\Delta H^\circ_{\text{combustion}} (\text{H}_2 (\text{g})) = -286 \text{ kJ mol}^{-1}$

$\Delta H^\circ_{\text{formation}} (\text{C}_3\text{H}_8 (\text{g})) = -104 \text{ kJ mol}^{-1}$

(i). Write the equation for the formation of propane.

(1 mark)

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(ii). Draw an energy cycle diagram that links the heat of formation of propane with its heat of Combustion of graphite and hydrogen. (3 marks)

(iii). Calculate the standard enthalpy of combustion of propane.

(2 marks)

(c). Other than the enthalpy of combustion, state one other factor which should be considered when choosing a fuel. (1 mark)

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

Volume of water used = 500cm³

Initial temperature of water = 25°C

Final temperature of water = 44.5°C

Mass of ethanol + lamp before burning = 121.5g

Mass of ethanol + lamp after burning = 120.0g

Calculate the

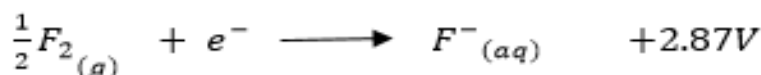
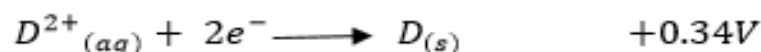
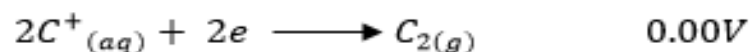
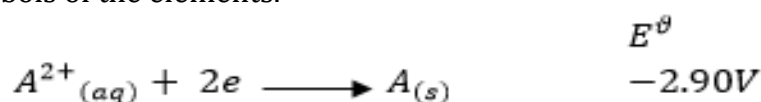
(i) Heat evolved during the experiment (density of water = 1 g/cm³, specific heat capacity of water = 4.2Jg⁻¹K⁻¹). **(1 mark)**

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

(iii) Write the thermochemical equation for the complete combustion of ethanol. **(1 mark)**

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4. (a) Use the standard electrode potentials for elements A, B, C, D and F given below to answer the questions that follow. The letters do not represent the actual symbols of the elements.



(i) Identify the strongest oxidizing agent. Give a reason. **(2 marks)**

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(ii) Which element is likely to be hydrogen? Give a reason for your answer. (2 marks)

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(iii) Identify two half-cells which when connected will produce the highest E^θ value. (1 mark)

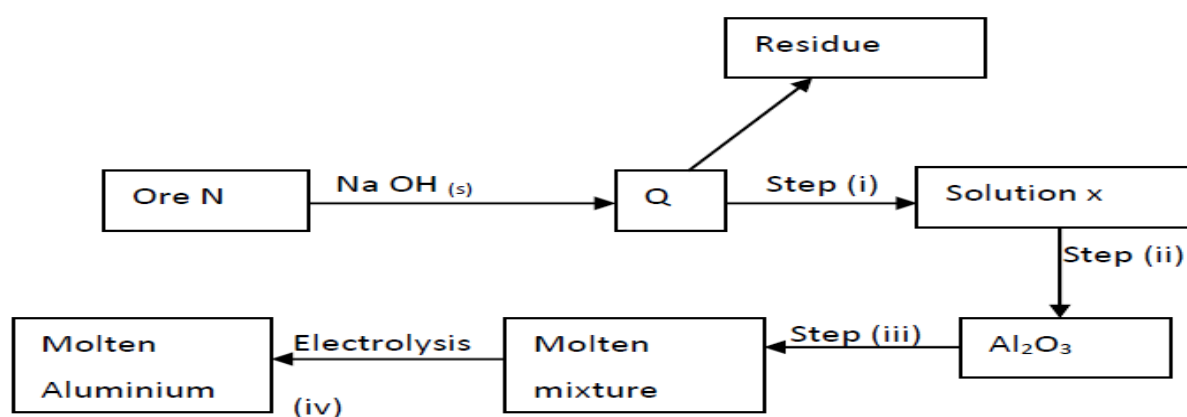
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(iv) Calculate the E^θ value of the electrochemical cell obtained when the half-cells of elements C and D are combined. (1 mark)

(b) Draw a fully labelled diagram to show how you can purify **LEAD ROD** through electrolysis. (3 marks)

(c) During electrolysis of aqueous copper (II) sulphate 144750 coulomb of electricity were used. Calculate the mass of copper metal that was obtained. (Cu = 64, 1 Faraday = 96500 C) (2mks)

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



- a) Name ore N (1mark)

- b) Explain why the ore is first dissolved in excess sodium hydroxide solution. (2 marks)

- c) Name the major compound present in the residue. (1mark)

- d) Give the formula of the aluminium compound present in solution. (1mrk)

- e) i) Explain how to obtain aluminium hydroxide from solution X. (1mark)

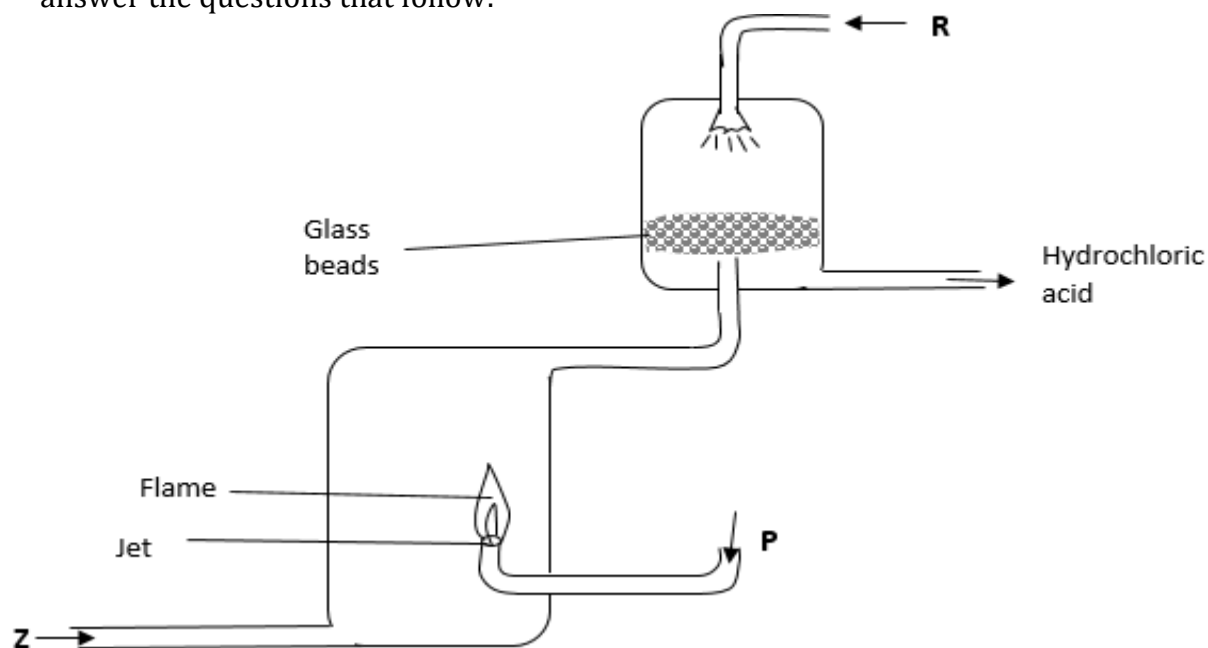
 ii) Write equation for reaction that takes place in (e) above. (1mark)

 iii) What is the role of cryolite in the extraction of alluminium. (1mark)

- f) Aluminium is a good conductor of heat and electricity. State two uses of aluminium based on this property. (2marks)

- g) The melting point of alluminium oxide is 2054°C , but electrolysis is not carried out between $800 - 900^{\circ}\text{C}$.
- (i) Why is the electrolysis not carried out at 2054°C ? (1mk)

6. The diagram below is used in the manufacture of Hydrochloric acid. Use it to answer the questions that follow:



- a) Identify substances; (2 marks)

R

P

- b) Why is the jet used in the set up above? (1 mark)

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- c) Write a chemical equation to show how substance **Z** can be prepared in laboratory. (1 mark)

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- d) State **one** large scale source of gas **P**. (1 mark)

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- e) Nitrogen and hydrogen reacts according to the following equation at 450°C and 200 atmospheres



State and explain how the yield of ammonia would be affected if the pressure is increased (2 marks)

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f) The half-life of sodium -20 is 8 seconds. P grams of sodium -20 decays to 3 grams in 32 seconds.

i Calculate the initial mass P, of the isotope. (2mks)

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i State one application of radioactivity in medicine. (1mk)

g) Study the information in the table below and answer the question that follows.

SALT	SOLUBILITY (g/100g of H ₂ O) at	
	45 °C	60 °C
Sodium carbonate	35	80
Lead (II) Nitrate	77	101

A mixture containing 70g of sodium carbonate and 72g of lead II nitrate in 100g of water at 60 °C was cooled to 45 °C.

i Identify the salt that crystallized out. (1mk)

i Calculate the mass of the salt that crystallized out. (2 mks)

7. An impure solid copper (II) carbonate weighing 10.8g was placed in a beaker containing 50 cm³ of dilute nitric (V) acid. The volume of carbon (IV) oxide produced was recorded after every 20 seconds and tabulated as follows.

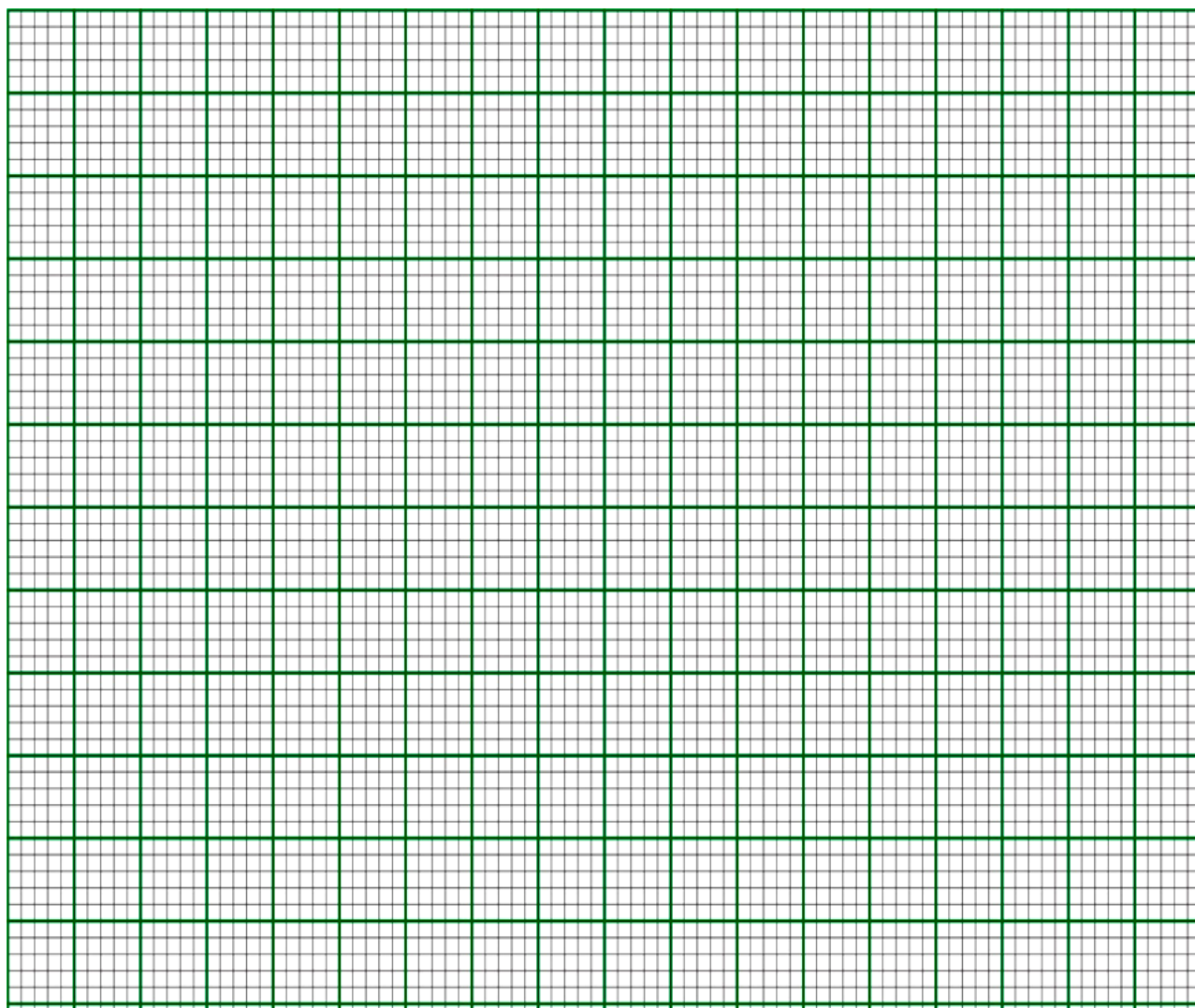
Time (s)	0	20	40	60	80	100	120
Volume of CO ₂ at S.T.P (cm ³)	0.0	650	900	1070	1100	1120	1120

On the grid provided, plot a graph of volume of carbon (Iv) oxide produced against time (3 marks)

a) Using the graph, calculate:

i) The rate of reaction between 20 and 40 seconds (2 marks)

ii) The rate of reaction at the 70th second (2 marks)



b) Explain the trend in the rate of reaction as the reaction progresses. (1 marks)

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c) Why was there no increase in volume of the gas produced after 100 seconds? (1 marks)

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d) How many moles of carbon (IV) oxide were in the maximum volume produced from this reaction? (M.G.V at s.t.p = 22400 cm³) (1 mark)

e) What mass of copper (II) carbonate will have reacted with the acid after 100 seconds? (Cu=64 C=12 O=16) (2 marks)