MARANDA HIGH SCHOOL

Kenya Certificate of Secondary Education
MOCK EXAMINATIONS 2022

233/2 **CHEMISTRY** **Paper 2**

AUGUST/SEPTEMBER 2022 – TIME 2 Hours

Name: ....Marking....Guide..........................Adm No: ....

Class: ....Candidate's Signature: .... Date: ..../..../2022.

Instructions to candidates

(a) Write your name, admission number, index number, and stream in the spaces provided above.

(b) Sign and write the date of the examination in the spaces provided

(c) Answer ALL the questions in the spaces provided.

(d) Candidates **MUST** answer all questions in English.

(e) KNEC mathematical tables and silent non-programmable electronic calculators may be used.

(f) This paper consists of **13 printed pages**

(g) Candidates should check the question paper to ascertain that ALL the pages are printed as indicated and that NO QUESTIONS ARE MISSING

FOR EXAMINER'S USE ONLY.

QUESTION	MAXIMUM SCORE	CANDIDATE'S SCORE
1	~~10~~ 09	
2	~~12~~ 13 .	
3	12	
4	11	
5	14	
6	11	
7	10	
TOTAL SCORE	**80**	

1

1. (a) The relationship between the pressure and volume of a fixed mass of gas was studied at 25°C. The data was recorded as shown in the table below.

Volume (m³)		1	2	4	6
Pressure (Pa) x 10⁵		12	6	3	2
Product of volume and pressure		12 ×10⁵	12 ×10⁴	12 ÷10⁵	12 ×10⁵

(i) Complete the table by calculating the product of the volume and pressure. (2 marks)

1.2×10^6 1.2×10^6 1.2×10^6 1.2×10^6

(ii) Using the data, state the law governing the relationship between volume and pressure of a fixed mass of a gas. (1 mark)

Volume of a fixed mass of a gas is inversely proportional to its pressure at constant temperature ✓

(b) The volume of nitrogen gas at 27°C and a pressure of 1 x 10⁵ pa is 8m³. Calculate its volume at 128°C and a pressure of 3.2 x 10⁵pa (2 marks)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

$$\frac{1 \times 10^5 \times 8}{300} = \frac{3.2 \times 10^5 \times V_2}{401}$$

$$V_2 = 3.342 \, m^3$$

(c) the set up below was used to study the properties of dry ice. Study it and answer the questions that follow:

Tube K

Tube L

Aqueous calcium hydroxide

dry ice

2

Obonyo — AH

05
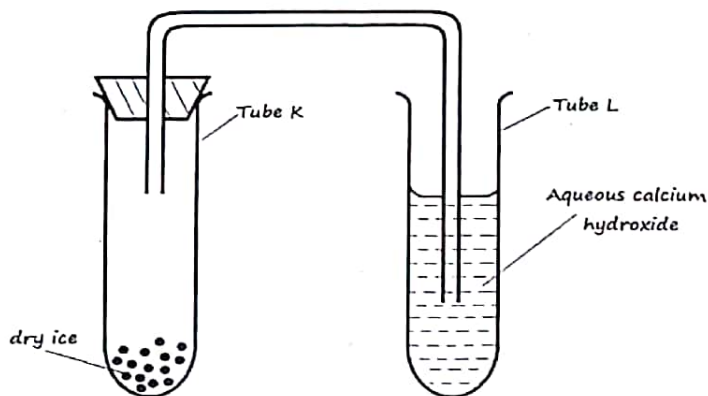
(i) State the observation(s) that was made in tubes K and L after some time. (2 marks)
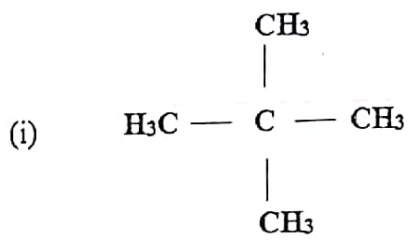
  I. Tube K ___Sublimes ✓___

  II. Tube L ___white precipitate solid/suspension___
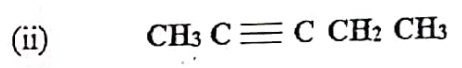
(ii) Name **two** processes that took place in tube K. (2 marks)

___Sublimation ✓ and Diffusion ✓___

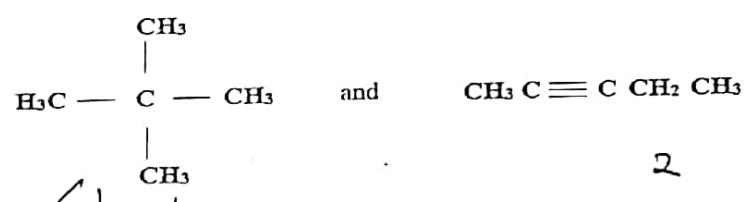2. (a) Give the names of the following compounds.

(i)

$$H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_3$$

(1 mark)

___2,2- dimethylpropane ✓___

(ii) $CH_3 C \equiv C\ CH_2\ CH_3$

(1 mark)

___Pent-2-yne. ✓___

(b) Describe a chemical test that can be carried out to distinguish between the compounds: (2 marks)

$$H_3C - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_3 \qquad and \qquad CH_3 C \equiv C\ CH_2\ CH_3$$

            2
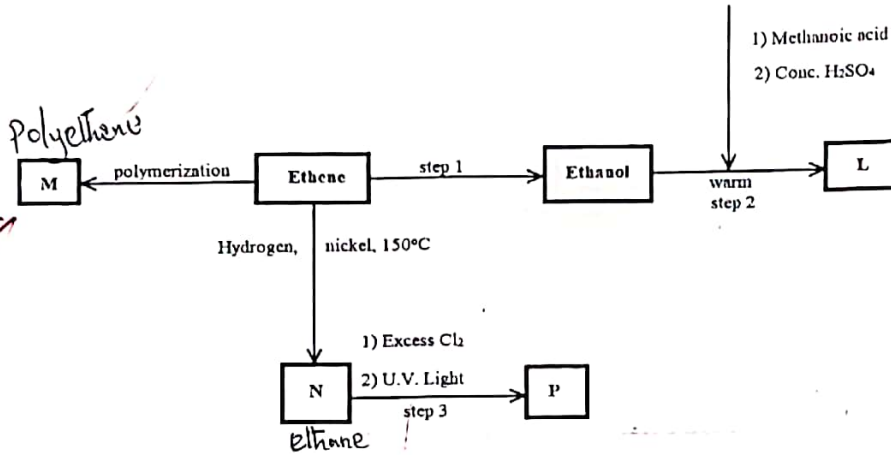
Test - 1
Observations - ½ each

✓ Ignite each. 2,2-dimethylpropane burns with non-sooty flame — Description 1mk
while Pent-2-yne burns with sooty flame.   —observ. ½
✓ Pass each through H⁺|KMnO₄. 1 does not decolourise   each
H⁺|KMnO₄ while 2 decolourises H⁺|KMnO₄.
✓ Use bromine water in the dark

Imbuga — ALL   08

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c) Study the flow chart below and answer the questions that follow

1) Methanoic acid

2) Conc. H_2SO_4

Polyethene

M ←polymerization— | Ethene | —step 1→ | Ethanol | —warm step 2→ | L |

Hydrogen, nickel, 150°C

1) Excess Cl_2
2) U.V. Light
step 3

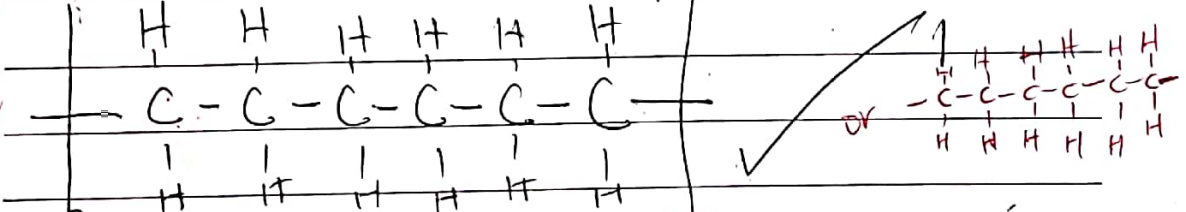| N | → | P |

ethane

(i) Name the compounds   (2 marks)

I) L: __Ethylmethanoate__ ✓

II) N: __Ethane__ ✓

(ii) Draw the structural formula of compound M showing **three repeating units.**   (1 mark)

H   H   H   H   H   H
| | | | | |
— C — C — C — C — C — C —
| | | | | |
H   H   H   H   H   H

or

H H H H H H
| | | | | |
— C — C — C — C — C — C —
| | | | | |
H H H H H H

(iii) Give the reagent and condition used in step 1   hydration.   (2 marks)

hydrolysis

Reagent — Water ✓   Reagent — Steam ✓

Condition — Conc. H_2SO_4 ✓   Condition: H_3PO_4 ✓
liquid H_2SO_4 res dil. H_2SO_4 Temp of 300°C / Heat at least 2 for
                                             Pressure (60-70 atm) (2 marks) 1mk

(Rose) -500
Kipk -1200
Abraham - 2000
Moun -600 (iv) State the type of reaction that takes place in:
Sugar -700
Winston -300   I) Step 2: __Esterification__ ✓
Noah -1900
Ian -1000   II) Step 3: __Substitution__ ✓

(v) The molecular formular of compound P is $C_2H_2Cl_4$. Draw the two structural formulae of
compound P   (2 marks)

Cl   Cl   Cl   Cl
| | | |
H — C — C — H   H — C — C — Cl
| | | |
Cl   Cl   H   Cl

4

Jared — ALL
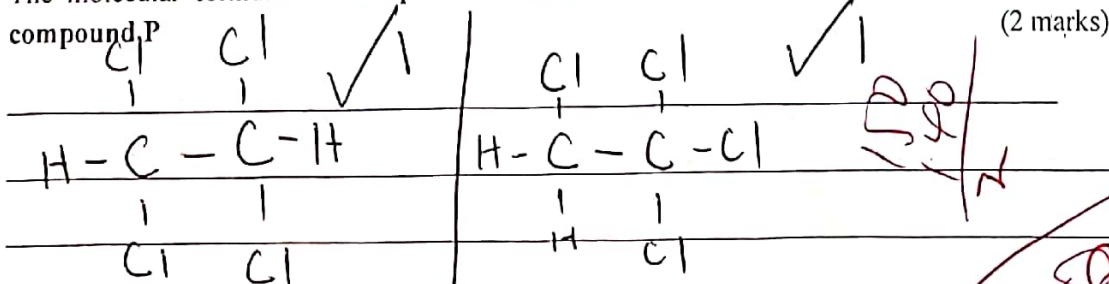
3. (a) The diagram below represents part of the structure of a sodium chloride crystal. The position of one of the sodium ions in the crystal is shown as +.
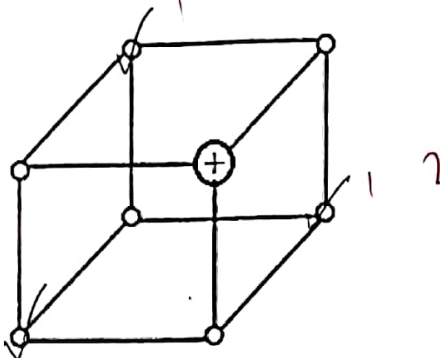
(i) On the diagram, mark the positions of the other three sodium ions (3 marks)

(ii) The melting and boiling points of sodium chloride are 801°C and 1413°C respectively. Explain why sodium chloride does not conduct electricity at 25°C but does at temperatures between 801°C and 1413°C. solid (2 marks)

At 25°C the ions are at fixed position while at above 801°C the ions are mobile.

(b) Give a reason why ammonia gas is highly soluble in water (1 mark)

It is polar due to hydrogen bonding

(c) The structure of an ammonium ion is shown below.
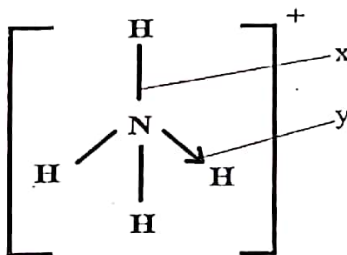
Name the types of bonds represented by the letters X and Y (1 mark)

X Covalent

Y Cordinate / Dative

Rose—ALL

(d) Carbon exists in different crystalline forms. Some of these forms were recently discovered in soot and are called fullerenes.

(i) What name is given to different crystalline forms of the same elements (1 mark)

Allotropes. ✓

(ii) Fullerenes dissolve in methylbenzene while other forms of carbon do not. Given that soot is a mixture of fullerenes and other solid forms of carbon, describe how crystals of fullerenes can be obtained from soot. (3 marks)

Add *~~methyl~~*benzene and st~~ir~~ to dissolve fullerenes- filter to obtain a solution of fullerene in Methylbenzene. Leave the solution in the sun for Methylbenzene to evaporate. (ref: evaporate the sln.

(iii) The relative molecular mass of one of the fullerenes is 720. What is the Molecular formula of this fullerene? (C = 12.0) (1 mark)

$$n = \frac{720}{12} = 60 \checkmark$$

$$C_{60} \checkmark$$

4. The set up below was used by a student to investigate the product formed when aqueous Copper (II) chloride was electrolysed using platinum electrodes.

platinum electrodes

aqueous copper (II) chloride
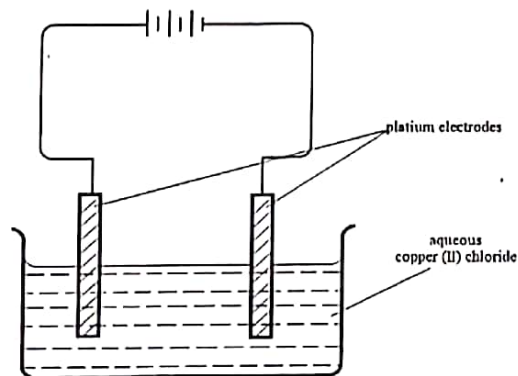
(a) (i) Write the equation for the reaction taking place at the cathode. (1 mark)

$$Cu^{2+}_{(aq)} + 2e^- \longrightarrow Cu_{(s)} \checkmark$$

^{6}Dr. Mulaka.—ALL ✓

06.

(ii) Name and describe a chemical test for the product initially formed at the anode when a highly concentrated solution of Copper (II) chloride is electrolysed. (3 marks)

Chlorine. Lower damp/wet blue litmus paper into the gas. The paper changes to red/then white/bleaches

~~reject colourless~~ -ss

(iii) How would the mass of the anode change if the platinum anode was replaced with copper metal? Explain (2 marks)

Decreases ✓ Cu anode is oxidised (dissolves)✓ explanation

_OR ($Cu_{(s)} \longrightarrow Cu^{2+}_{(aq)} + 2e$)_ ✓

(b) 0.6g of metal X were deposited when a current of 0.45A was passed through an electrolyte for 1 hour and 12 minutes. Determine the charge on the ion of metal X. (RAM of X = 59 1 Faraday = 96500 C) (3 marks)
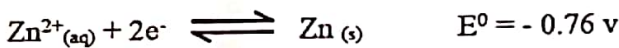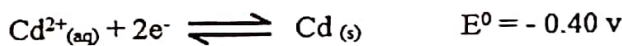
Accept correct alt way

$Mass = \dfrac{RAM \times Q}{nF}$

$Charge = \dfrac{R.A.M \times Q}{1F \times Mass\ deposited}$

$\dfrac{59 \times (0.45 \times 72 \times 60)}{96500 \times 0.6}$

$= 2 \quad$ or $\underset{=}{X^{2+}}$

$+2$ ✓ $\frac{1}{2}$ reg X^{+2}

(c) The electrode potentials for cadmium and zinc are given below

$Cd^{2+}_{(aq)} + 2e^- \rightleftharpoons Cd_{(s)}$ $E^0 = -0.40\ v$

$Zn^{2+}_{(aq)} + 2e^- \rightleftharpoons Zn_{(s)}$ $E^0 = -0.76\ v$

Explain why it is not advisable to store a solution of cadmium nitrate in a container made of zinc. (2 marks)

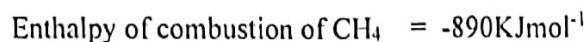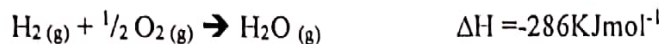$E^{\ominus} = E_{red} - E_{ox}$

$= -0.40 - 0.76 = +0.36 v$ ✓

Reaction is feasible✓ (possible)

5. (a) (i) what is meant by the term Enthalpy of formation? Heat produced / Heat evolved. (1 mark)

Enthalpy Change that occurs when One of mole of a compound is formed from its Constituent elements.

7

Joshua — ALL

(ii) The enthalpies of Carbon, methane and hydrogen are indicated below: -

$$C_{(s)} + O_{2\,(g)} \rightarrow CO_{2\,(g)} ; \qquad \Delta H = -393 KJmol^{-1}$$

$$H_{2\,(g)} + \tfrac{1}{2} O_{2\,(g)} \rightarrow H_2O_{(g)} \qquad \Delta H = -286 KJmol^{-1}$$

Enthalpy of combustion of CH_4 = $-890 KJmol^{-1}$

I) Draw an energy cycle diagram that links the enthalpy of formation of methane to enthalpies of combustion of carbon, hydrogen, and methane. (2 marks)

$$C_{(s)} + 2H_2(g) \longrightarrow CH_4(g)$$

$+O_2$ ΔH_2 O_2 ΔH_3 $+2O_2$

$$CO_2 + 2H_2O$$
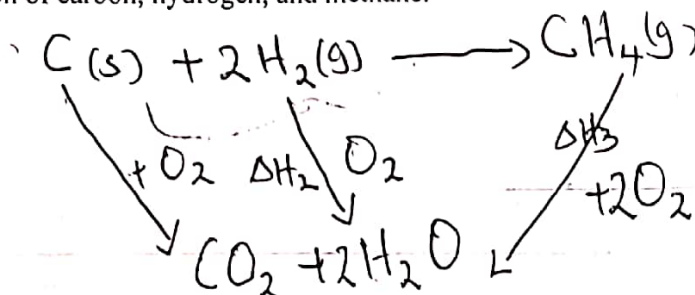
Equation – 1
balancing – 1

II) Determine the enthalpy of formation of methane. (2 marks)

$$\Delta H_f = \Delta H_o - \Delta H_3$$

but $\Delta H_2 = -393 + (2 \times 286) = -965$

$$= -965 + 890 = -75 kJ/mol$$

penalize
k mk
or sign

(b) An experiment was carried out where different volumes of dilute nitric (V) acid and aqueous potassium hydroxide both at 25°C were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table below.

Volume of nitric acid (cm³)	5	10	15	20	25	30	35	40	45
Volume of Potassium hydroxide (cm³)	45	40	35	30	25	20	15	10	5
Highest temperature of mixture (°C)	27.2	29.4	31.6	33.8	33.6	31.8	30.0	28.4	26.6

(i) On the grid provided, plot a graph of highest temperature (vertical axis) against volume of nitric (V) acid. (3 marks)

Timothy — ALL

8

20

5

20

A - ½
S - ½
P - 1
L - 1
_____
03
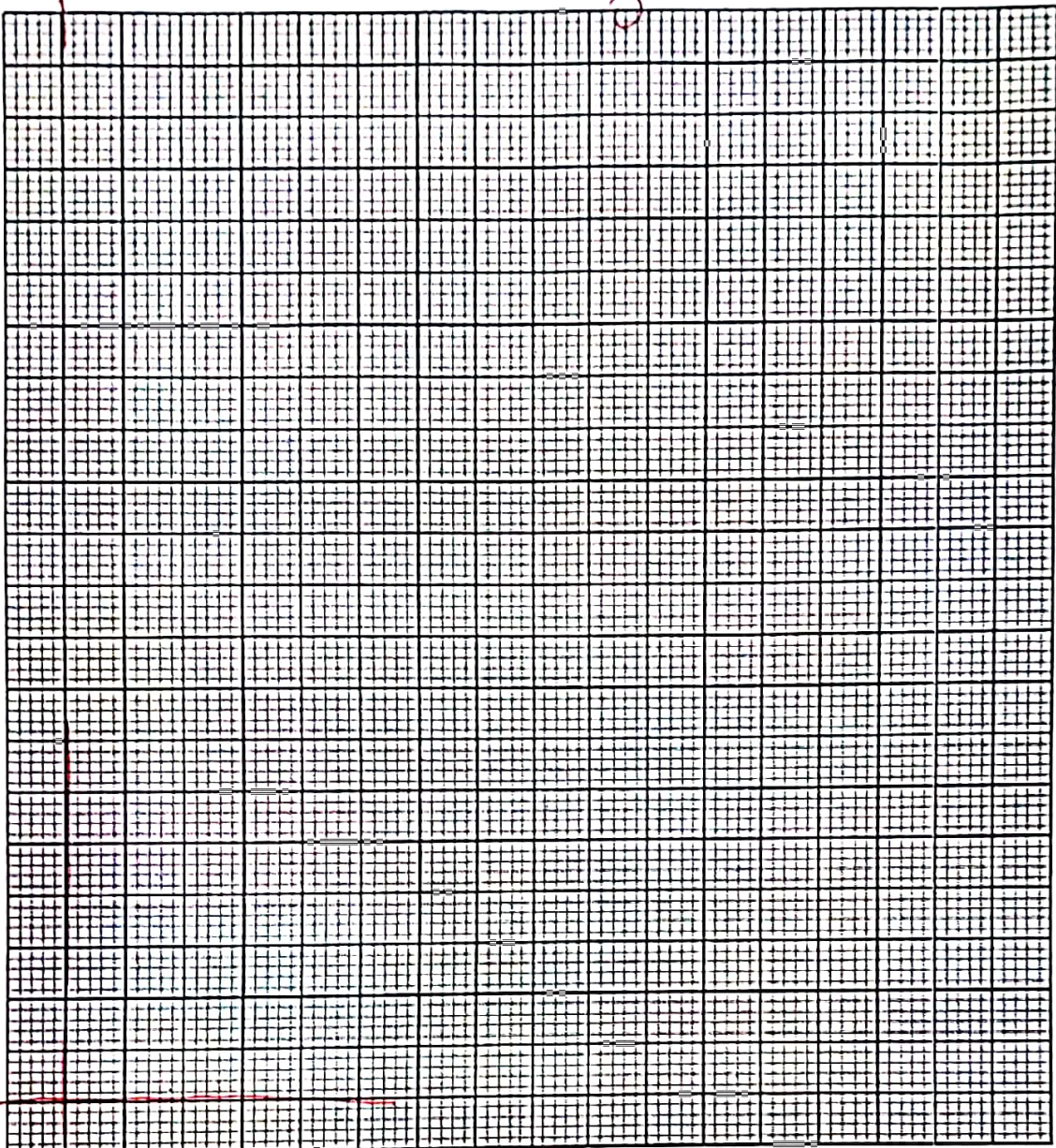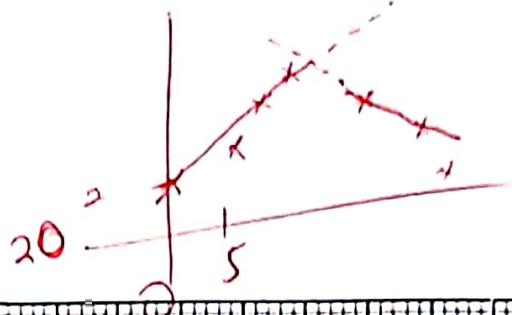
(ii) Using your graph, determine the:

I) Highest temperature reached   (1 mark)

Showing ✓½   Reading ✓½

II) Volume of acid and base reacting when highest temperature is reached.   (1 mark)

Showing ✓½   Reading ✓½
Volume of acid ✓½   Alkali ✓½

GOA — ALL   05

(iii) Calculate the amount of heat liberated during the neutralization process. (Specific heat capacity is 4.2Jg⁻¹K⁻¹ and density of solution is 1.0gcm⁻³). $m = 50cm^3 \times 1q = 50g/2$ **(2mks)**

$$\Delta H = mC\Delta T$$
$$= 50 \times 4.2 \times \Delta T$$
$$= \text{Correct Ans.} \times_2$$

(c) The molar enthalpy of neutralisation between nitric (V) acid and ammonia solution was found to be -52.2KJmol⁻¹, while that of nitric (V) acid and potassium hydroxide was – 57.1 KJmol⁻¹. Explain the difference in these values. **(2 marks)**

✓ Ammonia solution dessociates/ionizes partially hence some heat is used to ionize it completely while KOH is a strong base therefore dessociate fully.
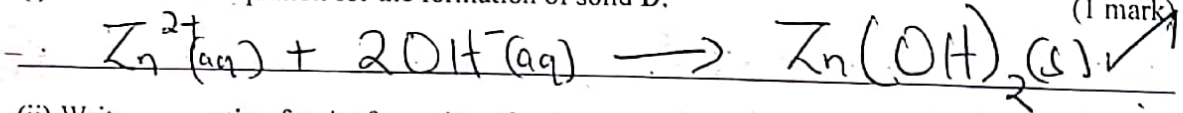
6. The scheme below shows the preparation of a certain salt. Study it and answer the questions that follow.
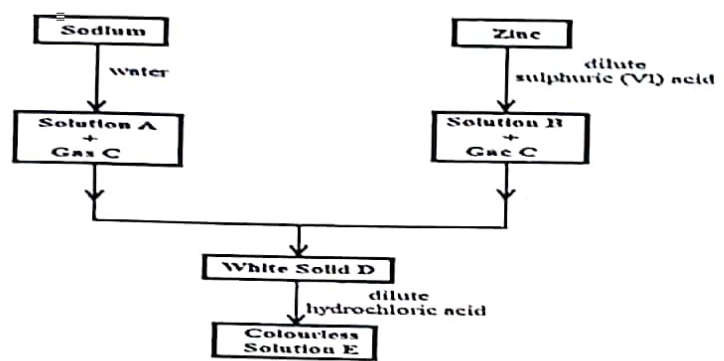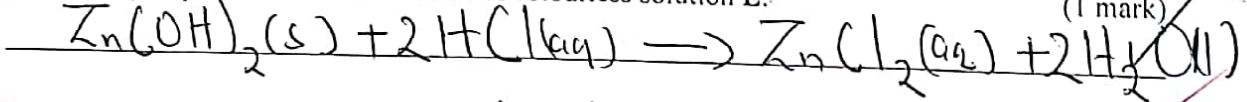
(a) Identify the following substances: **(2 marks)**

Solution A ___Sodium hydroxide / NaOH✓₂___

Solution B ___Zinc Sulphate / ZnSO₄ ✓₂___

Gas C: ___Hydrogen / H₂ ✓₂___

Solid D ___Zinc hydroxide / Zn(OH)₂ ✓₂___

(b) (i) write an ionic equation for the formation of solid D. **(1 mark)**

$$Zn^{2+}(aq) + 2OH^-(aq) \longrightarrow Zn(OH)_2(s) ✓$$

(ii) Write an equation for the formation of colourless solution E. **(1 mark)**

$$Zn(OH)_2(s) + 2HCl(aq) \longrightarrow ZnCl_2(aq) + 2H_2O(l)$$

Peter / Odundo.
P, R, V, Y, W   B, C, G, M, Or

(c) (i) Describe how the identity of gas C can be confirmed   (2 marks)

Lower a burning wooden splint. "Pop" sound produced. // Or the splint goes off with a pop sound. extinguishes.

(ii) Name the catalyst that can be used in the reaction between zinc and dilute sulphuric (VI) acid.
                                                                              (1 mark)

Copper (II) sulphate crystals

(d) Explain any two observations made when sodium reacts with water.   (2 marks)

✓ Darts on the surface of water since it is less dense than water / Darting propelled by $H_2(g)$ produced.
✓ Hissing sound — Production of the gas.
✓ Melts into silvery ball — Reaction is exothermic.

(e) Describe how you can obtain from solution E:
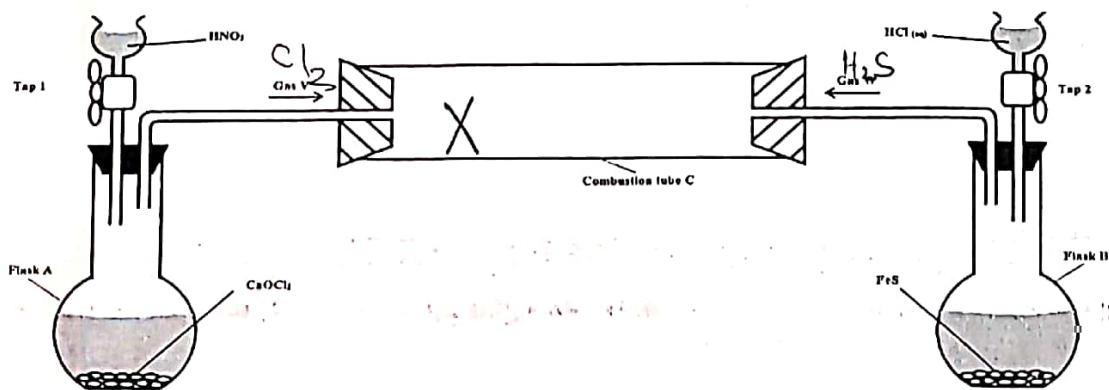(i) A hydrated salt   (1 mark)

Heat the solution to saturation, allow to cool and form crystals.

(ii) Anhydrous salt   (1 mark)

Heat the solution to dryness. ✓

7. A student set up the following arrangement to prepare and react gases V and W. Use it to answer the questions that follow. (S =32, H =1, Cl =35.5).

Elijah Omenda
B, C, G, M, Or P, R, V, Y, W   07

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