



# 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

- Write your name, admission number, index number, and stream in the spaces provided above.
- Sign and write the date of the examination in the spaces provided
- Answer **ALL** the questions in the spaces provided.
- Candidates **MUST** answer all questions in English.
- KNEC mathematical tables and silent non-programmable electronic calculators may be used.
- This paper consists of 13 printed pages
- 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	<del>10</del> 09	
2	<del>12</del> 13	
3	12	
4	11	
5	14	
6	11	
7	10	
TOTAL SCORE	80	

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 (m <sup>3</sup> )	1	2	4	6
Pressure (Pa) x 10 <sup>5</sup>	12	6	3	2
Product of volume and pressure	12 ✓	12 ✓	12 ✓	12 ✓

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

- (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.

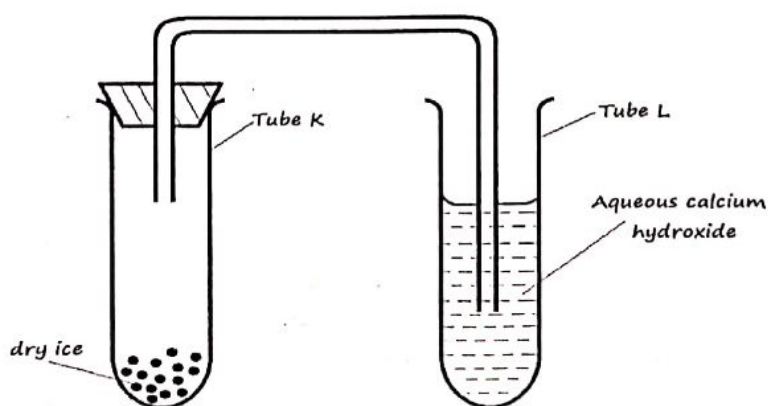
- (b) The volume of nitrogen gas at 27°C and a pressure of 1 x 10<sup>5</sup> pa is 8m<sup>3</sup>. Calculate its volume at 128°C and a pressure of 3.2 x 10<sup>5</sup>pa (2 marks)

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

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

$$V_2 = 3.342 \text{ m}^3$$

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



(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.

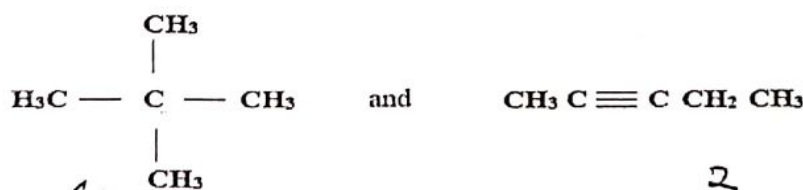


2,2-dimethylpropane ✓



Pent-2-yne ✓

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



Test - 1  
Observations - 1/2 each

✓ Ignite each. 1 2,2-dimethylpropane burns with non-sooty flame while Pent-2-yne burns with sooty flame.

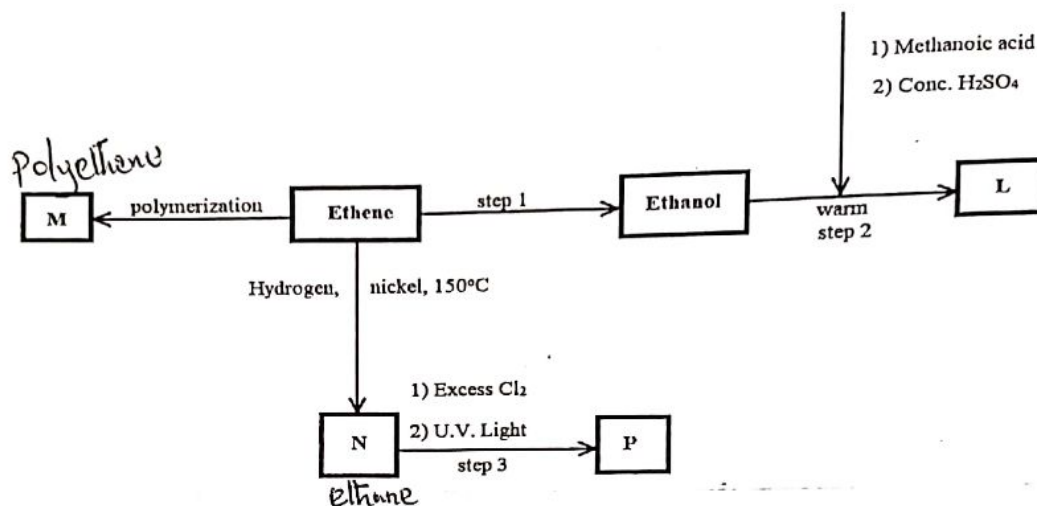
✓ Pass each through  $\text{H}^+/\text{KMnO}_4$ . 1 does not decolourise  $\text{H}^+/\text{KMnO}_4$  while 2 decolourises  $\text{H}^+/\text{KMnO}_4$ .

✓ Use bromine water in the dark

Imbuga - ALL



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



(i) Name the compounds

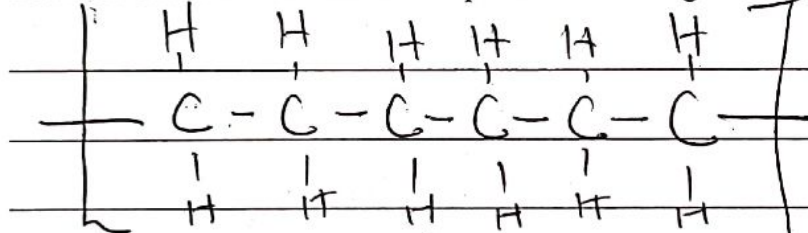
(2 marks)

I) L: Ethylmethanoate

II) N: Ethane

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

(1 mark)



(iii) Give the reagent and condition used in step 1

(2 marks)

Reagent - water

Reagent - steam

Condition - Conc.  $\text{H}_2\text{SO}_4$

Condition:  $\text{H}_3\text{PO}_4$

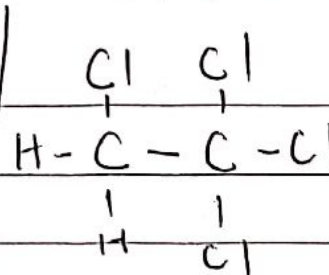
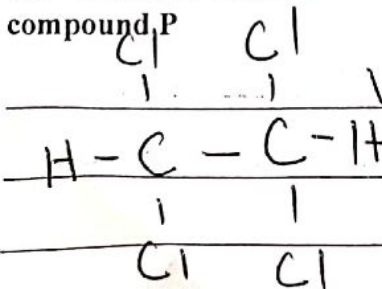
(iv) State the type of reaction that takes place in:

I) Step 2: Esterification

II) Step 3: Substitution

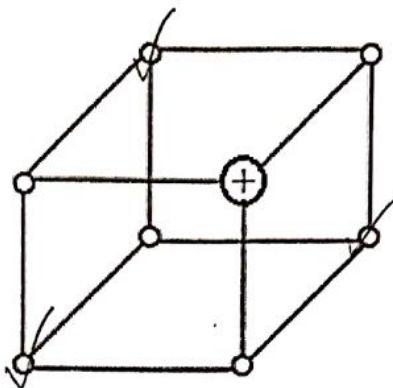
(v) The molecular formula of compound P is  $\text{C}_2\text{H}_2\text{Cl}_4$ . Draw the two structural formulae of compound P

(2 marks)



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)

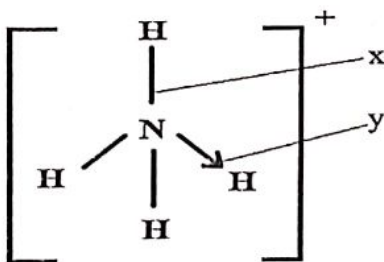
- (ii) The melting and boiling points of sodium chloride are  $801^{\circ}\text{C}$  and  $1413^{\circ}\text{C}$  respectively. Explain why sodium chloride does not conduct electricity at  $25^{\circ}\text{C}$  but does at temperatures between  $801^{\circ}\text{C}$  and  $1413^{\circ}\text{C}$ . (2 marks)

At  $25^{\circ}\text{C}$  the ions are at fixed position while at above  $801^{\circ}\text{C}$  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 Coordinate / 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)

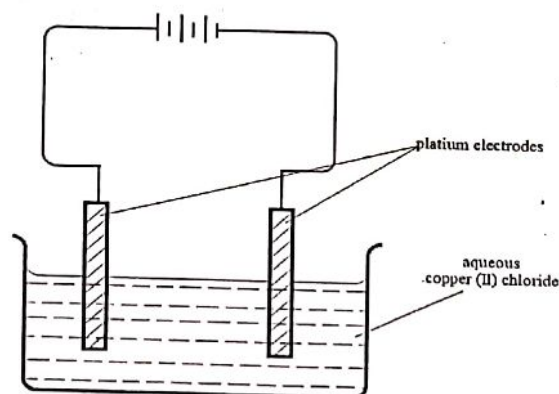
Add methylbenzene and stir to dissolve fullerenes. filter to obtain a solution of fullerene in Methylbenzene. Leave the solution in the dish for Methylbenzene to evaporate. ✓

- (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)

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

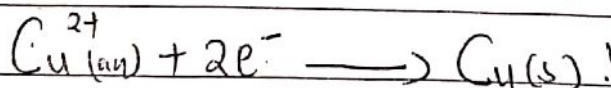
C<sub>60</sub> ✓

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.



- (a) (i) Write the equation for the reaction taking place at the cathode.

(1 mark)



Dr. Malaka - AL



- (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 to a pale colour.

- (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.  

$$\text{Cu(s)} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$$
 explanation:

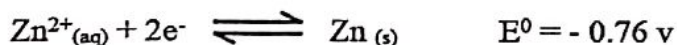
- (b) 0.6g of metal X were deposited when a current of 0.45A was passed through an electrolyte for 1 hour and 12 minutes. Determine the charge on the ion of metal X. (RAM of X = 59 1 Faraday = 96500 C) (3 marks)

$$\text{Charge} = \frac{R \cdot A \cdot M \times Q}{1F \times \text{Mass deposited}}$$

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

$$= 2+$$

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



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

$$E^0 = E_{\text{red}} - E_{\text{ox}}$$

$$= -0.40 - (-0.76) = +0.36 \text{ V}$$

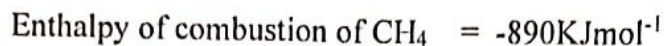
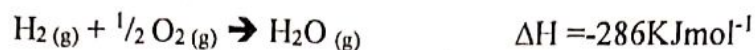
Reaction is feasible.

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

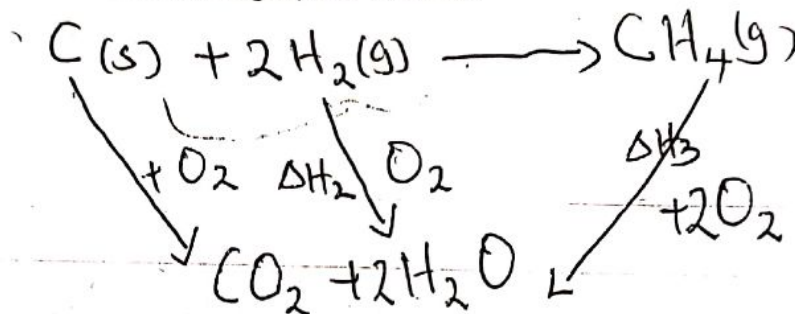
Heat produced / Heat evolved.  
 Enthalpy change that occurs when one mole of a compound is formed from its constituent elements.

Joshua - ALL

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



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)



Equation - 1  
balancing -

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

$$\Delta H_f = \Delta H_1 - \Delta H_3$$

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

$$= -965 + 890 = -75 \text{ kJ/mol}$$

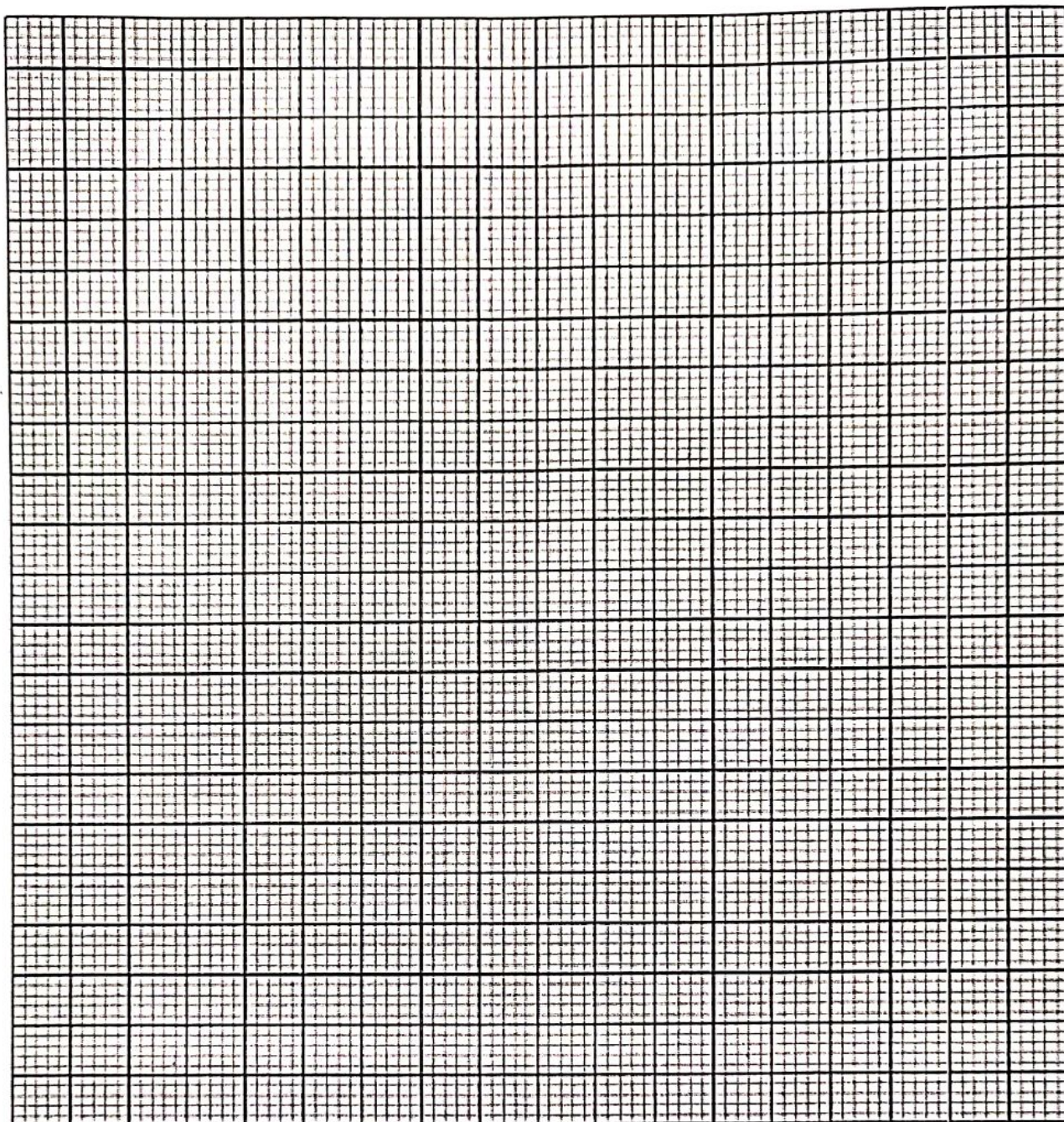
(b) An experiment was carried out where different volumes of dilute nitric (V) acid and aqueous potassium hydroxide both at 25°C were mixed and stirred with a thermometer. The highest temperature reached by each mixture was recorded in the table below.

Volume of nitric acid (cm <sup>3</sup> )	5	10	15	20	25	30	35	40	45
Volume of Potassium hydroxide (cm <sup>3</sup> )	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





A -  $\frac{1}{2}$   
S -  $\frac{1}{2}$   
P - 1  
L - 1  

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02

(ii) Using your graph, determine the:

I) Highest temperature reached

(1 mark)

\_\_\_\_\_ showing  $V_2$       Reading  $V_2$

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

(1 mark)

\_\_\_\_\_ showing  $V_2$       Reading  $V_2$   
\_\_\_\_\_ volume of acid  $V_2$       Alkali  $V_2$

GOA - ALL



(iii) Calculate the amount of heat liberated during the neutralization process. (Specific heat capacity is  $4.2 \text{ Jg}^{-1}\text{K}^{-1}$  and density of solution is  $1.0 \text{ gcm}^{-3}$ ).  $m = 50 \text{ cm}^3 \times 1 \frac{\text{g}}{\text{cm}^3} = 50 \text{ g}$  (2 marks)

$$\Delta H = mc\Delta T$$

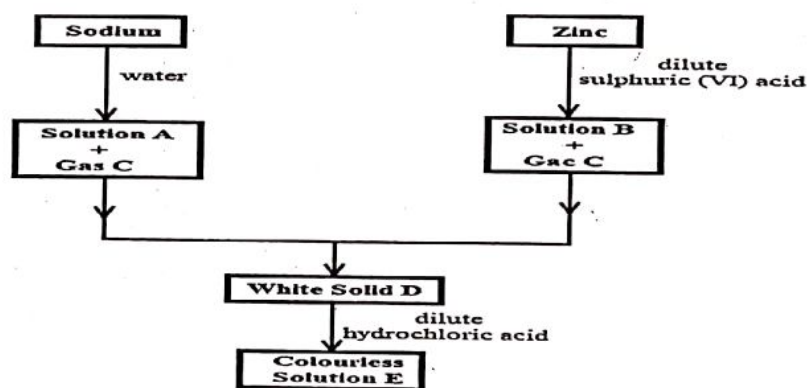
$$= 50 \times 4.2 \times \Delta T$$

$$= \text{Correct Ans.}$$

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

✓ Ammonia solution dissociates/ionizes partially hence some heat is needed to ionize it completely while KOH is a strong base therefore dissociate 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:

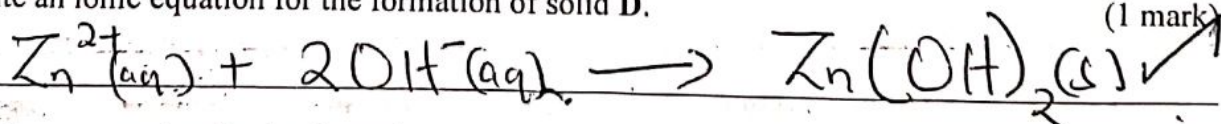
Solution A Sodium hydroxide /  $\text{NaOH}$  (2 marks)

Solution B Zinc sulphate /  $\text{ZnSO}_4$

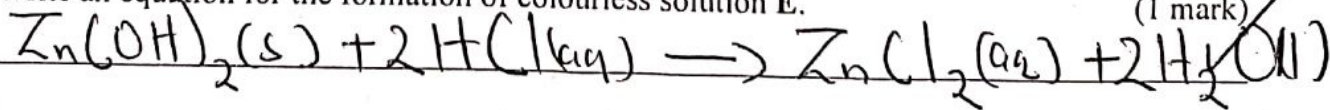
Gas C: Hydrogen /  $\text{H}_2$

Solid D Zinc hydroxide /  $\text{Zn(OH)}_2$

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



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



Peter / Odumdo.  
P, R, V, Y, W B, C, G, M, O

(c) (i) Describe how the identity of gas C can be confirmed (2 marks)  
 Lower  $\checkmark$  burning wooden splint. "Pop"  $\checkmark$  sound produced.

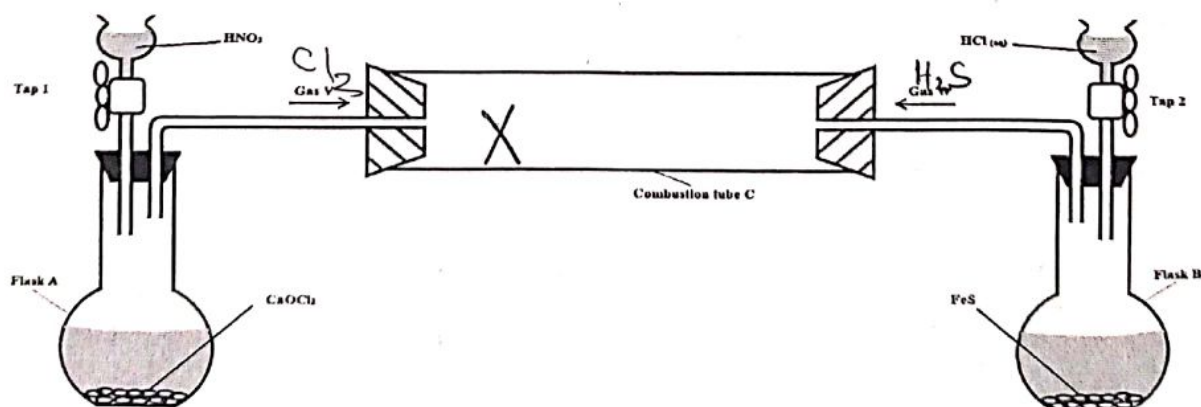
(ii) Name the catalyst that can be used in the reaction between zinc and dilute sulphuric (VI) acid. (1 mark)  
 Copper (II) sulphate crystals  $\checkmark$

(d) Explain any two observations made when sodium reacts with water. (2 marks)  
 $\checkmark$  Darts on the surface of water since it is less dense than water / Darting propelled by  $H_2(g)$  produced.  
 $\checkmark$  Hissing sound - Production of the gas.  
 $\checkmark$  Melts into silvery ball - Reaction is exothermic

(e) Describe how you can obtain from solution E: (1 mark)  
 (i) A hydrated salt  
 Heat the solution to saturation, allow to cool and form crystals.

(ii) Anhydrous salt (1 mark)  
 $\checkmark$  Heat the solution to dryness  $\checkmark$

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).



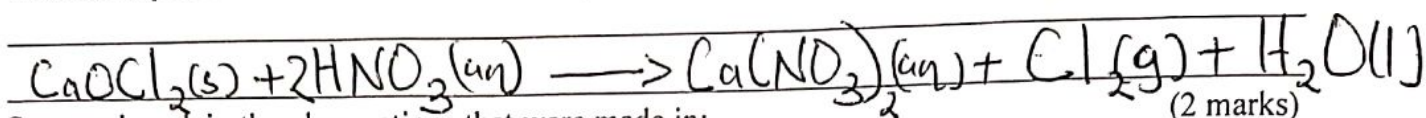
Eligah / Omenda  
 B, C, G, M, Or P, R, V, Y, W



Taps 1 and 2 were opened at the same time.

(i) Write an equation for the reaction that took place in flask A.

(1 mark)



(ii) State and explain the observations that were made in:

(2 marks)

I) Flask B

✓ Bubbles of a colourless gas which changes lead acetate

✓ paper black —  $\text{H}_2\text{S}(\text{g})$  /  $\text{AlI}$   
 ✓ Green solution of  $\text{FeCl}_2$  /  $\text{FeS}(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{FeCl}_2(\text{aq}) + \text{H}_2\text{S}(\text{g})$   
 II) Combustion tube (2 marks)

✓ Yellow deposits and white fumes towards the left. Due to formation of  $\text{S}$  and  $\text{HCl}(\text{g})$

(iii) Mark on the diagram the approximate position where reaction occurred in the combustion tube.

Explain your answer.

(2 marks)

Mark closer to flask A.  $\text{H}_2\text{S}$  is less dense therefore diffuses faster than  $\text{Cl}_2$

(iv) State one possible objective of the experiment apart from testing whether gas W reacts with gas V.

(1 mark)

To investigate the rate of diffusion between  $\text{Cl}_2$  and  $\text{H}_2\text{S}$ .

(v) Giving a reason, state one precaution that should be taken when carrying out this experiment.

(2 marks)

✓ Carried out in fume chamber. Gases produced are highly poisonous. ( $\text{H}_2\text{S}$  and  $\text{Cl}_2$ ).

Jesse / Alago  
 Dr, B, C, G, M, P, R, V, Y, W