

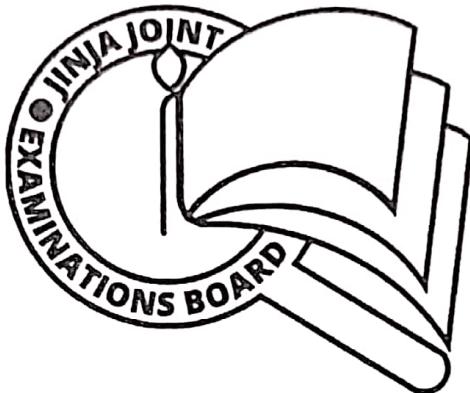
Name..... Centre/Index No.....

FATIE 4025
Lydia 4000
SAPATT 450

SAPATT 4050
FATIE 4030
LITDA 4000

Signature.....

545/2
CHEMISTRY
Paper 2
July / August, 2023
2 hours



JINJA JOINT EXAMINATIONS BOARD

Uganda Certificate of Education

MOCK EXAMINATION – JULY / AUGUST, 2023

CHEMISTRY

Paper 2

2 hours

INSTRUCTIONS TO CANDIDATES:

SECTION A: Consists of 10 structured questions.

Answer all questions in this section.

Answers to questions in section A should be written in the spaces provided on this question paper.

SECTION B: Consists of Semi – structured questions.

Attempt any TWO questions from this section.

Answers to the questions must be written in the answer sheet provided.

In both sections, all working must be clearly shown.

1 mole of a gas occupies $22,400 \text{ cm}^3$ at s.t.p

1 mole of a gas occupies $24,000 \text{ cm}^3$ at room temperature.

Use the following where necessary

H=1, C=12, O=16, Mg=24, Fe=56, Pb= 207, S = 32

For Examiner's use only

1	2	3	4	5	6	7	8	9	10	11	12	13	14	TOTAL

SECTION A (50 marks)

Attempt ALL questions in this section.

1. Magnesium burns in air to form a white solid M which when dissolved in dilute hydrochloric acid forms a colorless solution Q, that forms a white precipitate with silver nitrate solution. *(½ mark)*

(a) (i) Identify M.

.....
.....
.....

(ii) Write equation for the reaction leading to formation of M. *(1½ marks)*

.....
.....
.....
.....
.....

(b) (i) Name the colourless solution Q. *(½ mark)*

.....
.....
.....

(ii) Write equation for the reaction leading to formation of Q. *(1½ marks)*

.....
.....
.....

(c) (i) State the chemical name of the white precipitate. *(½ mark)*

.....
.....
.....

(ii) State the practical application of the reaction that led to the formed of the white precipitate. *(½ mark)*

.....
.....

2. Polyethene and cellulose are both polymers.

(a) State what is meant by the term polymer.

(1 mark)

.....
.....
.....

(b) State the type of polymer to which each of the polymers belong.

(i) Polyethene

(1 mark)

.....
.....

(ii) Cellulose

(1 mark)

.....
.....

(c) State one advantage of each of the polymers.

(i) Polyethene

(½ mark)

.....
.....
.....
.....

(d) State the monomers of:

(i) Polyethene

(½ mark)

.....
.....

(ii) Cellulose

(½ mark)

.....
.....

3. Zinc granules were put into a solution of Iron(II) sulphate.

(a) State what would be observed.

(1½ marks)

.....
.....

- 4
- (b) Write ionic equation for the reaction that took place. (1½ marks)

.....
.....
.....

- (c) State the type of reaction that took place. (½ mark)

.....
.....

- (d) Give a reason for your answer in (c). (1½ marks)

.....
.....
.....

4. Table 1 shows the number of protons, electrons and neutrons atoms of elements T, W, Y, and Z. Study the table and answer the questions that follow;

Table 1

Atoms	Protons	Electrons	Neutrons
T	8	10	8
W	16	16	18
Y	11	10	12
Z	16	16	17

- (a) Identify the represented atom which is/ are;

- (i) anion(s) (½ mark)

.....

.....

- (ii) cation(s) (½ mark)

.....

.....

- (iii) isotopes (1 mark)

.....

.....

- (iv) Elements that belong to the same group in the periodic table.
(1½ marks)

.....
.....
.....
.....

- (b) Y reacts with T to form compound R. Write the formula of R.
(1 mark)

.....
.....

- (c) State the type of bond formed in R.
(½ mark)

.....
.....

5. 5.6g of hydrocarbon L having a vapour density of 14 consists of 4.8g of carbon.

- (a) Calculate the;
(i) empirical formula of L
(2 marks)

.....
.....
.....
.....
.....
.....
.....
.....

- (ii) molecular formula of L.
(1½ marks)

.....
.....
.....
.....
.....
.....

(b) Write the name and structure of L. 6
(1 mark)

.....
.....

(c) State the group of hydrocarbons to which L belongs. (½ mark)

.....
.....

6. Oxygen can be prepared in the laboratory from hydrogen peroxide.

(a) State the condition(s) for the reaction. (1 mark)

.....
.....

(b) Write equation for the reaction leading to the formation of oxygen, (1½marks)

.....
.....
.....

(c) Write the name and formula of the substance formed when excess

oxygen reacts with hot;

(i) Sodium (1mark)
Name

.....
.....

Formula

.....
.....

(ii) Iron (1mark)
Name

.....
.....

.....

Formula

-
.....
- (d) State the general name given to the type of substance formed in c(ii).
(½mark)
-
.....

7. 3.6g of a mixture of silver nitrate and calcium chloride was shaken and filtered.

- (a) Identify the cation in the;
(i) filtrate

(1mark)

.....
.....

- (ii) residue *(1mark)*

.....
.....

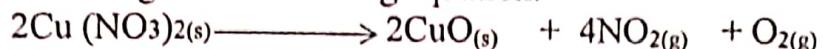
- (b) Name the reagent(s) that can be used to test for the anion in the filtrate. *(1mark)*

.....
.....

- (c) Describe how the named reagent(s) in (b) can be used to test for the anion. *(2marks)*

.....
.....
.....
.....
.....
.....

8. (a) Copper(ii) nitrate crystals when heated in a test tube decomposed according to the following equation.



Calculate the total volume of gases evolved at s.t.p if 3.2g of copper

- (ii) oxide was formed.

(3 ½ marks)

.....
.....
.....
.....
.....
.....
.....
.....
.....

- (b) To the solid product in (a) was added warm dilute nitric acid, followed by excess aqueous ammonia.

- (i) State what would be observed.

(½ mark)

.....
.....
.....
.....
.....
.....
.....
.....

9. When a colourless gas J was passed over heated iron wool, a white solid X was formed.

- (a) Identify;

- (i) J

(½ mark)

.....
.....
.....
.....
.....

- (ii) X

(½ mark)

(b) Write equation for the reaction that took place. (1½ marks)

.....
.....
.....

(c) To X was added water and resultant solution treated with aqueous silver nitrate.

(i) State what would be observed. (1 mark)

.....
.....
.....
.....
.....

(ii) Write ionic equation for the reaction that took place. (1½ marks)

10. Saturated sodium chloride solution was electrolysed using graphite anode and a mercury cathode.

(a) State what would be observed at the anode. (1mark)

.....
.....
.....
.....
.....

(c) The product formed at the cathode was reacted with oxygen. Write equation for the reaction that took place. (1 ½ marks)

.....
.....
.....

(d) State the two application(s) of electrolysis of saturated sodium chloride solution. (1mark)

.....
.....

SECTION B (30 MARKS)

Answer any two questions from this section

Any additional question(s) answered shall not be marked

11. (a) Chlorine gas can be prepared in the laboratory by reacting hydrochloric acid with solid V at room temperature.
- (i) Name solid V. (1 mark)
- (ii) Write equation for the reaction that would take place. (1 ½ marks)
- (b) Draw a setup of apparatus that would be used to prepare a pure sample of chlorine gas in the laboratory. (5 marks)
- (c) Chlorine was passed through water.
- (i) State what was observed. (1 mark)
- (ii) Write equation for the reaction that took place. (1 ½ marks)
- (d) The solution formed in (c) was divided into two portions. With explanations, state what would be observed if;
- (i) to the first portion was added pink colored flowers. (2 ½ marks)
- (ii) the second portion was exposed to sunlight. (3 marks)
12. (a) With the help of equations, describe how nitric acid can be manufactured by catalytic oxidation of ammonia. (7 marks)
- (b) Hot concentrated nitric acid was added to wood charcoal.
- (i) State what would be observed. (1 ½ marks)
- (ii) Write equation for the reaction that would take place. (1 ½ marks)
- (c) Ammonium nitrate is one of the fertilizers that are widely used in agriculture. When soils on which the fertilizer had been used were tested with litmus, litmus turned red. Explain the observation made. (5 marks)
13. (a) State what is meant by the term **hard water**. (1 mark)
- (b) Name the cations that cause hardness of water. (1 mark)
- (c) Describe how water becomes hard. (5 marks)
- (d) Magnesium hydrogen carbonate was heated gently in a test tube.

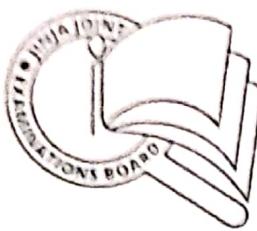
- (i) State what would be observed. (1 mark)
- (ii) Write equation for the reaction that would take place. (1 ½ marks)
- (iii) State the application of this reaction. (1 mark)
- (e) Describe the reactions of water with the following substances. (2½ marks)
- (i) Calcium. (2 marks)
- (ii) Iron.

14. (a) (i) Write equation for the reaction between zinc and dilute hydrochloric acid. (1 ½ marks)
- (ii) State how concentration can affect the rate of reaction in (a)(i). (2 marks)
- (b) State the conditions and write ionic equation for the reaction that would take place when sulphuric acid reacts with zinc. (2 ½ marks)
- (c) The table below shows volumes of hydrogen evolved when 0.26g of zinc granules was added to excess dilute hydrochloric acid.

Table 2

Volume hydrogen(cm ³)	0	30	49	63	74	84	92	92
Time(s)	0	15	30	45	60	75	90	105

- (i) Plot a graph of volume of hydrogen (vertical axis) against time (horizontal axis). (5 marks)
- (ii) Using your graph, determine the rate of reaction at 63 seconds. (2 marks)
- (iii) Calculate the volume of hydrogen formed at stp from the zinc that reacted. (2 marks)



JINJA JOINT EXAMINATIONS BOARD

MOCK EXAMINATIONS

545/2 - CHEMISTRY PAPER 2

MARKING GUIDE 2023

SECTION A (50 marks)

1(a)(i)	Magnesium oxide.	½
(ii)	$2\text{Mg}_{(s)} + \text{O}_{2(g)} \longrightarrow 2\text{MgO}_{(s)}$	1½
(b) (i)	Magnesium chloride. Rej formula or both	½
(ii)	$\text{MgO}_{(s)} + 2\text{HCl}_{(aq)} \longrightarrow \text{MgCl}_{2(aq)} + \text{H}_2\text{O}_{(l)}$	1 ½
C(i)	Silver chloride	½
(ii)	Testing for chloride ions	½
TOTAL		05
2a)	Polymer is a large complex molecule with big molecular mass which consists of small repetitive molecules called monomers.	1
(b) (i)	Synthetic polymers	1
(ii)	Natural polymers	1
(c) (i)	Its quality can be improved. OR EQUIVALENT	½
(ii)	It is cheap or equivalent	½
(d)(i)	Ethene	½
(ii)	Glucose	½
TOTAL		05

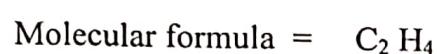
3(a)	The green solution turned colourless forming a grey deposit.	1½
(b)	$Zn(s) + Fe^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Fe_{(s)}$	1½
(c)	Displacement reaction OR EQUIVALENT	½
(d)	Zinc being more reactive than iron, it displaced iron from the solution forming zinc sulphate solution	1½
	TOTAL	05
4a(i)	T	½
(ii)	Y	½
(iii)	W,Z	1
(iv)	T & W,Z	1½
(b)	$Y_2 T / TY_2$	1
(C)	Ionic bond OR EQUIVALENT	½
	TOTAL	05
5(a) (i)	$H = 5.6 - 4.8$ $= 0.8$	
	Elements: C H	
	Composition 4.8 0.8	
	moles of atoms: <u>4.8</u> <u>0.8</u>	
	<u>12</u> <u>1</u>	
	<u>0.4</u> <u>0.08</u>	
	<u>0.4</u> <u>0.4</u>	
	Ratio 1 : 2	2
	Empirical formula = CH_2	

(iii) Molar mass=V.D
 $M.M = 2 \times 14$
 $= 28$

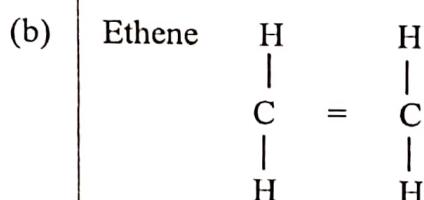
$$(CH_2)_n = 28$$

$$\frac{14n}{14} = \frac{28}{14}$$

$$n = 2$$



1½



1

(c) Alkenes

½

TOTAL

05

6(a) Presence of a catalyst
 No heating

1



1½

(c)(i) Sodium peroxide, Na_2O_2

1

(ii) Triiron tetraoxide OR Equivalent

1



½

(d) Mixed oxide

½

TOTAL

05

7(a)(i) Ca^{2+} or Equivalent

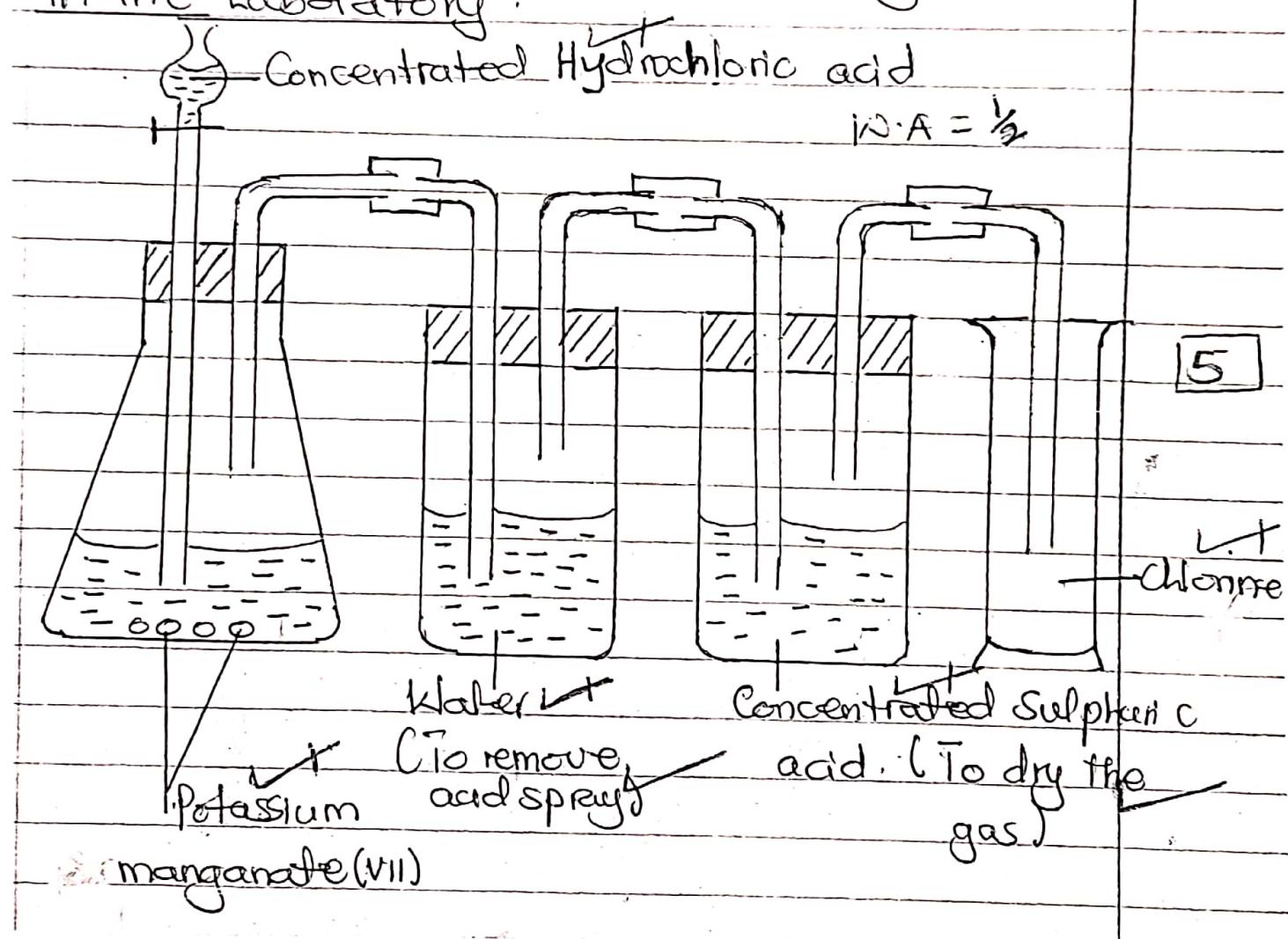
1

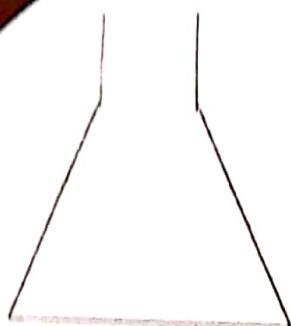
		1
(ii)	Ag^+ or Equivalent	1
(b)	Iron (II) sulphate	
	Concentrated sulphuric acid	1
(c)	To the nitrate solution in a test tube is added freshly prepared iron II sulphate solution followed by concentrated sulphuric acid poured on the sides of the test tube when in a slanting position. A brown ring is formed.	
	TOTAL	05
8(a)	$\text{F.m of CuO} = 64 + 16$ $= 80$	
	Moles of copper (II) oxide = $\frac{3.2}{80}$	$3\frac{1}{2}$
	Moles of gases = $\frac{5 \times 3.2}{2 \times 80}$	
	1 mole of gas at stp occupies 22.4 dm^3	
	$\frac{5 \times 3.2}{2 \times 80}$ moles at stp will occupy $\frac{22.4 \times 5 \times 3.2}{2 \times 80} = 2.24 \text{ dm}^3$	
(b)(i)	Deep blue solution	$\frac{1}{2}$
(ii)	Tetraammine copper (ii) ions	$\frac{1}{2}$
	$\text{Cu}(\text{NH}_3)^{2+}_{(4)}$ or EQUIVALENT	$\frac{1}{2}$
	TOTAL	05
9(a)(i)	Hydrogen chloride gas or equivalent	$\frac{1}{2}$
(ii)	Iron (II) chloride	$\frac{1}{2}$

(i)	$\text{Fe}_{(s)} + \text{HCl}_{(g)} \longrightarrow \text{FeCl}_{2(s)} + \text{H}_{2(g)}$	1½
(ii)	White precipitate Reject ppt	1
(iii)	$\text{Ag}^+_{(aq)} + \text{Cl}^-_{(aq)} \longrightarrow \text{AgCl}_{(s)}$	1½
TOTAL		
10(a)	Bubbles of a greenish-yellow gas	1
(b)	$2\text{Na/Hg}_{(s)} + 2\text{H}_2\text{O}_{2(l)} \longrightarrow 2\text{NaOH}_{(aq)} + \text{H}_{2(g)} + 2\text{Hg}_{(l)}$	1½
(c)	$2\text{H}_{2(g)} + \text{O}_{2(g)} \longrightarrow 2\text{H}_2\text{O}_{(l)}$	1½
(d)	Manufacture of chlorine Manufacture of sodium hydroxide	1
TOTAL		
SECTIONS B (30 MARKS)		
11(a)(i)	Potassium manganate VII or EQUIVALENT	½
(ii)	$2\text{KMnO}_{4(s)} + 16\text{HCl}_{(aq)} \longrightarrow 2\text{KCl}_{(aq)} + 2\text{MnCl}_{2(aq)} + 8\text{H}_2\text{O}_{(l)} + 5\text{Cl}_{2(g)}$	1½

- (b) Diagram showing a set-up of apparatus used to prepare a pure sample of chlorine in the laboratory.

Diagram showing a set-up of apparatus used to prepare a pure sample of chlorine in the laboratory.





(c)(i) Colourless solution turned greenish or yellowish.



(d)(i) The petals would be bleached by the Hypochlorous acid that would donate the oxygen.



(ii) The green solution turned colourless giving off bubbles of a colourless gas that relights a glowing splint.



TOTAL

15

12(a) Dry ammonia reacts with oxygen in presence of platinum catalyst at a temperature of $800^{\circ}\text{C} - 900^{\circ}\text{C}$, and a pressure of 4 - 5 atmospheres to form nitrogen monoxide.



The nitrogen monoxide formed is then cooled and reacted with excess oxygen to form nitrogen dioxide.



Nitrogen dioxide is reacted with more oxygen, and then absorbed in hot water to form nitric acid.

- b(i) $4\text{NO}_{2(\text{g})} + \text{O}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{l})} \longrightarrow 4\text{HNO}_{3(\text{aq})}$
The black solid dissolved with evolution of reddish-brown fumes and a colourless condensate that turns white anhydrous copper II sulphate blue. 1½
- (ii) $4\text{HNO}_{3(\text{aq})} + \text{C}_{(\text{s})} \longrightarrow 4\text{NO}_{2(\text{g})} + \text{CO}_{2(\text{g})} + 2\text{H}_2\text{O}_{(\text{l})}$ 1½
- (iii) Ammonium nitrate reacts with water in the soil to form ammonium hydroxide, a weak alkali, and nitric acid, a strong acid.
 $\text{NH}_4\text{NO}_{3(\text{s})} + \text{H}_2\text{O}_{(\text{l})} \longrightarrow \text{NH}_4\text{OH}_{(\text{aq})} + \text{HNO}_{3(\text{aq})}$ 5
 Ammonium hydroxide produces very few hydroxide ions, which are not enough to neutralize the many hydrogen ions produced by nitric acid.
 This therefore leaves excess hydrogen ions which make the soils acidic
TOTAL 15

- 13(a) Hard water is water which does not readily / easily form lather with soap. 1
- (b) Calcium ions
Magnesium ions Reject: Formula or both 1
- (c) When it rains, water reacts with carbon dioxide to form carbonic acid.
 $\text{H}_2\text{O}_{(\text{l})} + \text{CO}_{2(\text{g})} \longrightarrow \text{H}_2\text{CO}_{3(\text{aq})}$
 The carbonic acid formed then reacts with limestone in the rocks to form Calcium hydrogencarbonate which is then washed into water bodies making water hard. 5
 $\text{CaCO}_{3(\text{s})} + \text{H}_2\text{CO}_{3(\text{aq})} \longrightarrow \text{Ca}(\text{HCO}_3)_{2(\text{aq})}$

	A colourless solution formed a white precipitate	1
(ii)	$\text{Ca}(\text{HCO}_3)_{(aq)} \rightarrow \text{CaCO}_3{}_{(s)} + \text{CO}_{2(g)} + \text{H}_2\text{O}_{(l)}$	
(iii)	Removal of temporary hardness of water.	1½
(e(i))	Calcium sinks in water and reacts vigorously in the cold forming a milky solution.	1
(ii)	<u>Hot</u> Iron reacts with water as steam, and glows red, forming a black solid	2½
	TOTAL	2
14(a)(i)	$\text{Zn}_{(s)} + 2\text{HCl}_{(aq)} \rightarrow \text{ZnCl}_2{}_{(aq)} + \text{H}_2{}_{(g)}$	15
(ii)	<u>When the concentration of the acid is high, the reaction rate is faster.</u> This because <u>the particles are so close to each other.</u> When <u>the concentration is low the reaction rate is slower.</u>	2
(b)	Acid should be dilute A catalyst is required	
	$\text{Zn}_{(s)} + 2\text{H}^+{}_{(aq)} \rightarrow \text{Zn}^{2+}{}_{(aq)} + \text{H}_2{}_{(g)}$	2½

A graph of volume of hydrogen against time

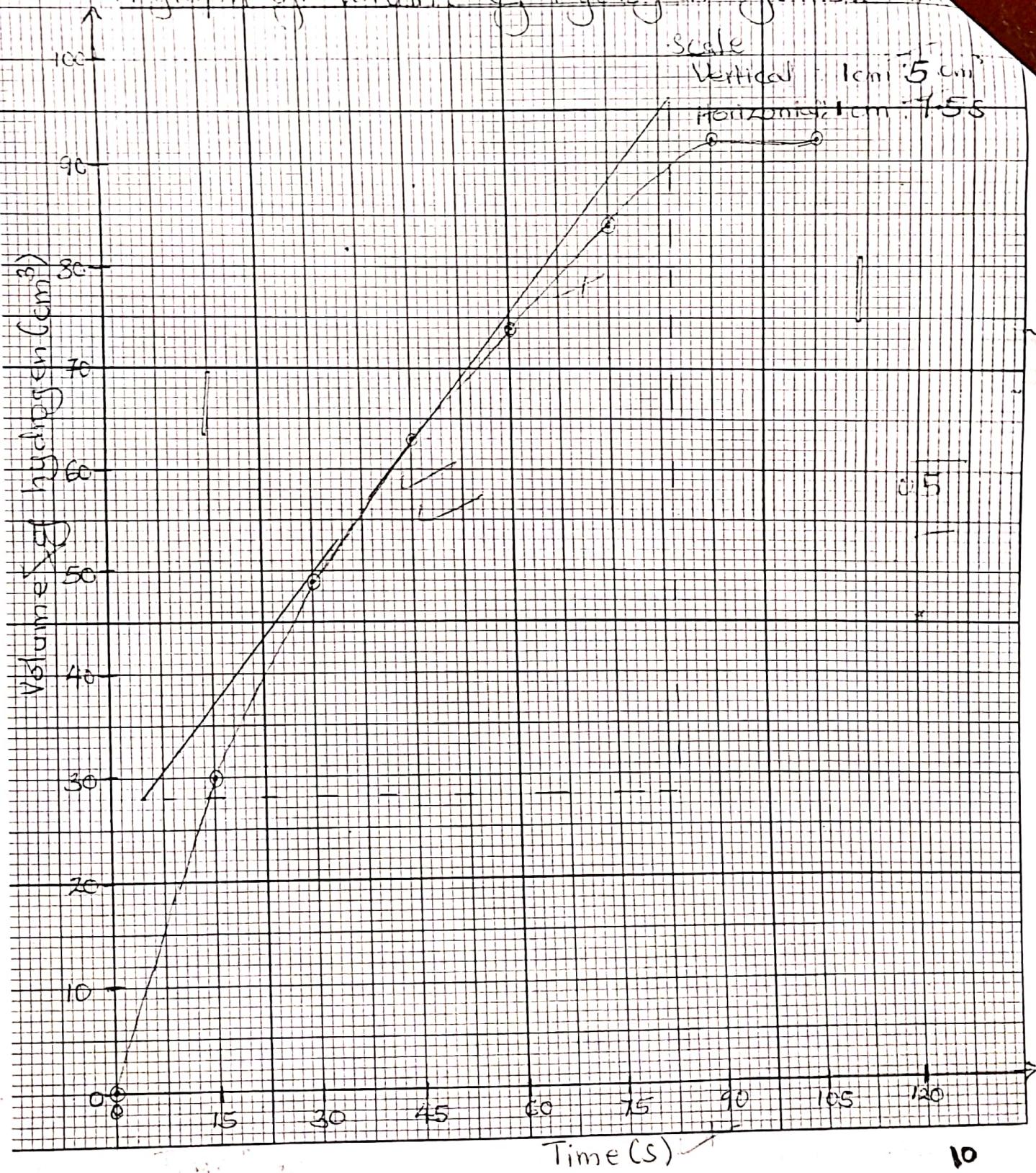
14G

A graph of volume of hydrogen against time

Scale

Vertical 1cm = 5 cm³

Horizontal 1cm = 15 s



(i) Title = $\frac{1}{2}$
Scale = 1
Axes = 1
Plotting = 2
Shape = $\frac{1}{2}$

5

2

(ii) Rate = $\frac{96 - 28}{76, 5 - 4.5}$
 $= 0.94 \text{ cm}^3 \text{ S}^{-1}$

(iii) Moles of zinc that reacted = $\frac{0.26}{65}$

1 mole of zinc produced 1 mole of hydrogen

$\frac{(0.26)}{65}$ moles of zinc produced $\frac{0.26}{65}$

$= 0.004 \text{ moles}$

1 mole of hydrogen occupies 22.4 dm^3 at s.t.p

$0.004 \text{ moles of hydrogen occupy } \frac{22.4 \times 0.004}{1}$

2

$= 0.0896$
 $= 0.09 \text{ dm}^3$

TOTAL

15

END