

NAME..... *Marking Scheme*

233/3

CHEMISTRY
(PRACTICAL)
SEPTEMBER

CLASS.....

ADM. NO.....

INDEX NO.....

SCHOOL.....

SIGN.....

DATE.....

KASSU JET EXAMINATIONS 2021

Kenya Certificate of Secondary Education

CHEMISTRY PAPER 3

Instructions to candidates

- Write your name, class, admission number, index number, signature and date in the spaces provided above.*
- Answer ALL the questions in the spaces provided in the question paper.*
- You are not allowed to start working with the apparatus for the first 15 minutes of the 2 ¼ hours allowed for this paper. This time is to enable you to read the question paper and make sure you have all the chemicals and apparatus that you may need.*
- All working MUST be clearly shown where necessary.*
- Mathematical tables and silent electronic calculators may be used.*
- This paper contains 8 printed pages.*

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1	<i>22</i>	<i>23</i>
2	10	<i>10</i>
3	<i>08</i>	<i>07</i>
Total Score	40	<i>40</i>

Examiner's Initials

1. You are provided with:-

- Solution Q, 2M Hydrochloric acid.
- Solution P, 0.15M Sodium thiosulphate
- Solution R, Sodium carbonate

Procedure 1

Measure 20cm³ of 0.15M Sodium thiosulphate (solution P) into a 250cm³ a conical flask. Place the beaker on a white piece of paper with ink mark 'X' on it. Measure 20cm³ of 2M hydrochloric acid solution Q using a 50cm³ measuring cylinder. Put the acid into the conical flask containing Sodium thiosulphate and immediately start off the stop watch. Determine the time taken for the mark 'X' to become invisible /obscured when viewed from above. Repeat the procedure by measuring different volumes of the acid and adding the volumes of the distilled water to complete Table I below.

Table I

Volume of acid (cm ³)	Volume of water (cm ³)	Volume of sodium thiosulphate (cm ³)	Time taken for mark 'X' to be invisible/obscured (seconds)	Reciprocal of time (sec ⁻¹) $\frac{1}{t}$
20	0	20	33	0.0303 ✓
18	2	20	37	0.0270 ✓
16	4	20	41	0.0244 ✓
14	6	20	47	0.0213 ✓
12	8	20	57	0.0175 ✓
10	10	20	63	0.0159 ✓

a) Complete table above

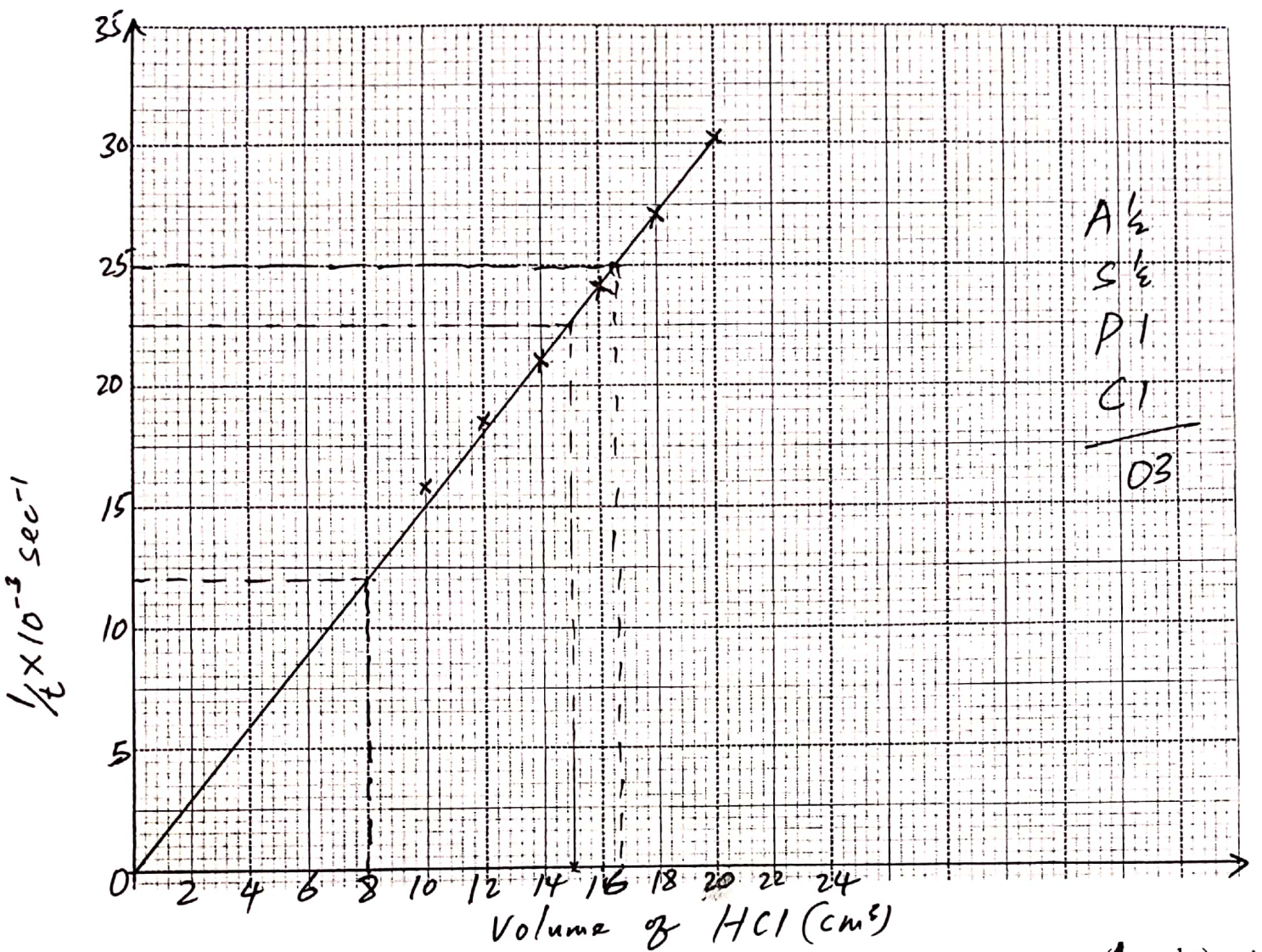
(6marks)

b) Plot a graph of 1/t (rate) against volume of acid used

(3 marks)

CTI
D 1/2
A 1/2
T 1

OB



A 1/2
S 1/2
P 1
C 1

03

c) Explain the shape of your graph

Increase in volume of HCl increases rate of reaction (1/t) 1/2
This is due to increase in number of reacting particles 1/2
hence more successful collisions. I

d) From the graph determine

(i) Time taken for the cross to be obscured/invisible when the volume of the acid is:

I) 15 cm³ (1 mark)

$\frac{1}{t} = 0.0225 \text{ s}^{-1}$ $t = 44.44 \text{ sec.}$

- Must be shown on graph. I

II) 8 cm³ (1 mark)

$\frac{1}{t} = 0.0120 \text{ s}^{-1}$ $t = 83.33 \text{ sec.}$

- Must be shown on graph. I

(ii) The volume of the acid used if the time taken for the cross to be obscured/invisible is:

I) 40 seconds (1 mark)

$$\frac{1}{t} = 0.025 \text{ s}^{-1} \quad | \quad v = 16.6 \text{ cm}^3 \text{ s}^{-1}$$

Must be shown on I graph

II) 43 seconds (1 mark)

$$\frac{1}{t} = 0.0233 \text{ s}^{-1} \quad | \quad v = 15.6 \text{ cm}^3 \text{ s}^{-1}$$

Must be shown on I graph

Procedure 2

Using a 10 cm³ measuring cylinder, place 10 cm³ of solution Q into a 250 ml volumetric flask. Add about 200 cm³ of distilled water. Shake well. Add more distilled water to top up to the mark. Label this solution T. Fill the burette with solution T. Using a pipette and pipette filler, pipette 25 cm³ of solution R into a conical flask. Add 3 drops of Phenolphthalein indicator and titrate with solution T.

- Record your results in the table.
- Repeat the titration two more times and complete the table.

Table 2

	I	II	III
Final burette reading	15.0	15.0	15.0
Initial burette reading	0.0	0.0	0.0
Volume of solution T (cm ³) added	15.0	15.0	15.0

(4 marks)

CTI
DI
AI
PAI
FAI
05

a) Determine the:-

(I) Average volume of solution T used.

(1 mark)

$$\frac{15.0 + 15.0 + 15.0}{3} = 15.0 \text{ cm}^3 \text{ s}^{-1}$$

ans (I)

07

(II) Moles of the acid in the average volume of solution T used. (2 marks)

$$M_1 V_1 = M_2 V_2$$

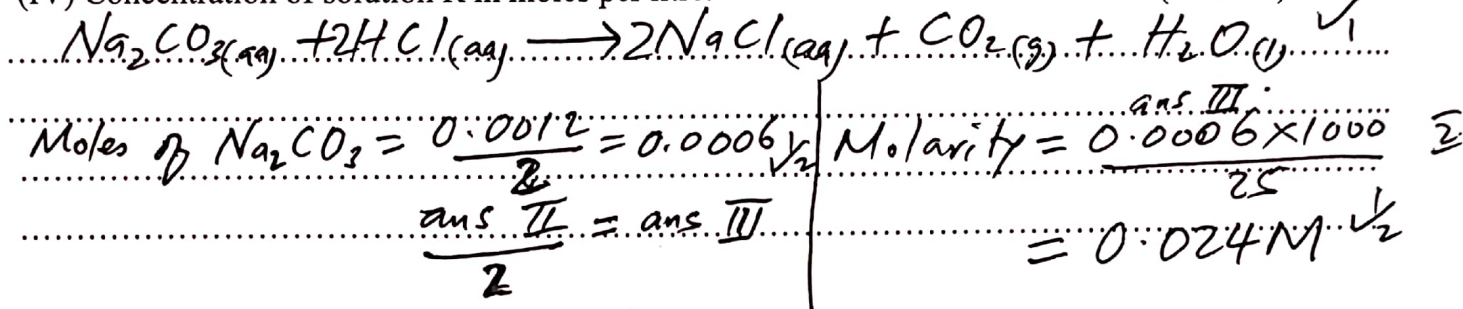
$$M_2 = \frac{10 \times 2}{250} = 0.08 \text{ M}$$

Accept any other method

$$\text{No. of moles used} = \frac{0.08 \times 15.0}{1000} = 0.0012 \text{ moles.}$$

$$0.08 \times \text{ans I} = \text{ans II}$$

(IV) Concentration of solution R in moles per litre. (2 marks)



2. (a) Put a spatula end-full of solid A into a boiling tube and add about 10cm³ of distilled water. Shake the mixture well. Divide the resultant solution into 4 equal portions.

Observations	Inferences
Solid A dissolves to form a pale green solution	Cu ²⁺ , Fe ²⁺
(½ mark)	(1 mark)

- (b) (i) The solution is suspected to contain ammonium ions. Using calcium hydroxide solid and red litmus paper provided, describe how you would confirm presence of the ammonium ions.

Description	Expected observations
To the 1st portion, add a little Ca(OH) ₂ and warm. Test the gas using a moist red litmus paper.	Colorless gas turns moist red litmus paper to blue
(1 mark)	(½ mark)

(ii) Carry out the actual test as described in (b) (i) above.

Observations	Inferences
Colourless gas turns moist red litmus paper to blue	NH_4^+
(1 mark)	(½ mark)

1½

(c) To the second portion, add 4 drops of hydrogen peroxide solution. Test the gas produced using a glowing splint.

Observations	Inferences
- Pale green solution turns brown	O_2 gas
- Colourless gas relights a glowing splint	Fe^{2+} (Must have appeared in (a))
(1 mark)	(1 mark)

2

(d) (i) The solution is also suspected to contain sulphite ions. Using Barium nitrate solution and dilute hydrochloric acid solution, describe how you would confirm presence of the sulphite ions.

Description	Expected observations
To the third portion, add 3 drops of $\text{Ba}(\text{NO}_3)_2$ followed by 3 drops of $\text{HCl}(\text{aq})$	White ppt soluble on addition of $\text{HCl}(\text{aq})$
(1 mark)	(1 mark)

2

05½

(ii) Carry out the actual test as described in (d) (i) above.

Observations	Inferences
White ppt insoluble on addition of HCl (aq)	SO_4^{2-}
(1 mark)	(½ mark)

3. You are provided with solid B. Carry out the tests below and record your observations and inferences in the spaces provided.

(i) Place one third of solid R on a metallic spatula. Burn it in a non-luminous flame of the Bunsen burner.

Observation	Inference
Solid B melts and burns with a yellow sooty/smoky flame	$C_1 = C_1 / -C \equiv C -$ present
(1 mark)	(1 mark)

(ii) Place the remaining solid in a test-tube. Add about 6cm³ of distilled water and shake the mixture well. Retain the solution for the next procedure.

Observation	Inference
Solid B dissolves to form a colourless solution	Polar organic compound
(1/2 mark)	(1/2 mark)

(I) In another 2cm³, add 2 drops of acidified potassium manganate (VII).

Observation	Inference
Purple KMnO ₄ /H ⁺ turns colourless Purple KMnO ₄ /H ⁺ is decolorized (1 mark)	$C=C$ / $C \equiv C$, R-OH present (1 mark)

(II) To about 1cm³, add 3 drops of acidified potassium dichromate (VI) and warm.

Observation	Inference
Orange K ₂ Cr ₂ O ₇ /H ⁺ turns to green (1/2 mark)	R-OH present (1/2 mark)

(III) To about 2cm³ of the solution, add 1g of solid A; sodium hydrogen carbonate.

Observation	Inference
Effervescence // Bubbling // Fizzing (1/2 mark)	H ⁺ / R-COOH / H ₂ O ⁺ present (1/2 mark)

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