SAMIA SUB-COUNTY JOINT EXAMINATION-2021

Kenya Certificate of Secondary Education (K.C.S.E) Trial Examination

CHEMISTRY PAPER 3

MARKING SCHEME

1. You are provided with :

   Solution **Q**, 2M Hydrochloric acid.

   Solution **P**, 0.15M Sodium thiosulphate

   Solution **R**, Sodium carbonate

Procedure 1

Measure 20cm^3 of 0.15M Sodium thiosulphate (solution **P**) into a 100cm^3 a glass beaker. Place the beaker on a white piece of paper with **ink mark 'X'** on it. Measure 20cm^3 of 2M hydrochloric acid solution **Q** using a 50cm^3 measuring cylinder. Put the acid into the glass beaker containing Sodium thiosulphate and immediately start off the stop watch. Determine the time taken for the **marks 'X'** to become invisible/obscured when viewed from above. Repeat the procedure by measuring different volumes of the acid and adding the volume of the distilled water to complete table 1 below.

Table 1

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}) $\frac{I}{t}$**
20	0	20	33	0.0301
18	2	20	37	0.0270
16	4	20	41	0.0240
14	6	20	47	0.0210
12	8	20	57	0.0180
10	10	20	63	0.0160

a. Complete the table below (6mks)

   CT 1

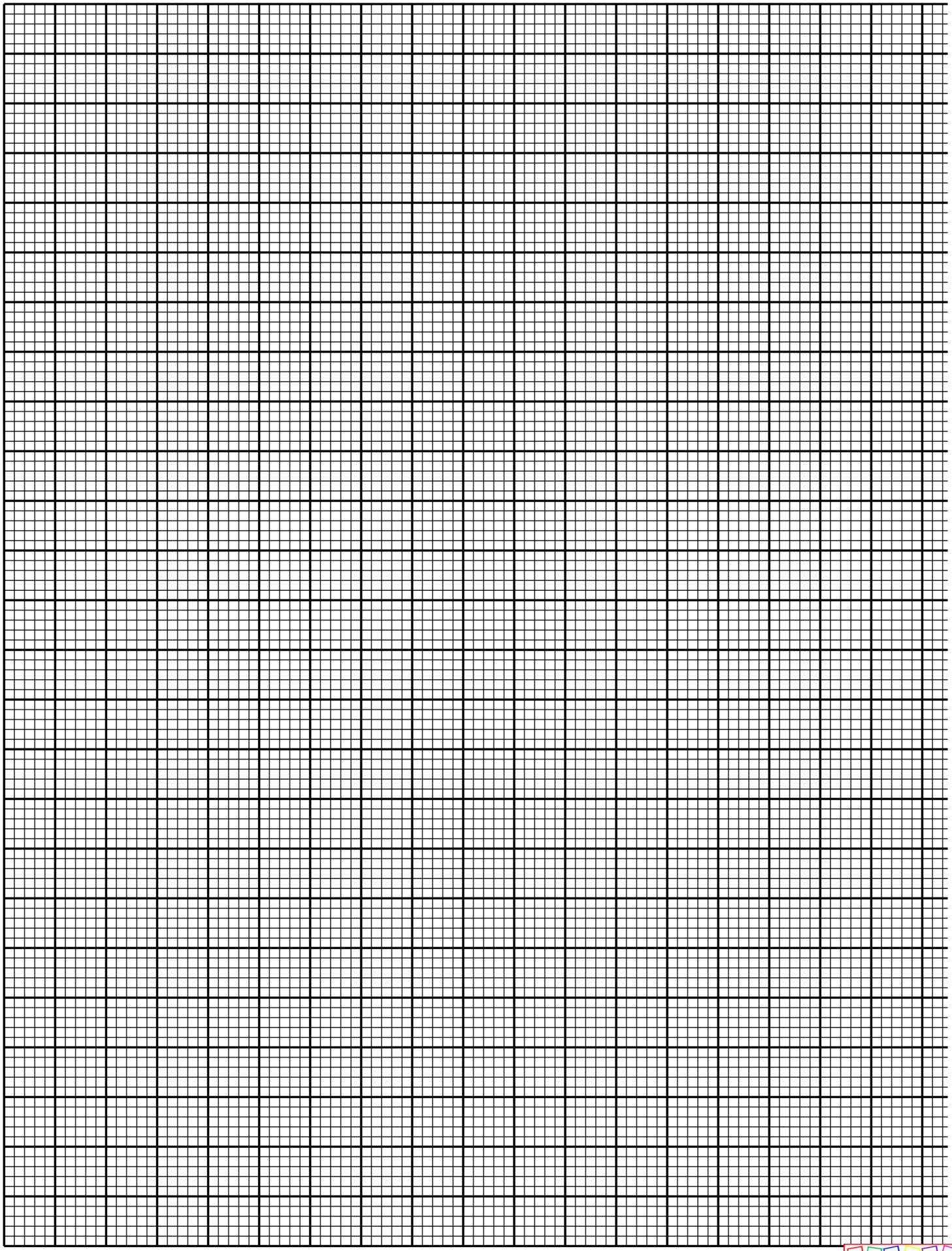
   DP ½

   AC ½

   TREND 1

   Calculations of R ½ for each calculation done correctly.

b. Plot a graph of I/t **(rate)** against volume of acid used. (3mks)



L ½
S ½
P ½
Line 1
03
The graph must be a straight line from the origin, otherwise award zero for the line

c. Explain the shape of your graph (1mk)
- Straight line graph from the origin ½ increase in volume of HCI increases rate of reaction $\frac{I}{t}$
- This is due to increase in the number of reacting particles hence more successful collisions. ½

d. From the graph determine;
i. Time taken for the cross to be obscured/invisible when the volume of the acid is:
$15cm^3$ (1mk)
- Showing on a correctly plotted graph
- If graph is not correctly plotted, penalize fully
$8cm^3$ (1mk)
- Some applies as in (i) above.

ii. The volume of the acid used if the time taken for the cross to be obscured/invisible is:
40seconds (1mk)
- Same to (i)
43 seconds (1mk)
- Same to (i)

Procedure 2

Using a $10cm^3$ measuring cylinder, place $10cm^3$ of solution **Q** into a **250ml** volumetric flask. Add about $200cm^3$ of distilled water. Shake well. Add more distilled water to top up to the mark. Labeled this solution **T**. Fill the burette with solution **T**. using a pipette and pipette filler, pipette $25cm^3$ of solution **R** into a conical flask. Add **3 drops** of phenolphthalein 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(cm^3)	15.0	15.0	15.0
Initial burette reading(cm^3)	0.0	0.0	0.0
Volume of solution T (cm^3) added	15.0	15.0	15.0

a. Determine the :

Average volume of solution **T** used (1mk)

$\frac{15.0 + 15.0 + 15.0}{3}$ ½

$= 15.0cm^3$ ½

Moles of the acid in the average volume of solution **T** used. (2mk)

$M_1V_1 = M_2V_2$

$M_2 = \frac{10 \times 2}{250cm^3}$ ½

$= 0.08M$ ½

No. of moles $= \frac{0.08 \times 15.0}{1000}$ ½

$= 0.0012$moles ½

Accept any other correct method

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

$Na_2CO_{3(s)} + 2HCl_{(aq)} \longrightarrow 2NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$

No. of moles in $Na_2CO_3 = \frac{0.0012}{2}$

$= 0.0006$ moles ½

Or answer in (iii) $=$ answer in $\frac{(ii)}{2}$

$M = \frac{0.0006 \times 1000}{25}$ 1mark

$= 0.024M$ ½

2.

a. Put a spatula end-full of **solid A** into a boiling tube and about $10cm^3$ of distilled water. Shake the mixture well. Divide the resultant solution into **4 equal** portions.

Observation	**Inferences**
Solid A dissolves to form a pale green solution. (½mk)	Cu^{2+} and Fe^{2+} present (1mk)

b. To the first portion, add a little calcium hydroxide solid and warm. Test any gases produced using both blue and red litimus paper.

Observation	**Inferences**
Red litmus paper turns ½ Blue litmus paper venaire blue ½ (1mk)	NH_4^+ present (1mk)

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

Observation	**Inferences**
- Pale green solution turns brown ½ - Colourless gas relights a glowing splint ½ (1mk)	Fe^{2+} oxidized to Fe^{3+} (must have appeared in (a) and tied to pale green turns brown in observation) (1mk)

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.

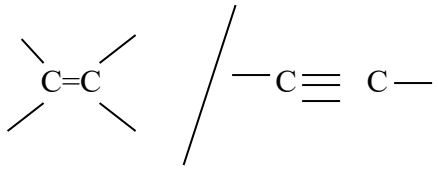
Observation	**Inferences**
- To the third portion add 3 drops of $Ba(NO_3)_2$ followed by 3 drops of HCI(aq) ½ (1mk)	White precipitate soluble on addition of dilute $HCI_{(aq)}$ (1mk)

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

Observation	**Inferences**
White precipitate insoluble on addition of HCI (1mk)	SO_4^{2-} Present (1mk)

3. You are provided with solid **B**. carry out the tests below and record your observation and inferences in the spaces provided.

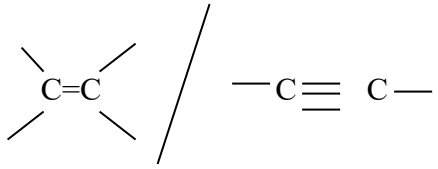
   i. Place one third of solid **B** on a metallic spatula. Burn it in a non-luminous flame of the Bunsen burner.

Observation	**Inferences**
Solid B melts and burns with yellow sooty flame (1mk)	 (1mk)

   ii. Place the remaining solid in a test-tube. Add about **6cm^3** of distilled water and shake the mixture well. Divide the resulting mixture into 4 portions.

Observation	**Inferences**
Solid B dissolves to form a colourless solution (½mk)	Polar organic compound. (½mk)

   a. To the first portion, **add 2** drops of acidified potassium manganite (VII)

Observation	**Inferences**
Purple $KMnO_4/H^+$ turns colourless Or Purple $KMnO_4/H^+$ is decolourised (1mk)	 R-OH presnt (1mk)

   b. To the second portion, **add 3** drops of acidified potassium dichromate (VI) and warm

Observation	**Inferences**
Orange colour of $K_2Cr_2O_7/H^+$ is retained/persists/remains orange/Does not turn to green (1mk)	R-OH absent (1mk)

c. To the third portion, **add 1g** of solid sodium hydrogen carbonate.

Observation	**Inferences**
Effervescence/bubbles/fizzing **<u>Reject</u>** Fizzling Hissing (½mk)	H^+/R-COOH/H_3O^+ present (½mk)

d. To the fourth portion, **add 5 drops** of ethanol followed by few drops of dilute sulphuric (VI)acid and warm

Observation	**Inferences**
Pleasant smell Fruity smell **Reject :** Sweet smell (½mk)	R-COOH Present (½mk)

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