**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 20cm3 of 0.15M Sodium thiosulphate (solution **P**) into a 100cm3 a glass beaker. 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 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(cm3)** | **Volume of water(cm3)** | **Volume of sodium thiosulphate (cm3)** | **Time taken for mark ‘X’ to be invisible/obscured(seconds)** | **Reciprocal of time (sec-1) 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 |

1. Complete the table below (6mks)

CT 1

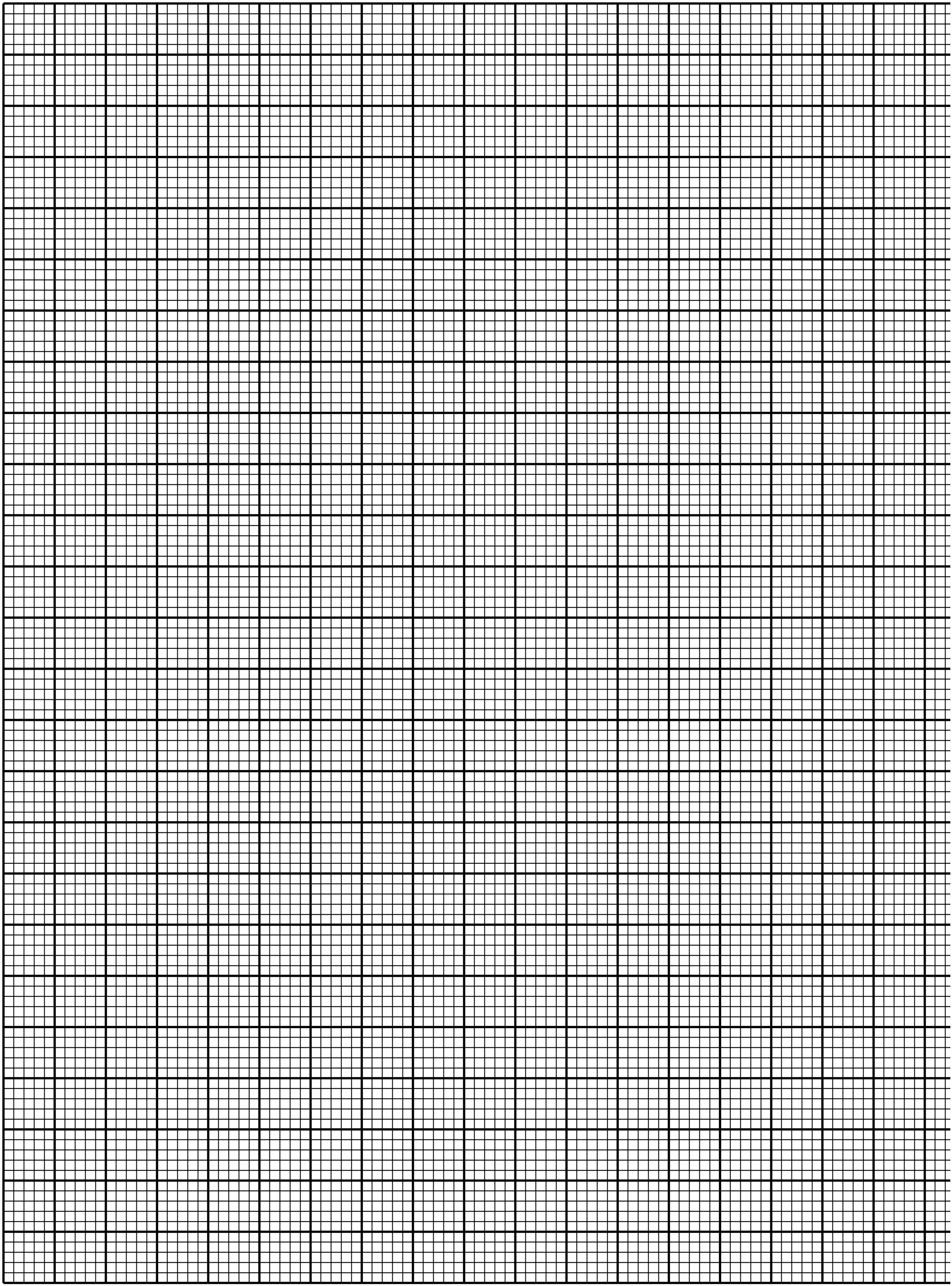
DP ½

AC ½

TREND 1

Calculations of R ½ for each calculation done correctly.

1. 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

1. Explain the shape of your graph (1mk)

* Straight line graph from the origin ½ increase in volume of HCI increases rate of reaction I

t

* This is due to increase in the number of reacting particles hence more successful collisions. ½

1. From the graph determine;
2. Time taken for the cross to be obscured/invisible when the volume of the acid is:

15cm3 (1mk)

* Showing on a correctly plotted graph
* If graph is not correctly plotted, penalize fully

**8cm3**  (1mk)

* Some applies as in (i) above.

1. 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 10cm3 measuring cylinder, place 10cm3 of solution **Q** into a **250ml** volumetric flask. Add about 200cm3 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 25cm3 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(cm3) | 15.0 | 15.0 | 15.0 |
| Initial burette reading(cm3) | 0.0 | 0.0 | 0.0 |
| Volume of solution T (cm3) added | 15.0 | 15.0 | 15.0 |

(4mks)

1. Determine the :

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

15.0 +15.0 +15.0 ½

3

=15.0cm3 ½

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

M1V1 =M2V2

M2 =10×2

250cm3 ½

=0.08M ½

No. of moles= 0.08×15.0 ½

1000

= 0.0012moles ½

Accept any other correct method

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

Na2CO3(s) +2HCI(aq) 2NaCI(aq) + CO2(g) +H2O(I)

No. of moles in Na2CO3 =0.0012

2

=0.0006 moles ½

Or answer in (iii) =answer in (ii)

2

M=0.0006×1000 1mark

25

= 0.024M ½

1. Put a spatula end-full of **solid A** into a boiling tube and about 10cm3 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) | Cu2+ and Fe2+ present  (1mk) |

1. 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) | NH4+ present  (1mk) |

1. 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) | Fe2+ oxidized to Fe3+  (must have appeared in (a) and tied to pale green turns brown in observation )  (1mk) |

1. 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(NO3)2 followed by 3 drops of HCI(aq) ½   (1mk) | White precipitate soluble on addition of dilute HCI(aq)  (1mk) |

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

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| White precipitate insoluble on addition of HCI  (1mk) | SO42-  Present  (1mk) |

1. You are provided with solid **B**. carry out the tests below and record your observation and inferences in the spaces provided.
2. 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) | C=C C C  (1mk) |

1. Place the remaining solid in a test-tube. Add about **6cm3** 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) |

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

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| Purple KMnO4/H+ turns colourless  Or  Purple KMnO4/H+ is decolourised  (1mk) | C=C C C  R-OH presnt  (1mk) |

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

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| Orange colour of K2Cr2O7/H+ is retained/persists/remains orange/Does not turn to green  (1mk) | R-OH absent  (1mk) |

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

|  |  |
| --- | --- |
| **Observation** | **Inferences** |
| Effervescence/bubbles/fizzing  **Reject**  Fizzling  Hissing  (½mk) | H+/R-COOH/H3O+ present  (½mk) |

1. 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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