

## FORM FOUR CLUSTER KCSE MODEL1

### CHEMISTRY PAPER 3 QUESTIONS

**1. You are provided with:**

- 0.2g Magnesium turnings solid A.
- 0.1M Sodium hydroxide, solution B
- Hydrochloric acid, solution C.

You are required to determine the concentration of hydrochloric acid, solution C in moles per litre.

**Procedure I**

- Measure 50cm<sup>3</sup> of C using a measuring cylinder and place it in a 100cm<sup>3</sup> beaker.
- Take the initial temperature of the solution and record it in the table below under time = 0.
- Add all the solid A once to the solution in the beaker and start a stopwatch immediately.
- Stir well and take the temperature of the mixture after every 30 seconds up to the 360 seconds.

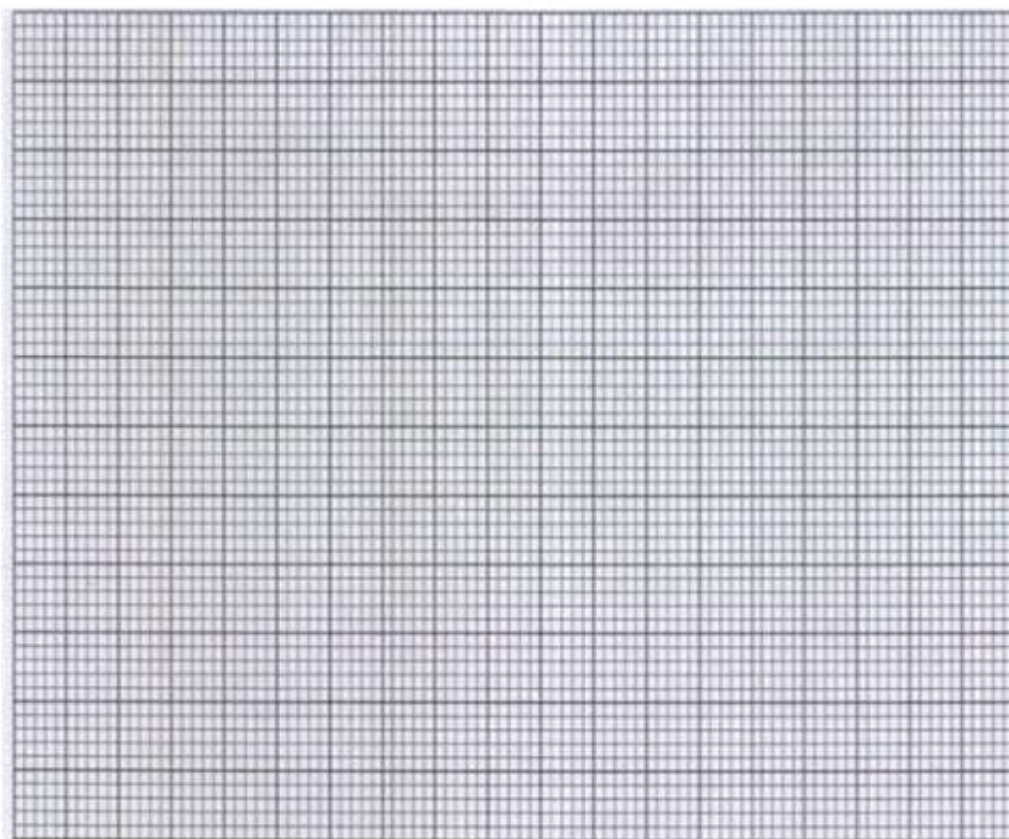
Retain the solution for procedure II below.

- Record your results in the table below.

**Table 1**

| Time (sec) | 0 | 30 | 60 | 90 | 120 | 150 | 180 | 210 | 240 | 270 | 300 | 330 | 360 |
|------------|---|----|----|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Temp (°C)  |   |    |    |    |     |     |     |     |     |     |     |     |     |

- a) On the grid provided, plot a graph of temperature against time.



b) From the graph, determine the highest change in temp for the reaction,  $\Delta T$ .

$\Delta T$ .  
=.....

c) Calculate the Heat of the reaction  $(\Delta H)$ . (1mark) (Density of solution =  $1\text{g/cm}^3$ , specific heat capacity =  $4.2\text{Jg}^{-1}\text{K}^{-1}$ ). .....

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d) Calculate the number of moles of Hydrochloric acid used in the reaction given that Molar heat of reaction of Hydrochloric acid with magnesium is  $-464\text{kJmol}^{-1}$

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### Procedure II

- Place all the solution obtained in procedure I in a clean  $250\text{cm}^3$  volumetric flask.

- Add distilled water to the mark.
- Label the solution as solution D.
- Fill the burette with solution D.
- Pipette 25cm<sup>3</sup> of solution B into a conical flask.

Add 2 – 3 drops of phenolphthalein indicator and titrate with solution D until the pink colour just disappears.

- Repeat the titration two more times and record your results in the table below.

**Table II**

| Burette readings(cm <sup>3</sup> )           | I | II | III |
|----------------------------------------------|---|----|-----|
| Final burette reading (cm <sup>3</sup> )     |   |    |     |
| Initial Burette reading (cm <sup>3</sup> )   |   |    |     |
| Volume of solution D used (cm <sup>3</sup> ) |   |    |     |

f) Calculate (i) the number of moles of solution B, sodium hydroxide used.

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ii) The number of moles of Hydrochloric acid used in solution D.

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iii) The number of moles of Hydrochloric acid in 250cm<sup>3</sup> of solution D. (1mark)

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iv) The number of moles of the original Hydrochloric acid in 50cm<sup>3</sup> of solution C.

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v) The concentration of the original hydrochloric acid solution C in moles per litre.

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2. (a)

You are provided with solid V. Carry out the tests below and write your observations and inferences in the spaces provided. a) i) Place all solid V provided into a clean boiling tube, add about 5cm<sup>3</sup> distilled water.

Shake the contents thoroughly and filter. Retain both the filtrate and the residue.







| Observations | Inferences |
|--------------|------------|
| ( ½ mark)    | ( ½ mark)  |

b) Put the remaining solid Q in a boiling tube and add about 10cm<sup>3</sup> of distilled water shake well and warm.

Use about 2cm<sup>3</sup> portions of the solution obtained in a test – tube for each of the tests b (i), b(ii) and b(iii). b

(i) To the first portion add 2 to 3 drops of acidified potassium manganate (VII) solution and shake well.

| Observations | Inferences |
|--------------|------------|
| (1mark)      | (1mark)    |

b) ii) To the second portion dip a universal indicator paper and determine the pH of the solution.

| Observations | Inferences |
|--------------|------------|
| ( ½ mark)    | ( ½ mark)  |

| Observations | Inferences |
|--------------|------------|
| ( ½ mark)    | ( ½ mark)  |

b) iii) To the third portion add the solid sodium hydrogen carbonate provided.



| Observations | Inferences |
|--------------|------------|
| ( ½ mark)    | ( ½ mark)  |