

**032/2A CHEMISTRY****MARKING SCHEME**

1. Pipette used 25.00 cm<sup>3</sup> (*01mark*)

**Table of results (04 marks)**

| Experiment                         | Pilot | 1     | 2     | 3     |
|------------------------------------|-------|-------|-------|-------|
| Final readings (cm <sup>3</sup> )  | 20.10 | 40.00 | 20.00 | 40.00 |
| Initial reading (cm <sup>3</sup> ) | 0.00  | 20.00 | 0.00  | 20.00 |
| Volume used (cm <sup>3</sup> )     | 22.10 | 20.00 | 20.00 | 20.00 |

a). Average volume (volume of acid) =  $\frac{v_1+v_2+v_3}{3}$  (*1/2 mark*)

Average volume =  $\frac{20.10+20.00+20.00}{3}$  (*1/2 mark*)

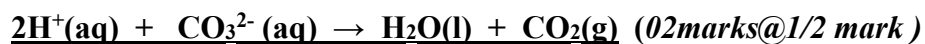
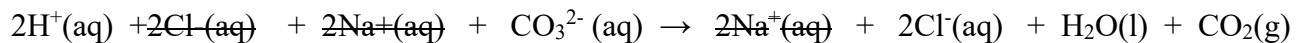
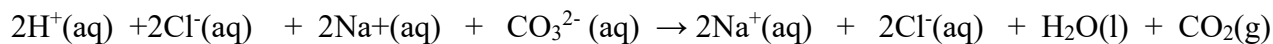
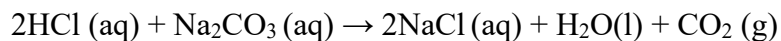
=  $\frac{60.00}{3}$  (*1/2 mark*)

**Average volume (volume of acid) = 20.00 cm<sup>3</sup>** (*1/2 mark*)

- b). **20.00 cm<sup>3</sup>** of T required **25.00 cm<sup>3</sup>** B for complete reaction (*01mark@1/2 mark*)



- d). Ionic equation:



e). Concentration of T in mole per litre.

$$\begin{aligned}\text{Mr of HCl} &= (1 \times 1) + (1 \times 35.5) \\ &= \underline{\underline{36.5 \text{ g/mol}}} \quad (01 \text{ marks})\end{aligned}$$

$$\text{Molarity} = \frac{\text{concentration}}{\text{molar mass}} \quad (1/2 \text{ mark})$$

$$\text{Concentration of T} = 3.65 \text{ g/dm}^3$$

$$\text{Molarity} = \frac{3.65 \text{ g/dm}^3}{36.5 \text{ g/mol}}$$

$$= 0.1 \text{ M}$$

**Concentration of T in mol/dm<sup>3</sup> is 0.1M** (02 marks)

f). (i). Concentration of B in mol/dm<sup>3</sup>

**Data:**

$$\text{Volume of acid (V}_a\text{)} = 20.00 \text{ cm}^3$$

$$\text{Volume of base (V}_b\text{)} = 25.00 \text{ cm}^3$$

$$\text{Molarity of T acid (M}_a\text{)} = 0.1 \text{ M} \quad (1/2 \text{ mark})$$

$$\text{Number of moles of acid (n}_a\text{)} = 1 \text{ mol}$$

$$\text{Number of moles of base (n}_b\text{)} = 2 \text{ mol}$$

**Formula:**

$$\frac{M_a V_a}{M_b V_b} = \frac{n_a}{n_b} \quad (1/2 \text{ mark})$$

**Calculations:**

$$\frac{0.1 \text{ M} \times 20.00 \text{ cm}^3}{M_b \times 25.00 \text{ cm}^3} = \frac{2}{1}$$

$$M_b = 0.04 \text{ M}$$

**Concentration of B in mol/litre = 0.04M** (02 marks)

ii. Concentration of B in g/dm<sup>3</sup>

Formula:

$$\text{Molarity} = \frac{\text{concentration}}{\text{molar mass}} \quad (1/2 \text{ mark})$$

$$\begin{aligned}\text{Molar mass of Na}_2\text{CO}_3 &= (2 \times 23) + (1 \times 12) + (3 \times 16) \\ &= \underline{\underline{106 \text{ g/mol}}}\end{aligned}$$

$$\text{Concentration of pure (g/dm}^3\text{)} = \text{Molarity (M)} \times \text{Molar mass (g/mol)}$$

$$= 0.04 \text{ mol/dm}^3 \times 106 \text{ g/mol} \quad (001/2 \text{ mark})$$

**Concentration of pure Na<sub>2</sub>CO<sub>3</sub> (g/dm<sup>3</sup>) = 4.24g/dm<sup>3</sup> (01 1/2 mark)**

g). The percentage purity of Na<sub>2</sub>CO<sub>3</sub>

$$\text{Concentration of pure Na}_2\text{CO}_3 = \frac{\text{mass(g)}}{\text{volume (dm}^3\text{)}}$$

$$250\text{cm}^3 = 250/1000 = 0.25\text{dm}^3$$

$$\text{Concentration of impure Na}_2\text{CO}_3 = \frac{1.2\text{g}}{0.25(\text{dm}^3)}$$

$$= 4.8\text{g/dm}^3 \text{ (02marks)}$$

$$\text{Percentage purity} = \frac{\text{concentration of pure}(\frac{\text{g}}{\text{dm}^3})}{\text{Concentration of impure}(\frac{\text{g}}{\text{dm}^3})} \times 100\% \text{ (1/2 mark)}$$

$$\text{Percentage purity} = \frac{4.24\text{g/dm}^3}{4.80\text{g/dm}^3} \times 100\%$$

**The percentage purity = 88.33% (02mark)**

## 2. SOLUTION

(a) Table of results (05mark)

| Number of experiment | Volume of D (cm <sup>3</sup> ) | Volume of distilled H <sub>2</sub> O (cm <sup>3</sup> ) | Concentration of Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub> (mol/dm <sup>3</sup> ) | Time (t) in second | Rate of reaction(S <sup>-1</sup> ) |
|----------------------|--------------------------------|---------------------------------------------------------|---------------------------------------------------------------------------------------|--------------------|------------------------------------|
| 1                    | 50                             | 50                                                      | 0.13                                                                                  | 10.22              | 0.10                               |
| 2                    | 40                             | 50                                                      | 0.10                                                                                  | 13.63              | 0.07                               |
| 3                    | 30                             | 50                                                      | 0.08                                                                                  | 17.22              | 0.06                               |
| 4                    | 20                             | 50                                                      | 0.05                                                                                  | 25.34              | 0.04                               |
| 5                    | 10                             | 50                                                      | 0.03                                                                                  | 55.50              | 0.02                               |

$$\text{Molarity} = \frac{\text{Concentration g/dm}^3}{\text{Molar mass}}$$

Molar mass

$$\text{Molarity} = \frac{20.54\text{g/dm}^3}{158.11\text{g/mol}}$$

$$158.11\text{g/mol}$$

Molarity =  $0.13 \text{ mol/dm}^3$  (1/2 mark)

**Experiment 1**

$$0.13 \times 50 = 6.5$$

$$6.5 \div 50 = 0.13 \text{M} \text{ (1/2 mark)}$$

**Experiment 2**

$$0.13 \times 40 = 5.2$$

$$5.2 \div 50 = 0.10 \text{M} \text{ (1/2 mark)}$$

**Experiment 3**

$$0.13 \times 30 = 3.9$$

$$3.9 \div 50 = 0.08 \text{M} \text{ (1/2 mark)}$$

**Experiment 4**

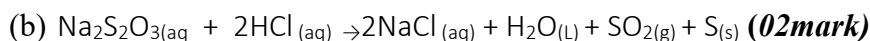
$$0.13 \times 20 = 2.6$$

$$2.6 \div 50 = 0.05 \text{M} \text{ (1/2 mark)}$$

**Experiment 5**

$$0.13 \times 10 = 1.3$$

$$1.3 \div 50 = 0.03 \text{M} \text{ (1/2 mark)}$$



(c) Substance that was produced during the reaction which obscured the mark X was

Sulphur (S) ( sulphur precipitates) (01mark)

(d) Conclusion: As concentration of sodium thiosulphate decreases the time taken for disappearance of letter X increases. (02mark)

(e) The smell is irritating choking smell produced due to production of Sulphur dioxide ( $\text{SO}_2$ ) (02mark)

(f) Increase in concentration of sodium thiosulphate increases the rate of chemical reaction so concentration is directly proportional to the rate of chemical reaction. (Decrease in concentration of sodium thiosulphate decrease the rate of chemical reaction) (04mark)

(g) The graph of time (y-axis) against Concentration of  $\text{Na}_2\text{S}_2\text{O}_3$  (x- axis) (06 mark)

❖ Heading= 01 mark

❖ Graph= 03 mark

❖ Scale= 01 mark

❖ Labelling=01mark

(horizontal vertical axis)

# THE GRAPH OF TIME AGAINST CONCENTRATION OF SODIUM THIOSULPHATE.

SCALE  
Hs  $1\text{cm} \equiv 0.02\text{mol/dm}^3$   
Vs  $1\text{cm} \equiv 5\text{seconds}$

