



# CHRISTIAN SOCIAL SERVICES COMMISSION

An Ecumenical Body of Tanzania Episcopal Conference and Christian Council of Tanzania

P.O. Box 9433, Dar es Salaam, Tanzania

CSSC-SOUTHERN ZONE FORM FOUR JOINT EXAMINATION

032/2B CHEMISTRY 2B

(MARKING GUIDE)

Time 2:30 hours

AUGUST 2024.

1. If 25cm<sup>3</sup> pipette used, the table of results is:

Burette reading	Pilot	1	2	3
Final reading (cm <sup>3</sup> )	25.40	25.20	24.90	24.90
Initial reading (cm <sup>3</sup> )	0.00	0.00	0.00	0.00
Titre volume used (cm <sup>3</sup> )	25.40	25.20	24.90	24.90

FT = 01 Mark, DP = 01 Mark and Ac = 02 Marks

(a) (i) The mean titre volume =  $\frac{T_1+T_2+T_3}{3}$  (0.5mark)

$$= \frac{25.20+24.90+24.90}{3} \text{ (0.5mark)}$$
$$= 25\text{cm}^3$$

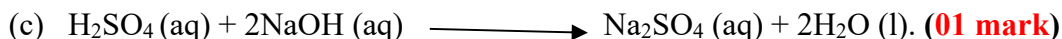
The average volume of acid used is 25cm<sup>3</sup>. (01mark)

(ii) 25cm<sup>3</sup> of solution BB required 25cm<sup>3</sup> of solution CC for complete neutralization. (01mark)

(iii) The colour change at the end point was from Orange/ Yellow to Pink. (01 mark)

(b) (i) It can be used because the reaction involves strong acid and strong base in which any of the two indicators (POP or MO) can be suitable. (01 mark)

(ii) It might lead to errors in the volume of acid used because the air space will be filled with acid first before dropping on the metal carbonate solution which in turn reduces a few volume of acid from the reading in the burette. (01 mark)



Data given

Mass of impure H<sub>2</sub>SO<sub>4</sub> solution = 3.5g

Volume of H<sub>2</sub>SO<sub>4</sub> solution = 500cm<sup>3</sup> (0.5dm<sup>3</sup>)

Mass of NaOH solution = 4g

Volume of NaOH solution = 1000cm<sup>3</sup> (1dm<sup>3</sup>)

Volume of acid, V<sub>a</sub> = 25cm<sup>3</sup>

Volume of base, V<sub>b</sub> = 25cm<sup>3</sup> **(01mark)**

Number of moles of acid, n<sub>a</sub> = 1mol

Number of moles of base, n<sub>b</sub> = 2mol

Required to find the percentage purity of H<sub>2</sub>SO<sub>4</sub> =?

From,

$$\text{Concentration} = \frac{\text{mass}}{\text{volume}} \quad \text{(0.5 mark)}$$

$$= \frac{4\text{g}}{1\text{dm}^3} \quad \text{(0.5 mark)}$$

$$= 4 \text{ g/dm}^3$$

The concentration of base (NaOH) is 4g/dm<sup>3</sup> (01 mark)

Again from,

$$\text{Molarity} = \frac{\text{concentration}}{\text{molar mass}} \quad \text{(0.5 mark)}$$

$$= \frac{4\text{g/dm}^3}{40\text{g/mol}} \quad \text{(0.5 mark)}$$

$$= 0.1\text{mol/dm}^3$$

The molarity of base (NaOH) is 0.1mol/dm<sup>3</sup>. (01 mark)

Then from,

$$\frac{M_a V_a}{M_b V_b} = \frac{n_a}{n_b} \quad \text{(0.5 mark)}$$

$$M_a = \frac{M_b V_b n_a}{V_a n_b} \quad \text{(0.5 mark)}$$

$$= \frac{0.1\text{M} \times 25\text{cm}^3 \times 1\text{mol}}{25\text{cm}^3 \times 2\text{mol}} \quad \text{(0.5 mark)}$$

$$= 0.05\text{M}$$

The molarity of pure acid (H<sub>2</sub>SO<sub>4</sub>) is **0.05mol/dm<sup>3</sup>**. (01 mark)

Again from,

$$\text{Molarity} = \frac{\text{concentration}}{\text{molar mass}} \quad (0.5 \text{ mark})$$

$$\text{Concentration} = \text{Molarity} \times \text{Molar mass} \quad (0.5 \text{ mark})$$

$$= 0.05\text{mol/dm}^3 \times 98\text{g/mol} \quad (0.5 \text{ marks})$$

$$= 4.9\text{g/dm}^3$$

The concentration of pure acid (H<sub>2</sub>SO<sub>4</sub>) is **4.9g/dm<sup>3</sup>**. (01 mark)

Again from,

$$\text{Concentration} = \frac{\text{mass}}{\text{volume}} \quad (0.5 \text{ mark})$$

$$= \frac{3.5\text{g}}{0.5\text{dm}^3} \quad (0.5 \text{ mark})$$

$$= 7\text{g/dm}^3$$

The concentration of impure acid (H<sub>2</sub>SO<sub>4</sub>) is **7g/dm<sup>3</sup>** (01 mark)

Then from,

$$\text{Percentage purity} = \frac{\text{concentration of pure sample}}{\text{concentration of impure sample}} \times 100\% \quad (0.5 \text{ mark})$$

$$= \frac{4.9\text{g/dm}^3}{7\text{g/dm}^3} \times 100\% \quad (0.5 \text{ mark})$$

$$= 70\%$$

The percentage purity of sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) is **70%**. (01 mark)

2.

### SOLUTION

a) The aim of the whole experiment is to show the effect of concentration on the rate of chemical reaction.

**02 marks**

b) Table of results

Table 1

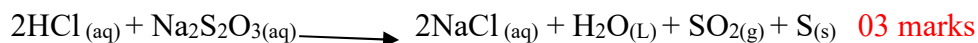
Number of experiment	Volume of U(cm <sup>3</sup> )	Volume of V(cm <sup>3</sup> )	Volume of T(cm <sup>3</sup> )	Time (t) in second	1/t(sec <sup>-1</sup> )
1	8	10	2	<b>21.12</b>	<b>0.047</b>
2	6	10	4	<b>28.62</b>	<b>0.035</b>
3	4	10	6	<b>44.78</b>	<b>0.022</b>
4	2	10	8	<b>102.31</b>	<b>0.010</b>
5	1	10	9	<b>295.65</b>	<b>0.003</b>

10 marks@ each row 2 mark

c)

- i. The experiment in which the reaction was fast was experiment number 1 because it has higher concentration and the time taken for disappearance of letter X was the shortest compared to others.  
02 marks
- ii. The experiment in which the reaction was slow was experiment number 5 because it has lower concentration and the time taken for disappearance of letter X was the longest compared to others.  
02 marks

d)



e)

- i. Concentration
  - ii. Temperature
  - iii. Pressure
  - iv. Catalyst 02 marks
- f) The electronic configuration of the product which cause the solution to cloud letter X , the product was Sulphur (S) and its electronic configuration = 2:8:6 02 marks
- g) Conclusion

As concentration decreases, the times taken for the disappearance of letter X increases. Or concentration is inversely proportional to the time but the concentration is directly proportional to the rate of reaction. **02 marks**