

032/2A CHEMISTRY**MARKING SCHEME**

1. Pipette used 25.00 cm³ (01mark)

Table of results (04 marks)

Experiment	Pilot	1	2	3
Final readings (cm ³)	20.10	40.00	20.00	40.00
Initial reading (cm ³)	0.00	20.00	0.00	20.00
Volume used (cm ³)	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)

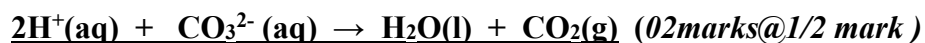
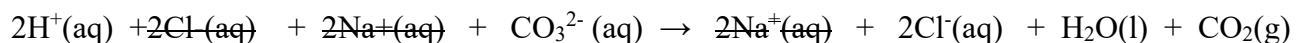
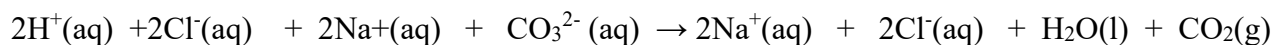
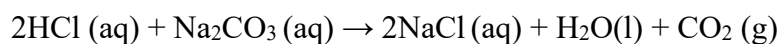
= $\frac{60.00}{3}$ (1/2 mark)

Average volume (volume of acid) = 20.00 cm³ (1/2 mark)

- b). **20.00 cm³** of A required **25.00 cm³** B for complete reaction (01mark@1/2 mark)



- d). Ionic equation:



e). Concentration of A in mole per litre.

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

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

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

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

$$= 0.1 \text{ M}$$

Concentration of A in mol/dm³ is 0.1M (02 marks)

f). (i). Concentration of B in mol/dm³

Data:

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

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

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

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

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

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/dm³

Formula:

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

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

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

$$= 0.04 \text{ mol/dm}^3 \times 106 \text{ g/mol} \quad (1/2 \text{ mark})$$

Concentration of pure Na₂CO₃ (g/dm³) = 4.24g/dm³ (01 1/2 mark)

g). The percentage purity of Na₂CO₃

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

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

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

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

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

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

The percentage purity = 88.33% (02mark)

Question.2

S/N	Experiments	Observation	Inference
(a).	Appearance of sample R was observed. (i). Color	White (01 mark)	NH ₄ ⁺ Na ⁺ Ca ²⁺ , Zn ²⁺ Pb ²⁺ may be present (01 mark)
	(ii). Texture	Crystalline form (01 mark)	NO ₃ ⁻ , SO ₄ ²⁻ , Cl ⁻ may be present (01 mark)
(b).	To a small portion of a dry sample in a test tube enough amount of distilled water was added.	Soluble forming a colorless solution (01 mark)	NH ₄ ⁺ Na ⁺ NO ₃ ⁻ may be present (01 mark)
(c).	A small portion of a dry sample in a dry test tube, was heated gently then strongly.	Cracking sound with brown gas was evolved.	NO ₃ ⁻ of Pb ²⁺ may be present. (01 mark)

		<p>(01 mark)</p> <p>Residue reddish brown when hot and yellow when cold was observed.</p> <p>(01 mark)</p>	<p>Pb^{2+} may be present.</p> <p>(01 mark)</p>
(d).	To a small portion of a dry sample in a test tube concentrated H_2SO_4 acid was added.	<p>Brown fumes were evolved, which turn moist blue litmus paper red and intensify on addition of copper turnings.</p> <p>(01 mark)</p>	<p>NO_3^- may be present.</p> <p>(01 mark)</p>
(e).	To a small amount of a sample solution portion add NaOH till in excess.	<p>White precipitate soluble in excess was observed.</p> <p>(01 mark)</p>	<p>$\text{Pb}^{2+}, \text{Zn}^{2+}$ may be present.</p> <p>(01 mark)</p>
	(f). To another small portion aqueous ammonium solution was added slowly till excess	<p>White precipitates insoluble in excess were observed</p> <p>(01 mark)</p>	<p>Pb^{2+} may be present.</p> <p>(01 mark)</p>
	(g) To the other portion potassium iodide was added till in excess.	<p>Yellow precipitates which disappears on warming and re-appear on cooling</p> <p>(01 mark)</p>	<p>Pb^{2+} confirmed.</p> <p>(01 mark)</p>
	(h). To another portion of the solution of sample R in a test tube, add copper turnings was added followed by concentrated Sulphuric acid then warm.	<p>Brown fumes evolved</p> <p>(01 mark)</p>	<p>NO_3^- Confirmed</p> <p>(01 mark)</p>

Conclusion

- (a) (i) The cation in sample R is **Pb²⁺**. (01 mark)
- (ii). The anion in R is **NO₃⁻** (01 mark)
- (ii) The name of sample R is **Lead (II) nitrate** (01 mark)
- (iii) The chemical formula of sample R is **Pb(NO₃)₂** (01 mark)
- (iv). $2\text{Pb}(\text{NO}_3)_2 (\text{s}) \longrightarrow 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$ (01 mark)