032/2A CHEMISTRY

MARKING SCHEME

1. Pipette used 25.00 cm^3 ***(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) = $\frac{v1+v2+v3}{3}$ ***(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^3 ***(1/2 mark)***

b). 20.00 cm^3 of A required **25.00 cm^3** B for complete reaction ***(01mark@1/2 mark)***

c). $2HCl\,(aq) + Na_2CO_3\,(aq) \rightarrow 2\,NaCl\,(aq) + H_2O(l) + CO_2\,(g)$ ***(01mark)***

d). Ionic equation:

$2HCl\,(aq) + Na_2CO_3\,(aq) \rightarrow 2NaCl\,(aq) + H_2O(l) + CO_2\,(g)$

$2H^+(aq) + 2Cl^-(aq) + 2Na+(aq) + CO_3^{2-}\,(aq) \rightarrow 2Na^+(aq) + 2Cl^-(aq) + H_2O(l) + CO_2(g)$

$2H^+(aq) + \cancel{2Cl\,(aq)} + \cancel{2Na+(aq)} + CO_3^{2-}\,(aq) \rightarrow \cancel{2Na^+(aq)} + 2Cl^-(aq) + H_2O(l) + CO_2(g)$

$2H^+(aq) + CO_3^{2-}\,(aq) \rightarrow H_2O(l) + CO_2(g)$ ***(02marks@1/2 mark)***

e). Concentration of A in mole per litre.

Mr of HCl = (1x1) + (1x 35.5)

= <u>36.5g/mol</u> ***(01marks)***

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

Concentration of A = 3.65g/dm^3

Molarity = $\frac{3.65\ g/dm3}{36.5g/mol}$

= 0.1M

<u>Concentration of A in mol/dm^3 is 0.1M</u> ***(02marks)***

f). (i). Concentration of B in mol/dm^3

Data:

Volume of acid (Va) = 20.00 cm^3

Volume of base (Vb) = 25.00 cm^3

Molarity of A acid (Ma) = 0.1M ***(1/2 mark)***

Number of moles of acid (n_a) = 1mol

Number of moles of base (n_b) = 2mol

Formula:

$\frac{MaVa}{MbVb} = \frac{Na}{Nb}$ ***(1/2 mark)***

Calculations:

$\frac{0.1M \times 20.00cm3}{Mb \times 25.00\ cm3} = \frac{2}{1}$

Mb = 0.04M

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

ii. Concentration of B in g/dm^3

Formula:

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

Molar mass of Na_2CO_3= (2x23) + (1x12) + (3x16)

=<u>106g/mol</u>

Concentration of pure (g/dm^3)= Molarity(M) x Molar mass (g/mol)

= 0.04mol/dm^3 x 106g/mol **(1/2 mark)**

Concentration of pure Na_2CO_3 (g/dm^3) = 4.24g/dm^3 ***(01 1/2mark)***

g). The percentage purity of Na_2CO_3

Concentration of pure Na_2CO_3 $\frac{\text{mass(g)}}{volume\ (dm3)}$

250cm^3= 250/1000=0.25dm^3

Concentration of impure Na_2CO_3 $\frac{1.2\text{g}}{0.25(dm3)}$

= 4.8g/dm^3 ***(02marks)***

Percentage purity= $\frac{\text{concentration of pure}(\frac{\text{g}}{\text{dm3}})}{Concentration\ of\ impure\ (\frac{g}{dm3})}$ x 100% **(*1/2 mark)***

Percentage purity = $\frac{4.24\text{g/dm3}}{4.80g/dm3}$ X 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)***

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

Conclusion

(a) (i) The cation in sample R is **Pb^{2+}** ***(01 mark)***

(ii). The anion in R is **NO_3^-** ***(01 mark)***

(ii) The name of sample R is **Lead (II) nitrate (** ***01 mark)***

(iii) The chemical formula of sample R is **$Pb(NO_3)_2$** ***(01 mark)***

(iv). $2Pb(NO_3)_2\ (s) \rightarrow 2PbO(s) + 4NO_2(g) + O_2(g)$ ***(01 mark)***