CHRISTIAN SOCIAL SERVICES COMMISSION (CSSC)
NORTHERN ZONE JOINT EXAMINATIONS SYNDICATE (NZ-JES)

FORM FOUR PRE – NATIONAL EXAMINATION AUGUST 2025
CHEMISTRY 2A (PRACTICAL)

032/2A

MARKING SCHEME

1.   **(a)** i. **Methyl orange indicator** – it is the titration between strong acid against weak base.
_____(0.5 marks)

ii. Balanced chemical equation;

$$H_2SO_{4\ (aq)} + Na_2CO_{3\ (aq)} \longrightarrow Na_2SO_{4\ (aq)} + CO_{2\ (g)} + H_2O_{(l)}$$ _____(1 marks)

iii.   To ensure thorough mixing up of chemicals during titration. _____(0.5 marks)

(a) The volume of pipette used was **25 cm^3**   (1 marks)
Burette readings (table of result 4.5mark, consistence and two decimal places.
1$^{1/}$2 marks) $= Total$ **6marks**

Titration number	Pilot	1	2	3
Final readings (cm^3)	12.60	25.10	37.50	12.60
Initial readings(cm^3)	0.00	12.60	25.10	0.00
Titre volume (cm^3)	12.60	12.50	12.40	12.60

$$\text{Average volume} = \frac{V_1 + V_2 + V_3}{3} = 12.50 \text{ cm}^3$$

∴ **Average volume of acid used $= $ 12.50 cm^3** _____($Total$ 1 mark)

Alternatively;

The volume of pipette used was **20 cm³**
Burette readings

Titration number	Pilot	1	2	3
Final readings (cm³)	10.10	20.10	30.00	40.10
Initial readings(cm³)	0.00	10.10	10.10	30.00
Titre volume (cm³)	10.10	10.00	9.90	10.10

$$\text{Average volume} = \frac{V_1 + V_2 + V_3}{3} = 10.00 \text{ cm}^3$$
$$\therefore \textbf{Average volume of acid used} = \textbf{10.00 cm}^3$$

(b)

  (i)   **12.5 cm³** of acid required **25 cm³** of base for complete reaction. ($Total$ 1 marks)

  (ii)   Percentage purity of **TT**
  From
$$\text{Molarity of base} = \frac{\text{Concentration}}{\text{Molar mass}}$$
$$= \frac{5.3 \text{ g dm}^{-3}}{106 \text{ g mol}^{-1}}$$
$$= 0.05 \text{ mol dm}^{-3}$$
$$\therefore \textbf{Molarity of base is } \textbf{0.05 M} \quad _____(Total \text{ 2 mark})$$

  Given;
$$\text{Molarity of acid, } M_a = ?$$
$$\text{Molarity of base, } M_b = 0.05 \text{ M}$$
$$\text{Volume of acid, } V_a = 12.5 \text{ cm}^3$$
$$\text{Volume of base, } V_b = 25 \text{ cm}^3$$
$$\text{Number of moles of aci, } n_a = 1$$
$$\text{Number of moles of base, } n_b = 1$$
  From;
$$M_a = \frac{M_b \times V_b \times n_a}{V_a \times n_b}$$
$$= \frac{0.05M \times 25 \text{ cm}^3 \times 1}{12.5 \text{ cm}^3 \times 1}$$
$$= 0.1 \text{ mol dm}^{-3}$$
$$\therefore \textbf{Molarity of pure sulphuric acid is } \textbf{0.1M} _____(Total \text{ 3 mark})$$

But;

$$\text{Concentration}_{\text{pure}} = \text{Molarity}_{\text{pure}} \times \text{Molar mass}$$

$$= 0.1 \text{ mol dm}^{-3} \times 98 \text{ g mol}^{-1}$$

$$= 9.8 \text{g dm}^{-3}$$

∴ **Concentration of pure sulphuric acid is 9.8 g dm^{-3}** _____(*Total* 2 mark)

From;

3.5 g of impure dissolved in 250 cm^3 of distilled water

? dissolved in 1000 cm^3 of distilled water

So;

$$\text{Conc} = \frac{3.5 \text{ g} \times 1000 \text{ cm}^3}{250 \text{ cm}^3}$$

$$= 14 \text{ g}$$

∴ **Concentration of impure sulphuric acid is 14 g dm^{-3}** _____(*Total* 2 mark)

But;

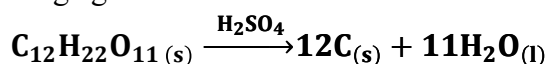$$\% \text{ purity} = \frac{\text{Concentration}_{\text{pure}}}{\text{Concentration}_{\text{impure mixture}}} \times 100\%$$

$$= \frac{9.8 \text{g dm}^{-3}}{14 \text{ g dm}^{-3}} \times 100\%$$

$$= 70\%$$

∴ **Percentage purity of sulphuric acid is 70%** _____(*Total* 3 mark)

(c) Two (2) properties of each;
  (i) Sulphuric acid – TT
  - It is a dehydrating agent.
    $$C_{12}H_{22}O_{11\,(s)} \xrightarrow{\textbf{H}_2\textbf{SO}_4} 12C_{(s)} + 11H_2O_{(l)}$$

  - It is an oxidizing agent.
    $$Cu_{(s)} + 2H_2SO_{4\,(l)} \longrightarrow CuSO_{4\,(aq)} + 2H_2O_{(l)} + SO_{2\,(g)}$$

  (ii) Sodium carbonate – LL
  - It is soluble in water.
  - It does not decompose on heating (it is stable). (*Total* 2 marks)

2.

Sample **W**

S/N	Experiments	Observation	Inference
1	**Appearance**	**Colour** – Green powder was observed	Cu^{2+} may be present.
		Texture – powder form was observed	HCO_3^-, CO_3^{2-} may be present.
2	**Flame test**	Bluish green coloured flame was observed	Cu^{2+} may be present.
3	**Action of heat**	Black residue was observed Colourless gas evolved which turns lime water milky	Cu^{2+} may be present HCO_3^-, CO_3^{2-} may be present
4	**Action of dil.HCl on solid sample**	Effervescence of colourless gas was evolved	HCO_3^-, CO_3^{2-} may be present.
5	**Action of conc. H₂SO₄ on a solid sample**	Effervescence of colourless gas was evolved	HCO_3^-, CO_3^{2-} may be present.
6	**Solubility**	Green coloured solution was observed but insoluble in water	Cu^{2+} may be present. CO_3^{2-} of Cu may be present.
7	**Action of NaOH on a sample solution**	Blue precipitate was formed, insoluble in excess.	Cu^{2+} may be present.
8	**Actionof ammonia solution on a sample solution**	Pale blue precipitate was formed, soluble in excess forming a deep blue solution	Cu^{2+} may be present.
9	**Confirmatory test for copper on (i) addition of ammonia solution (ii) addition of potasium hexacyanoferrateII**	Pale blue precipitate was formed, soluble in excess of aqueous ammonia forming a deep blue solution	Cu^{2+} was confirmed.
		Reddish brown precipitate was formed	
10	**Confirmatory test for carbonate**	White precipitate insoluble in dilute HCl	CO_3^{2-} confirmed.

$(@2\ marks = 20\text{marks})$

Conclusion:

i. The cation in sample W was Cu^{2+} and anion was CO_3^{2-} (2 marks)

The compound W was copper **(ii) carbonate / CUCO₃**   (1marks)

ii. **Balanced** chemical equation $CUCO_{3(s)} \longrightarrow CuO_{(s)} + CO_{2(g)}$ (2marks)