

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



FORM FOUR PRE-NATIONALEXAMINATION2026

032/2B

**CHEMISTRY 2B
MARKING SCHEME**

1. (a)

Table of result

Burette reading

Pipette used = 20cm³

Experiment	Pilot	1	2	3
Final reading (cm ³)	11.00	10.10	10.30	10.40
Initial reading (cm ³)	0.00	0.00	0.00	0.00
Volume used (cm ³)	11.00	10.10	10.30	10.40

4marks

$$\text{Average volume of acid used} = \frac{V_1 + V_2 + V_3}{3} \text{1mark}$$

$$= \frac{10.10 + 10.30 + 10.40}{3}$$

Average volume of the acid used = 10.20cm³ **1mark**

(b) (i) 20cm³ of M requires 10.20cm³ of H for complete reaction. **1mark**

(ii) The colour change was from Pink to colourless **1mark**

(iii) No Methyl orange is not suitable because it works best for strong acid and strong base titrations so due to Ph range P.O.P is more suitable. **1mark**

(c) Value of X

Case I: Calculate the molarity of an acid (H)

Data given

Molarity of base (M_b) = 0.05M

Volume of a base (V_b) = 20cm³ **01mark**

Volume of an acid (V_a) = 10cm³

Number of mole of an acid (n_a) = 1

Number of mole of a base (n_b) = 2

Molarity of a base (M_b) = required?

Solution

From

$$\frac{M_a V_a}{M_b V_b} = \frac{n_a}{n_b} \text{ **01mark**}$$

$$\begin{aligned} M_a &= \frac{M_b V_b n_a}{V_a n_b} \\ &= \frac{0.05M \times 20 \text{ cm}^3 \times 1}{10 \text{ cm}^3 \times 2} \\ &= 0.05M \end{aligned}$$

$\therefore$ Concentration of acid in mol/dm³ is 0.05M **01mark**

Case II: Calculate the Concentration of an anhydrous in g/dm³ acid (H)

Data given

Molarity of an acid (M_a) = 0.05M

Molar mass of anhydrous acid = 90g/mol **01mark**

Concentration of acid in g/dm³ = ???

Solution

From

$$\text{Molarity} = \frac{\text{Concentration}}{\text{Molar mass}} \quad \mathbf{01 \text{ mark}}$$

Concentration = Molarity x molar mass

Concentration = 0.05M X 90g/mol

Concentration of anhydrous acid = 4.5g/dm³ **01mark**

Case III: Calculate the Concentration of anhydrated acid in g/dm³ acid (H)

$$\text{Concentration} = \frac{\text{mass}}{\text{Volume}} \quad 01\text{mark}$$

$$= \frac{6.3\text{g}}{1\text{dm}^3}$$

$$= 6.3 \text{ g/dm}^3 \quad 01\text{mark}$$

Case Iv: Calculate value of X (water of crystallization) hydrated acid (H)

Data given

Concentration of anhydrous acid (g/dm³) = 4.5g/dm³

Concentration of hydrated acid (g/dm³) = 6.3g/dm³ **01mark**

Molar mass of anhydrous acid = 90g/mol

Value of x = required

Solution

From

$$\frac{\text{Concentration of anhydrous}}{\text{Concentration of hydrated}} = \frac{\text{Molar mass of anhydrous}}{\text{Molar mass of hydrated}} \quad 01\text{mark}$$

$$\frac{4.5\text{g/dm}^3}{6.5\text{g/dm}^3} = \frac{90\text{g/mol}}{90 + 18x}$$

$$6.5 \times 90 = 4.5 (90 + 18x)$$

$$\underline{6.5 \times 90 = 90 + 18x}$$

$$4.5$$

$$130 = 90 + 18x$$

$$130 - 90 = 18x \quad \text{01mark}$$

$$\underline{40} = \underline{18x}$$

$$18 \quad 18$$

$$X = 2 \quad \text{02marks}$$

(d) Precaution you should observe to ensure accuracy in the experiment **4marks**

- Rinse all apparatus before use.
- Use white tiles to see colour change clearly
- Add the acid dropwise near the end point
- Swirl the mixture content during titration.

2.

S/N	OBSERVATIONS	INFERENCES
a)	White powder	CO_3^{2-} , HCO_3^- of NH_4^+ , Na^+ , Ca^{2+} , Zn^{2+} , Pb^{2+} may be present.
b)	No gas evolves.	CO_3^{2-} of Na^+ may be present
c)	Effervescence of a colourless gas evolves, which turns lime water milky and moist litmus paper from blue to red.	CO_3^{2-} or HCO_3^- may be present
d)	Golden yellow flame	Na^+ may be present.
e)	Soluble forming a colourless solution.	CO_3^{2-} , HCO_3^- of Na^+ , NH_4^+ may be present.
i	Golden yellow flame	Na^+ Confirmed
ii	White precipitate is formed before warming the contents	CO_3^{2-} confirmed

@experiment2marks =14marks

(i) The cation is Na^+ and the anions is CO_3^{2-} **1.5marks@= 3marks**

(ii) The sample is Na_2CO_3 **02marks**

(iii) $\text{Na}_2\text{CO}_3 \xrightarrow{\text{Heat}} \text{CO}_2(\text{g}) + \text{Na}_2\text{O}(\text{s})$ **03marks**

(iv) Uses of sodium carbonate **03marks**

- **Water softening** – Removes calcium and magnesium ions from hard water.
- **Manufacture of glass** – Used in making soda-lime glass for windows, bottles, and containers.
- **Production of soaps and detergents** – Acts as a cleaning agent and helps remove grease.
- **Paper and textile industries** – Used in processing paper and dyeing fabrics.
- **Neutralizing acids** – Being alkaline, it is used to neutralize acidic solutions.
- **Laboratory reagent** – Used in chemical analysis and preparation of other sodium compounds.