

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



**FORM FOUR PRE – NATIONAL EXAMINATION 2025**

**032/2B**

**CHEMISTRY 2B**

**MARKING SCHEME**

Question 1. (a) **04marks**

B. Reading

Pipette used = 25cm<sup>3</sup>

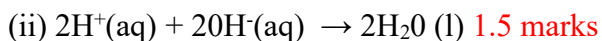
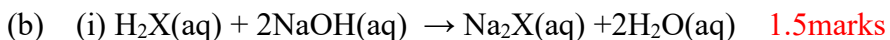
Experiment	Pilot	1	2	3
Final volume (cm <sup>3</sup> )	12.70	25.30	37.70	12.50
Initial volume (cm <sup>3</sup> )	00.0	12.70	25.30	00.0
Volume used (cm <sup>3</sup> )	12.70	12.60	12.40	12.50

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

$$\text{Average volume} = \frac{12.6\text{cm}^3 + 12.4\text{cm}^3 + 12.5\text{cm}^3}{3}$$

Average volume is 12.5cm<sup>3</sup> **02marks**

- (i) Therefore, average volume of an acid is 12.5cm<sup>3</sup>  
 (ii) 12.5Cm<sup>3</sup> of solution S required of 25cm<sup>3</sup> of solution R for complete reaction. **1mark**



(c) Molarity of S

Data given

Concentrated molarity ( $M_c$ ) = 2M

Concentrated volume ( $V_c$ ) = 100cm<sup>3</sup>      01/2 mark

Diluted volume ( $V_d$ ) = 2000cm<sup>3</sup>

Diluted molarity ( $M_d$ ) = ?

Solution

From  $M_c V_c = M_d V_d$       01/2 mark

$$M_d = \frac{M_c V_c}{V_d}$$

$V_d$

$$M_d = \frac{2M \times 100\text{cm}^3}{2000\text{cm}^3}$$

$$2000\text{cm}^3 \quad 01\text{mark}$$

Therefore,  $M_d$  is 0.1M      01mark

1. (c) Molarity of R:

Data given

Molarity of an acid ( $M_a$ ) = 0.1M

Volume of an acid ( $V_a$ ) = 12.5cm<sup>3</sup>

Number of moles of an acid ( $n_a$ ) = 1      01/2 mark

Volume of a base ( $V_b$ ) = 25cm<sup>3</sup>

Number of moles of a base ( $n_b$ ) = 2

Molarity of a base ( $M_b$ ) = ?

Solution:

From

$$M_a V_a = n_a$$

$$M_b V_b = n_b \quad 01/2 \text{ mark}$$

$$M_b = \frac{M_a V_a n_b}{V_b n_a}$$

$V_b n_a$

$$M_b = \frac{0.1M \times 12.5\text{cm}^3 \times 2}{25\text{cm}^3 \times 1} \quad 01\text{mark}$$

$$25\text{cm}^3 \times 1$$

Therefore, molarity of base is 0.1 M.      01mark

(c) (ii) Data given

Molarity of a base ( $M_b$ ) = 0.1M

Molar mass of a base = 40g/mole 01/2 mark

Concentration of a base = ?

Solution

From

Molarity =  $\frac{\text{Conc in g/dm}^3}{\text{Molar mass}}$

Molar mass 01/2 mark

Concentration = Molarity x molar mass

Concentration = 0.1M x 40g/dm<sup>3</sup> 01mark

Therefore, concentration of a base in g/dm<sup>3</sup> is 4g/dm<sup>3</sup> 01mark

(d) (i) Data given

Molarity of an acid ( $M_a$ ) = 0.1M

Molar mass of an acid = ? 01/2 mark

Solution

Molarity =  $\frac{\text{concentration}}{\text{Molar mass}}$  01/2 mark

Molar mass

Molar mass =  $\frac{\text{Concentration}}{\text{Molarity}}$

Molarity

Molar mass =  $\frac{9\text{g/dm}^3}{0.1\text{ M}}$

0.1 M

Therefore, Molar mass of S is 90g/mole 01mark

(d) (ii) RAM of X

$$1 \times 2 + X = 90$$

$$X = 90 - 2 \quad \text{02marks}$$

Therefore, RAM of X is 88

(e) From



Number of hydrogen atoms (H=2, C= 2 and O = 4)

$$2 \times 1 + 2 \times 12 + 16 \times 4 = 90$$

Then X is Oxalate ion, Structure  $\text{H}_2\text{C}_2\text{O}_4$ , IUPAC name is Ehan-1,2-dioic acid (Oxalic Acid).

02marks

(f) Data given:

Molarity of an acid = 0.1M

Volume of an acid =  $12.5\text{cm}^3$

Number of moles = ?

01/2 mark

Solution.

Molarity of an acid =  $\frac{\text{number of mole}}{\text{Volume}}$

Volume

Convert  $\text{cm}^3$  to  $\text{dm}^3$

$$1\text{dm}^3 = 1000\text{cm}^3$$

$$x = 12.5\text{cm}^3$$

$$x = 1.25 \times 10^{-2}\text{dm}^3 \text{ then,}$$

01/2 mark

Number of mole of an acid = Molarity of acid x volume of an acid

$$\text{Number of mole of an acid} = 0.1 \text{ mol/dm}^3 \times 1.25 \times 10^{-2}\text{dm}^3$$

Therefore, Number of mole of an acid is  $1.25 \times 10^{-3}$  01/2 mark

1. (f) Data given:

Molarity of base = 0.1M

01/2 mark

Volume of bas =  $25\text{cm}^3$

Number of moles = ?

Solution.

Molarity of base =  $\frac{\text{number of mole}}{\text{Volume}}$

Volume

Convert  $\text{cm}^3$  to  $\text{dm}^3$  **01/2 mark**

$$1\text{dm}^3 = 1000\text{cm}^3$$

$$x = 25\text{cm}^3$$

$$x = 2.5 \times 10^{-2}\text{dm}^3 \text{ then,}$$

Number of mole of a base = Molarity of acid x volume of a base

$$\text{Number of mole of a base} = 0.1 \text{ mol/dm}^3 \times 2.5 \times 10^{-2}\text{dm}^3$$

Therefore, Number of mole of a base is  $2.5 \times 10^{-3}$  **01/2 mark**

(g) P.O.P indicator was suitable for this experiment because weak acid reacted with strong base.  
**01mark**

#### Question 2.

S/N	Experiment	Observations	Inference
(a)	Appearance of sample T	White	$\text{NH}_4^+$ , $\text{Na}^+$ , $\text{Ca}^{2+}$ , $\text{Zn}^{2+}$ , $\text{Pb}^{2+}$ may be present
	(i) Color		
	(ii) Texture	Powder form	$\text{CO}_3^{2-}$ , $\text{HCO}_3^-$ may be present.
	(iii) Odour	Choking smell	$\text{NH}_4^+$ may be present.
	(iv) Deliquescence	Absorbs water from the atmosphere to form a solution.	$\text{NO}_3^-$ , $\text{Cl}^-$ , $\text{SO}_4^{2-}$ may be present.
(b)	A little sample T was heated in a dry test tube.	White sublimate and a colourless gas evolves, which turns moist litmus paper from red to blue.	$\text{NH}_4^+$ may be present
(c)	A full spatula of sample T was put in a dry test tube, followed by addition of dil HCl, and evolution of a gas was tested with blue litmus paper.	Effervescence of a colourless gas evolves, which turns lime water milky and moist litmus paper from blue to red.	$\text{CO}_3^{2-}$ , $\text{HCO}_3^-$ may be present
(d)	A full spatula of sample T was put in a dry test tube, followed by addition of Conc Sulphuric acid, and evolution of a gas was	Effervescence of a colourless gas evolves. The gas turns lime water milky and moist litmus paper from blue to red.	$\text{CO}_3^{2-}$ , $\text{HCO}_3^-$ may be present

	tested with blue litmus paper.		
(e)	A little sample T was added in a test tube followed by addition of distilled water and solution was divided in to the three portions.	Soluble forming a colourless solution.	$\text{CO}_3^{2-}$ , $\text{HCO}_3^-$ of $\text{Na}^+$ , $\text{NH}_4^+$ may be present.
	(i). To the first portion ammonia solution was added in drop wise till in excess.	No precipitate was formed	$\text{NH}_4^+$ may be present.
	(ii) To the second portion sodium hydroxide solution was added in drop wise till in excess.	No precipitate was formed; on warming, a colourless gas with a choking smell which turns moist litmus paper from red to blue evolved	$\text{NH}_4^+$ may be present.
	(iii). To the third portion add barium chloride ( $\text{BaCl}_2$ ), solution was added then followed by dilute HCl.	White precipitate soluble in dilute HCl is formed.	$\text{CO}_3^{2-}$ confirmed.
(f)	A spatula of solid sample T was put in a dry test tube and then followed by addition of NaOH solution just to cover the solid, then warmed gently and gas evolved was tested	Colourless gas evolves which turns moist litmus paper from red to blue.	$\text{NH}_4^+$ confirmed

Total 13.5marks

### Conclusion

- i. Cation present in sample T is  $\text{NH}_4^+$  02marks
- ii. Anion present in sample T is  $\text{CO}_3^{2-}$  02marks
- iii. The chemical formula for compound T is  $(\text{NH}_4)_2\text{CO}_3$  02marks
- iv. Write the IUPAC name of compound T Ammonium carbonate 1.5marks
- v.  $\text{BaCl}_2(\text{aq}) + (\text{NH}_4)_2\text{CO}_3(\text{aq}) \rightarrow \text{BaCO}_3(\text{s}) + 2\text{NH}_4\text{Cl}(\text{aq})$   
 $\text{Ba}^{2+} + 2\text{Cl}^- + 2\text{NH}_4^+ + \text{CO}_3^{2-} \rightarrow \text{BaCO}_3(\text{s}) + 2\text{NH}_4^+ + 2\text{Cl}^-$   
 $\text{Ba}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{BaCO}_3(\text{s})$  02marks
- vi.  $(\text{NH}_4)_2\text{CO}_3(\text{s}) \xrightarrow{\Delta} 2\text{NH}_3(\text{g}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$  02marks