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 = $25cm^3$

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

Average volume = $\frac{V1 + V2 + V3}{3}$

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

Average volume is $12.5cm^3$ 02marks

(i) Therefore, average volume of an acid is $12.5cm^3$

(ii) $12.5Cm^3$ of solution S required of $25cm^3$ of solution R for complete reaction. 1mark

(b) (i) $H_2X(aq) + 2NaOH(aq) \rightarrow Na_2X(aq) + 2H_2O(aq)$ 1.5marks

(ii) $2H^+(aq) + 2OH^-(aq) \rightarrow 2H_20\ (l)$ 1.5 marks

(c) Molarity of S

Data given

Concentrated molarity (Mc) = 2M

Concentrated volume (Vc) = $100cm^3$ 01/2 mark

Diluted volume (Vd) = $2000cm^3$

Diluted molarity (Md) = ?

Solution

From McVc = MdVd 01/2 mark

$$Md = \frac{McVc}{Vd}$$

$$Md = \frac{2M \times 100cm^3}{2000cm^3}$$ 01mark

Therefore, Md is 0.1M 01mark

1. (c) Molarity of R:
   Data given
   Molarity of an acid(Ma) = 0.1M
   Volume of an acid (Va) = 12.5cm3
   Number of moles of an acid (na) = 1 01/2 mark
   Volume of a base (Vb) = 25cm3
   Number of moles of a base (nb) = 2
   Molarity of a base (Mb) = ?
   Solution:
   From
   MaVa = na
   MbVb nb 01/2 mark
   $$Mb = \frac{MaVanb}{Vbna}$$

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

Therefore, molarity of base is 0.1 M. 01mark

(c) (ii) Data given

Molarity of a base (Mb) = 0.1M

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

Concentration of a base = ?

Solution

From

Molarity = $\frac{\text{Conc in g/dm}^3}{\text{Molar mass}}$ 01/2 mark

Concentration = Molarity x molar mass

Concentration = 0.1M x 40g/dm^3 01mark

Therefore, concentration of a base in g/dm^3 is 4g/dm^3 01mark

(d) (i) Data given

Molarity of an acid (Ma) = 0.1M

Molar mass of an acid = ? 01/2 mark

Solution

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

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

Molar mass = $\frac{\text{9g/dm3}}{\text{0.1 M}}$

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

(d) (ii) RAM of X

1 x 2 + X = 90

X = 90 -2 02marks

Therefore, RAM of X is 88

(e) From

H_2X

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

2 x 1+ 2x12+ 16 x 4 = 90

Then X is Oxalate ion, Structure $H_2C_2O_4$, IUPAC name is Ehan-1,2-dioic acid (Oxalic Acid).

02marks

(f) Data given:

Molarity of an acid = 0.1M

Volume of an acid = $12.5cm^3$

Number of moles = ? 01/2 mark

Solution.

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

Convert cm^3 to dm^3

$1dm^3 = 1000cm^3$

$x = 12.5cm^3$

$x = 1.25 \times 10^{-2}dm^3$ then, 01/2 mark

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

Number of mole of an acid $=0.1\ mol/dm^3 \times 1.25x10^{-2}dm^{-3}$

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

1. (f) Data given:

Molarity of base = 0.1M 01/2 mark

Volume of bas = $25cm^3$

Number of moles = ?

Solution.

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

Convert cm^3 to dm^3 01/2 mark

$1dm^3 = 1000cm^3$

$x = 25cm^3$

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

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

Number of mole of a base $=0.1\ mol/dm^3 \times 2.5x10^{-2}dm^{-3}$

Therefore, Number of mole of a base is $2.5x\ 10^{-3}$ 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 (i) Color	White	NH_4^+, Na^+, Ca^{2+}, Zn^{2+}, Pb^{2+} may be present
	(ii) Texture	Powder form	CO_3^{2-}, HCO_3^- may be present.
	(iii) Odour	Choking smell	NH_4^+ may be present.
	(iv) Deliquescence	Absorbs water from the atmosphere to form a solution.	NO_3^-, Cl^-, $SO4^{2-}$ 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.	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.	CO_3^{2-}, 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.	CO_3^{2-}, 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.	CO_3^{2-} , HCO_3^- of Na^+ , NH_4^+ may be present.
	(i). To the first portion ammonia solution was added in drop wise till in excess.	No precipitate was formed	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	NH_4^+ may be present.
	(iii). To the third portion add barium chloride ($BaCl_2$), solution was added then followed by dilute HCl.	White precipitate soluble in dilute HCl is formed.	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.	NH_4^+ confirmed

Total 13.5marks

Conclusion

i. Cation present in sample T is NH_4^+ 02marks

ii. Anion present in sample T is CO_3^{2-} 02marks

iii. The chemical formula for compound T is $(NH_4)_2CO_3$ 02marks

iv. Write the IUPAC name of compound T Ammonium carbonate 1.5marks

v. $BaCl_2(aq) + (NH_4)_2CO_3(aq) \rightarrow BaCO_3(s) + 2NH_4Cl(aq)$

$Ba^{2+} + \cancel{2Cl^-} + \cancel{2NH_4^+} + CO_3^{2-} \rightarrow BaCO_3(s) + \cancel{2NH_4^+} + \cancel{2Cl^-}$

$Ba^{2+}(aq) + CO_3^{2-}(aq) \rightarrow BaCO_3(s)$ 02marks

vi. $(NH_4)_2CO_3(s) \longrightarrow 2NH_3(g) + CO_2(g) + H_2O(l)$ 02marks