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

FORM SIX PRE-NATIONAL EXAMINATIONS 2026
132/3A CHEMISTRY 3A

MARKING SCHEME

1. Volume of pipette used was $25cm^3$

(0.5marks)

Titration numbers	Pilot	1	2	3
Initial readings(cm^3)	0.00	10.30	20.40	30.40
Final reading(POP),cm^3	6.40	16.60	26.60	36.70
Final reading(MO),ccm^3	10.30	20.40	30.40	40.50
Volume used(POP),cm^3	6.40	6.30	6.30	6.30
Volume used(MO),cm^3	3.90	3.80	3.70	3.80

(03marks)

Summary:

$25cm^3$ of AA solution required $6.30cm^3$ of BB in the presence of POP and $3.80cm^3$ of BB in the presence of MO for complete neutralization.

(1.50marks)

(a) The ionic equation for the reactions;

((i) Procedure

$OH^- + H^+ \longrightarrow H_2O$

$CO_3^{2-} + H^+ \longrightarrow HCO_3^-$ **(1.0marks)**

(ii) Procedure (iv)

$HCO_3^{2-} + H^- \longrightarrow H_2O + CO_2$ **(0.5marks)**

(b) (i) In order to allow the double indicators.

Since the DD is weak base solution favoured by mixture (weak base + strong acid) in double

indicator.so, it cannot react completely with strong acid hence intermediate product formed which will be completed by addition of CC solution.

(1marks)

(ii) .$NaOH + HCl \longrightarrow NaCl + H_2O$

. $Na_2CO_3 + HCl \longrightarrow 2NaCl + CO_2 + H_2O$

(1marks)

(c) Molarity of NaOH

(i) . From equation, $NaOH + HCl \longrightarrow NaCl + H_2O$

na = 1

nb = 1

Ma = 0.2M

Va = $25cm^3$

Mb = ?

From

$$\frac{}{}$$

Mb = $$\frac{}{}$$

$$= \frac{0.2M \times 2.5 \times 1}{25 \times 1} = 0.02M$$

Molarity of NaOH 0.02M **(1.5Marks)**

Molarity of Na_2CO_3

From; $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$

na = 2

nab = 1

Vb = $25cm^3$

Va = $7.cm^3$

Ma = $0.2cm^3$

Mb = ?

From,

$$\frac{}{} = \frac{}{}$$

$$Mb = \frac{\quad}{\quad}$$

$$= \frac{0.21 \times 76 \times 1}{25 \times 2}$$

$$= 0.03M$$

Molarity of Na_2CO_3 0.03M **(02marks)**

(ii). To calculate concentration of NaOH and Na_2CO_3 in g/dm^3

From ,

$$\text{Molarity} = \frac{(\ /\ ^3)}{(\ \text{—})}$$

Then,for NaOH

$$\text{Molarity} = \frac{(\ /\ ^3)}{(\ \text{—})}$$

But conc = Molarity ×molar mass of NaOH

= 0.02M × 40 g/mol

Conc in g/dm^3 = 0.8 g/dm^3 **(02marks)**

For Na_2CO_3

$$\text{Molarity} = \frac{(\ /\ ^3)}{(\ \text{—})}$$

Conc g/dm^3 = 0.03M x 106 g/mol

= 3.18g/dm^3

Conc in $g/dm^3$of Na_2CO_3 = 3.18g/dm^3 **(02marks)**

(iii). Percentage composition by mass of NaOH

Conc of NaOH = 0.8g/dm^3

Conc of Na_2CO_3 = 3.18g/dm^3

Conc of the mixture =(0.8+ 3.18)g/dm^3

=3.98g/dm^3 **(02marks)**

Then percentage composition $= \frac{(\quad)}{\quad} \times 100\%$

$$= \frac{0.8\ /\ ^3}{3.98\ ^3} \times 100\%$$

20%

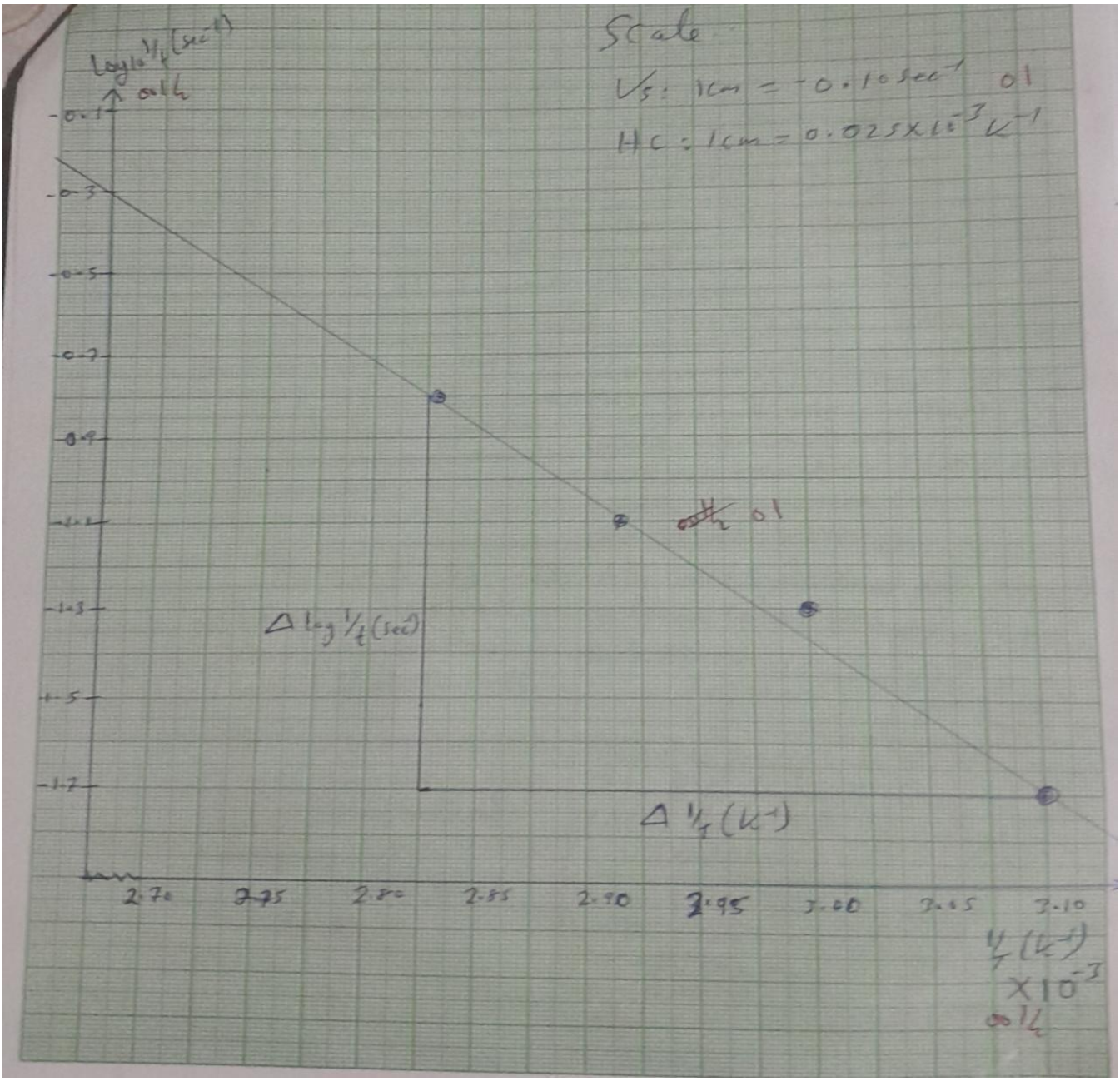
The composition by mass of NaOH =20% **(02marks)**

2. Table of results

Temperature of reaction mixture		Time of reaction t(sec)	$\frac{1}{}(K^{-1})$	$\frac{1}{}(sec^{-1})$	$\log\frac{1}{}(sec^{-1})$
θ(°C)	T(k)				
50	323	42	3.10×10^{-3}	0.02	-1.70
60	333	20	3.00×10^{-3}	0.05	-1.30
70	343	20	2.92×10^{-3}	0.10	-1.00
80	353	5	2.83×10^{-3}	0.20	-0.70

(06 marks)

(a) **The graph of $\log 10\,{}^{1}/\,Sec$ against ${}^{1}K^{-1}$**


Log10 1/t (sec-1)
∝ 1/t
Scale
1/t : 1cm = 0.10 sec-1
HC : 1cm = 0.025 x 10-3 K-1
-0.1
-0.3
-0.5
-0.7
-0.9
-1.1
-1.3
-1.5
-1.7
Δ log 1/t (sec)
Δ 1/t (K-1)
2.70
2.75
2.80
2.85
2.90
2.95
3.00
3.05
3.10
1/t (K-1)
x10-3
∝ 1/t

(03 marks)

(b)

$$= \frac{\Delta \log \frac{1}{}(sec^{-1})}{\Delta \frac{1}{}(T^{-1})}$$

$$= \frac{-0.8-(-1.7)}{2.825\times10^{-3}-3.10\times10^{-3}}$$

$$= \frac{0.9}{-2.75\times10^{-4}}$$

$$= -3.273\times10^{3}\text{ksec}^{-1}$$

∴The slope was -3.273×10^{3}ksec^{-1} **(02 marks)**

(c) From

$$\log \frac{1}{}(sec^{-1}) = \frac{-Ea}{2.303} + \log_{10} A$$

$$= \frac{-Ea}{2.303}$$

Ea = −(slope × 2.303R)

since slope = −3.273 × 103ksec−1 R = 8.314Jk−1mol−1

Ea = −(−3.273 × 103 × 8.314 × 2.303)Jmol−1 Ea = 6.27 × 104Jmol−1

∴The activation energy was 6.27×10^{4}Jmol^{-1} **(02 marks)**

The value of A

from the vertical $(\log \frac{1}{t}) = \log_{10} A$

$\log \frac{1}{} = -0.3$

$\log_{10} A = -0.3(00\frac{1}{2}\text{mark})$

$A = \log^{-1}_{10}(-0.3)$

A = 0.501

∴The value of A was 0.50 **(01 marks**

3. (i)

S/NO	EXPERIMENT	OBSERVATION	INFERENCE
(a)	Appearance of the sample	(i) White	Non transition metals may be present
		(ii) Crystalline form **(0.5marks)**	NO_3^- ,SO_4^{2-} ,Cl $C_2O_4^{2-}$,CrO_4^{2-} ,CH_3COO^- ,may be present **(0.5marks)**
(b)	Action of heat of the sample	White sublimate and colourless gas with choking smell which turn moist red litmus paper blue **(0.5marks)**	NH_4^+ may be present **(0.5marks)**
		Colourless gas evolves which form moist litmus paper from blue o red and form dense white fumes with ammonia gas **(0.5marks)**	Cl^- may be present **(0.5marks)**
(c)	Solubility of the sample M	The sample is soluble in cold water **(0.5maarks)**	Cl^- may be present except those of Ag^+ and Pb^{2+} ,Na^+, K^+ ,NH_4^+ ,may be present **(0.5marks)**
(d)	Action of NaOH of solution of M	No precipitate formed **(0.5marks)**	NH_4^+ may be present **(0.5marks)**
(e)	Action of fresh $FeSO_4$ solution on solution of M followed by concentrated H_2SO_4 through the side of the test tube	No brown ring is observed but gives a gas which turns moist litmus paper from blue to red and form dense white fumes on adding of conc.H_2SO_4.**(0.5marks)**	NO_3^- absent Cl^- may be resent **(0.5marks)**

(f)	Action of lead ethanoate and boil	White precipitate formed which dissolves slowly on boiling **(0.5marks)**	Cl^- of Pb^{2+} may be present **(0.5marks)**
(g)	Confirmatory test for cation To small sample a dilute NaOH is added, then moist litmus paper is passed to the mouth of test tube containing the mixture. Dipping a glass rod in conc HCl and passed it o the test tube containing the mixture.	Colourless gas which turns moist red litmus paper blue and formed white fumes with concentrated HCl evolved. **(01marks)**	NH_4^+ NH_4^+ Confirmed **(01marks)**
	Confirmatory test for anion. To a small volume of extract into test tube, HNO_3 is added followed by $AgNO_3$, Then $NH_{3(aq)}$.	White precipitate soluble in dilute ammonia solution is formed **(01marks)**	Cl^- Confirmed **(01marks)**

(ii). $NH_4Cl_{(s)} \longrightarrow NH_{3(aq)} + HCl_{(g)}$ **(02marks)**

(iii). NH_4Cl **(02 marks)**