SERIES 7 EXAMS
233/3 – CHEMISTRY PAPER 3 - MARKING SCHEME

1		1	2	3
	Final burette reading (cm³)	25.3	25.1	25.2
	Initial burette reading (cm³)	0.0	0.0	0.0
	Volume of base, solution A used (cm³)	25.3	25.1	25.2

Complete table   - (1mk)
Decimals   - (1mk)
Accuracy   - (1mk)
                  (3mks)

(a) (i)   Average volume of solution A

$$= \frac{25.3 + 25.1 + 25.2}{3} \quad \checkmark\tfrac{1}{2}$$

$$= 25.2 \text{cm}^3 \checkmark\tfrac{1}{2}$$

(ii)   Moles of NaOH $= \dfrac{25.2 \times 0.08}{1000} \quad \checkmark\tfrac{1}{2}$

$$= 0.00216 \text{ moles } \checkmark\tfrac{1}{2}$$

(b) (i)   Mole ratio of acid: base
∴Moles of acid in 25cm³

$$= \tfrac{1}{2} \times 0.00216 \quad \checkmark\tfrac{1}{2}$$

$$= 0.00108 \text{ moles } \checkmark\tfrac{1}{2}$$

(ii)   25cm³ _____ 0.00108 moles
250cm³ _____?

$$= \frac{250^{10} \times 0.00108}{25_{1}} \quad \checkmark\tfrac{1}{2}$$

$$= 0.0108 \text{ moles } \checkmark\tfrac{1}{2}$$

(c) (i)   Moles of Na_2CO_3

$$= \frac{2.0}{106} \quad \checkmark\tfrac{1}{2} \qquad M\,Mass\ of\ Na_2CO_3 = 106$$

$$= 0.0189 \text{ moles } \checkmark\tfrac{1}{2}$$

(ii)   Mole ratio of carbonate: dibasic acid
       = 1: 1 $\checkmark\tfrac{1}{2}$
∴Moles of acid ≡ moles of carbonate that reacted
       = 0.0189 moles $\checkmark\tfrac{1}{2}$

(iii) Total no of moles of acid
       = Moles of excess acid + moles that reacted with carbonate.
       = 0.00108 + 0.0189 $\checkmark\tfrac{1}{2}$
       = 0.01998 moles $\checkmark\tfrac{1}{2}$
50cm³ of original acid _____ 0.01998 moles
1000cm³ of original acid _____ ?

$$= \frac{1000 \times 0.01998}{50} \checkmark\tfrac{1}{2}$$

$$\therefore \text{Concentration} = \underline{0.3996M} \checkmark\tfrac{1}{2}$$

(d) (i)   15.75g _____ 250cm³

        ?   ←   1000cm³

        $= 15.75 \times 4 \checkmark\tfrac{1}{2}$

        $= 63g/L$

Molar mass $= \dfrac{63g/L}{0.3996} \checkmark\tfrac{1}{2}$

             $= 157.66g$

(ii) $2 + 24 + 4 \times 16 + 18\chi = 157.66$

         $90 + 18\chi = 157.66 \checkmark\tfrac{1}{2}$

           $18\chi = 67.66$

            $\chi = \dfrac{67.66}{18} = 3.76$

            $\chi \simeq 4 \checkmark\tfrac{1}{2}$

2. **TABLE 2**

Experiment	1	2	3	4	5
Volume of HCl K(cm³)	5	5	5	5	5
Volume of $Na_2S_2O_3$	10	10	10	10	10
Temp.°C of $Na_2S_2O_3$	22	30	40	50	60
Time (sec)	100	52	31	20	18
$\dfrac{1}{Time}\left(Sec^{-1}\right)$	1.00×10^{-3}	19.2×10^{-3}	32.2×10^{-3}	50×10^{-3}	55×10^{-3}

           Complete table   (2mks)

           Correct trend   (1mk)

           Accuracy   (1mk)

NB: Accuracy mk $\pm 1°C$ of Sch. Value $\Rightarrow$ S. Value is temperature of $Na_2S_2O_3$ at 1ˢᵗ experiment.

(iii)   As the temperature increases the rate of reaction increases. (1mk)

(iv)   I   At 48°C $\rightarrow 40.4 \times 10^{-3} \checkmark\tfrac{1}{2}$ $10^{-3} \times 40.4 = \dfrac{1}{\chi}$

                            $\dfrac{1}{0.0404} = \chi = 24.75$ $\checkmark\tfrac{1}{2}$

     II   Temp.°C whose rate is 0.05 sec⁻¹ is 50°C. $\checkmark\tfrac{1}{2}$

3.	I	(a)		Observation	Inference
				- Colourless gas turn ✓½ lime water white ppte	CO_3^{2-} ✓½ HCO_3^{2-} (any)
				- Solid turn to yellow – no white-cold ✓½	Zn^{2+} ✓½
				Observation	Inference
		(b)	(i)	- White residue ✓½	$ZnCO_3$ ✓½
				- Colourless filtrate ✓½	K^+, Na^+, NH_4^+ ✓1 present Mg^{2+}, Ca^{2+} (any one ion) ✓½
			(ii)	Observation	Inference
				No white ppte ✓½	K^+, Na^+, NH_4^+ ✓1 present (absent Pb^{2+}, Al^{3+})
				Observation	Inference
			(iii)	White ppte ✓½	SO_4^{2-}, SO_3^{2-}, CO_3^{2-} ✓1 present All 3 – 1mk 2 - ½mk 1 – 0mk
				Observation	Inference
			(iv)	White ppte ✓½	SO_3^{2-}, CO_3^{2-} present
				Observation	Inference
			(v)	Acidified $KMnO_4$ is decolourised ✓½	SO_3^{2-} ✓½

3.	II	(a)		Observation	Inference
				- Liquid Z burns with a pale blue flame/non-sooty flame	— C — C — ✓½ present/ C = C , — C ≡ C – absent - Z is a saturated cpd- in words
		(b)		Observation	Inference
				- Forms one layer. - Liquids are miscible ✓½	Z is a polar compound ✓½
				Observation	Inference
		(c)	(i)	Red and blue litmus retains their colour ✓½	- OH ✓1
			(ii)	Observation	Inference
				Ph = 7 ✓½	- OH ✓1
				Observation	Inference
			(iii)	No effervescence ✓½	- OH ✓½ or R-COOH/ — C – OH /H⁺ absent
				Observation	Inference

			(iv)	Colour changes from orange to green ✓½	R – OH ✓1 confirmed