

Name of the Student: _____

Max. Marks : 23 Marks

Time : 23 Minutes

Mark Schemes

Q1.

(a) $k = \text{rate} / [\text{CH}_3\text{CH}_2\text{COOCH}_3][\text{H}^+]$

1

or

$$= \frac{1.15 \times 10^{-4}}{(0.150)(0.555)}$$

$$= 1.38 \times 10^{-3} \text{ to } 1.4 \times 10^{-3}$$

1

$$\text{mol}^{-1} \text{ dm}^3 \text{ s}^{-1}$$

1

(b) $\text{ans} = \text{rate constant} \times (\frac{1}{2} \times 0.150) \times (\frac{1}{2} \times 0.555)$
ignore units

$$= \text{rate constant} \times 0.0208$$

$$2.88 \times 10^{-5} \quad (1.38 \times 10^{-3} \text{ gives } 2.87 \times 10^{-5})$$

Allow 2.87 – 2.91 $\times 10^{-5}$ (1.4 $\times 10^{-3}$ gives 2.91 $\times 10^{-5}$)

1

(c) $[\text{H}^+] = \text{rate} / k[\text{CH}_3\text{COOCH}_2\text{CH}_3]$

1

$$= \frac{4.56 \times 10^{-5}}{(8.94 \times 10^{-4})(0.123)}$$

$$= 0.415 \text{ (0.4146)}$$

1

pH = 0.38 mark independently

$$[\text{H}^+] = 0.41 \text{ gives } \text{pH} = 0.39$$

1

[7]

Q2.

- (a) (i) $[H^+][OH^-]$ 1
- $-\log [H^+]$ 1
- (ii) $[H^+] = [OH^-]$ 1
- (iii) $(2.0 \times 10^{-3}) \times 0.5 = 1.0 \times 10^{-3}$ 1
- (iv) $[H^+] = \frac{4.02 \times 10^{-14}}{1.0 \times 10^{-3}} \quad (= 4.02 \times 10^{-11})$ 1
- $pH = 10.40$ 1
- (b) (i) $K_a = \frac{[H^+][CH_3CH_2COO^-]}{[CH_3CH_2COOH]}$ 1
- $= \frac{[H^+]}{[CH_3CH_2COOH]}$ 1
- $[H^+] = \sqrt{(1.35 \times 10^{-5}) \times 0.125} \quad (= 1.30 \times 10^{-3})$ 1
- $pH = 2.89$ 1
- (c) (i) $(50.0 \times 10^{-3}) \times 0.125 = 6.25 \times 10^{-3}$ 1
- (ii) $(6.25 \times 10^{-3}) - (1.0 \times 10^{-3}) = 5.25 \times 10^{-3}$ 1
- (iii) $\text{mol salt formed} = 1.0 \times 10^{-3}$ 1
- $[H^+] = K_a \times \frac{[CH_3CH_2COOH]}{[CH_3CH_2COO^-]}$ 1
- $= (1.35 \times 10^{-5}) \times \frac{(5.25 \times 10^{-3}) / V}{(1.0 \times 10^{-3}) / V} \quad (= 7.088 \times 10^{-5})$ 1
- $pH = 4.15$ 1

[16]