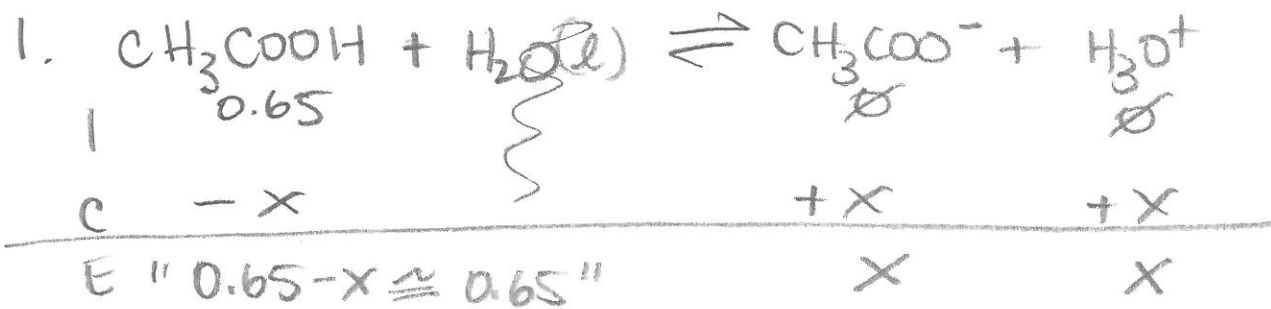


ACID BASE PART I

SHORT ANSWER REVIEW



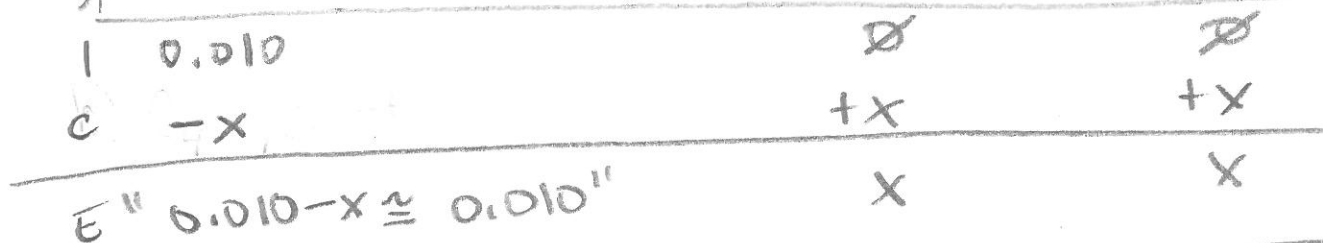
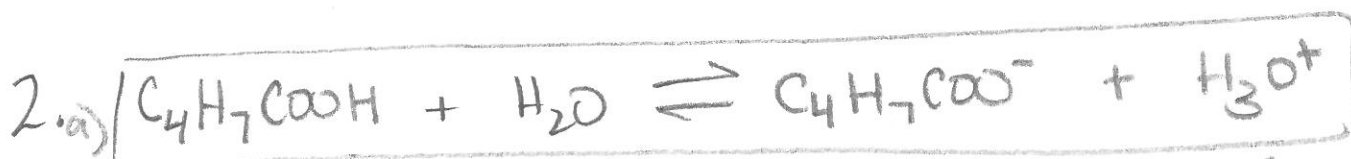
$$K_a = \frac{x^2}{0.65} = 1.8 \times 10^{-5} \rightarrow \sqrt{x^2} = \sqrt{(1.8 \times 10^{-5})(0.65)}$$

$$x = 3.4 \times 10^{-3}$$

$$\therefore [\text{H}_3\text{O}^+]_E \approx 3.4 \times 10^{-3} \text{ M}$$

$$\text{pH} \approx -\log [3.4 \times 10^{-3}]$$

$$\boxed{\text{pH} = 2.47}$$



$$K_a = \frac{x^2}{0.010} = 1.54 \times 10^{-5} \rightarrow \sqrt{x^2} = \sqrt{(1.54 \times 10^{-5})(0.010)}$$

$$x = 3.9 \times 10^{-4}$$

$$\therefore [\text{H}_3\text{O}^+]_E = 3.9 \times 10^{-4} \text{ M}$$

$$\text{pH} = -\log (3.9 \times 10^{-4})$$

$$\text{b. } \boxed{\text{pH} = 3.41}$$



$$\begin{array}{r} \text{C} \quad -6 \times 10^{-4} \qquad \qquad \qquad +6 \times 10^{-4} \qquad \qquad \qquad +6 \times 10^{-4} \\ \hline \text{E} \quad X - 6 \times 10^{-4} \qquad \qquad \qquad 6 \times 10^{-4} \qquad \qquad \qquad 6 \times 10^{-4} \end{array}$$

$$\text{pH} = 3.2 \therefore [\text{H}_3\text{O}^+]_{\text{E}} = \text{antilog}(-3.2) = 6 \times 10^{-4}$$

$$K_a = \frac{(6 \times 10^{-4})^2}{X - 6 \times 10^{-4}} = 1.8 \times 10^{-5} \Rightarrow (6 \times 10^{-4})^2 = 1.8 \times 10^{-5} X - 1.1 \times 10^{-8}$$

$$\rightarrow \frac{4 \times 10^{-7} - 1.1 \times 10^{-8}}{1.8 \times 10^{-5}} = \frac{1.8 \times 10^{-5} X}{1.8 \times 10^{-5}} \rightarrow 2 \times 10^{-2} \text{ M} = X$$

$$\frac{1 \times 10^{-2} \text{ mol CH}_3\text{COOH}}{1 \text{ L}} \times 1 \text{ L} = 2 \times 10^{-2} \text{ mol} \times \frac{60.0 \text{ g}}{1 \text{ mol}}$$

$$\begin{array}{l} 2 \text{ C} = 24.0 \\ 2 \text{ O} = 32.0 \\ 4 \text{ H} = 4.0 \\ \hline \end{array}$$

$$\boxed{\approx 1 \text{ g CH}_3\text{COOH}}$$

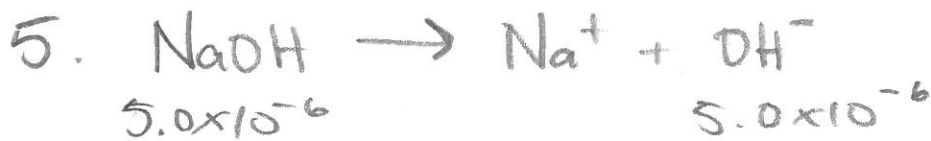
$$4. \frac{[\text{H}^+]^2 \times [\text{SO}_3^{2-}]}{K_{a(3)} [\text{H}_2\text{SO}_3]} = \frac{[\text{H}^+] [\text{HSO}_3^-]}{K_{a(1)} [\text{H}_2\text{SO}_3]} \times \frac{[\text{H}^+] [\text{SO}_3^{2-}]}{[\text{HSO}_3^-]}$$

$$\Rightarrow \frac{[\text{H}^+] [\text{H}^+] [\text{SO}_3^{2-}]}{[\text{H}_2\text{SO}_3]}$$

$$\Rightarrow \frac{[\text{H}^+]^2 [\text{SO}_3^{2-}]}{[\text{H}_2\text{SO}_3]}$$

$$K_{a3} = 1.5 \times 10^{-2} \times 1.0 \times 10^{-7}$$

$$\boxed{K_{a3} = 1.5 \times 10^{-9}}$$



$$\therefore [\text{OH}^-] = 5.0 \times 10^{-6} \rightarrow \text{pOH} = -\log(5.0 \times 10^{-6})$$
$$= 5.30$$

$$[\text{H}_3\text{O}^+] = \frac{1.00 \times 10^{-14}}{5.0 \times 10^{-6}}$$
$$= 2.0 \times 10^{-9}$$

$$\text{pH} = 14.000 - 5.30$$

$$\text{pH} = 8.70$$

$$[\text{H}_3\text{O}^+] = \text{antilog}(-8.70)$$

$$\boxed{= 2.0 \times 10^{-9}}$$



b/c $4.3 \times 10^{-7} > 5.6 \times 10^{-11}$
 H_2CO_3 is the stronger acid.



$$K_w = K_a \times K_b \quad \therefore K_a = \frac{1.00 \times 10^{-14}}{4.1 \times 10^{-9}} = \boxed{2.4 \times 10^{-6}}$$



e) Reactants b/c $K_a \text{H}_2\text{CO}_3 > K_a \text{H}_2\text{PO}_4^-$



* PRODUCTS are favoured. b/c $K_a \text{HSO}_4^- > K_a \text{H}_3\text{PO}_4$

