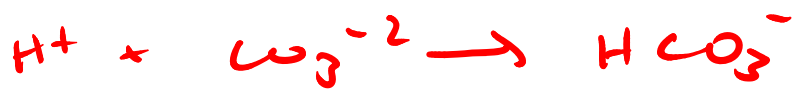
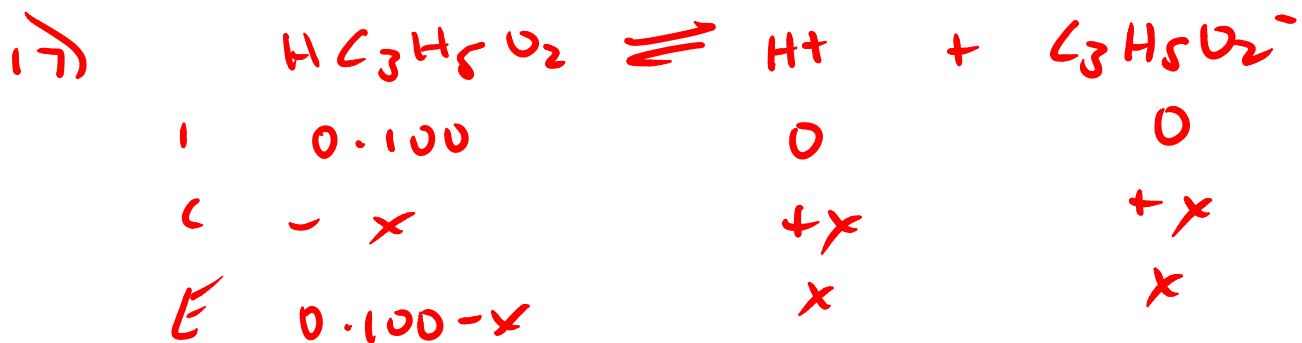


15)  $\text{HCO}_3^- : \text{CO}_3^{2-}$  solution

Strong acid:  $\text{H}^+$  reacts with  $\text{CO}_3^{2-}$



Strong base:  $\text{OH}^-$  reacts with  $\text{HCO}_3^-$



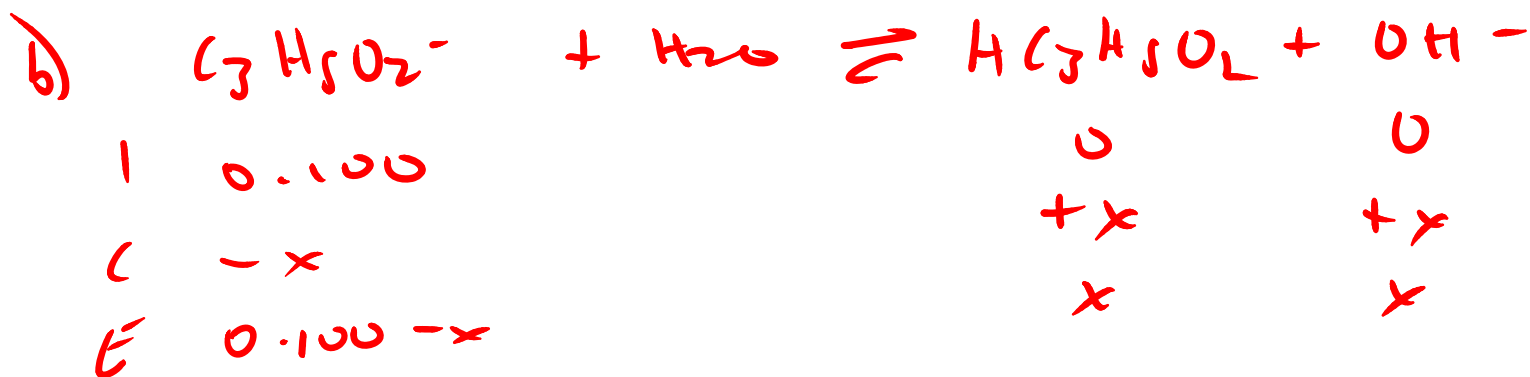
$$K_a = \frac{[\text{H}^+][\text{C}_3\text{H}_5\text{O}_2^-]}{[\text{HC}_3\text{H}_5\text{O}_2]}$$

$$1.3 \times 10^{-5} = \frac{x^2}{0.100 - x}$$

$$x = [\text{H}^+] = 1.1 \times 10^{-3} \text{ M}$$

$$\text{pH} = 2.96$$

5% rule  $\frac{1.1 \times 10^{-3}}{0.10} \times 100 = 1.1\% \checkmark$



$$K_b = \frac{1.0 \times 10^{-14}}{1.3 \times 10^{-5}} = 7.7 \times 10^{-10} = \frac{[HC_3H_5O_2][OH^-]}{[C_3H_5O_2^-]}$$

$$7.7 \times 10^{-10} = \frac{x^2}{0.100} \quad (\rightarrow)$$

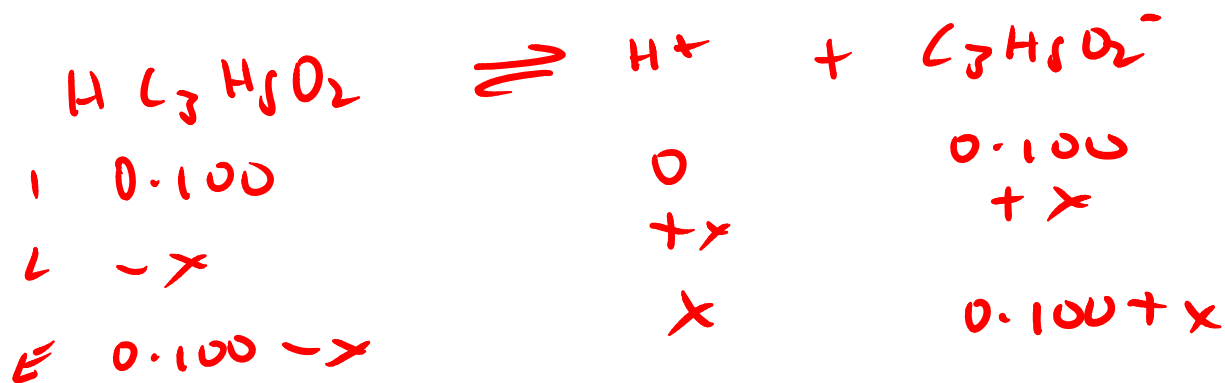
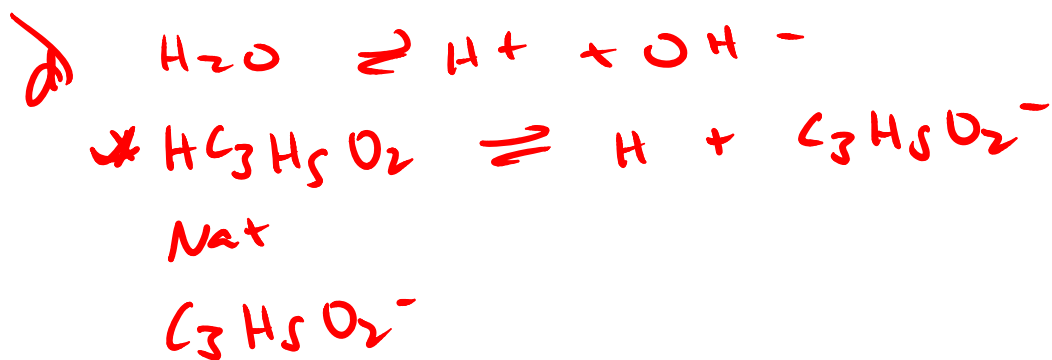
$$x = [OH^-] = 8.8 \times 10^{-6} M$$

$$pOH = -\log(8.8 \times 10^{-6}) = 5.06$$

$$pH = 14 - 5.06 = 8.94$$

$$\% = \frac{8.8 \times 10^{-6}}{0.100} \times 100 = 0.0088\% \checkmark$$

c) Pure water  $[H^+]:[OH^-] = 1.0 \times 10^{-7} M$   
 $pH = -\log(1.0 \times 10^{-7}) = 7$



$$K_c = \frac{[H^+][C_3H_5O_2^-]}{[HCl_3H_5O_2]}$$

$$1.3 \times 10^{-5} = \frac{(0.100 + x)(x)}{0.100 - x}$$

$$\% = \frac{1.3 \times 10^{-5}}{0.10} \times 100$$

$$x = [H^+] = 1.3 \times 10^{-5} M$$

$$pH = -\log(1.3 \times 10^{-5}) = 4.89$$

1a)  $0.100\text{ M HC}_3\text{H}_5\text{O}_2$   
% dissociation:  $\frac{1.1 \times 10^{-3}}{0.100} \times 100 = 1.1\%$



% dissociation  $\frac{1.3 \times 10^{-5}}{0.100} \times 100 = 1.3 \times 10^{-2}\%$

% dissociation decreased ... common ion effect

