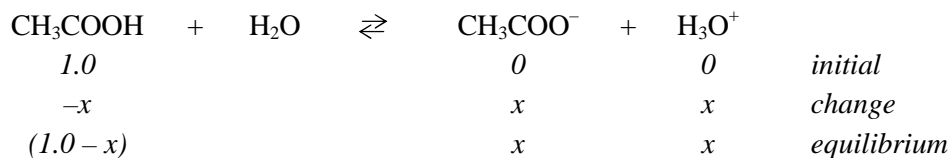
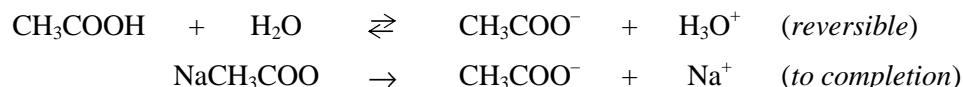
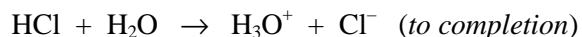


**Part 3. The Ionization Constant of Acetic Acid****Solution: 10 ml of 1.0 M CH<sub>3</sub>COOH****Measured:** pH**To be determined:** K<sub>a</sub>**Calculations:** 1.  $[\text{H}_3\text{O}^+] = 10^{-\text{pH}} = x$ 2. Determine  $[\text{CH}_3\text{COO}^-]$  and  $[\text{CH}_3\text{COOH}]$  from the following:

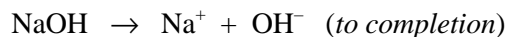
$$3. K_a = \frac{[\text{H}_3\text{O}^+][\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]} = \frac{x^2}{(1.0 - x)}$$

**Solution: 20 ml of 1.0 M NaCH<sub>3</sub>COO + 10 ml of 1.0 M CH<sub>3</sub>COOH****Measured:** pH**To be determined:** K<sub>a</sub>**Calculations:** 1.  $[\text{H}_3\text{O}^+] = 10^{-\text{pH}}$ 2. Determine  $[\text{CH}_3\text{COO}^-]$  in a new volume of 30 ml (*dilution problem*)3. Determine  $[\text{CH}_3\text{COOH}]$  in a new volume of 30 ml (*dilution problem*)

$$4. K_a = \frac{[\text{H}_3\text{O}^+][\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]}$$

**Part 4. Buffering Capacity****Solution: 30 ml of DI H<sub>2</sub>O + 4 ml of 2.0 M HCl****To be determined:** pH (calculated)**Calculations:** 1. Determine  $[\text{HCl}]$  in a new volume of 34 ml (*dilution problem*)2.  $[\text{H}_3\text{O}^+] = [\text{HCl}]$ 3.  $\text{pH}_{\text{calc}} = -\log [\text{H}_3\text{O}^+]$

**Solution: 30 ml of DI H<sub>2</sub>O + 4 ml of 2.0 M NaOH**



**To be determined:** pH (calculated)

**Calculations:** Use the same approach as shown above for the (H<sub>2</sub>O + 2.0 M HCl) solution.

$$\text{Remember, that } [\text{H}_3\text{O}^+] \times [\text{OH}^-] = 10^{-14}$$

**Solution: 30 ml of 1.0 M NaCH<sub>3</sub>COO + 30 ml of 1.0 M CH<sub>3</sub>COOH = 60 ml of the buffer**

**To be determined:** pH (calculated)

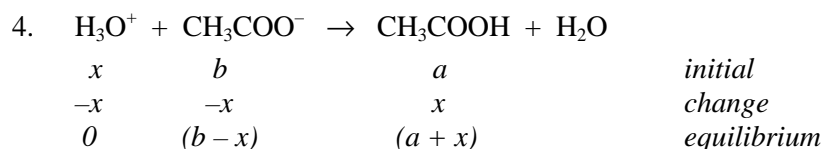
- Calculations:**
1. Determine [CH<sub>3</sub>COO<sup>-</sup>] in a new volume of 60 ml (*dilution problem*)
  2. Determine [CH<sub>3</sub>COOH] in a new volume of 60 ml (*dilution problem*)

$$3. \quad \text{pH} = \text{pK}_a + \log \frac{[\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]} \quad \text{Use } K_a = 1.76 \times 10^{-5}$$

**Solution: 30 ml of the buffer (prepared previously) + 4 ml of 2.0 M HCl**

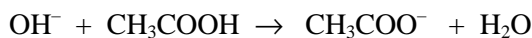
**To be determined:** pH (calculated)

- Calculations:**
1. Determine the initial number of moles of CH<sub>3</sub>COOH in solution: *a*
  2. Determine the initial number of moles of CH<sub>3</sub>COO<sup>-</sup> in solution: *b*
  3. Determine the number of moles of HCl added: *x*



$$5. \quad \text{pH} = \text{pK}_a + \log \frac{\text{moles of CH}_3\text{COO}^-}{\text{moles of CH}_3\text{COOH}} = \text{pK}_a + \log \frac{(b-x)}{(a+x)} \quad \text{Use } K_a = 1.76 \times 10^{-5}$$

**Solution: 30 ml of the buffer (prepared previously) + 4 ml of 2.0 M NaOH**



**Calculations:** Use the same approach as shown above for the (buffer + 2.0 M HCl) solution.