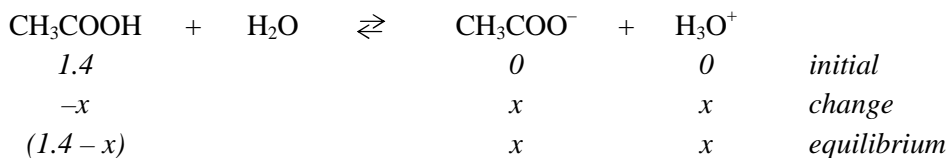
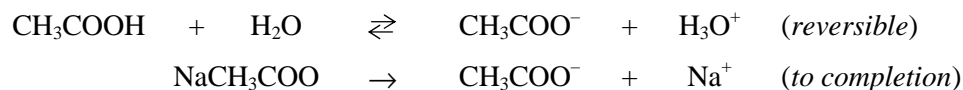


Part 3. The Ionization Constant of Acetic Acid**Solution: 10 ml of 1.4 M CH₃COOH**

pH – measured

K_a – ?**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:

$$3. \quad K_a = \frac{[\text{H}_3\text{O}^+][\text{CH}_3\text{COO}^-]}{[\text{CH}_3\text{COOH}]} = \frac{x^2}{(1.4 - x)}$$

Solution: 20 ml of 1.4 M NaCH₃COO + 10 ml of 1.4 M CH₃COOH

pH – measured

K_a – ?**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*)

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

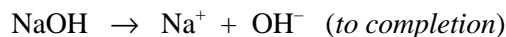
Part 4. Buffering Capacity**Solution: 30 ml of DI H₂O + 2 ml of 3.0 M HCl**

pH – measured

pH (calculated) – ?

Calculations: 1. Determine $[\text{HCl}]$ in a new volume of 32 ml (*dilution problem*)2. $[\text{H}^+] = [\text{HCl}]$ 3. $\text{pH}_{\text{calc}} = -\log [\text{H}^+]$

Solution: 30 ml of DI H₂O + 2 ml of 3.0 M NaOH



pH – measured

pH (calculated) – ?

Calculations: Use the same approach as shown above for the (H₂O + 3.0 M HCl) solution.

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

Solution: 30 ml of 1.4 M NaCH₃COO + 30 ml of 1.4 M CH₃COOH = 60 ml of the buffer

pH – measured

pH (calculated) – ?

Calculations: 1. Determine $[\text{CH}_3\text{COO}^-]$ in a new volume of 60 ml (*dilution problem*)

2. Determine $[\text{CH}_3\text{COOH}]$ 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) + 2 ml of 3.0 M HCl

pH – measured

pH (calculated) – ?

Calculations: 1. Determine the number of moles of CH₃COOH in solution: *a*

2. Determine the number of moles of CH₃COO⁻ in solution: *b*

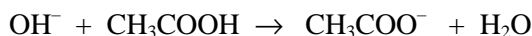
3. Determine the number of moles of HCl added: *x*



<i>x</i>	<i>b</i>	<i>a</i>	<i>initial</i>
<i>-x</i>	<i>-x</i>	<i>x</i>	<i>change</i>
<i>0</i>	<i>(b - x)</i>	<i>(a + x)</i>	<i>equilibrium</i>

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

Solution: 30 ml of the buffer (prepared previously) + 2 ml of 3.0 M NaOH



Calculations: Use the same approach as shown above for the (buffer + 3.0 M HCl) solution.