

1. What is the pH of a solution containing 0.75 M lactic acid and 0.25 M sodium lactate?

$$pH = -\log 1.38 \times 10^{-4} + \log \frac{.25}{.75}$$

$$pH = 3.38$$

2. What is the pH of a solution containing 0.25 M ammonia and 0.40 M ammonium chloride?

$$pH = -\log 5.6 \times 10^{-10} + \log \frac{.25}{.40}$$

$$pH = 9.05$$

3. What is the ratio of sodium benzoate to benzoic acid that will produce a pH of 4.30?

$$4.30 = -\log 6.4 \times 10^{-5} + \log R$$

$$R = 1.28$$

$$\frac{1.28}{1} \quad \begin{array}{l} \text{NaC}_7\text{H}_5\text{O}_2 \\ \text{HC}_7\text{H}_5\text{O}_2 \end{array}$$

4. What is the pH of 70 grams of ammonium chloride and 600 ml of 14.5 M ammonia that has been diluted to 1.0 L? (molar mass of ammonium chloride 53.49 g/mol)

$$\frac{70 \text{ g}}{53.49 \text{ g}} \times \frac{1 \text{ mol}}{1} = 1.31 \text{ mol NH}_4\text{Cl} / 1 \text{ L} = 1.31 \text{ M}$$

$$\frac{14.5 \text{ M}}{1 \text{ L}} \times .60 \text{ L} = 8.7 \text{ mol NH}_3 / 1 \text{ L} = 8.7 \text{ M}$$

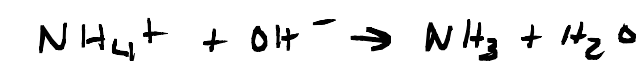
$$pH = -\log 5.6 \times 10^{-10} + \log \frac{8.7}{1.3}$$

$$pH = 10.08$$

5. How does the pH of 400 mL of 0.20 M ammonia and 0.30 M ammonium chloride change when 100 mL of 0.05 M NaOH is added to the solution?

$$\frac{.2 \text{ M}}{\text{L}} \times .4 \text{ L} = 0.08 \text{ mol } \text{NH}_3, \quad \frac{.3}{.4} = .12 \text{ mol } \text{NH}_4^+$$

$$\frac{.05}{.1} = .005 \text{ mol } \text{NaOH}$$



$$\begin{array}{r} .12 \\ - .005 \\ \hline .115 \end{array} \quad \begin{array}{r} .08 \\ - .005 \\ \hline .075 \end{array} \quad \begin{array}{r} .12 \\ + .005 \\ \hline .125 \end{array}$$

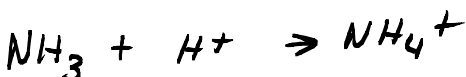
$$\text{pH} = -\log 5.6 \times 10^{-10} + \log \frac{.085}{.115}$$

$$\text{pH} = 9.12$$

6. How does the pH of 400 mL of 0.20 M ammonia and 0.30 M ammonium chloride change when 100 mL of 0.05 M HCl is added to the solution?

$$\frac{.2 \text{ M}}{\text{L}} \times .4 \text{ L} = 0.08 \text{ mol } \text{NH}_3, \quad \frac{.3}{.4} = .12 \text{ mol } \text{NH}_4^+$$

$$\frac{.05}{.1} = .005 \text{ mol } \text{HCl}$$



$$\begin{array}{r} .08 \\ - .005 \\ \hline .075 \end{array} \quad \begin{array}{r} .08 \\ - .005 \\ \hline .075 \end{array} \quad \begin{array}{r} .12 \\ + .005 \\ \hline .125 \end{array}$$

$$\text{pH} = -\log 5.6 \times 10^{-10} + \log \frac{.075}{.125}$$

$$\text{pH} = 9.03$$

7. What is the ratio of acetate ion to acetic acid in a 0.2 M acetic acid /sodium acetate buffer that has a pH of 4.6?

$$4.6 = -\log 1.8 \times 10^{-5} + \log R$$

$$R = \frac{.717}{1}$$

$$\frac{.1434}{.2}$$

8. What is the pH of an acetic acid buffer that has an acetate ion to acetic acid ratio of 0.1?

$$-\log 1.8 \times 10^{-5} + \log .1$$

$$\text{pH} = 3.74$$

9. What is the pH of an acetic acid buffer that has an acetate ion to acetic acid ratio of 0.01?

$$pH = -\log 1.8 \times 10^{-5} + \log .01$$

$$2.74$$

10. What is the pH of a buffer that contains 0.39 M acetic acid and 0.78 M sodium acetate?

$$pH = -\log 1.8 \times 10^{-5} + \log \frac{.78}{.39}$$

$$pH = 5.05$$

11. Using table A5-1, (Page A22) which acid would you choose to create a buffer solution at a pH of 9.2?

$$10^{-9.2} = 6.3 \times 10^{-10}$$

Hydrocyanic

$$K_a \ 6.2 \times 10^{-10}$$

$$9.2 = -\log 6.2 \times 10^{-10} + \log R$$

$$R = .98$$

12. Using table A5-1, (Page A22) which acid would you choose to create a buffer solution at a pH of 3.5?

$$10^{-3.5} = 3.16 \times 10^{-4}$$

Nitrous

$$K_a \ 4 \times 10^{-4}$$

$$3.5 = -\log 4 \times 10^{-4} + \log R \quad R = 1.26$$