

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?

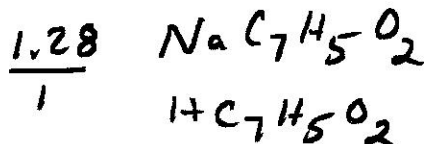
$$pH = -\log 5.6 \times 10^{-10} + \log \frac{.25}{.40}$$

$$pH = 9.05$$

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

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

$$R = 1.28$$



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)

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

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

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

$$pH = 10.08$$

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?

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

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

$$\text{NH}_4^+ + \text{OH}^- \rightarrow \text{NH}_3 + \text{H}_2\text{O}$$

.12	.005	.08
- .005	- .005	+ .005
.115		.085

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

$$\text{pH} = 9.12$$

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?

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

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

$$\text{NH}_3 + \text{H}^+ \rightarrow \text{NH}_4^+$$

.08	.005	.12
- .005	- .005	+ .005
.075		.125

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

$$\text{pH} = 9.03$$

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?

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

$$R = \frac{.717}{1} \quad \frac{.1434}{.2}$$

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?

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

$$2.74$$

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

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

$$\text{pH} = 5.05$$

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

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

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