

1. What is the pH of a buffer solution made by mixing 100.0 mL of 1.0 M sodium acetate and 100.0 mL of 1.0 M acetic acid?

base
 $\text{C}_2\text{H}_3\text{O}_2^-$

$\text{HC}_2\text{H}_3\text{O}_2$

100 mL $\text{C}_2\text{H}_3\text{O}_2^-$ 100 mL $\text{HC}_2\text{H}_3\text{O}_2$

$\text{pH} = \text{pK}_a + \log\left(\frac{[\text{base}]}{[\text{acid}]}\right)$

$\text{pH} = 4.74 + \log\left(\frac{0.5}{0.5}\right)$

$V_{\text{final}} = 200 \text{ mL or } 0.2 \text{ L}$

$\text{pH} = 4.74$

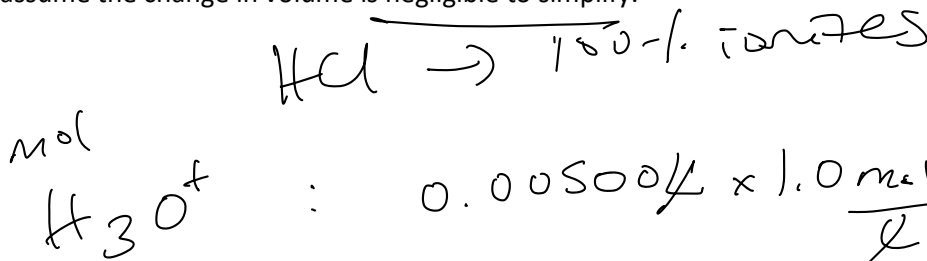
$[\text{base}] = \frac{0.100 \text{ mol}}{0.2 \text{ L}} = 0.50 \text{ M}$

$\text{HC}_2\text{H}_3\text{O}_2$

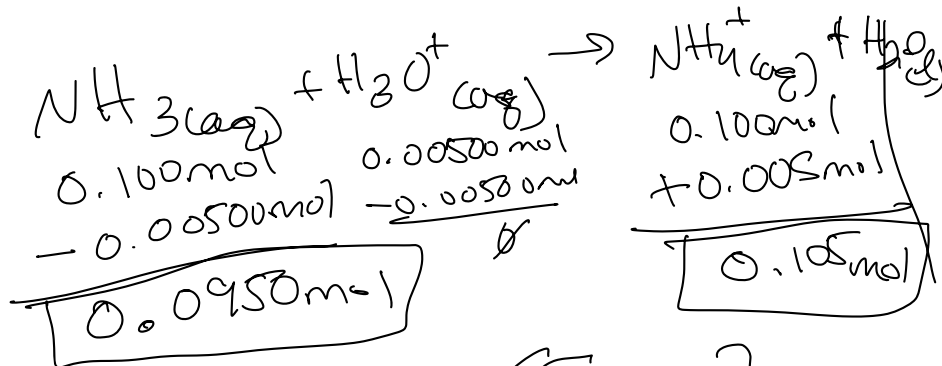
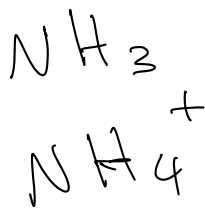
$0.100 \text{ L} \times \frac{1.0 \text{ mol}}{\text{L}} = 0.100 \text{ mol}$

$\frac{0.100 \text{ mol}}{0.2 \text{ L}} = 0.50 \text{ M}$

2. Calculate the pH when 5.00 mL of 1.0 M HCl is added to 1.0 L of buffer solution with an ammonia concentration of 0.100 M and ammonium chloride concentration of 0.100 M. You can assume the change in volume is negligible to simplify.



buffer



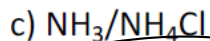
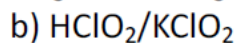
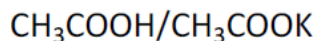
$\text{pH} = \text{pK}_a + \log\left(\frac{[\text{base}]}{[\text{acid}]}\right)$

$\text{pH} = 9.25 + \log\left(\frac{0.0950}{0.105}\right)$

$\text{pH} = 9.25 - 0.04$

$$pH = 9.21$$

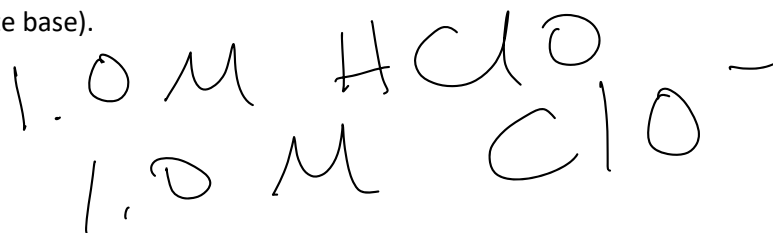
3. Pick the best choice to make a buffer solution with a pH of 7.20. You will need to look up K_a or K_b values.



$pK_a \sim 7.5$

4. Using your choice from QUESTION 3, calculate the volume of acid and base needed to prepare 1.0 L of a 0.100 M buffer solution with a pH of 7.2. You have available 1.0 M stock solutions of the acid and base in the lab. (For example, 1.0 M HA (generic weak acid) and 1.0 M NaA (sodium salt of the conjugate base).)

"x" acid
 "y" base
 total moles =
 mol acid +
 mol base



1.00 mol = x + y (1st eq.)

2nd eq.
 $pH = pK_a + \log\left(\frac{[base]}{[acid]}\right)$

$7.2 = 7.5 + \log\left(\frac{y}{x}\right)$
 $-0.3 = \log\left(\frac{y}{x}\right)$

$$\frac{y}{x} = 0.50 \quad \xrightarrow{-0.3} \quad \frac{y}{x} = 0.100 - x$$

$$\frac{0.100 - x}{x} = 0.50$$

$$\frac{0.100 - x}{x} = \frac{0.50x}{x}$$

$$0.100 = 1.5x$$

$$x = 0.067 \text{ mol acid}$$

$$y = 0.100 - 0.067 =$$

$$0.033 \text{ mol base}$$

67.0 mL of 1.0 M acid +
33.0 mL of 1.0 M base salt