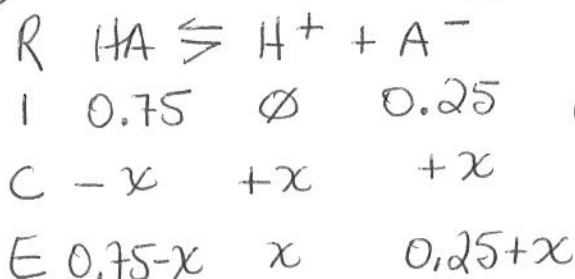


### Buffer Problems

1. Lactic acid is found in milk and human muscle tissue. HA

Calculate the pH of a solution containing 0.75 M lactic acid,  $\text{HC}_3\text{H}_5\text{O}_3$  ( $K_a$  of  $1.4 \times 10^{-4}$ ) and 0.25 M sodium lactate. (pH 3.38)

④



①  $\text{HA} \rightleftharpoons \text{H}^+ + \text{A}^-$     ②  $K_A = \frac{[\text{H}^+][\text{A}^-]}{[\text{HA}]}$

$[\text{H}^+] = 4.2 \times 10^{-4} \text{ M}$

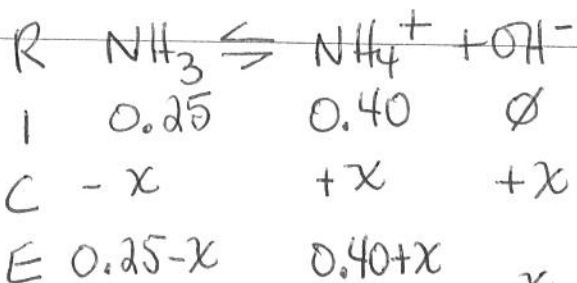
⑥ pH 3.38

③  $[\text{H}^+] = K_A \frac{[\text{HA}]}{[\text{A}^-]}$

⑤  $(1.4 \times 10^{-4}) \left( \frac{0.75}{0.25} \right)$

2. A buffered solution contains 0.25 M  $\text{NH}_3$  ( $K_b = 1.8 \times 10^{-5}$ ) and 0.40 M  $\text{NH}_4\text{Cl}$ .

Calculate the pH of this solution. (pH 9.05)



$\therefore [\text{H}^+] = 8.89 \times 10^{-10} \text{ M}$

pH 9.05

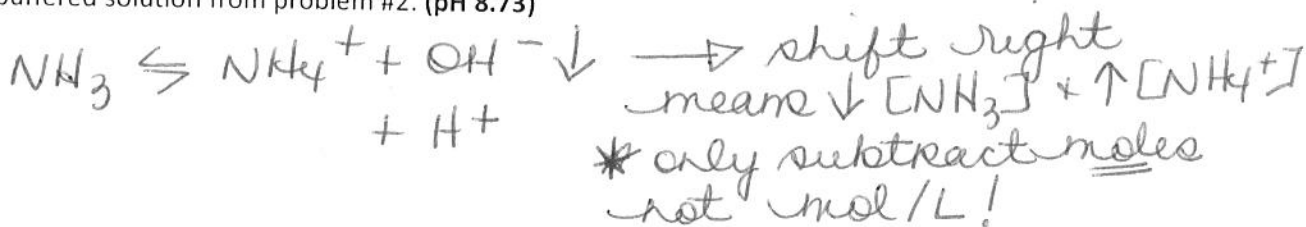
$K_B = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_3]}$

$[\text{OH}^-] = K_B \frac{[\text{NH}_3]}{[\text{NH}_4^]}$

$= (1.8 \times 10^{-5}) \left( \frac{0.25}{0.40} \right)$

$[\text{OH}^-] = 1.125 \times 10^{-5} \text{ M}$

3. Calculate the pH of the solution that results when 0.10 mol gaseous HCl is added to 1.0 L of the buffered solution from problem #2. (pH 8.73)



$[\text{OH}^-] = K_B \frac{[\text{new NH}_3]}{[\text{new NH}_4^+]} = (1.8 \times 10^{-5}) \left( \frac{0.25 \text{ mol} - 0.10 \text{ mol}}{0.40 \text{ mol} + 0.10 \text{ mol}} \right)$

$= 5.4 \times 10^{-6} \frac{\text{mol}}{\text{L}} \text{ OH}^-$

$\therefore \text{H}^+ = 1.85 \text{ mol/L}$

pH 8.73