FLINN SCIENTIFIC

Name_____

Data Tables

Part A. pH of Acetic Acid–Sodium Acetate Buffer

mL of 0.2 M HCl added	pH		mL of 0.2 M NaOH added	pH	
	Actual	Calc.		Actual	Calc.
0			0		
1.0			1.0		
2.0			2.0		
3.0			3.0		
4.0			4.0		
5.0			5.0		
6.0			6.0		
7.0			7.0		
8.0			8.0		
9.0			9.0		
10.0			10.0		

Part B. pH of Ammonia–Ammonium Chloride Buffer

mL of 0.2 M HCl added	pH		mL of 0.2 M NaOH added	pH	
	Actual	Calc.		Actual	Calc.
0			0		
1.0			1.0		
2.0			2.0		
3.0			3.0		
4.0			4.0		
5.0			5.0		
6.0			6.0		
7.0			7.0		
8.0			8.0		
9.0			9.0		
10.0			10.0		

Part C.

mL of 0.1 M CH_3COOH _____ mL pH _____ (calc.)

mL of 0.1 M $NaCH_3COO$ _____ mL pH _____ (actual)

Calculations

1. Using Equation 4 on page 1, calculate the pH of the Part A acetic acid–sodium acetate buffer solution before and after 1.0 mL of 0.2 *M* HCl solution is added to the buffer. K_a of acetic acid equals 1.8×10^{-5}. Enter these in the Part A Data Table.
2. Repeat the pH calculation for each successive 1.0 mL increment of 0.2 *M* HCl added to the buffer. Enter these values in the Part A Data Table.
3. When strong base is added to a buffer of a weak acid–conjugate base, the acid reacts with the base to form water and its conjugate base.

   $HA(aq) + OH^-(aq) \rightarrow H_2O(l) + A^-(aq)$

   Calculate the pH of the Part A acetic acid–sodium acetate buffer solution after 1.0 mL of the 0.2 *M* NaOH solution is added to the buffer. Enter this value in the Part A Data Table.
4. Repeat the pH calculation for each successive 1.0 mL increment of 0.2 *M* NaOH added to the buffer. Enter these values in the Part A Data Table.
5. The ammonia–ammonium chloride buffer solution is a weak base–conjugate acid buffer solution. K_b for $NH_3 = 1.8 \times 10^{-5}$. Using Equation 4 on page 1 and the relationship, pH = 14.0 – pOH, calculate the pH of the ammonia–ammonium chloride buffer solution after 1.0 mL of 0.2 *M* HCl is added to the buffer solution. The initial moles of both NH_3 and NH_4Cl in 50 mL of the buffer solution are 0.0025 moles. Record the pH value in the Part B Data Table.

   $$NH_3(aq) + H_3O^+(aq) \rightarrow NH_4^+(aq) + H_2O(l).$$

6. Repeat the pH calculation for each successive 1.0 mL increment of 0.2 *M* HCl added to the buffer. Enter these values in the Part B Data Table.
7. Repeat the pH calculations for each 1.0 mL increment of 0.2 *M* NaOH added to the ammonia–ammonium chloride buffer solution. Enter these values in the Part B Data Table.

Post-Laboratory Review Questions

1. Calculate the pH change when 1 mL 0.2 M HCl is added to 50 mL of deionized water. How does this pH value change compare to those obtained when 1 mL of 0.2 M HCl is added to the buffers?

2. At what point did each of the buffers lose their effectiveness? Explain.