

## Data Tables

### Part 1. 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 2. pH of Ammonia–Ammonium Chloride Buffer

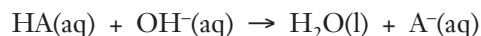
mL of 0.2 M HCl added	pH		mL of 0.2 M NaOH added	pH	
	actual	calc.		actual	calc.
0			0		
1.0			1.0		
2.0			2.0		
3.0			3.0		
4.0			4.0		
5.0			5.0		
6.0			6.0		
7.0			7.0		
8.0			8.0		
9.0			9.0		
10.0			10.0		

### Part 3

mL of 0.1 M CH<sub>3</sub>COOH \_\_\_\_\_ mL pH 5.00 (calc.)  
mL of 0.1 M NaCH<sub>3</sub>COO \_\_\_\_\_ mL pH \_\_\_\_\_ (actual)

### Calculations

- Using Equation 4 on page 2, calculate the pH of the Part 1 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  $1.8 \times 10^{-5}$ . Enter these values in the Part 1 Data Table.
- 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 1 Data Table.
- 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.



Calculate the pH of the Part 1 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 1 Data Table.

- 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 1 Data Table.
- The ammonia–ammonium chloride buffer solution is a weak base–conjugate acid buffer solution.  $K_b$  for NH<sub>3</sub> equals  $1.8 \times 10^{-5}$ . Using Equation 4 on page 2 and the relationship;

$$\text{pH} = 14.0 - \text{pOH}$$

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<sub>3</sub> and NH<sub>4</sub>Cl in 50 mL of the buffer solution are 0.0025 moles. Record the pH value in the Part 2 Data Table. [NH<sub>3</sub>(aq) + H<sub>3</sub>O<sup>+</sup>(aq) → NH<sub>4</sub><sup>+</sup>(aq) + H<sub>2</sub>O(l).]

- 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 2 Data Table.
- 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 2 Data Table.

### Post-Lab Questions

- Calculate the pH change when 1 mL of 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?
- At what point did each of the buffers lose their effectiveness? Explain.