Date _____ Name _____

Section _____ Team _____

Instructor _____ _____

Pre-Lab Study Questions

1. How is the pH of a solution related to the $[H_3O^+]$?

2. Using the equation for K_w, explain how $[OH^-]$ changes when more H_3O^+ is added.

3. Is a solution with a pH of 12.0 acidic or basic?

4. Is a solution with a pH of 2.0 acidic or basic?

5. What is a buffer?

6. If you add acid or base to water, how will the pH change?

7. If you add acid or base to a buffer, how will the pH change?

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REPORT SHEET

Acids, Bases, pH, and Buffers

A. Reference Colors for pH Using Red Cabbage Indicator

pH	Colors of Acidic Solutions
1	red
2	light red
3	light purple
4	purple
5	light purple
6	purple

pH	Colors of Basic Solutions
8	Light blue
9	dark blue
10	Darker blue
11	dark green
12	light green
13	yellow

pH	Color of Neutral Solution
7	violet / Blue

B. Measuring pH

Substance	1. Color with Indicator	2. pH Using Indicator	3. pH Using pH Meter	4. Acidic, Basic, or Neutral?
Household cleaners				
vinegar	light red	2	2	
ammonia	light blue	8	8	
Drinks, juices				
lemon juice	light purple	3	3	
apple juice	light purple	3	3	
Detergents, shampoos				
shampoo	light purple	5		
detergent	light blue	8		
hair conditioner	"	8		
Health aids				
mouthwash	violet / blue	7		
antacid	light blue	8		
aspirin	purple	4		

Other items				

Questions and Problems

Q1 Complete the following table:

$[H_3O^+]$	$[OH^-]$	pH	Acidic, Basic, or Neutral?
2.0×10^{-6}	5×10^{-9}	5.70	
6.6×10^{-10}	6.3×10^{-5}	9.8	
2.9×10^{-12}	3.5×10^{-3}	11.5	
10^{-7}	10^{-7}	7	Neutral

Q2 A solution has a $[OH^-]=4.0\times10^{-5}$ M. What are the $[H_3O^+]$ and the pH of the solution?

$H^+ = \frac{10^{-14}}{4\times10^{-5}} = 2.5\times10^{-10}$

$pH = 9.60$

Q3 A sample of 0.0084 mol of HCl is dissolved in water to make a 1500-mL solution. Calculate the molarity of the HCl solution, the $[H_3O^+]$, and the pH. For a strong acid such as HCl, the $[H_3O^+]$ is the same as the molarity of the HCl solution.

$$HCl(aq) + H_2O(l) \longrightarrow H_3O^+(aq) + Cl^-(aq)$$

$\frac{0.0084}{1500} \times 1000 = 5.6\times10^{-3}$ M.

$pH = 2.25$

C. Effect of Buffers on pH

C.1 Effect of adding acid

Solution	1. Initial pH	2. pH after 5 drops of HCl	3. pH after 10 drops of HCl	4. pH change	5. Buffer yes or no?
H_2O	6,5	1,3	1.1	5,4	NO
0.1 M NaCl	6,2	1,4	1,1	5,1	NO
High pH buffer	10	9,6	9,4	0,6	B
Low pH buffer	4	3,8	3,7	0,3	B

C.2 Effect of adding base

Solution	1. Initial pH	2. pH after 5 drops of NaOH	3. pH after 10 drops of NaOH	4. pH change	5. Buffer yes or no?
H_2O	6,5	12,7	13	6.4	NO
0.1 M NaCl	6,2	12,6	13	6,8	NO
High pH buffer	10	10,2	10,3	0,3	B
Low pH buffer	4	4,3	4,4	0,4	B

Questions and Problems

Q4 Which solution(s) showed the greatest change in pH? Why?

Q5 Which solutions(s) showed little or no change in pH? Why?

Q6 Normally, the pH of the human body is fixed in a very narrow range between 7.35 and 7.45. A patient with an acidotic blood pH of 7.3 may be treated with an alkali such as sodium hydrogen carbonate. Why would this treatment raise the pH of the blood?