CH 223
Sample Quiz #3 Name: _____ Lab Section: _____

Be sure to show all work, use the correct number of significant figures, circle final answers and use correct units in all problems.

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1. Amphoteric species as acids and bases (4 points)

   a) Write the chemical equation which corresponds to the $\mathbf{K_a}$ value for $\mathbf{HCO_3^{1-}}$ showing all reactants and products.

   b) Write the chemical equation which corresponds to the $\mathbf{K_b}$ value for $\mathbf{HCO_3^{1-}}$ showing all reactants and products.

2. Complete and balance the following acid-base reactions. Identify the acid, base, conjugate acid and conjugate base in each reaction. Predict whether the equilibrium lies predominantly to the left or the right. (4 points)

   a. $HBr + NH_3 \rightarrow$

   b. $HOCl + H_2O \rightarrow$

3. What is the pH of a 0.116 M $Mg(OH)_2$ solution? Assume $Mg(OH)_2$ is a strong base. (3 points)

4. My soft drink has a pH of 6.22. Is the soft drink acidic, alkaline or neutral? Calculate the hydronium and hydroxide ion concentration in the soft drink. (3 points)

5. Benzoic acid, C_6H_5COOH, is a weak acid ($K_a = 6.28*10^{-5}$). If I dissolve 1.22 g of C_6H_5COOH in enough water to make 500. mL of solution, what is the resulting pH of the solution? (4 points)

6. If one wished to make a buffer using HF without adding strong acids or bases, what else would have to be added to make the buffer? What would be the formula of the chemical species added if it were joined to lithium? (2 points)

CH 223
Sample Quiz #3 Name: _____ Lab Section: _____
Answers
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1. Amphoteric species as acids and bases (4 points)

   a) Write the chemical equation which corresponds to the $\mathbf{K_a}$ value for $\mathbf{HCO_3^{1-}}$ showing all reactants and products.

   $\mathbf{HCO_3^{1-}} + H_2O \rightleftharpoons \mathbf{CO_3^{2-}} + \mathbf{H_3O^+}$

   b) Write the chemical equation which corresponds to the $\mathbf{K_b}$ value for $\mathbf{HCO_3^{1-}}$ showing all reactants and products.

   $\mathbf{HCO_3^{1-}} + H_2O \rightleftharpoons \mathbf{H_2CO_3} + OH^{1-}$

2. Complete and balance the following acid-base reactions. Identify the acid, base, conjugate acid and conjugate base in each reaction. Predict whether the equilibrium lies predominantly to the left or the right. (4 points)

   a. $HBr + NH_3 \rightarrow \mathbf{NH_4^+} + \mathbf{Br^{-1}}$ **RIGHT (SA)**
   SA WB CA CB

   b. $HOCl + H_2O \rightarrow \mathbf{OCl^{-1}} + \mathbf{H_3O^{+1}}$ **LEFT (WA)**
   WA WB CB CA

3. What is the pH of a 0.116 M $Mg(OH)_2$ solution? Assume $Mg(OH)_2$ is a strong base. (3 points)

   pH = 13.365 *13.365487*

4. My soft drink has a pH of 6.22. Is the soft drink acidic, alkaline or neutral? Calculate the hydronium and hydroxide ion concentration in the soft drink. (3 points)

   Acidic!
   $[H_3O^+] = 6.0 \times 10^{-7}$ M
   $[OH^{-1}] = 1.7 \times 10^{-8}$ M

5. Benzoic acid, C_6H_5COOH, is a weak acid ($K_a = 6.28*10^{-5}$). If I dissolve 1.22 g of C_6H_5COOH in enough water to make 500. mL of solution, what is the resulting pH of the solution? (4 points)

   pH = 2.951

6. If one wished to make a buffer using HF without adding strong acids or bases, what else would have to be added to make the buffer? What would be the formula of the chemical species added if it were joined to lithium? (2 points)

   LiF