Chapter 14 Review
Acids and Bases

1. What would the [OH⁻] be for a 0.0545 M solution of hydrofluoric acid?

2. What would be the pH for a 0.0333 M solution of lithium hydroxide?

3. What would be the [H⁺] for a 0.0745 M solution of calcium hydroxide?

4. Calculate the pH of the following solutions.
   a. 0.1825 g HCl dissolved in 200 cm³ of distilled water.

   b. 0.98 g of H₂SO₄ dissolved in 500 cm³ of distilled water. (Assume the acid acts as a dibasic acid by completely dissociating).

5. Methanoic acid, HCOOH, is a weak acid with a \( K_a = 1.6 \times 10^{-4} \). Calculate the pH of a 0.2 M solution of methanoic acid.

6. Determine the percent dissociation of a 2.25 M weak base solution with a pH = 11.8.

7. What is the pH of a 0.18 M solution of NH₄Cl? (\( K_b \) of NH₃ = 1.8 \( \times 10^{-5} \))
8. Sodium Benzoate, $C_6H_5COONa$, is a salt of the weak acid, benzoic acid $C_6H_5COOH$. A 0.10 M solution of sodium benzoate has a pH of 8.60.
   a. Calculate the $[OH^-]$ in the sodium benzoate solution described above.

   \[
   \text{pH} = 5.40 \\
   [OH^-] = 3.98 \times 10^{-6} \text{ M}
   \]

   b. Calculate the value of the equilibrium constant for the rxn:

   \[
   C_6H_5COO^- + H_2O \rightleftharpoons C_6H_5COOH + OH^- \\
   \]

   \[
   K_b = \frac{(3.98 \times 10^{-6})^2}{9.7 \times 10^{-2}} \\
   [K_b = 1.6 \times 10^{-10}]
   \]

   c. Calculate the acid dissociation constant, $K_a$, for benzoic acid.

   \[
   K_a = \frac{[H_2O] [OH^-]}{[C_6H_5COOH]} \\
   [K_a = 6.25 \times 10^{-5}]
   \]

   d. Identify the acid, the base, the conjugate acid, and the base in the equation above.

   \[
   C_6H_5COO^- \quad \text{Base} \\
   C_6H_5COOH \quad \text{C.A.} \\
   H_2O \quad \text{Acid} \\
   OH^- \quad \text{C.B.}
   \]

9. Determine if the following salts are acidic, basic, or neutral:
   a. NaF \textbf{Basic} \\
   b. NH$_4$Cl \textbf{Acidic} \\
   c. LiBr \textbf{Neutral} \\
   d. KCN \textbf{Basic} \\
   e. CH$_3$NH$_3$Cl \textbf{Acidic} \\
   f. NaF \textbf{Basic}

10. Discuss the three different definitions of acids and bases (Arrhenius, Bronsted-Lowery, and Lewis).

11. Put the following in order of increasing acid strength:
   a. HClO$_3$, HIO$_3$, HBrO$_3$
   b. HAsO$_4^{2-}$, H$_3$AsO$_4$, H$_2$AsO$_4^-$

12. Put the following in order of increasing base strength:
   a. SeO$_4^{2-}$, H$_2$SeO$_4$, HSeO$_4^-$
   b. IO$^-$, I$_2$O$_7^-$, IO$_5^-$