1. A 4.2 M solution of a weak acid is 6.2% dissociated. Calculate the $K_a$ for the acid and $K_b$ for the conjugate base.

2. The hydrogen phthalate ion, $C_8H_5O_4^-$, is a weak acid with $K_a = 2.0 \times 10^{-7}$. If you have a 125 mL solution with 1.28 g of the hydrogen phthalate ion in water what is the pH of that solution?

3. The pH of a solution of Ba(OH)$_2$, is 10.66 at 25°C. What are the $[\text{OH}^-]$ and $[\text{H}_3\text{O}^+]$ for the solution? If you have a total volume of 122.57 mL how many grams of barium hydroxide do you have?
4. The active ingredient in aspirin is acetylsalicylic acid, $\text{HC}_9\text{H}_7\text{O}_4$, a monoprotic acid with $K_a = 3.3 \times 10^{-4}$ at 25 °C. What are the pH, pOH, $K_b$, $[\text{H}_3\text{O}^+]$, and $[\text{OH}^-]$ of a solution obtained by dissolving two aspirin tablets, each containing 500 mg of acetylsalicylic acid, in 2.50 mL of water?

5. Ephedrine, a central nervous system stimulant, is used in nasal sprays as a decongestant. This compound is a weak organic base with $K_b = 1.4 \times 10^{-4}$. What is the pH of a 5.41 M solution of ephedrine? What are the $[\text{OH}^-]$, $[\text{H}_3\text{O}^+]$, $K_b$, pOH, and $K_w$ for this reaction at 25 °C?

6. A chemist dissolves 5.00 g of an unknown monoprotic acid into 250 mL of water. She determines the pH to be 2.50 and finds on the bottle a $K_b = 1.14 \times 10^{-9}$. Determine the molar mass of the acid.
7. Consider the titration of 1.50 g of nitric acid in 52.3 mL of water with 2.3 g of calcium hydroxide in 145.6 mL of water. Calculate the pH after 0.00 mL, 25.0 mL, 50.0 mL, and 200 mL of base have been added. How much base is required to react exactly with all the acid?
8. The autoionization of water is an endothermic process. What is the pH of pure water at 25 °C? Does the value for the pH of pure water increase, decrease, or remain the same as a sample of water is cooled from 25 °C to 10 °C. Is the water acidic, basic, or neutral at 10 °C. What happens to the value of $K_w$ as the temperature of water increases?