1. a. Hydrochloric acid, HCl*(aq)*, breaks up into ions (a cation and an anion) in a water solution. Write a chemical equation that represents this process.

   b. Nitric acid, HNO$_3$*(aq)*, also breaks up into ions (a cation and an anion) in a water solution. Write a chemical equation that represents this process.

   c. Write a definition describing what happens to acids when they interact with water.

2. a. Sodium hydroxide, NaOH, breaks up into ions (a cation and an anion) in water solution. Write a chemical equation that represents this process.

   b. Potassium hydroxide, KOH, also breaks up into ions (a cation and an anion) in water solution. Write a chemical equation that represents this process.

   c. NaOH and KOH are classified as bases. Write a definition describing what happens to bases when they interact with water.

3. Defining acids and bases in terms of the characteristic ions that are released in water solution is the Arrhenius Theory of acids and bases. In the space below, list some examples of Arrhenius acids and Arrhenius bases.

Arrhenius Acids	Arrhenius Bases

4. a. Draw the Lewis structure for water, H_2O.

b. Describe how water might break up into ions. Write a chemical equation for this process. How is water related to Arrhenius acids and bases?

c. Unlike HCl, only a small fraction of water molecules break up into ions. The equilibrium constant for water dissociating into ions is 1.0×10^{-14}. Write an equilibrium expression for the dissociation of water. What would be the concentration of each of the ions in a pure sample of water?

5. a. pH is a measure of the [H$^+$]. The pH of pure water $= 7$. Write an equation that relates pH to [H$^+$] by comparing 7 with the [H$^+$] of pure water.

    b. Use Le Châtelier's Principle to predict what would happen to the [H$^+$] and [OH$^-$] of a water sample if you added HCl to it. What would happen to the value of the pH?

    c. Use Le Châtelier's Principle to predict what would happen to the [H$^+$] and [OH$^-$] of a water sample if you added NaOH to it. What would happen to the value of the pH?

    d. pOH is a measure of the [OH$^-$]. The pOH of pure water $= 7$. Write an equation that relates pOH to [OH$^-$] by comparing 7 with the [OH$^-$] of pure water.

6. a. The [H$^+$] in a particular aqueous solution is 1.0×10^{-4} M. Calculate the [OH$^-$] for this solution.

    b. The [OH$^-$] in a particular aqueous solution is 1.0×10^{-5} M. Calculate the [H$^+$] of this solution.

    c. The [H$^+$] in a particular aqueous solution is 6.0 M. Calculate the [OH$^-$] of this solution.

7. a.   Calculate the pH and pOH of a solution with a $[H^+] = 3.68 \times 10^{-8}$ M.

    b.   Calculate the $[H^+]$ and $[OH^-]$ of a solution with a pH = 4.22.