CHM 111
Chapter 15 study guide / learning objectives

Chapter 15 deals with acids and bases. This is the first of a series of two chapters in your textbook that discusses acids and bases in the context of chemical equilibrium. You will learn about the equilibrium of weak acids and bases,. about the self-ionization of water and about pH. You will also learn that there is more than one definition of the terms acid and base.

At the end of this chapter, you should be able to:

[Definitions / Terminology]
- Define an acid and a base using the Arrhenius definition.
- Define an acid and a base using the Bronsted-Lowry definition.
- Define an acid and a base using the Lewis definition.
- Define what is meant by a "strong" or "weak" acid or a base.
- Define conjugate acid-base pair, conjugate acid, and conjugate base *[Hint: look in the book under the Bronsted-Lowry definition]*
- Define pH.

[Acid-base definitions]
- Give example chemical reactions that illustrate each of the acid-base definitions: Arrhenius, Bronsted-Lowry, and Lewis.
- Label Arrhenius, Bronsted-Lowry, and Lewis acids/bases in a given chemical reaction.
- Explain the differences between the Arrhenius, Bronsted-Lowry, and Lewis definitions.
- Given the chemical formulas of an acid and a base, write the product of their reaction using any/all of the acid-base definitions.

[Strength of acids and bases]
- Give examples of common strong acids and strong bases.
- Describe the relationship between acid strength and the strength of the bond holding the acidic proton (hydrogen ion) to the acid.

[Water's self-ionization]
- Write the equilibrium reaction and equilibrium constant expression for the self-ionization of water.
- Use the equilibrium constant for the self-ionization of water to calculate concentration of hydrogen/hydronium ion and hydroxide ion in solutions. (Memorize the value of this constant, $K_w = 1.0 \times 10^{-14}$.)
- Explain how the addition of an acid or base affects the water equilibrium.

[The pH scale, and how to find the pH of a strong acid or base solution]

- Convert from $[H^+]$ (or $[H_3O^+]$) to pH.
- Convert from pH to $[H^+]$ (or $[H_3O^+]$).
- Given the pH of a solution, tell whether it is acidic, basic, or neutral.
- Calculate the pH of a strong acid solution of a given concentration. Or, given the pH, calculate the concentration of the strong acid solution.
- Calculate the pH of a strong base solution of a given concentration. Or, given the pH, calculate the concentration of the strong base solution.

[Practice exercises from the textbook]

- 15.29, 15.31, 15.33, 15.35, 15.41, 15.53, 15.55, 15.57, 15.59, 15.61, 15.63, 15.67, 15.71, 15.79