Chapter 15
Acids-Base Equilibria: Proton Transfer in Biological Systems
Learning Objectives

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To satisfy the minimum requirements for this course, you should be able to:

1. Explain the difference between weak and strong acids/bases and:
    ● be able to identify and give the names and formulas of strong acids and bases. (see Chemistry Reference Sheet)
    ● write acid or base ionization reactions, including equations to show how amines act as weak bases and how carboxylic acids act as weak acids in aqueous solution.
    ● rank a series of weak acids or weak bases by acid or base strength given their K_a or K_b values (K_a found in Table A5.1, K_b found in Table A5.3; Appendix 5, pp. APP-25 - APP-27).
    ● Define the meaning of percent ionization of a weak acid or base and how it relates to the magnitude of K.

2. Describe how molecular structure influences the relative tendency of different acids to ionize in water and be able to predict/explain the relative acid strengths of:
    ● binary acids (e.g. HF, HCl, HBr and HI)
    ● oxoacids (HNO_3, H_2SO_4, H_3PO_4, *etc.*)

3. Discuss the general properties of Brønsted acids and bases by:
    ● identifying Brønsted-Lowry acids and bases.
    ● identifying the conjugate base associated with a given Brønsted acid.
    ● identifying the conjugate acid associated with a given Brønsted base.

4. Explain what is meant by the autoionization of water and write the K_w expression for the process.

5. Define pH, pOH, $[H^+]$, and $[OH^-]$ and given the value of one of these, be able to calculate the values of the other three for the same solution.

6. Recognize the relationship between the strength of an acid and that of its conjugate base and be able to use the equation $K_w = K_a K_b$.

7. Generate a RICE table for weak acid or weak base ionization in water and be able to:
    ● calculate the pH for a weak acid solution in water, given the initial acid concentration and K_a.
    ● calculate K_a given the initial acid concentration and pH.
    ● calculate the pH for a weak base solution in water, given the initial base concentration and K_b.
    ● calculate K_b given the initial base concentration and pH.

8. Write stepwise ionization equations and define the corresponding equilibrium-constant expressions for polyprotic acids.

9. Given the formula for a soluble ionic compound (or "salt"), predict whether its aqueous solution will be acidic, basic, or neutral. Given appropriate data, be able to calculate the pH of a salt solution.