1.2: Chemical Kinetics

Chemical kinetics is the study of how fast chemical reactions occur. In Chapter 5, we see that there is a unique way to specify what we mean by “how fast.” We call this specification the ***reaction rate***. Chemical kinetics is the study of the factors that determine the rate of a particular reaction. There are many such factors, among them:

- temperature
- pressure
- concentrations of the reactants and products
- nature and concentrations of “spectator species” like a solvent or dissolved salts
- isotopic substitution
- presence or absence of a catalyst.

We will look briefly at all of these, but the thrust of our development will be to understand how the rate of a reaction depends on the concentrations of the reaction’s reactants and products.

Many reactions that we observe actually occur as a sequence of more simple reactions. Such a sequence of simple reaction steps is called a ***reaction mechanism***. Our principal goal is to understand the relationships among concentrations, reaction rates, reaction mechanisms, and the conditions that must be satisfied when a particular reaction reaches equilibrium. We will find that two related ideas characterize equilibrium from a reaction-rate perspective. One is that concentrations no longer change with time. The other is a fundamental postulate, called ***the principle of microscopic reversibility***, about the relative rates of individual steps in an overall chemical reaction mechanism when the reacting system is at equilibrium.