

Section 13.1

Chemical Equilibria



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Learning Objectives



- Describe the nature of equilibrium systems
- Explain the dynamic nature of a chemical equilibrium

Writing Reversible Reactions



- When you begin studying chemical reactions it's easiest to talk about chemical reactions that proceed completely from the reactants to products.



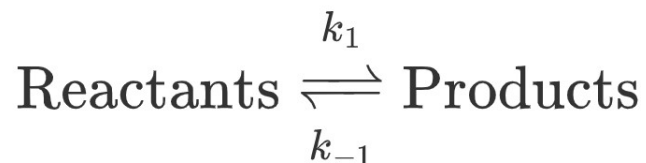
- In actuality, most reactions are **reversible** to some extent. Reactants can be converted to products and products can be converted to reactants.



Reversible Rates



- When a reaction is reversible, there is a forward rate (k_1) and a reverse rate (k_{-1}).

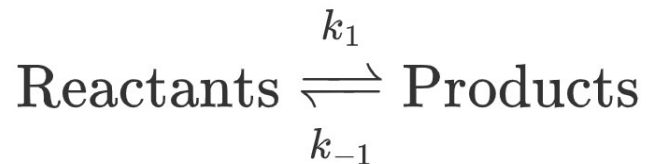


- When forward rate is faster than the reverse rate, $k_1 > k_{-1}$, the reaction will proceed towards the products.
- When the reverse rate is faster than the forward rate, $k_1 < k_{-1}$, the reaction will proceed towards the reactants.

Chemical Equilibrium

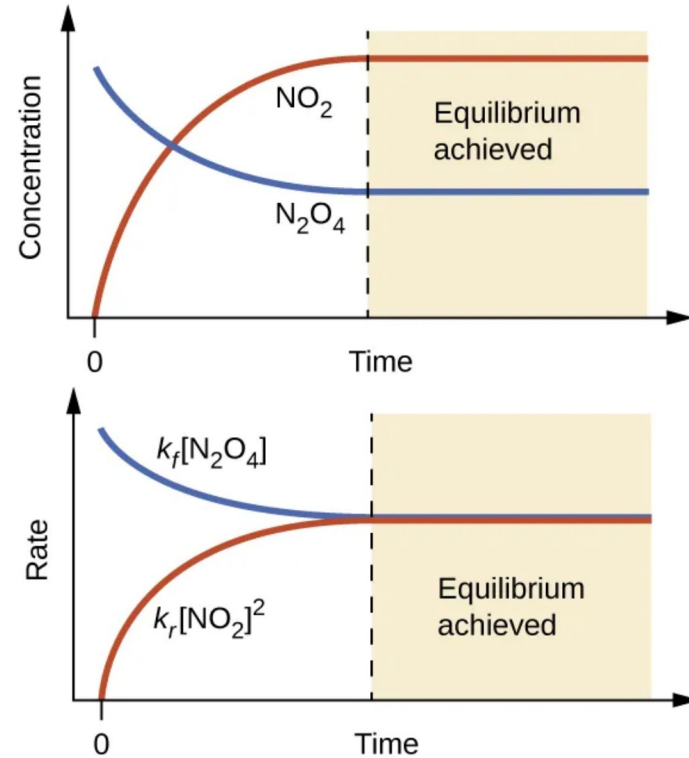
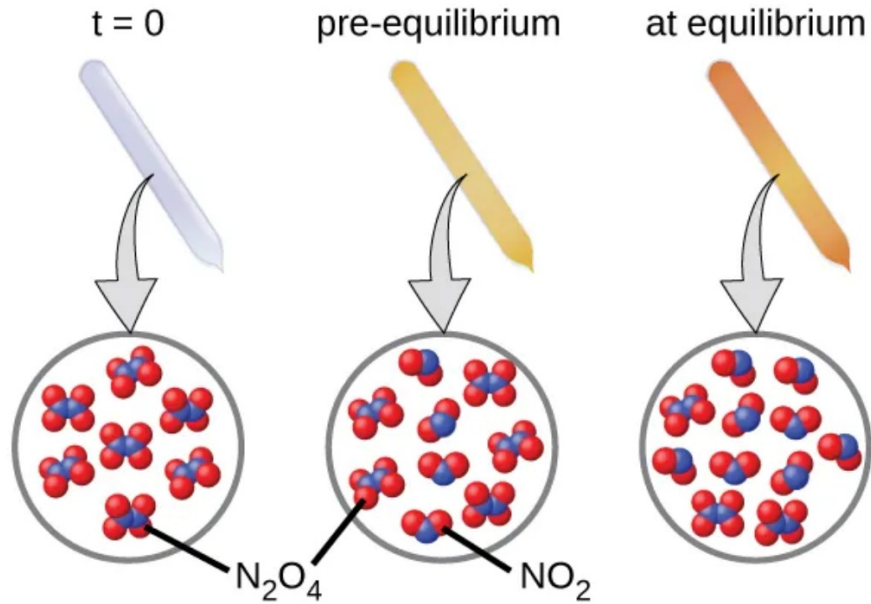
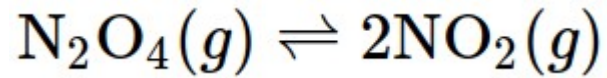


- When the two rates are equal, $k_1 = k_{-1}$, **equilibrium** has been reached. The concentrations of the reactants and products remains constant.



- The relative concentrations of reactants and products in equilibrium systems vary greatly.
 - Some systems contain mostly products at equilibrium
 - Some contain mostly reactants
 - Some contain appreciable amounts of both

Equilibrium Example



Physical Equilibrium



- Physical processes can also reach equilibrium.
 - We saw an example of this with vapor pressure in the previous chapter.

