

Key Concept *Chemical Equilibrium*

When a chemical reaction is reversible, the reaction will eventually reach a state of equilibrium. At equilibrium, the concentrations of the reactants and products are constant, and the reaction is no longer occurring.

At equilibrium, the rate of the forward reaction is equal to the rate of the reverse reaction.

Key Concept *Le Chatelier's Principle*

Le Chatelier's principle states that if a system at equilibrium is subjected to a change in concentration, temperature, or pressure, the system will shift its equilibrium position to counteract the change.

For example, if the concentration of a reactant is increased, the system will shift to the right to produce more products.

Similarly, if the temperature of an exothermic reaction is increased, the system will shift to the left to produce more reactants. If the pressure of a reaction is increased, the system will shift to the side with fewer moles of gas.

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Key Concept *Equilibrium Constant*

The equilibrium constant, K , is a measure of the extent to which a reaction proceeds. It is defined as the ratio of the concentrations of the products to the concentrations of the reactants, each raised to the power of its stoichiometric coefficient.

For a general reaction:

$$aA + bB \rightleftharpoons cC + dD$$

the equilibrium constant is given by:

$$K = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

where $[A]$, $[B]$, $[C]$, and $[D]$ are the concentrations of the reactants and products, respectively.

The equilibrium constant is a constant for a given reaction at a given temperature. It can be used to predict the direction of a reaction and to calculate the concentrations of the reactants and products at equilibrium.

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