

Chemistry: Equilibrium Systems

Equilibrium Systems: General Principles

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Equilibrium systems are systems in which the forward and reverse reactions occur at the same rate, resulting in no net change in the concentrations of the reactants and products. This state is known as dynamic equilibrium. The equilibrium constant, K_c , is a measure of the extent to which a reaction proceeds towards the products. 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, K_c , is given by:

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

where $[A]$, $[B]$, $[C]$, and $[D]$ are the concentrations of the reactants and products, respectively, and a , b , c , and d are their stoichiometric coefficients.

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

The equilibrium constant, K_c , is a constant for a given reaction at a given temperature. It is independent of the initial concentrations of the reactants and products. The value of K_c can be used to predict the direction in which a reaction will proceed to reach equilibrium.

Le Chatelier's Principle states that if a system at equilibrium is subjected to a change in concentration, temperature, or pressure, the system will adjust itself to counteract the change and restore equilibrium.

For example, if the concentration of a reactant is increased, the system will shift in the forward direction to consume the excess reactant and produce more products. Similarly, if the temperature is increased, the system will shift in the endothermic direction to absorb the excess heat.