15: Chemical Equilibrium

OVERVIEW OF THE CHAPTER

15.1, 15.2, 15.3, 15.4, 15.5 The Equilibrium State: K_p and K_c

Review: Gas laws (10.3, 10.4); gas-law constant (10.4); stoichiometric equivalences (3.6); concept of dynamic equilibrium (11.5)

Learning Goals: You should be able to:

1. Write the equilibrium-constant expression for a chemical system at equilibrium, whether heterogeneous or homogeneous, using the law of mass action.
2. Numerically evaluate K_c from a knowledge of the equilibrium concentrations (or pressure) of reactants or products.
3. Interpret the magnitude of K_c and what it tells us about the composition of an equilibrium mixture.
4. Relate the equilibrium constant for a chemical reaction to the equilibrium constant for the reverse reaction.

15.6 Calculating Equilibrium Concentrations

Review: Stoichiometric relationships (3.6)

Learning Goals: You should be able to use the equilibrium constant to calculate equilibrium concentrations.

15.6, 15.7 Reaction Quotient and Le Chatelier's Principal

Review: Enthalpy (5.3, 5.4)

Learning Goals: You should be able to:

1. Calculate the reaction quotient, Q, and by comparison with the value of K_c determine whether a reaction is at equilibrium. If it is not at equilibrium, predict in which direction it will shift to reach equilibrium.
2. State Le Chatelier's principle.
3. Explain how the equilibrium quantities of reactants and products are shifted by changes in temperature, pressure, or their concentrations.
4. Explain how the enthalpy of a reaction determines the change in the value of an equilibrium constant when temperature is changed.
5. Describe the effect of a catalyst on a system at equilibrium.