

CHM 111**Chapter 13 study guide / learning objectives**

Chapter 13 in OpenStax discusses the basics of chemical equilibrium. You will learn what chemical equilibrium is, the factors that control equilibrium, and how to control the direction and extent of a chemical reaction. The material in this chapter is particularly important, as it forms the foundation of most of the rest of the course!

At the end of this chapter, you should be able to:

[Definitions / Terminology]

- Define terms associated with chemical equilibrium: **equilibrium**, **equilibrium constant** (concentration-based), **reaction quotient**, **Le Chateleur's principle**,

[The equilibrium constant]

- Write concentration-based equilibrium constant expressions for given reactions. (We will use concentration-based equilibrium expressions to handle all homogeneous and heterogeneous equilibria.)
- Write concentration-based equilibrium constant expressions for reactions that include pure substances and solvents.
- Decide whether an equilibrium favors products or reactants based on the value of the equilibrium constant.

[The reaction quotient]

- Write an expression for the reaction quotient, Q , for a given reaction.
- Given the concentrations in an equilibrium mixture, calculate the reaction quotient.
- Compare Q and K to determine which direction a reaction must proceed to reach equilibrium.

[Equilibrium calculations]

- Calculate the value of the equilibrium constant for a reaction given the concentration or amounts of reactants and products at equilibrium.
- Calculate the concentration or amount of one reactant or product at equilibrium given concentrations or amounts of the others.
- Determine the amount of products and reactants produced at equilibrium given the initial concentration or amount of reactants.
- Use basic algebra and the quadratic formula to derive and solve equations based on equilibrium expressions.

[Factors that influence equilibrium]

- List and describe the three factors that can influence an equilibrium.
- Describe the effect of a catalyst on an equilibrium mixture.
- Use Le Chateleur's principle to determine which way an equilibrium will shift when a change in reactant or product concentration is made.
- Determine the effect of a temperature change on the equilibrium mixture of an endothermic or exothermic reaction.
- Determine the effect of a pressure change on a gas phase equilibrium.
- Describe the optimum conditions for a given chemical reaction (temperature, pressure, concentrations, etc.).

[Practice exercises from the OpenStax text]

- 1, 3, 5, 9, 13, 15, 17(a,c,e only), 33, 35, 37, 39, 41, 53, 65, 79