

CHAPTER 13 CHEMICAL EQUILIBRIUM

We will spend about five lecture days on this chapter.

- ❖ Day 1. Sections 1 – 4: During the first class meeting we will focus on how kinetics makes a segue into equilibrium. We will learn how to write equilibrium constants two different ways, and learn how to interpret equilibrium constants.
- ❖ Day 2. Section 5: We'll discuss "mass action expressions" that let us understand what needs to happen in order to get to equilibrium. We will do some equilibrium calculations, using equilibrium concentrations to determine equilibrium constants and visa versa. You will become adept at setting up and using "ICE" tables.
- ❖ Day 3. Sections 6 – 8: Next we will spend time with LeChâtelier's principle which addresses what happens when we alter a system at equilibrium.
- ❖ Day 4. Sections 9 – 11: We will learn the role that temperature plays in shifting an equilibrium. Finally, we will end the chapter the way we started: tying kinetics and equilibrium together.

Section 13.1 Describe the equilibrium state in terms of the rate of the forward reaction, the rate of the reverse reaction, and concentrations of reactants and products.

Section 13.2 Given any balanced chemical equation representing a homogenous equilibrium, write the equilibrium equation.

From the equilibrium concentrations of products and reactants, calculate the equilibrium constant K_c .

Judge whether a mixture is at equilibrium by comparing the equilibrium constant expression to the value of the equilibrium constant K_c .

Do problems 1 – 4, 26, 28, and 30.

Section 13.3 Given the equilibrium partial pressures of reactants and products, calculate the equilibrium constant K_p .

From a value of K_c and a balanced equation, calculate K_p . From a value of K_p and a balanced equation, calculate K_c .

Do problems 5, and 6.

Section 13.4 Given any balanced chemical equation representing a heterogeneous equilibrium, write the equilibrium equation.

Do problems 7, and 38 – 58 even.

Section 13.5 From the value of K_c or K_p , determine whether mainly products or mainly reactants exist at equilibrium.

For a given mixture of reactants and products,

determine whether a system is at equilibrium. If it is not, determine the direction in which the reaction must go to achieve equilibrium.

Given K_c and initial concentrations of reactants and/or products, calculate the equilibrium concentrations of reactants and/or products.

Given K_p and initial partial pressures of reactants and/or products, calculate the equilibrium partial pressures of reactants and/or products.

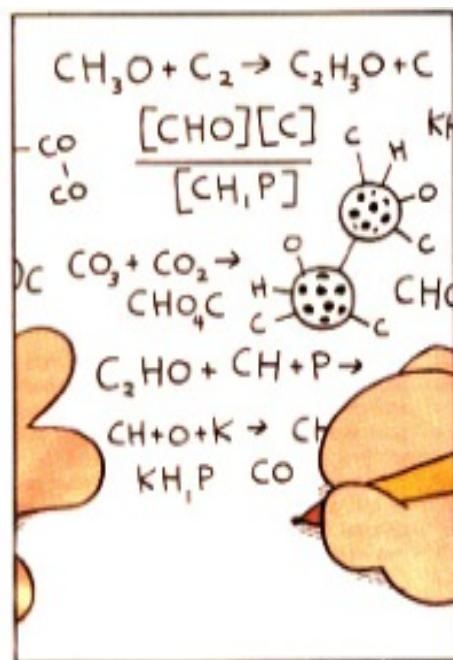
Do problems 8 – 15, and 60 – 78 even.

Section 13.6 State the three factors that can be employed to alter the composition of an equilibrium mixture.

Section 13.7 Apply Le Châtelier's principle to determine the reaction direction when a system at equilibrium reacts to a stress applied to the system in the form of a concentration change.

Do problem 16.

Section 13.8 Apply Le Châtelier's principle to determine the reaction direction when a system at equilibrium reacts to a stress applied to the system in the form of a pressure or volume change.



Do problems 17 and 18.

Section 13.9 Apply Le Châtelier's principle to determine the reaction direction when a system at equilibrium reacts to a stress applied to the system in the form of a temperature change.

Do problems 19 – 21, 32,

Section 13.10 Describe the effect of adding a catalyst to a system at equilibrium

Do problem 22, 34, 36, and 80 – 90 even.

Section 13.11 Describe the relationship between the equilibrium constant and the ratio of the rate constants for the forward and reverse reactions. Solve problems involving this relationship.

Do problem 23, and 92 – 96 even.

Chapter 12, revisited. We now know how to handle reaction mechanisms in which the second step is the slow step. Do Problem 12.19 and 12.84.