Problem Solving

in Chapter 18

Reaction Equilibrium

Name ____________________

Class ____________________

Date ____________________

In Chapter 18, you learned the concept of equilibrium. At the macroscopic level, a reaction in a closed system has reached equilibrium if all the reactants and products of the reaction are present and the observable properties of the system are not changing. That is, the reaction appears to stop before it forms the maximum amount of products that you predict from the amount of reactants present. At the submicroscopic level, the explanation for this behavior is that the forward and reverse reactions are taking place at exactly the same rate when equilibrium is attained. In order to master the concepts in this chapter, you must be able to solve equilibrium problems.

Chapter 18 Problem-Solving Hints

- Reread Section 18.1 of your text to learn how to write a balanced equation for reactions that come to equilibrium.
- Review Sections 18.4 and 18.5 of your text so that you can determine the equilibrium constant expression for any reaction that comes to equilibrium. Know how to handle substances in the solid, gas, liquid, and aqueous forms.
- Remember: For reactions at equilibrium, the equilibrium constant expression is based solely on the equation for the reaction, provided that the temperature does not change.
- Practice rearranging mathematical expressions so that you can solve for one variable in the expression.
- Practice using your calculator to solve numerical expressions involving products, quotients, and exponents.

Example Problem

The reaction, $C(s) + 2H_2(g) \rightleftharpoons CH_4(g)$*, is allowed to come to equilibrium at 25 °C. The value of the equilibrium constant at 25 °C is* 8.1×10^8*. If the equilibrium concentration of hydrogen gas is* $1.00 \times 10^{-5} M$*, what is the equilibrium concentration of methane gas,* CH_4*?*

Analyze the Problem

▶ Recognizing that this is an equilibrium problem, **use a similar method** to the one used to solve other equilibrium problems. One of the first things you need is the equilibrium constant expression for the reaction.

$$K_{eq} = \frac{[CH_4]}{[H_2]^2}$$