Chemistry II Z & Z Ch 13 Chemical Equilibrium

1. Define the term *reversible reaction.* Give an example of a reversible reaction and show how to represent it in equation form.

2. Define these terms:
   Chemical equilibrium Dynamic equilibrium Equilibrium position
   Equilibrium expression

3. Write the law of mass action as a generalized equation in which A and B are reactants and C and D are products.

4. Write the equilibrium expression for each of these reactions.
   a. $aA_{(s)} + bB_{(g)} \Leftrightarrow cC_{(g)} + dD_{(s)}$
   b. $aA_{(l)} + bB_{(g)} \Leftrightarrow cC_{(l)} + dD_{(l)}$
   c. $aA_{(l)} + bB_{(s)} \Leftrightarrow cC_{(g)} + dD_{(g)}$
   d. $aA_{(s)} + bB_{(l)} \Leftrightarrow cC_{(g)} + dD_{(s)}$

5. How is the reaction quotient calculated? Describe the rules for determining if a reversible reaction is at equilibrium once the reaction quotient has been calculated.

6. State in your own words LeChatelier's Principle.

7. In terms of LeChatelier's Principle, explain why changes in concentration, pressure, and temperature affect the equilibrium of a reaction.

8. Describe the problems encountered by Haber in the production of ammonia. How did he manipulate variables that affect the equilibrium of reversible reactions to produce ammonia?

9. For the reaction given below, 2.00 moles of A and 3.00 moles of B are placed in a 6.00-L container.
   $A(g) + 2B(g) \rightleftharpoons C(g)$
   At equilibrium, the concentration of A is 0.282 mol/L. What is the concentration of B at equilibrium?

10. Determine the equilibrium constant for the system $N_2O_4 \rightleftharpoons 2NO_2$ at 25°C, if the equilibrium concentrations are: $[N_2O_4] = 3.30 \times 10^{-2}\ M$, $[NO_2] = 1.41 \times 10^{-2}\ M$.

11. An equilibrium reaction, $A_2(g) + 3B_2(g) \rightleftharpoons 2C(g)$, has a K_p at 225°C of $4.4 \times 10^{-3}/\text{atm}^2$. What is K for this reaction at that temperature?

12. Given a system at equilibrium, be able to predict how changes in the system will affect the direction a reaction will proceed.