Chapter 18
Study Guide

1. Write the expression for the equilibrium constant for each of the following reactions.
   a. $H_2(g) + Cl_2(g) \leftrightarrows 2HCl(g)$
   b. $N_2(g) + 3\ H_2(g) \leftrightarrows 2\ NH_3(g)$
   c. $HCN(g) \leftrightarrows H^+(aq) + CN^-(aq)$
   d. $H_2SO_4(g) \leftrightarrows H^+(aq) + HSO^{4-}(aq)$
   e. $PbF_2(s) \leftrightarrows Pb^{2+}(aq) + 2F^-(aq)$

2. From the data provided below, calculate the value of the equilibrium constant for the reaction.
   a. $H_2(g) + Cl_2(g) \leftrightarrows 2HCl(g)$
   $[H_2] = [Cl_2] = 1.0 \times 10^{-2}$; $[HCl] = 1.0 \times 10^{-4}$

   b. $N_2(g) + 3\ H_2(g) \leftrightarrows 2\ NH_3(g)$
   $[N_2] = 4.4 \times 10^{-2}$; $[H_2] = 1.2 \times 10^{-1}$; $[NH_3] = 3.4 \times 10^{-3}$

3. For the reaction $N_2O_4\,(g) \leftrightarrows 2NO_2\,(g)$, $K_{eq} = 0.2$. At a particular time, the following concentrations are measured; $[N_2O_4] = 2.0\ M$, $[NO_2] = 0.2\ M$. Is this reaction at equilibrium? If not, in which direction will the reaction proceed?

4. For the reaction $2ICl\,(g) \leftrightarrows I_2\,(g) + Cl_2\,(g)$, $K_{eq} = 0.11$. At a particular time, the following concentration are measured; $[ICl] = 2.5M$, $[I_2] = 2.0M$, $[Cl_2] = 1.2M$. Is this reaction at equilibrium? If not, in which direction will the reaction proceed?

5. Name the 3 stresses that may be applied to a chemical equilibrium to cause it to shift.

6. Describe LeChatelier's Principle.

7. For the reaction below, mark whether the stress listed will cause the reaction to move forward or in reverse.

$$Zn(s) + 2HCl(l) \leftrightarrows ZnCl_2(l) + H_2(g);\ \Delta H = -235kJ$$

a.	Increase Heat	e.	Increase $[ZnCl_2]$	i.	Decrease $[H_2]$
b.	Increase Pressure	f.	Increase [HCl]	j.	Decrease Pressure
c.	Increase $[H_2]$	g.	Decrease [HCl]	k.	Decrease Heat
d.	Increase [Zn]	h.	Decrease $[ZnCl_2]$		

8. In a system at equilibrium, the _____ are equal.

9. In a system at equilibrium, the _____ are constant.

10. K_{sp} depends on the _____ of the solution.

11. How many ions are produced by the dissolution of a unit of $CaCl_2$?

12. When referred to in terms of K_{sp}, Q is called the _____. If $Q > K_{sp}$, the solution is _____ _____. If $Q < K_{sp}$, the solution is _____. If $Q = K_{sp}$, the solution is _____.

13. What is the common-ion effect?

14. Write the expression for the solubility product constant for $SrSO_4$.

15. Write the expression for the solubility product constant for $A1_2(SO_4)_3$.

16. Write the expression for the solubility product constant for AgI.

17. A sample of $SrCO_3(s)$ is added to pure water and allowed to come to equilibrium at 25°C. The concentration of Sr^{2+} is $4.0 \times 10^{-5} M$ at equilibrium. What is the value of K_{sp} for $SrCO_3$?

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18. A sample of $BaSO_4(s)$ is added to pure water and allowed to come to equilibrium at 25°C. The concentration of Ba^{2+} is $1.05 \times 10^{-5} M$ at equilibrium. What is the value of K_{sp} for $BaSO_4$?

19. What will be the equilibrium concentration of dissolved ions in a saturated solution of $Pb(OH)_2$ at 25°C? K_{sp} for the reaction is 1.2×10^{-15}.

20. What will be the equilibrium concentration of dissolved ions in a saturated solution of $SrSO_4$ at 25°C? K_{sp} for the reaction is 3.44×10^{-7}.