REVIEW QUESTIONS
Chapter 15

1. A mixture of 0.10 mol of NO, 0.050 mol of H_2 and 0.10 mol of H_2O is placed in a 1.0-L flask and allowed to reach equilibrium as shown below:

$$2\ NO\ (g) + 2\ H_2\ (g) \rightleftharpoons N_2\ (g) + 2\ H_2O\ (g)$$

At equilibrium [NO] = 0.062 M. Calculate the equilibrium constant, K_c, for this reaction.

2. At 700°C, K_c = 20.4 for the reaction shown below:

$$SO_2\ (g) + ½\ O_2\ (g) \rightleftharpoons SO_3\ (g)$$

Calculate K_c and K_P for the reaction shown below:

$$2\ SO_2\ (g) + O_2\ (g) \rightleftharpoons 2\ SO_3\ (g)$$

3. At 100°C, K_c= 0.078 for the following reaction:

$$SO_2Cl_2\ (g) \rightleftharpoons SO_2\ (g) + Cl_2\ (g)$$

In an equilibrium mixture, $[SO_2Cl_2]$ = 0.136 M and $[SO_2]$ = 0.072 M. What is the concentration of Cl_2 in the equilibrium mixture?

4. At 373 K, $K_p = 0.416$ for the equilibrium:

$$2\ NOBr\ (g) \rightleftharpoons 2\ NO\ (g) + Br_2\ (g)$$

If the partial pressures of NOBr and NO are equal at equilibrium, what is the partial pressure of Br_2?

5. A mixture of 0.100 mol CO_2, 0.0500 mol H_2 and 0.100 mol H_2O are place in a 1.00-L flask and allowed to come to equilibrium as shown below. At equilibrium $[CO_2] = 0.0954$ M.

$$CO_2\ (g) + H_2\ (g) \rightleftharpoons CO\ (g) + H_2O\ (g)$$

a) What are the equilibrium concentrations of H_2, CO and H_2O?

b) Calculate K_c and K_p for this reaction at 25.0°C.

6. When 2.00 mol each of hydrogen and iodine are mixed in a 1.00-L flask, 3.50 mol of HI is produced at equilibrium:

$$H_2\,(g) + I_2\,(g) \rightleftharpoons 2\,HI\,(g)$$

Calculate the equilibrium constant K_c for this reaction.

7. The equilibrium constant for the reaction

$$SO_2\,(g) + NO_2\,(g) \rightleftharpoons SO_3\,(g) + NO\,(g)$$

has a numerical value of 3.00 at a given temperature. 1.50 mol each of SO_2 and NO_2 are mixed in a 1.00-L flask and allowed to reach equilibrium. What percent of SO_2 is converted to product?

8. The following equilibrium exists at 1000 ºC with $K_c = 2.00$.

$$2\ COF_2\ (g) \rightleftharpoons CO_2\ (g) + CF_4\ (g)$$

If a 5.00-L mixture contains 0.145 mol COF_2 , 0.262 mol of CO_2 and 0.074 mol of CF_4 at 1000 ºC, in which direction will the mixture proceed to reach equilibrium?

9. A 0.831-g sample of SO_3 is placed in a 1.00-L flask and heated to 1100 K. The SO_3 decomposes to SO_2 and O_2, as shown below. At equilibrium, the total pressure in the container is 1.300 atm. Find the values of K_p and K_c for this reaction at 1100 K.

$$2\ SO_3\ (g) \rightleftharpoons 2\ SO_2\ (g) + O_2\ (g)$$

10. Predict how each of the following changes affect the amount of H_2 present in an equilibrium mixture in the reaction

$$3\ Fe\ (s)\ +\ 4\ H_2O\ (g) \rightleftharpoons Fe_3O_4\ (s)\ +\ 4\ H_2\ (g) \qquad \Delta H = -150\ kJ$$

a) Raising the temperature of the mixture.

b) Adding more H_2O (g).

c) Doubling the volume of the container holding the mixture.

d) Adding a catalyst.

11. At 2000 °C the equilibrium constant for the reaction below is $K_c = 2.4 \times 10^3$. If the initial concentration of NO is 0.500 M, what are the equilibrium concentrations of each substance?

$$2\ NO\ (g) \rightleftharpoons N_2\ (g)\ +\ O_2\ (g)$$

12. The reaction below has an equilibrium constant $K_c = 6.90$. If 0.100 mol of BrCl is placed in a 500-mL flask and allowed to come to equilibrium, what are the equilibrium concentrations of each substance?

$$Br_2\,(g) + Cl_2\,(g) \rightleftharpoons 2\,BrCl\,(g)$$

13. An equilibrium mixture of H_2, I_2, and HI at 458°C contains 2.24×10^{-2} M H_2, 2.24×10^{-2} M I_2 and 0.155 M HI in a 5.00-L flask. What are the equilibrium concentrations when equilibrium is reestablished following the addition of 0.100 mol of HI?