Unit 7 – Chapter 13: Chemical Equilibrium **Name _____**

Assignment #2: Equilibrium Constant (K_c) & K_p Calculations **Period _____**

1) At a particular temperature a 2.00-L flask at equilibrium contains 2.89 x 10^{-4} mol N_2, 2.50 X 10^{-5} mol O_2, and 2.00 X 10^{-2} mol N_2O. Calculate K_c at this temperature for the reaction

$$2\ N_{2(g)} + O_{2(g)} \longleftrightarrow 2\ N_2O_{(g)}$$

If $[N_2]$ = 2.00 X 10^{-4} *M*, $[N_2O]$ = 0.200 *M*, and $[O_2]$ = 0.00245 *M*, does this represent a system at equilibrium?

2) At 1100 K, K_p = 0.25 for the reaction

$$2\ SO_{2(g)} + O_{2(g)} \longleftrightarrow 2\ SO_{3(g)}$$

What is the value of K_c at this temperature?

3) The equilibrium constant, K_p, is 2.4 X 10^3 at a certain temperature for the reaction

$$2\ NO_{(g)} \longleftrightarrow N_{2(g)} + O_{2(g)}$$

For which of the following sets of conditions is the system at equilibrium? For those that are not at equilibrium, in which direction will the system shift?

a. P_{NO} = 0.010 atm, P_{N2} = 0.11 atm, P_{O2} = 2.0 atm
b. P_{NO} = 0.0078 atm, P_{N2} = 0.36 atm, P_{O2} = 0.67 atm
c. P_{NO} = 0.0062 atm, P_{N2} = 0.51 atm, P_{O2} = 0.18 atm

4) The reaction

$$2\ NO_{(g)} + Br_{2(g)} \longleftrightarrow 2\ NOBr_{(g)}$$

has K_p = 109 at 25^{0}C. If the equilibrium partial pressure of Br_2 is 0.0159 atm and the equilibrium partial pressure of NOBr is 0.0768 atm, calculate the partial pressure of NO at equilibrium.

5) A sample of $S_{8(g)}$ is placed in an otherwise empty rigid container at 1325 K at an initial pressure of 1.00 atm, where it decomposes to $S_{2(g)}$ by the reaction

$$S_{8(g)} \longleftrightarrow 4\ S_{2(g)}$$

At equilibrium, the partial pressure of S_8 is 0.25 atm. Calculate the K_p for this reaction at 1325 K.

6) Nitrogen gas (N_2) reacts with hydrogen gas (H_2) to form ammonia (NH_3). At 200^0C in a closed container, 1.00 atm of nitrogen gas is mixed with 2.00 atm of hydrogen gas. At equilibrium, the total pressure is 2.00 atm. Calculate the partial pressure of hydrogen gas at equilibrium.

7) At a particular temperature, $K_c = 1.00 \times 10^2$ for the reaction

$$H_{2(g)} + I_{2(g)} \longleftrightarrow 2\ HI_{(g)}$$

In an experiment, 1.00 mol H_2, 1.00 mol I_2, and 1.00 mol HI are introduced into a 1.00-L container. Calculate the concentrations of all species when equilibrium is reached.

8) At a particular temperature, $K_c = 4.0 \times 10^{-7}$ for the reaction

$$N_2O_{4(g)} \longleftrightarrow 2\ NO_{2(g)}$$

In an experiment, 1.0 mol N_2O_4 is placed in a 10.0-L vessel. Calculate the concentrations of N_2O_4 and NO_2 when this reaction reaches equilibrium.

9) Lexan is a plastic used to make compact discs, eyeglass lenses, and bullet-proof glass. One of the compounds used to make Lexan is phosgene ($COCl_2$), an extremely poisonous gas. Phosgene decomposes by the reaction

$$COCl_{2(g)} \longleftrightarrow CO_{(g)} + Cl_{2(g)}$$

For which $K_p = 6.8 \times 10^{-9}$ at 100^0C. If pure phosgene at an initial pressure of 1.0 atm decomposes, calculate the equilibrium pressures of all species.