K_{eq} Practice -- Chemistry 121 Hanson

Most answers are at the OpenStax site. Note that the OpenStax text does not assume you have an equation-solving calculator. Since you do, please learn how to use it. Make an ICE table, express the equilibrium expression in term of a variable *x*, solve for *x* using your calculator's solver, then use *x* to get the equilibrium values.

1. What are the concentrations of PCl_5, PCl_3, and Cl_2 in an equilibrium mixture produced by the decomposition of a sample of pure PCl_5 with $[PCl_5] = 2.00\ M$?

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g) \qquad K_c = 0.0211$$

2. Calculate the equilibrium concentrations of NO, O_2, and NO_2 in a mixture at 250 °C that results from the reaction of 0.20 *M* NO and 0.10 *M* O_2. (answer at OpenStax is wrong; I got x=0.0965)

$$2NO(g) + O_2(g) \rightleftharpoons 2NO_2(g) \qquad K_c = 2.3 \times 10^5 \text{ at } 250°C$$

3. Calculate the pressures of NO, Cl_2, and NOCl in an equilibrium mixture produced by the reaction of a starting mixture with 4.0 atm NO and 2.0 atm Cl_2.

$$2NO(g) + Cl_2(g) \rightleftharpoons 2NOCl(g) \qquad K_P = 2.5 \times 10^3$$

4. At 25 °C and at 1 atm, the partial pressures in an equilibrium mixture of N_2O_4 and NO_2 are $P_{N_2O_4} = 0.70$ atm and $P_{NO_2} = 0.30$ atm.

(a) Predict how the pressures of NO_2 and N_2O_4 will change if the total pressure increases to 9.0 atm. Will they increase, decrease, or remain the same?

(b) Calculate the partial pressures of NO_2 and N_2O_4 when they are at equilibrium at 9.0 atm and 25 °C.

5. Consider the reaction between H_2 and O_2 at 1000 K

$$2H_2(g) + O_2(g) \rightleftharpoons 2H_2O(g) \qquad K_P = 1.33 \times 10^{20}$$

If 0.500 atm of H_2 and 0.500 atm of O_2 are allowed to come to equilibrium at this temperature, what are the partial pressures of the components?

6. Liquid N_2O_3 is dark blue at low temperatures, but the color fades and becomes greenish at higher temperatures as the compound decomposes to NO and NO_2. At 25 °C, a value of $K_P = 1.91$ has been established for this decomposition. If 0.236 moles of N_2O_3 are placed in a 1.52-L vessel at 25 °C, calculate the equilibrium partial pressures of $N_2O_3(g)$, $NO_2(g)$, and NO(g).