Equilibrium Calculations

1. The decomposition of nitrogen monoxide gives this equilibrium:

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

Initially 0.867 mol/L of $NO_{(g)}$ was placed in a 1.0 L sealed flask at 500 °C. If the percent reaction of $NO_{(g)}$ is 35 %, calculate K_c. ***(0.0725)***

2. In a 1.00 L vessel, 0.500 mol of nitrogen gas and 0.500 mol of oxygen gas were reacted at 773 K to produce nitrogen monoxide gas. The percent reaction was found to be 20.0%.

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

Calculate the equilibrium concentrations of all three species.

(N_2 & O_2 = 0.4 mol/L: NO = 0.2 mol/L)

3. An equilibrium was established in a 1.00 L container when 0.700 mol of phosphorus pentachloride gas was decomposed at 500 K. At equilibrium, the concentration of chlorine gas was 0.0740 mol/L. ***(omit solids; 2.43×10^{-11})***

$$4\ PCl_{5(g)} \rightleftharpoons P_{4(s)} + 10\ Cl_{2(g)}$$

Calculate the equilibrium constant for this system.

4. After 0.869 mol/L $N_2O_{4(g)}$ was added to a 1.00 L container at 105 °C, a brown gas, NO_2, appeared. The percent reaction of $N_2O_{4(g)}$ was found to be 36%.

$$N_2O_{4\,(g)} \rightleftharpoons 2\,NO_{2(g)}$$

Calculate the equilibrium constant for this system. ***(0.704)***

5. At high temperatures, nitrogen and oxygen gases react to produce nitrogen monoxide. Calculate the equilibrium concentration of nitrogen monoxide if the equilibrium concentrations of oxygen and nitrogen are 0.357 mol/L and K is 2.8×10^{-4} at 1800 K. ***(0.00597 mol/L)***

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

6. 1.32 mol/L $N_2O_{5\,(g)}$ was placed in a sealed vessel. Calculate the equilibrium concentration of the products, $NO_{2(g)}$ and $O_{2(g)}$, if the percent reaction of $N_2O_{5(g)}$ was measured to be 15%.

$$2\,N_2O_{5\,(g)} \rightleftharpoons 4\,NO_{2(g)} + O_{2(g)}$$

(NO_2 = 0.36 mol/L: O_s = 0.099 mol/L)