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AP Chemistry – Calculating K_{eq} – 42

Name _____Per ___

1. Phosphorus trichloride gas and chlorine gas react to form phosphorus pentachloride gas: $PCl_{3(g)} + Cl_{2(g)} \leftrightarrow PCl_{5(g)}$. A gas vessel is charged with a mixture of $PCl_{3(g)}$ and $Cl_{2(g)}$, which is allowed to equilibrate at 450 K. At equilibrium the partial pressures of the three gases are $P_{PCl3} = 0.124$ atm, $P_{Cl2} = 0.157$ atm, and $P_{PCl5} = 1.30$ atm. (a) What is the value of K_{eq} at this temperature? (b) Does the equilibrium favor reactants or products?

2. Methanol, CH_3OH, is produced commercially by the catalyzed reaction of carbon monoxide and hydrogen: $CO_{(g)} + 2H_{2(g)} \leftrightarrow CH_3OH_{(g)}$. An equilibrium mixture in a 2.00 L vessel is found to contain 0.0406 moles CH_3OH, 0.170 moles CO, and 0.302 moles H_2 at 500 K. Calculate K_{eq} at this temperature.

3. A mixture of 1.374 g of H_2 and 70.31 g of Br_2 is heated in a 2.00 L vessel at 700. K. These substances react as follows: $H_{2(g)} + Br_{2(g)} \leftrightarrow 2HBr_{(g)}$. At equilibrium the vessel is found to contain 0.566 g of H_2. (a) Calculate the equilibrium partial pressures of H_2, Br_2, and HBr.

4. Calculate the value of K_{eq} for the reaction in problem 3.

5. A flask is filled with 1.500 atm of $N_2O_{4(g)}$ and 1.000 atm $NO_{2(g)}$ at 25°C. After equilibrium is reached, the partial pressure of NO_2 is 0.512 atm. (a) Write the equilibrium reaction.

(b) What is the equilibrium partial pressure of N_2O_4?

(c) Calculate the value of K_{eq} for the reaction.

6. At 900 K the following reaction has $K_{eq} = 0.345$: $2SO_{2(g)} + O_{2(g)} \leftrightarrow 2SO_{3(g)}$. In an equilibrium mixture the partial pressures of SO_2 and O_2 are 0.165 atm and 0.755 atm, respectively. What is the equilibrium partial pressure of SO_3 in the mixture?