# Equilibrium Problems I

1. A one liter container initially contains 0.777 mol of $SO_3$ gas. Some of the sulfur trioxide decomposes into sulfur dioxide and oxygen:

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

If 0.520 mol of $SO_3$ remain at equilibrium, what is the value of K for this equilibrium system ?
(answer: 0.031)

2. Consider the following equilibrium: $2\,HI_{(g)} \Leftrightarrow H_{2(g)} + I_{2(g)}$
When two moles of HI are placed in a 10 liter vessel and the system is allowed to reach equilibrium , it is found that the vessel contains 0.50 mol of $H_2$. Calculate the equilibrium constant for this reaction. (answer: 0.25)

3. Consider the following equilibrium: $2\,NOBr_{(g)} \Leftrightarrow 2\,NO_{(g)} + Br_{2(g)}$
Two moles of NOBr are placed in an empty two liter flask. After equilibrium is established 0.25 moles of $Br_2$ are found to be present. Calculate the equilibrium constant (K) for this reaction. (answer: 0.0139)

4. Given: $2\,HI_{(g)} \Leftrightarrow H_{2(g)} + I_{2(g)}$ and $K = 0.01$ . Starting with 4.20 mol of HI in a 9.6 L container, calculate the equilibrium concentrations of $H_2$, $I_2$, and HI. Start by setting up the appropriate data table. (answers: $[HI] = 0.364M$; $[H_2] = [I_2] = 0.037$ M)

5. For the reaction $2\,NO_{(g)} \Leftrightarrow N_{2(g)} + O_{2(g)}$ suppose 5 mole of pure NO gas is placed in a 10 liter container and allowed to come to equilibrium. Given that $K = 0.4$ calculate the equilibrium concentrations for all the components. (answer: $[NO] = 0.22$ M; $[N_2]=[H_2] = .14M$)

6. A mixture of 3 mol $SO_2$, 4 mol of $NO_2$, 1 mol of $SO_3$, and 4 mol of NO is placed in a two liter vessel. The following equilibrium is reached:

$$SO_{2(g)} + NO_{2(g)} \Leftrightarrow SO_{3(g)} + NO_{(g)}$$

When equilibrium is obtained the vessel is found to contain 2 mol of $SO_2$. Calculate the equilibrium concentration of all the components. Given: $K = 1.66$
(answers; $[SO_2] = 1.0$ M; $[NO_2] = 1.5$ M; $[SO_3] = 1.0$ M; $[NO] = 2.5M$)