**Problem Set #7 Equilibrium Calculations**

1.SO3 (g)  + H2O (g) ⇄ H2SO4 (l)

At equilibrium (25 oC): [SO3] = 0.400 M [H2O] = 0.480 M [H2SO4] = 0.600 M

Calculate the value of the equilibrium constant, Keq.

2. PCl5 (s) + H2O (g) ⇄ 2 HCl (g) + POCl3 (g)

At equilibrium (100oC) a 2.0L flask contains:

0.075 mol of PCl5 0.050 mol of H2O 0.750 mol of HCl 0.500 mol of POCl3

Calculate the Keq for the reaction.

3. Keq = 798 at 25 oC for the reaction:

 2 SO2 (g) + O2 (g) ⇄ 2 SO3 (g).

In a particular mixture at equilibrium, [SO2] = 4.20 M and [SO3] = 11.0 M. Calculate the equilibrium [O2] in this mixture at 25oC.

4. Consider the following equilibrium systemshown below.

2 SO2 (g) + O2 (g) ⇄ 2 SO3 (g) (100oC)

0.600 moles of SO2 and 0.600 moles of O2 are present in a 4.00 L flask at equilibrium.

If the Keq = 680.0, calculate the [SO3] at 100oC.

 5.Consider the following equilibrium:

2 NO2 (g) ⇄ N2O4 (g) (20oC)

2.00 moles of NO2 and 1.60 moles of N2O4 are present in a 4.00 L flask at equilibrium. Calculate the value of Keq at 20oC.

6.Consider the following equilibrium system below:

2 SO3 (g) ⇄ 2 SO2 (g) + O2 (g) (100oC)

4.00 moles of SO2 and 5.00 moles of O2 are present in a 2.00 L container at equilibrium. Calculate the equilibrium concentration of SO3 and the number of moles SO3 present if the value Keq = 1.47 x 10-3 at 100oC.

7. If at equilibrium [H2] = 0.200M and [I2] = 0.200M and Keq = 55.6 at 250oC, calculate the equilibrium concentration of HI for the following system:

H2 (g) + I2 (g) ⇄ 2 HI (g)

 8. 1.60 moles CO, 1.60 moles H2O, 4.00 moles CO2, 4.00 moles H2 are found in an 8.00 L container at 690oC at equilibrium for the following chemical system: CO (g) + H2O (g) ⇄ CO2 (g) + H2 (g)

Calculate the value of the equilibrium constant.

**Problem Set #8 Equilibrium Calculations**

Solve each problem and show all of your work.

1. At equilibrium, a 5.0L flask contains:

0.75 mol of PCl5 0.50 mol of H2O 7.50 mol of HCl 5.00 mol of POCl3

Calculate the Keq for the reaction:

PCl5 (s) + H2O (g) ⇄ 2HCl (g) + POCl3 (g)

2. Keq = 798 for the reaction at a particular temperature:

2 SO2 (g) + O2 (g) ⇄ 2 SO3 (g).

In a particular mixture at equilibrium, [SO2] = 4.20 M and [SO3] = 11.0 M. Calculate the equilibrium [O2] in this mixture.

3. Consider the following equilibrium:

2 SO2 (g) + O2 (g) ⇄ 2 SO3 (g)

When 0.600 moles of SO2 and 0.600 moles of O2 are placed into a 1.00 L container and allowed to reach equilibrium, the equilibrium [SO3] is to be 0.250 M. Calculate Keq .

4. Consider the following equilibrium:

2 NO2 (g) ⇄ N2O4 (g)

2.00 moles of NO2 are placed in a 1.00 L flask and allowed to react. After equilibrium is established, 1.80 moles of NO2 are present. Calculate Keq.

5. Consider the chemical system below:

2 SO2 (g) + O2 (g) ⇄ 2 SO3 (g)

4.00 moles of SO2 and 5.00 moles O2 are placed in a 2.00 L container at 200oC and allowed to reach equilibrium. If the equilibrium [O2] is 2.00 M, calculate the value of Keq.

6. If the initial [H2] = 0.200 M, [I2] = 0.200 M and Keq = 55.6 (at 250oC) calculate the equilibrium concentrations of all molecules in the following chemical system.

H2 (g) + I2 (g) ⇄ 2 HI (g)

7. 1.60 moles CO and 1.60 moles H2O are placed in a 2.00 L container at 690 oC

 CO (g) + H2O (g) ⇄ CO2 (g) + H2 (g)Keq = 10.0

Calculate all equilibrium concentrations.

 8. SO3 (g) + NO (g) ⇄ NO2 (g) + SO2 (g) ; Keq = 0.800 at 100oC.

If 4.00 moles of each reactant are placed in a 2.00L container, calculate all equilibrium concentrations at 100oC for the chemical system shown above.

\*9. Consider the following equilibrium system:

2 NO2 (g) ⇌ N2O4 (g)

Two sets of equilibrium data are listed for the same temperature.

 Container 1 2.00 L 0.12 moles NO2 0.16 moles N2O4

Container 2 5.00 L 0.26 moles NO2 ? moles N2O4

Determine the number of moles N2O4 in the second container.