Worksheet B **Equilibrium Calculations**

Solve each problem and show all of your work.

1. At equilibrium, a 5.0L flask contains: 0.75 mol of PCl_5 0.50 mol of H_2O 7.50 mol of HCl 5.00 mol of $POCl_3$

   Calculate the Keq for the reaction: $\mathbf{PCl_{5\,(s)} + H_2O_{\,(g)} \rightleftarrows 2HCl_{\,(g)} + POCl_{3\,(g)}}$

2. Keq= 798 for the reaction: $\mathbf{2SO_{2\,(g)} + O_{2\,(g)} \rightleftarrows 2SO_{3\,(g)}}$.

   In a particular mixture at equilibrium, $[SO_2]$= 4.20 M and $[SO_3]$=11.0 M. Calculate the equilibrium $[O_2]$ in this mixture.

3. Consider the following equilibrium: $\mathbf{2SO_2\,(g) + O_2\,(g) \rightleftarrows 2SO_3\,(g)}$

When a 0.600 moles of SO_2 and 0.600 moles of O_2 are placed into a 1.00 litre container and allowed to reach equilibrium, the equilibrium $[SO_3]$ is to be 0.250M. Calculate the Keq value.

4. Consider the following equilibrium: $\mathbf{2\,NO_{2(g)} \rightleftarrows N_2O_{4(g)}}$

If 2.00 moles of NO_2 are placed in a 1.00 L flask and allowed to react. At equilibrium 1.80 moles NO_2 are present. Calculate the K_{eq}.

5. $\mathbf{2\,SO_{2(g)} + O_{2(g)} \rightleftarrows 2\,SO_{3(g)}}$

4.00 moles of SO_2 and 5.00 moles O_2 are placed in a 2.00 L container at 200°C and allowed to reach equilibrium. If the equilibrium concentration of O_2 is 2.00 M, calculate the Keq

6. If the initial $[H_2]$ = 0.200M, $[I_2]$ = 0.200M and Keq = 55.6 at 250°C calculate the equilibrium concentrations of all molecules.

   $\mathbf{H_2\,(g) + I_2\,(g) \rightleftarrows 2HI\,(g)}$

7. 1.60 moles CO and1.60 moles H_2O are placed in a 2.00L container at 690 °C (Keq=10.0).

   Calculate all equilibrium concentrations. $\mathbf{CO\,(g) + H_2O\,(g) \rightleftarrows CO_2\,(g) + H_2\,(g)}$

8. $\mathbf{SO_{3(g)} + NO_{(g)} \rightleftarrows NO_{2(g)} + SO_{2(g)}}$

   K_{eq} = 0.800 at 100°C. If 4.00 moles of each reactant are placed in a 2.00L container, calculate all equilibrium concentrations at 100°C.

9. Consider the following equilibrium system: $2NO_{2(g)} \rightleftharpoons N_2O_4$

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

Container 1	2.00 L	0.12 moles NO_2	0.16 moles N_2O_4
Container 2	5.00 L	0.26 moles NO_2	? moles N_2O_4

Determine the number of moles N_2O_4 in the second container. Get a Keq from the first container and use it for the second container.

Worksheet A **Equilibrium Calculations**

Solve each problem and show all of your work.

1. $SO_{3(g)} + H_2O_{(g)} \rightleftarrows H_2SO_{4(l)}$

At equilibrium $[SO_3] = 0.400M$ $[H_2O] = 0.480M$ $[H_2SO_4] = 0.600M$

Calculate the value of the equilibrium constant.

2. At equilibrium at 100°C, a 2.0L flask contains:

0.075 mol of PCl_5 0.050 mol of H_2O 0.750 mol 0f HCl 0.500 mol of $POCl_3$

Calculate the Keq for the reaction:

PCl_5 (s) + H_2O (g) ⇄ 2HCl (g) + $POCl_3$ (g)

3. Keq= 798 at 25°C for the reaction: **$2SO_2$ (g) + O_2 (g) ⇄ $2SO_3$ (g).**

In a particular mixture at equilibrium, $[SO_2]$= 4.20 M and $[SO_3]$=11.0M. Calculate the equilibrium $[O_2]$ in this mixture at 25°C.

4. Consider the following equilibrium:

$2SO_2$ (g) + O_2 (g) ⇄ $2SO_3$ (g)

0.600 moles of SO_2 and 0.600 moles of O_2 are present in a 4.00 L flask at equilibrium at 100°C. If the Keq = 680, calculate the SO_3 concentration at 100°C.

5. Consider the following equilibrium:

$2\ NO_{2(g)} \rightleftarrows N_2O_{4(g)}$

2.00 moles of NO_2 and1.60 moles of N_2O_4 are present in a 4.00 L flask at equilibrium at 20°C. Calculate the Keq at 20°C .

6. **$2\ SO_{3(g)} \rightleftarrows 2\ SO_{2(g)} + O_{2(g)}$**

4.00 moles of SO_2 and 5.00 moles O_2 are present in a 2.00 L container at 100°C and are at equilibrium. Calculate the equilibrium concentration of SO_3 and the number of moles SO_3 present if the Keq = 1.47×10^{-3}.

7. If at equilibrium $[H_2] = 0.200M$ and $[I_2] = 0.200M$ and Keq=55.6 at 250°C, calculate the equilibrium concentration of HI.

H_2 (g) + I_2 (g) ⇄ 2HI (g)

8. 1.60 moles CO, 1.60 moles H_2O, 4.00 moles CO_2, 4.00moles H_2 are found in a 8.00L container at 690°C at equilibrium.

CO (g) + H_2O (g) ⇄ CO_2 (g) + H_2 (g)

Calculate the value of the equilibrium constant.