

**Chemistry 12 – Dynamic Equilibrium**  
**Learning Goal B6**  
**Equilibrium Calculations: Problem Set E**

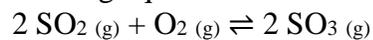
Solve each problem and show all of your work.

1. At equilibrium, a 5.0L flask contains:  
0.75 mol of  $\text{PCl}_5$       0.50 mol of  $\text{H}_2\text{O}$       7.50 mol of  $\text{HCl}$       5.00 mol of  $\text{POCl}_3$   
Calculate the  $K_{\text{eq}}$  for the reaction:  
$$\text{PCl}_5 (\text{s}) + \text{H}_2\text{O} (\text{g}) \rightleftharpoons 2\text{HCl} (\text{g}) + \text{POCl}_3 (\text{g})$$

2.  $K_{\text{eq}} = 798$  for the reaction at a particular temperature:  $2 \text{SO}_2 (\text{g}) + \text{O}_2 (\text{g}) \rightleftharpoons 2 \text{SO}_3 (\text{g})$ .

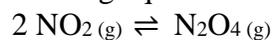
In a particular mixture at equilibrium,  $[\text{SO}_2] = 4.20 \text{ M}$  and  $[\text{SO}_3] = 11.0 \text{ M}$ . Calculate the equilibrium  $[\text{O}_2]$  in this mixture.

3. Consider the following equilibrium:



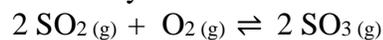
When 0.600 moles of  $\text{SO}_2$  and 0.600 moles of  $\text{O}_2$  are placed into a 1.00 L container and allowed to reach equilibrium, the equilibrium  $[\text{SO}_3]$  is to be 0.250 M. Calculate  $K_{\text{eq}}$ .

4. Consider the following equilibrium:



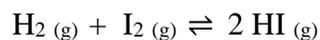
2.00 moles of  $\text{NO}_2$  are placed in a 1.00 L flask and allowed to react. After equilibrium is established, 1.80 moles of  $\text{NO}_2$  are present. Calculate  $K_{\text{eq}}$ .

5. Consider the chemical system below:

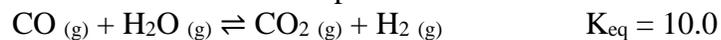


4.00 moles of  $\text{SO}_2$  and 5.00 moles  $\text{O}_2$  are placed in a 2.00 L container at  $200^\circ\text{C}$  and allowed to reach equilibrium. If the equilibrium  $[\text{O}_2]$  is 2.00 M, calculate the value of  $K_{\text{eq}}$ .

6. If the initial  $[\text{H}_2] = 0.200 \text{ M}$ ,  $[\text{I}_2] = 0.200 \text{ M}$  and  $K_{\text{eq}} = 55.6$  (at  $250^\circ\text{C}$ ) calculate the equilibrium concentrations of all molecules in the following chemical system.



7. 1.60 moles  $\text{CO}$  and 1.60 moles  $\text{H}_2\text{O}$  are placed in a 2.00 L container at  $690^\circ\text{C}$

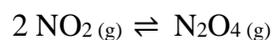


Calculate all equilibrium concentrations.



If 4.00 moles of each reactant are placed in a 2.00L container, calculate all equilibrium concentrations at  $100^\circ\text{C}$  for the chemical system shown above.

\*9. Consider the following equilibrium system:



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

Container 1	2.00 L	0.12 moles $\text{NO}_2$	0.16 moles $\text{N}_2\text{O}_4$
Container 2	5.00 L	0.26 moles $\text{NO}_2$	? moles $\text{N}_2\text{O}_4$

Determine the number of moles  $\text{N}_2\text{O}_4$  in the second container.