

**Problem Set #13**

Name:

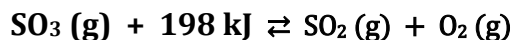
Part 1 – Write the equilibrium constant expression (Keq) for the following reactions.

- $\text{PCl}_5(\text{g}) \rightleftharpoons \text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g})$
- $\text{H}_2(\text{g}) + \text{O}_2(\text{g}) \rightleftharpoons \text{H}_2\text{O}(\text{g})$
- $\text{NH}_3(\text{aq}) + \text{H}_2\text{O}(\text{l}) \rightleftharpoons \text{NH}_4^+(\text{aq}) + \text{OH}^-(\text{aq})$
- $\text{N}_2\text{O}_4(\text{g}) \rightleftharpoons \text{NO}_2(\text{g})$
- $\text{NO}(\text{g}) + \text{H}_2(\text{g}) \rightleftharpoons \text{N}_2(\text{g}) + \text{H}_2\text{O}(\text{g})$

Part 2 – Using the Keq expressions you wrote in Part 1, calculate the value of Keq given the following concentrations.

- $[\text{PCl}_5] = 1.25 \text{ M}$ ,  $[\text{PCl}_3] = 2.45 \text{ M}$ ,  $[\text{Cl}_2] = 1.00 \text{ M}$
- $[\text{H}_2] = 0.25 \text{ M}$ ,  $[\text{O}_2] = 0.75 \text{ M}$ ,  $[\text{H}_2\text{O}] = 1.75 \text{ M}$
- $[\text{NH}_3] = 2.75 \times 10^{-3} \text{ M}$ ,  $[\text{NH}_4^+] = 3.25 \times 10^{-5} \text{ M}$ ,  $[\text{OH}^-] = 1.50 \times 10^{-2} \text{ M}$
- $[\text{N}_2\text{O}_4] = 3.50 \text{ M}$ ,  $[\text{NO}_2] = 2.25 \text{ M}$
- $[\text{NO}] = 0.355 \text{ M}$ ,  $[\text{H}_2] = 0.750 \text{ M}$ ,  $[\text{N}_2] = 0.450 \text{ M}$ ,  $[\text{H}_2\text{O}] = 1.00 \text{ M}$

Part 3 – Using the following equation at equilibrium, fill in the chart indicating the changes that occur.



	Imposed Change	Equilibrium Shift	$[\text{SO}_3]$	$[\text{SO}_2]$	$[\text{O}_2]$	Keq value
11.	Increase $[\text{SO}_2]$					
12.	Decrease pressure					
13.	Increase temperature					
14.	Decrease $[\text{O}_2]$					
15.	Decrease $[\text{SO}_3]$					