**CHEM 1105** **PROBLEM SET 5**

1. In the following system

$$3O_2(g) + 2H_2S(g) \rightleftharpoons 2H_2O(g) + 2SO_2(g)$$

in a 500 mL container, the initial number of moles were: $O_2$ 0.50; $H_2S$ 0.36; $H_2O$ 0.68; $SO_2$ 0.56. At equilibrium,there was 0.76 mole of $H_2O$. Calculate

(a) the number of moles of $O_2$, $H_2S$ and $SO_2$ at equilibrium,
(b) the equilibrium concentration of all gases, and
(c) $K_c$.

2. Starting with 0.85 g Fe and 1.00 g CO in a 3.0 L vessel, when the system $Fe(s) + 5CO(g) \rightleftharpoons Fe(CO)_5(g)$ reached equilibrium there was 0.64 g of Fe. Calculate $K_c$ for the system.

3. For the equilibrium $CO_2(g) + H_2(g) \rightleftharpoons CO(g) + H_2O(g)$, $K_c$ is 0.080 at 400°C and 0.41 at 600°C. Is the forward reaction endothermic or exothermic? Explain.

4. For the equilibrium $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$, $\Delta H$ for the forward reaction is negative.

(a) If the temperature is increased,
   (1) how will the system change? Explain in terms of what changes will occur in the concentrations of all gases;
   (2) will the value of $K_c$ get larger or smaller? Explain.

(b) If $SO_2$is removed, how will the system change? Explain.

(c) If $SO_3$ is removed, will the value of $K_c$ change?

(d) If $SO_3$ is added, will the $SO_2$ concentration increase or decrease? Explain.

5. Given the following equilibria

(a) $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

(b) $2CO_2(g) \rightleftharpoons 2CO(g) + O_2(g)$

if CaO is added to system (b) in equilibrium, will the concentration of CO increase or decrease? Explain.