1. A gaseous chemical equilibrium has an equilibrium constant with the following form.

$$K_p = \frac{P_{HI}^2}{P_{H_2} P_{I_2}}$$

A) Write a balanced chemical equation for this equilibrium.

B) Write an expression for K_c and determine the relationship between K_p and K_c.

C) A container holds $[H_2] = 2.95 \times 10^{-3}$ M, $[I_2] = 5.22 \times 10^{-4}$ M, and $[HI] = 1.95 \times 10^{-3}$ M at 25 °C. If $K_c = 48.8$ at 25 °C, in which direction will the reaction proceed in the container?

2. In the lab you synthesize green crystals of trihydrate potassium ferrioxalate ($K_3[Fe(C_2O_4)_3]\cdot 3H_2O$) from aqueous solutions of $FeCl_3$ and $K_2C_2O_4$. Recrystallization from a saturated aqueous solution of your products is a commonly used technique to purify your desired products.

A) Write a solubility product equilibrium constant for the following dissolution:

$$K_3[Fe(C_2O_4)_3]\cdot 3H_2O\ (s) \rightleftharpoons 3K^+\ (aq) + [Fe(C_2O_4)_3]^{3-}\ (aq) + 3H_2O\ (l)$$

B) If cooling the saturated solution results in solid crystal formation, the dissolution of the $K_3[Fe(C_2O_4)_3]\cdot 3H_2O$ is ...

Endothermic Exothermic

3. Consider the following aqueous equilibrium:

$$Fe^{3+}\ (aq) + SCN^-\ (aq) \rightleftharpoons FeSCN^{2+}\ (aq) \qquad K_c = 148 \text{ at } 298 \text{ K}$$

In which direction will the equilibrium shift if ...

A) Water is added such that the total volume is doubled

B) NaOH is added

C) $Fe(NO_3)_3$ is added

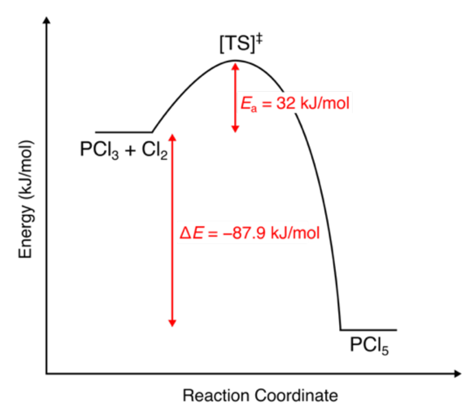
4. Consider the reaction between phosphorus(III) chloride and chlorine gas to produce phosphorus(V) chloride.

$$PCl_3\,(g) + Cl_2\,(g) \rightleftharpoons PCl_5\,(g) \qquad K_p = 24.2 \text{ at } 523 \text{ K}$$

A) A 1.00 L container at constant temperature contains $P_{PCl_3} = 1.5$ atm, $P_{Cl_2} = 0.72$ atm, and $P_{PCl_5} = 0$ atm initially. Calculate the partial pressures of each gas at equilibrium.

B) Describe some ways in which we can increase the yield of PCl_5 (g).

C) The energy diagram for the reaction is shown below. Determine how the number of moles of PCl_5 at equilibrium would change if system were heated.



5. Consider the following weak-acid equilibrium.

$$CH_3COOH\,(aq) + H_2O\,(l) \rightleftharpoons CH3COO^-\,(aq) + H_3O^+\,(aq) \qquad K_a = 1.76 \times 10^{-5} \text{ at } 298 \text{ K}$$

Calculate $[H_3O^+]$ at equilibrium if the initial concentration of CH3COOH is 1.59 M.