Practice Exam for Exam 2

1. Calculate the ***pH of a solution*** when 0.365 g of lithium hydroxide are added to 100.0 mL of 0.8663 M benzoic acid.

   Calculate the ***pH of the solution*** when 50.0 mL of 0.153 M hydrochloric acid is added to the mixture from above.

2. A 0.25 mol sample of a weak acid with an unknown pKa was combined with 10.0 mL of 3.00 M KOH, and the resulting solution was diluted to 1.500 L. The measured pH of the solution was 3.85. What is the ***pKa of the weak acid***?

3. Consider the reaction:

$$PCl_{5(g)} \leftrightharpoons PCl_{3(g)} + Cl_{2(g)} \qquad \Delta H^\circ = +124 \text{ kJ}$$

a. A reaction mixture at 453 K initially contains 522 bar of PCl_5. At equilibrium, the total pressure in the reaction mixture is 748 bar. Calculate $\boldsymbol{K_p}$ at this temperature.

b. A second reaction mixture at 175 K initially contains 255 bar of PCl_3 and 168 bar Cl_2. What is the equilibrium ***partial pressure of PCl_5*** in this mixture?

c. How will the ***equilibrium pressure of PCl_5 change*** if the temperature is decreased?

4. A solution is prepared so that the initial concentration of aluminum nitrate is 0.10 M, the initial concentration of sodium fluoride is 1.50 M, and the initial concentration of sodium phosphate is 2.00 M. Assume the complex ion formed contains the highest number of ligands to the central metal ion.

   a. Does a precipitate form from this solution?

   b. What is the equilibrium concentration of aluminum ions in the solution?

5. What is the ***equilibrium concentration of cobalt(III) ion*** in a solution that is 0.20 M ethylenediamine (en) and 0.0150M cobalt(III) nitrate.

6. Calculate the ***molar solubility of silver oxalate*** in 1.00 M sodium thiocyanate.