# Exercise 7.5
# Equilibrium Constants and ICE Tables

*Some instructors will review ICE tables when discussing equilibrium and free energy. Others will wait until acids and bases at the end of the course. This exercise can be done at either point in the course. Use of ICE tables ought to have been taught in high school, so doing this exercise early shouldn't hurt – even if your instructor waits to cover the topic later.*

*Please note that ICE tables can use any property that is directly proportional to moles under the given conditions: molarity of solutes, partial pressures of gases (at constant V and T), volumes of gases (at constant P and T) and, of course, moles.*

*Remember that equilibrium constants use activities! Some species always have an activity of 1…*

1. At 25 ℃, the equilibrium constant for the reaction below is $5.0 \times 10^{-13}$.

$$AgBr_{(s)} \rightleftharpoons Ag^{+}_{(aq)} + Br^{-}_{(aq)}$$

(a) Enough silver bromide is added to water to ensure that equilibrium is reached. Calculate the concentrations of each ion at equilibrium.

(b) Calculate the minimum mass of silver bromide required to reach equilibrium in 1.00 L solution.

2. At 25 ℃, the equilibrium constant for the reaction below is $1.8 \times 10^{-5}$.

$$CH_3CO_2H_{(aq)} \rightleftharpoons H^+_{(aq)} + CH_3CO^-_{2(aq)}$$

6.32 g $CH_3CO_2H$ is added to water to make a solution with a total volume of 125 mL. Calculate the concentrations of the products and reactants when equilibrium has been reached.

3. At 200 ℃, the equilibrium constant for the reaction below is 0.155.

$$PCl_{5(g)} \rightleftharpoons PCl_{3(g)} + Cl_{2(g)}$$

If 0.125 mol $PCl_5$ is added to a 2.50 L flask, what is the pressure of each gas when equilibrium has been reached?

*I recommend that you check your answer to #3 before doing #4 to confirm that you properly incorporated the effect of temperature.*

4. At 250 ℃, the equilibrium constant for the reaction below is 122.

$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2\,HI_{(g)}$$

A 5.00 L flask is charged with $0.25\ mol\ H_{2(g)}$ and $0.25\ mol\ I_{2(g)}$ and heated to 250 ℃. Calculate the pressures of all three gases when equilibrium is reached.