DETERMINATION OF AN EQUILIBRIUM CONSTANT
Help Page #1

On the pdf describing the lab it says that the equilibrium constant for the following reaction will be determined:

$$Fe^{3+} + SCN^- \leftrightarrow FeSCN^{2+} \qquad K = [FeSCN^{2+}]/[Fe^{3+}][SCN^-]$$

To determine the equilibrium constant, we will need the equilibrium concentrations. So, the question is how do we get them? I have annotated the document with some questions that will help you to do the first two parts of the lab assignment. My annotations are in green.

The equilibrium concentration of $FeSCN^{2+}$ will be determined photometrically as described below. The equilibrium concentrations of Fe^{3+} and SCN^- will be determined by using known amounts of each (given the initial concentrations) and using the concepts of equilibrium. These concentrations can then be placed in the equilibrium constant expression to determine K.

Where below does it describe how we will get the [$FeSCN^{2+}$]? Where will we get the known amounts of each? What "concepts of equilibrium" is it referring to?

The concentration of $FeSCN^{2+}$ will be determined by comparison of the color intensity of the unknown to the color intensity of samples with known concentrations. Actually, the ability of the solution to absorb light at a particular wavelength (447 nm), which is an indication of the intensity (or concentration), will be compared. A plot of absorbance versus concentration will be prepared from known samples. The absorbance of the unknown is then found and the corresponding concentration is determined from the plot.

What kind of a plot is being described here?

To get known concentrations of $FeSCN^{2+}$, the above equilibrium is forced way to the right by combining a large amount of Fe^{3+} with a relatively small amount of SCN^-. The amount of $FeSCN^{2+}$ is then assumed to be the same as the amount of the limiting reactant SCN^- originally added.

Why is it talking about limiting reactants?

The plot of absorbance versus concentration is theoretically linear (the mathematical expression is of the form y = mx + b). To actually make the plot, determine five points by finding the absorbance of five different solutions, each made with 6.3 mL of 0.2 M Fe^{3+}, but using 0.0, 0.5, 1.0, 1.5, and 2 mL of 0.002 M SCN^-, respectively. To each of these solutions add enough 0.1 M HNO_3 to make a total of 25 mL. Plot the absorbance versus $FeSCN^{2+}$ concentration (which is assumed to be the same as the concentration of SCN^- added, since it will be the limiting reactant). Plot absorbance along the y-axis and concentration along the x-axis.

What is this paragraph all about? Why use the amounts that are given?

Determine K for each of the following experiments and report the average with an uncertainty. Use the following solutions.

What will we do with this table? Why is it set up the way it is?

Experiment	0.002 M Fe^{3+}	0.002 M SCN^-	0.1 M HNO_3
1	5.00 mL	1.00 mL	4.00 mL
2	5.00 mL	2.00 mL	3.00 mL
3	5.00 mL	3.00 mL	2.00 mL
4	5.00 mL	4.00 mL	1.00 mL
5	5.00 mL	5.00 mL	0.00 mL

Discuss experiment #5 with the instructor before leaving the lab!