Determination of an Equilibrium Constant Worksheet

As you work through the steps in the lab procedure, record your experimental values and the results on this worksheet. Use the exact values you record for your data to make later calculations.

For the following questions absorbance measurements should be reported to three decimal places. Concentrations are from calculations involving the volume (3 significant figures) and molarity (3 significant figures).

If you are having difficulty with the significant figures for the tables in this assignment, try writing out your concentrations in decimal notation. Remember that significant figures can be lost when subtracting values.

For example, 1.00e-3 (3sf) − 1.53e-4 (3sf) seems like it should give 8.47e-4 (3sf).

However, let's view this with the values written out:

$$\begin{array}{rl} 0.00100 & \text{(3sf)} \\ -0.000153 & \text{(3sf)} \\ \hline 0.00085 & \text{(2sf)} \end{array}$$

A significant figure has been lost because the least precise number, 0.00100, is only good to the hundred-thousandths place.

Part A - Calibration Curve of $FeSCN^{2+}$ Solutions

What is the initial concentration of SCN^- in Solution 1A? Consider using the formula $C_iV_i = C_fV_f$.

Given your result from Question 1, what is the concentration of $FeSCN^{2+}$ in Solution 1A? Consider the stoichiometry of the $FeSCN^{2+}$ formation reaction. (Enter your result in Table A.)

Table A. Calibration Curve of $FeSCN^{2+}$ Solutions

Solution #	**Volume of 0.100 *M* Fe^{3+} (mL)**	**Volume of 5.00 × 10^{-4} *M* SCN^- (mL)**	**Volume of water (mL)**	**Total Volume (mL)**	**[$FeSCN^{2+}$] (*M*)**	**Absorbance at ∼470 nm**
blank	1.00	0.00	5.00	6.00	- - - - - -	- - - - - -
1A	1.00	1.00	4.00	6.00		
2A	1.00	1.50	3.50	6.00		
3A	1.00	2.00	3.00	6.00		
4A	1.00	2.50	2.50	6.00		
5A	1.00	3.00	2.00	6.00		

Equation of Trendline $y =$ _____ $x +$ _____ $R^2 =$ _____

Upload your graph as a file with a maximum size of 1 MB. (*You will upload this file in the WebAssign question.*)

In Part A, how does the intensity of the color of the solutions vary with the concentration of $FeSCN^{2+}$ in solution?

In Part A, how does the absorbance of the solutions vary with the concentration of $FeSCN^{2+}$ in solution?

Part B - Measuring [$FeSCN^{2+}$] in Equilibrium Mixtures

Complete the following table. (Use your calibration curve from Part A and your absorbance data from Part B to calculate the equilibrium concentration of $FeSCN^{2+}$. Remember that the y-value from the calibration curve represents the absorbance and the x-value the concentration.)

Table B. Measuring [$FeSCN^{2+}$] in Equilibrium Mixtures

Solution #	Volume of $2.00 \times 10^{-3} M$ Fe^{3+} (mL)	Volume of $2.00 \times 10^{-3} M$ SCN^- (mL)	Volume of water (mL)	Total Volume (mL)	Initial [Fe^{3+}] (M)	Initial [SCN^-] (M)	Absorbance at ~470 nm	Calculated Equilibrium [$FeSCN^{2+}$] (M)
1B	1.00	3.00	2.00	6.00				
2B	2.00	3.00	1.00	6.00				
3B	3.00	3.00	0.00	6.00				
4B	3.00	2.00	1.00	6.00				
5B	3.00	1.00	2.00	6.00				

Complete the reaction table for Solution 1B below. (All entries should be in **molarity**.)

	$\mathbf{Fe^{3+}}(aq)$	$+\ \mathbf{SCN^{-}}(aq)$	$\rightleftharpoons\ \mathbf{FeSCN^{2+}}(aq)$
[initial]			
[Δ]			
[final]			

From the equilibrium concentrations in the table for Solution 1B above, calculate the equilibrium constant for the reaction. (Enter your answer to two significant figures.)