Pre-Laboratory Assignment:  
Determination of $K_c$ for a Complex Ion Formation

Name ____________________________________________  Section _________

A student mixes 5.0 mL of 0.00200 M Fe(NO$_3$)$_3$ with 5.0 mL 0.00200 KSCN. She finds that the concentration of FeSCN$^{2+}$ in the equilibrium mixture is 0.000125 M. Follow these steps to determine the corresponding experimental value of $K_c$ for the reaction of Fe$^{3+}$ and SCN$^-$ to produce this complex ion. Show your calculations for each step below and then place the appropriate value(s) in the equilibrium (or 'ICE') table near the bottom of the page.

**Step 1.** Calculate the molarity of Fe$^{3+}$, SCN$^-$, and FeSCN$^{2+}$ initially present after mixing the two solutions, but prior to any reaction taking place. $(M_1V_1 = M_2V_2)$

**Step 2.** Determine the expression and initial value for $Q_c$. Then give the appropriate signs of the concentration changes for each species in terms of the reaction’s shift, or $x$, into the 'ICE' table.

**Step 3.** Fill in the equilibrium value for the molarity of FeSCN$^{2+}$. From this, you can determine the value of $x$.

**Step 4.** Given the value of $x$, determine the equilibrium molarities of Fe$^{3+}$ and SCN$^-$. 

\[
\begin{array}{c|c|c|c}
\text{Fe}^{3+} (aq) & + & \text{SCN}^- (aq) & \Rightarrow \text{FeSCN}^{2+} (aq) \\
\hline
I & & & \\
C & & & \\
E & & & \\
\end{array}
\]

**Step 5.** Give the correct expression for $K_c$ for this equation. Then calculate the value of $K_c$ for the reaction from the equilibrium concentrations. Use correct significant figures.

**Step 6.** On the reverse side, complete an 'ICE' table using this same procedure, but using a different reaction stoichiometry: Fe$^{3+}$ + 2 SCN$^- \Rightarrow$ FeSCN$^{2+}$. Assume that the equilibrium concentration of FeSCN$^{2+}$ is 0.0000625 M, or one-half its previous value. Remember how the reaction stoichiometry affects the expression for $K_c$. 

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*K_c* Determination  
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