6.P: Determination of Kc for a Complex Ion Formation (Pre-Lab)

A student mixes 5.0 mL of 0.00200 M $\mathrm{Fe(NO_3)_3}$ with 5.0 mL 0.00200 M KSCN. She finds that the concentration of $\mathrm{FeSCN^{2+}}$ in the equilibrium mixture is 0.000125 M. Follow these steps to determine the corresponding experimental value of K_c for the reaction of $\mathrm{Fe^{3+}}$ and $\mathrm{SCN^-}$ 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 $\mathrm{Fe^{3+}}$, $\mathrm{SCN^-}$, and $\mathrm{FeSCN^{2+}}$ 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 $\mathrm{FeSCN^{2+}}$. From this, you can determine the value of x.
- *Step 4.* Given the value of x, determine the equilibrium molarities of $\mathrm{Fe^{3+}}$ and $\mathrm{SCN^-}$.

'ICE' Table

	$\mathrm{Fe^{3+}(aq)}$	$+$ $\mathrm{SCN^-(aq)}$	$\rightleftharpoons$ $\mathrm{FeSCN^{2+}(aq)}$
I			
C			
E			

- *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: $\mathrm{Fe^{3+} + 2\,SCN^- \rightleftharpoons Fe(SCN)_2^{2+}}$ (ignore that fact that this is incorrect since the reaction is not balanced with respect to charge). Assume that the equilibrium concentration of $\mathrm{FeSCN^{2+}}$ is 0.0000625 M, or one-half its previous value. Remember how the reaction stoichiometry affects the expression for K_c.