

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

Name \_\_\_\_\_

Section \_\_\_\_\_

A student mixes 5.0 mL of 0.00200 M  $\text{Fe}(\text{NO}_3)_3$  with 5.0 mL 0.00200 M  $\text{KSCN}$ . She finds that the concentration of  $\text{FeSCN}^{2+}$  in the equilibrium mixture is 0.000125 M. Follow these steps to determine the corresponding experimental value of  $K_c$  for the reaction of  $\text{Fe}^{3+}$  and  $\text{SCN}^-$  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  $\text{Fe}^{3+}$ ,  $\text{SCN}^-$ , and  $\text{FeSCN}^{2+}$  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  $\text{FeSCN}^{2+}$ . From this, you can determine the value of  $x$ .

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

'ICE' Table			
	$\text{Fe}^{3+}(\text{aq})$	+ $\text{SCN}^-(\text{aq})$	$\rightleftharpoons \text{FeSCN}^{2+}(\text{aq})$
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:  $\text{Fe}^{3+} + 2\text{SCN}^- \rightleftharpoons \text{FeSCN}^{2+}$ . Assume that the equilibrium concentration of  $\text{FeSCN}^{2+}$  is 0.0000625 M, or one-half its previous value. Remember how the reaction stoichiometry affects the expression for  $K_c$ .

