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Pre-Lab Questions: Equilibrium Constant Determination for $FeSCN^{+2}$

1. A student mixes 5.00 mL of 2.00×10^{-3} M $Fe(NO_3)_3$ with 5.00 mL of 2.00×10^{-3} M KSCN. She finds that in the equilibrium mixture, the concentration of $FeSCN^{2+}$ is 1.40×10^{-4} M. Find K_c for $Fe^{3+}(aq) + SCN^-(aq) \rightleftharpoons FeSCN^{2+}(aq)$.

   Step 1. Calculate the initial, diluted concentrations of the Fe^{3+} and SCN^- ions in the total of 10.00 ml solution using $M_1V_1 = M_2V_2$

   $[Fe^{3+}]$_____ $[SCN^-]$_____

   Step 2. Use the initial concentrations of the Fe^{3+} and SCN^- ions along with the equilibrium concentration of the $FeSCN^{2+}$ ion and the reaction stoichiometry to determine the equilibrium concentrations of Fe^{3+} and SCN^-.

	$[Fe^{3+}]$	+	$[SCN^-]$	⇋	$[FeSCN^{2+}]$
initial	_____		_____		_____
Δ	_____		_____		_____
equil	_____		_____		_____

   Step 3. Solve for the value of K_c for the reaction. (Use Eq. 2 and the results of Step 2.)

   K_c = _____

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Data: Determination of the Equilibrium Constant for the Formation of $FeSCN^{+2}$

Mixture	Vol. of 2.00×10^{-3} M $Fe(NO_3)_3$ (in mL)	Vol. of 2.00×10^{-3} M KSCN (in mL)	Vol. of H_2O (in mL)	Absorbance
1	5.00	1.00	4.00	_____
2	5.00	2.00	3.00	_____
3	5.00	3.00	2.00	_____
4	5.00	4.00	1.00	_____
5	5.00	5.00	0.00	_____

Mixture	Initial Concentrations AFTER MIXING		Equilibrium Concentrations				
	$[Fe^{+3}]$	$[SCN^-]$	$[Fe^{+3}]$	+ $[SCN^-]$	⇋ $[FeSCN^{+2}]$		K_c
1	_____	_____	_____	_____	_____		_____
2	_____	_____	_____	_____	_____		_____
3	_____	_____	_____	_____	_____		_____
4	_____	_____	_____	_____	_____		_____
5	_____	_____	_____	_____	_____		_____

Hint: Set up each mixture as shown in the pre-lab *Reaction-Initial-Change-Equilibrium*

Average K_c _____

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Post-Lab Questions: Determination of the Equilibrium Constant for the Formation of $FeSCN^{+2}$

1. Are the K_c values on the previous page consistent? If not, suggest a reason for any large differences.

2. In carrying out this analysis, we made the assumption that the reactants were reacting as a 1:1 mole ratio, as given by Equation 1. There is no inherent reason why the reaction might not have been a 1:2 mole ratio:

$$Fe^{3+}(aq) + 2\ SCN^{-}(aq) \rightleftharpoons Fe(SCN)_2^{+}(aq) \qquad (3)$$

   a. Fill in the equilibrium values in the chart below using your experimental data and this new reaction ratio:

Reaction	**$Fe^{+2}(aq)$ +**	**$2\ SCN^{-}(aq) \rightleftharpoons$**	**$Fe(SCN)_2^{+}(aq)$**
test tube 1 mixture at equilibrium			
test tube 5 mixture at equilibrium			

   b. Calculate the value of K_c using the data from the test tube 1 mixture, assuming that the reaction is actually the one shown in equation 3.

   c. Calculate the value of K_c using the data from the test tube 5 mixture, assuming that the reaction is actually the one shown in equation 3.

   d. Compare the K_c values that you calculated in parts a and b above. Are they consistent? Do you think Reaction 3 is occurring?