

Name: _____

Section: _____

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

1. A student mixes 5.00 mL of 2.00×10^{-3} M $\text{Fe}(\text{NO}_3)_3$ 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 $\text{Fe}^{3+}(\text{aq}) + \text{SCN}^{-}(\text{aq}) \rightleftharpoons \text{FeSCN}^{2+}(\text{aq})$.

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

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

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^{-} .

	$[\text{Fe}^{3+}]$	+	$[\text{SCN}^{-}]$	\rightleftharpoons	$[\text{FeSCN}^{2+}]$
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 $\text{Fe}(\text{NO}_3)_3$ (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	_____

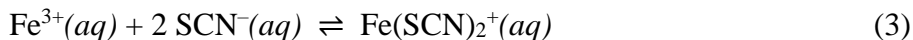
Mixture	Initial Concentrations AFTER MIXING		Equilibrium Concentrations		K_c
	$[\text{Fe}^{+3}]$	$[\text{SCN}^-]$	$[\text{Fe}^{+3}]$	$[\text{SCN}^-]$	
1	_____	_____	_____	_____	_____
2	_____	_____	_____	_____	_____
3	_____	_____	_____	_____	_____
4	_____	_____	_____	_____	_____
5	_____	_____	_____	_____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

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

Post-Lab Questions: Determination of the Equilibrium Constant for the Formation of FeSCN²⁺

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:



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

Reaction	Fe³⁺(aq) +	2 SCN⁻(aq) ⇌	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?