**Determining the Equilibrium Constant, Keq**

*Method A*

**Purpose**:

1. Determine the equilibrium constant, Keq, for the formation of Iron (III) Thiocyanate ion at room temperature.
2. Prove that the equilibrium constant is unaffected by concentration changes.

**Pre-Lab Information**

This experiment will deal with the reversible formation of the Iron (III) Thiocyanate complex ion.

Fe3+(aq) + SCN-(aq) ⮀ FeSCN2+(aq)

In this lab, you will be measuring colour intensities to determine the equilibrium concentration of iron (III) thiocyanate. To do this, you will use a spectrophotometer to measure the absorbance of light and with this information and Beer’s Law, you will be able to calculate the equilibrium concentration of FeSCN2+. However, you still need to make use of ICE tables to determine the equilibrium concentrations of Fe3+ and SCN- in order to calculate the equilibrium constant for this reaction.

**Materials**:

0.001mol/L KSCN Fe(NO3)3 solutions (0.01M, 0.008M, 0.005M)

3 test tubes 3 matched cuvettes pipettes spectrophotometer

**Procedure**:

1. Pipette 5 mL of each Fe(NO3)3 solution into three different test tubes.
2. Pipette 5 mL of 0.001M KSCN into each of the three test tubes.
3. Starting with test tube 1, pour the contents in a cuvette until it is ¾ full. Do not over fill. Repeat for the remaining test tubes.
4. Take the cuvettes to the spectrophotometer and record the absorbance for each solution. Make sure to wipe the outside of the cuvette with a kimwipe before measuring the absorbance. Confirm that the spectrophotometer is set to a wavelength of 565 nm.

**Calculations**:

Complete the following tables and provide sample calculations as directed.

[FeSCN2+] at equilibrium can be calculated from the absorbance via the following method:

*Method A:*

*Beer-Lambert Law, more commonly known as Beer’s Law, states that the optical absorbance of a coloured substance in a transparent solvent varies linearly with both the sample cell pathlength and the coloured substance’s concentration.*

***A = ab[FeSCN2+]***

*A = absorbance*

*a = absorptivity constant for a given solution at a given wavelength  
 at a wavelength of 565 nm, a = 4700 L/mol/cm*

*b = pathlength, 1.00 cm*

Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

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**Results**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Test Tube** | **Initial**  **[Fe3+]** | **Initial**  **[SCN-]** | **Absorbance** | **Equilibrium**  **[FeSCN2+]** |
| **1** |  |  |  |  |
| **2** |  |  |  |  |
| **3** |  |  |  |  |

**Analysis**

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Tube 1** | **[Fe3+]** | **[SCN-]** | **[FeSCN2+]** |
| Initial |  |  | **Keq** |
| Change |  |  |  |
| Equilibrium |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Tube 2** | **[Fe3+]** | **[SCN-]** | **[FeSCN2+]** |
| Initial |  |  | **Keq** |
| Change |  |  |  |
| Equilibrium |  |  |  |

|  |  |  |  |
| --- | --- | --- | --- |
| **Test Tube 3** | **[Fe3+]** | **[SCN-]** | **[FeSCN2+]** |
| Initial |  |  | **Keq** |
| Change |  |  |  |
| Equilibrium |  |  |  |

**Sample Calculations**

Show your work for the following calculations, for test tube 2.

1. Initial concentration of Fe3+
2. Initial concentration of SCN-
3. Equilibrium concentration of FeSCN2+
4. Equilibrium constant

**Conclusion**

1. Based on your data, what is the equilibrium constant for this reaction? What does this tell us about the equilibrium?
2. Do your results support the fact that an equilibrium constant is independent of concentration changes? Justify your answer.