Josh Whitehead
V1069343

PRELAB 4 QUIZ

The following questions have been adapted from Stanton, Zhu and Atwood, "Experiments in General Chemistry Featuring Measurenet", 2nd ed.

1. Complete the table below by calculating the initial SCN^- and final $Fe(SCN)^{2+}$ concentrations for each of the five standard solutions. In addition to the volume of KSCN indicated in the table below, each solution contains 5.00 mL of $Fe(NO_3)_3$ and sufficient 0.050 M HNO_3 to produce a total volume of 25.00 mL of solution.

$$Fe^{3+}(aq) + SCN^-(aq) \rightleftarrows Fe(SCN)^{2+}(aq)$$

Molarity of KSCN = 0.00165 M   Molarity of $Fe(NO_3)_3$ = 0.165 M

Solution	*Volume SCN^-*	*Initial $[SCN^-]$ (M)*	*$[Fe(SCN)^{2+}]_{final}$ (M)*	*Absorbance*
1	5.00 mL	3.3×10^{-4}	3.3×10^{-4}	1.590
2	4.00 mL	2.64×10^{-4}	2.64×10^{-4}	1.320
3	3.00 mL	1.98×10^{-4}	1.98×10^{-4}	0.990
4	2.00 mL	1.32×10^{-4}	1.32×10^{-4}	0.690
5	1.00 mL	6.6×10^{-5}	6.6×10^{-5}	0.335

$M_{KSCN} = M_{SCN^-} = 0.00165 M \rightarrow n_{SCN^-} = 0.00165 M \times 0.005 L = \underline{8.25\times10^{-6} mol}$

$M_{SCN^-} = \frac{8.25\times10^{-6} mol}{0.025 L} = 3.3\times10^{-4}$

$M_{Fe(NO_3)_3} = 0.165 \rightarrow n_{Fe(NO_3)_3} = 0.165 M \cdot 0.005 L = \underline{8.25\times10^{-4} mol}$

$n_{Fe^{3+}} = n_{Fe(NO_3)_3} = 8.25\times10^{-4} mol$

$\therefore (8.25\times10^{-4}) Fe^{3+} + (8.25\times10^{-6}) SCN^- \rightleftarrows (X) Fe(SCN)^{2+}$

SCN^- is limiting reactant $\therefore X = 8.25\times10^{-6} mol\ SCN^- \cdot \frac{1}{1} = \underline{8.25\times10^{-6} mol\ Fe(SCN)^{2+}}$

$\therefore n_{SCN^-} = n_{Fe(SCN)^{2+}} \rightarrow M_{SCN^-} = M_{Fe(SCN)^{2+}}$

2. Plot the absorbance versus the $Fe(SCN)^{2+}$ concentration data in Question 1 to prepare a standard curve, then perform a linear regression analysis to determine the equation for the line. Write this equation below in standard y = mx + b format:

Standard Curve: $Y = 4757.6X + 0.043$

Josh Whitehead
V10693343

3. An equilibrium solution is prepared by mixing 2.75 mL of 0.00165 M SCN^-, 5.00 mL of 0.00165 M Fe^{3+} and 2.75 mL of HNO_3, where this solution's absorbance is determined to be 0.915. Using the standard curve prepared in Question 2, you then determine that the equilibrium concentration of $Fe(SCN)^{2+}$ in this solution is 1.83×10^{-4} M. Prepare an ICE table for this equilibrium mixture, being sure to include the initial concentrations, changes in concentrations and the equilibrium concentrations of Fe^{3+}, SCN^- and $Fe(SCN)^{2+}$:

$V_{Tot} = (2(2.75)+5)\ mL = 10.5\ mL$

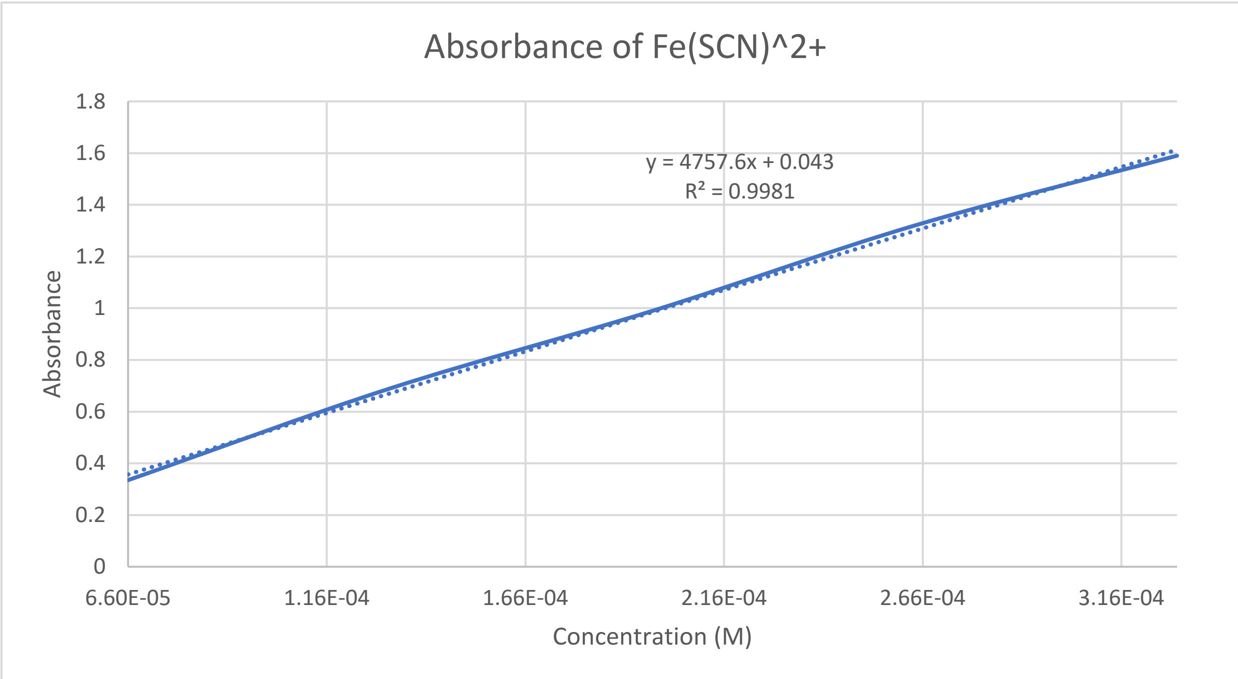
$M_{I\,Fe^{3+}} = \dfrac{0.00165\ M \cdot 0.005\ L}{0.0105\ L} = 7.86 \times 10^{-4}\ M$

$M_{I\,SCN^-} = \dfrac{0.00165\ M \cdot 0.00275\ L}{0.0105\ L} = 4.32 \times 10^{-4}\ M$

	$[Fe^{3+}]$	$[SCN^-]$	$[Fe(SCN)^{2+}]$
i	7.86×10^{-4} M	4.32×10^{-4} M	0
C	$-x$ -1.83×10^{-4}	$-x$ -1.83×10^{-4}	x 1.83×10^{-4}
e	6.03×10^{-4}	2.49×10^{-4}	1.83×10^{-4}

4. Determine K for the equilibrium mixture in Question 3.

$K = \dfrac{1.83\times10^{-4}}{(2.49\times10^{-4})(6.03\times10^{-4})} = \boxed{1.22\times10^{3}}$


Absorbance of Fe(SCN)^2+
y = 4757.6x + 0.043
R² = 0.9981
Absorbance
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
6.60E-05
1.16E-04
1.66E-04
2.16E-04
2.66E-04
3.16E-04
Concentration (M)