Equilibrium-II Virtual Lab Expectations and Grading (**Due Jan 24, 2022**)

Chem 112000-2: Section-33

January 20, 2022

1 General Remarks

This can be handwritten or typed, though typed is easier to read/grade. Or, some portions can be handwritten and some can be typed. Though, you may run out of space if you try and handwrite it. If it is handwritten, make sure that it is legible and the scan is readable. Note this assignment is due Monday **Jan 24, 2021** at 5:30 pm.

If something still doesn't make sense, please email me!

2 Pre-Lab Questions (15 points)

Question 1 is worth 5 points. This is a straight forward numeric problem. Be mindful of significant figures and units.

Question 2 is worth 10 points. For part a, balance the equations and you need to report 6 values total ($[Fe^{3+}]$, $[A^-]$, and the complex for each reaction). For part b, write the equilibrium expressions and give the numerical values for both cases in (a).

3 Data Analysis (60 points)

As the directions specify, please only provide 1 sample calculation for each solution. If multiple sample calculations are reported, points will be taken off (roughly half those allocated to sample calculations). Also, be mindful of units and significant figures throughout.

Table 1, fill in the last 2 columns. You need 2 sample calculations for this table: one for $[Fe^{3+}]_i$ and one for $[SCN^-]_i$. **Note that this is similar to the 4th table in the lab manual, under the 'Preparation of Solutions' bullet 5. That is, 'The concentrations [$Fe(NO_3)_3$] and [KSCN] given in the table are from 10.0 mL of each stock solution to form a mixture whose total volume is 20.0 mL.'**

Table 2, the first two columns should be the same as the last 2 from table 1. You only need to compute A/A_1 where A_1 is solutions 1 absorbance. You only need 1 sample calculation

for the absorbance.

Table 3 and 4 are the same, except they differ in which reaction you assume to take place. The first column, A/A_1 should come from the last column of table 2. Recall for solution 1, we assume all the SCN^- is converted to the complex at equilibrium. From this, compute $[Fe^{3+}]_{eq}$ and then K_{eq}. For solutions 2-5, use the A/A_1 ratio and the concentration of the complex in solution 1 to determine the concentration of the complex in the solution (Beer's law will be helpful). From here, compute $[Fe^{3+}]_{eq}$, $[SCN^-]_{eq}$, and then finally K_{eq}. For each table, show only 1 calculation for each of the following:

1. Calculation of the complex concentration
2. Calculation of $[Fe^{3+}]_{eq}$
3. Calculation of $[SCN^-]_{eq}$
4. Calculation of K_{eq}

I recommend you use solution 2s values when showing the sample calculations.

So, to be clear, there should only be 2 calculations in table 1, 1 calculation in table 2, 4 calculations in table 3, and 4 calculations in table 4.

4 Discussion (20 points)

Each subquestion is worth 5 points each. Question 1 should be straight forward and familiar at this point. **You do not need to show your work for average or standard deviation.** Determine which K_{eq} is correct and hence which complex is being formed. Use this for the rest of the questions in the discussion.

For question 2, specifically say which value(s) you omit. If there are no outliers, then state that and nothing more is needed. Only do this for the complex you say is forming in question 1.

For question 3, show your work when computing $[SCN^-]_{eq}$ (points will be taken off if not shown). Justify your response using the value you get. Only do this for the complex you say is forming in question 1.

For question 4, use what you calculated in question 3 to determine the percentage and ratio. Explain if it makes sense or not the value you get. Only do this for the complex you say is forming in question 1.

5 Conclusion (5 points)

In this section, summarize the main results (which complex is forming, and the K_{eq}). Discuss errors via theory or experiment that could influence your results.