

Lab Guide - Determining the Rate of a Reaction Advanced Chemistry - April 2011

1. Due Date: Tuesday, April 19, 2011

2. Fill in $[I^-]_0$ and $[S_2O_8^{2-}]_0$

The initial concentration of each of these ions must be determined distinctly for each trial. This will require you to use the formula $C_1V_1 = C_2V_2$ as shown below.

For $[I^-]_0$ in trial 1,

$C_1 = 0.20 \text{ M}$ (from the bottom of page 2 of the lab)

$V_1 = 20.0 \text{ mL} = 0.0200 \text{ L}$ (from the second column of the table)

$C_2 = [I^-]_0 = ?$ (to be determined)

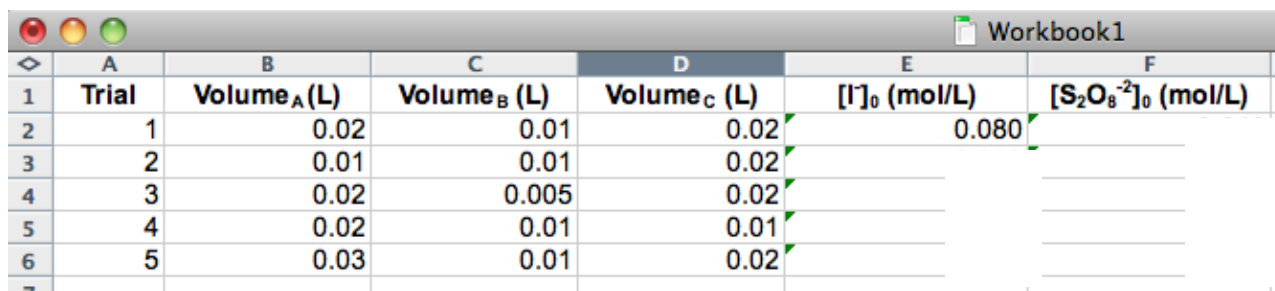
$V_2 = 50.0 \text{ mL} = 0.0500 \text{ L}$ (total volume of all solutions added in trial 1)

Using the formula shown above,

$(0.20 \text{ M})(0.0200 \text{ L}) = C_2(0.0500 \text{ L})$

$C_2 = 0.080 \text{ M} \leftarrow$ **this value would go in the cell for $[I^-]_0$ in trial 1**

This calculation must be repeated nine more times to fill in the rest of the concentration values. An alternate option would be to plug all of your numbers into Excel, or another spreadsheet program, and make it do the work for you. An example of this is shown below. (This took less than 10 minutes to make from a blank spreadsheet.)



	A	B	C	D	E	F
	Trial	Volume _A (L)	Volume _B (L)	Volume _C (L)	$[I^-]_0$ (mol/L)	$[S_2O_8^{2-}]_0$ (mol/L)
1	1	0.02	0.01	0.02	0.080	
2	2	0.01	0.01	0.02		
3	3	0.02	0.005	0.02		
4	4	0.02	0.01	0.01		
5	5	0.03	0.01	0.02		
6						
7						

3. Analysis Questions

1. Consider the reaction mechanism shown in the lab outline. It illustrates that this reaction happens in two stages, with the first one as the rate-determining step. The experiment has been set up such that the concentration of reactants that is being varied is only involved in the rate-determining step, but the point of this question is to focus on the molar ratios shown in the balanced equation. It may be difficult to draw conclusions about the rate law for this reaction based on the experimental data we derived (which was not extremely accurate) but do your best. Once you have this information, you can discuss the reaction kinetics at work here and why the reaction might proceed the way it does. Things you can mention in your answer include **activation energy**, **collision theory** and/or **the Maxwell-Boltzmann Distribution**.

2. This question can be answered by examining your experimental data. Again, do your best to draw some sort of conclusion given the inaccuracies in our experiment.
3. See number 2 above.
4. This question allows you to further expand on your answer for question 1. What is the order of the reaction with respect to each of the reactants, according to your experimental data? Is this accurate to the established value (available online if you look for it)? Discuss why or why not.
5. Extra research will be required to answer this question, as the reaction for the catalyst was not provided. This information is certainly available to you if you are resourceful. Remember that a catalyst remains unchanged after the reaction has been completed.

Good luck completing your lab report and have a safe and relaxing Songkran break! If you have any questions then we will address them in class on Monday when we return to school.