Rate Law of the Thiosulfate Reaction

Reminder – Goggles must be worn at all times in the lab!

Introduction:

In this lab you will be attempting to determine the form of the rate law for the reaction between hydrochloric acid (HCl) and sodium thiosulfate ($Na_2S_2O_3$). In aqueous solution, the reaction that occurs can be represented by

$$Na_2S_2O_3 + 2\ HCl \rightarrow 2\ NaCl + S + SO_2 + H_2O$$

As the reaction proceeds, the production of insoluble sulfur will prevent visible light from passing through the solution. This provides us the opportunity to compare the length of time to reach this point at varying concentrations of reactants. Of course, concentration is not the only factor that effects the rate of a reaction. Temperature can also be a factor, so it will be important to attempt to perform the reactions at a constant temperature.

Materials:

Large and medium test tubes	1.0 M HCl solution	0.20 M $Na_2S_2O_3$
10 mL pipet and pump	Thermometer	Stop watch/Cell phone

Purpose:

The purpose of this experiment is to determine the correct form of the rate law for this reaction.

Caution!

The reaction we are studying produces sulfur dioxide gas, SO_2, which is a know respiratory irritant. In addition to the room ventilation, we will have the doors open while performing this lab. We will also remove products to the fume hood in the back room as each trial is completed.

However, if at any time you experience breathing difficulties, please excuse yourself from the classroom to get some fresh air. Alert your instructor if you think your symptoms require the attention of the nurse. Sulfur dioxide gas may be especially problematic for students with asthma.

Some Procedural Suggestions:

1. Be sure that HCl and $Na_2S_2O_3$ do not come into contact until you are ready for the reaction to start.
2. Keep track of reaction and solution temperature.
3. Think about the total volume of the reacting solutions, and keeping that constant.
4. During the reaction, hold the test tube at the top, and look through the solution in the test tube while holding this lab paper right behind the solution in the tube. When you can no longer see the cross through the test tube, stop the stop watch and record the time elapsed.

5. When a reaction has completed, have a member of your group take the test tube to the fume hood in the back room. Dispose of the contents of the test tube into the waste container located there. This will help keep SO_2 from building up in the room.
6. Be certain that all glassware is thoroughly cleaned at the end of the lab. Always wear your googles during the cleaning of glassware, as the "splash back" from cleaning is when many instances of chemical contamination of the eye occur.

RESULTS

	[$Na_2S_2O_3$]	**[HCl]**	**Time to completion, s**
Trial #1			
Trial #2			
Trial #3			
Trial #4			

This data table is a suggested format only. I suggest that *at least* six trials be performed. Think deeply about the reasons for that.