

Chemistry 14BL  
Pre-lab Report Guidelines for the Kinetics Experiment

The Experimental Procedures for this Experiment are Provided as a Handout

**(I) On-line Technique Videos For This Experiment**

Click on the title below to download the video (require [Real Player](#))

- (1) [Laboratory Safety](#) (this video was shown on the first day of the lab)
- (2) [Solution Preparation](#)
- (3) [Spectrophotometric Analysis](#)

If you have trouble downloading the videos, go to the following Web site and click on the appropriate title to download the video.

<http://oid.ucla.edu/Webcast/Chemistry/>

[On-line resource for chemical kinetics](#)

**(II) Pre-Lab Report Guideline**

- The title of the experiment
- A reference identifying the procedure handout
- A short introduction summarizing **the goals of the experiment AND the techniques** that you will use in the experiment
- A brief flow chart summary of the procedures of the experiment
- Calculate the approximate molarity for solution 3 and the sodium hypochlorite (assume *6.15% by weight to volume*). You will need to read the lab procedure in order to complete these calculations. **SHOW ALL YOUR WORK.**

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**(II) Pre-Lab Report Guideline**

- MSDS information for **sodium hypochlorite** (concentration between 5-6% by weight and volume) and **FD&C RED #3 (Erythrosine B)**

*Note: For FD&C Red #3 MSDS, go to the following website and type Erythrosine B in the search engine:*

<http://chemfinder.cambridgesoft.com/>

**Note: In MSDS, select the site that gives you the MSDS information closest to the concentration or grade listed above for each individual chemical.**

You should record the following MSDS information in your notebook for the chemicals listed above.

**(Printouts directly from the Web pages will NOT be accepted!!)**

- (a) Product Name
- (b) Chemical Formula
- (c) Formula Weight
- (d) Melting Point; Boiling Point and Density
- (e) Health Hazard Data (**summarize in your own words**)
- (f) Spill and Disposal procedures (**summarize in your own words**)

*Note: Not all information is available for this particular compound. Make sure you check all the links in the CS Chemfinder Web site. If a particular information could not be found, cite the URL address of the link(s) that you used to search for that particular information.*

Use **NEW** pages in the lab notebook for the following items:

- A **BLANK** table to record the preliminary information on the weight of the dye, bleach concentration and initial solution absorbances.
- Set up a **BLANK** data table to record the measured absorbances and times for **EACH** of the reaction trial. Leave space for a heading that will identify the trial number and the experimental conditions for the trial during the lab period.

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## Post-lab Report Guidelines for the Kinetics Experiment

### This is a GROUP Report

#### (I) DATA & DATA ANALYSIS (MUST show ALL your work in order to receive any credit)

Write down the names of all the members in the group. Write out the responsibility of each member both for the experiment and for the post-lab report.

- Calculate the molarity for the bleach solution. (*you may assume that the stock bleach solution contains only NaOCl and that the concentration given on the bottle has a unit of w/v%*)

Note: Make sure that you are using the w/v% given on the BOTTLE of NaOCl in the lab for the above calculation

- Calculate the **precise** molarity of food-dye solution 1, food-dye solution 2 & food-dye solution 3.
- Calculate the **initial** concentration (molarity) of the food-dye solution in **EACH** trial.
- Using the Beer's law formula, calculate the **molar extinction coefficient**,  $\epsilon$ , for the food dye. You may assume that the diameter of the culture tube to be 1.00cm.

*(Hint: for this part, use the absorbance you obtained in the lab under "Calibration of Spectrophotometer" to find the molar extinction coefficient of the red food-dye.)*

- In tabular form, now set up an **EXCEL spreadsheet table** for **EACH** trial. Label the columns as time, absorbance, [dye],  $\ln$  [dye] and  $1/[\text{dye}]$ . Print out the data and attach them to your report.
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Note: [ ] means the concentration has a unit of mol/L.

*(Hint: From Beer's law, use your experimental absorbances measured at various times together with the molar extinction coefficient of the dye to calculate the [dye] at various time for EACH TRIAL)*

*Provides a legend for each table that gives the experimental condition (temperature, volumes of each reagent etc.)*

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#### (II) Graphs

Using EXCEL, plot the following **three** graphs for **EACH TRIAL**:

- [dye] vs. time
- $\ln[\text{dye}]$  vs. time
- $1/[\text{dye}]$  vs time

Be sure to title your graphs, and label the axes including units. EACH of your graph **MUST** include a legend for the experimental condition of EACH TRIAL. Print EACH graph on a separate piece of paper.

#### (III) Analysis

- From a visual inspection of the plots (*see above*), select the linear relationships to establish **a**, the order of the reaction with respect to the dye. You should do this for each of your trial.

*Note: if you have trouble determining the order with respect to dye for trial 5 & 6 based on visual inspection, try using trial 3 & 4 as your reference,*

*(Refer to lecture guide for the relationship between the shape of the graph and the order of the chemical species)*

- By comparing the ratio of the slopes of the lines for trials 1&5, determine **b**, the order of the reaction with respect to hypochlorite. *Refer to the lab handouts page 2 & 3 on how to find the order of the hypochlorite using the ratio of the slopes.*
- By comparing the ratio of the slopes of the lines for trials 1&6, determine **b**, the order of the reaction with respect to hypochlorite.
- Compare the two values of the **b**. Do they agree?
- Using the plots that give linear relationships, determine the rate constant ( $k$ ) for **each trial**. Do they agree with each other? The rate constants should have the appropriate units.

(Hint:  $\text{Slope} = -k [\text{NaOCl}]^b$  where **b** is the order of the bleach you found earlier. **[NaOCl]** is the **INITIAL MOLARITY** of the sodium hypochlorite for the trial )

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#### (IV) Conclusions

- Summarize your results and the justifications for using the graphs you did to determine the order of the reaction.

- Write out the experimental rate law for the experiment based on the order of the dye and the order of the sodium hypochlorite that you obtained in this report.

*Note: Do NOT average out the orders that you obtained (i.e. the values of  $a$  and  $b$ ) when writing out the experimental rate law. Write the most probable rate law if the orders do not agree with each other among various trial. Give your explanation for the reason behind such a rate law,*

- Kinetics studies can disprove a proposed mechanism, but can never prove a mechanism. Explain whether the results that you have obtained are consistent with the mechanism proposed at the beginning of this assignment.