

Honors Chemistry Reaction Rates Lab

NAMES:

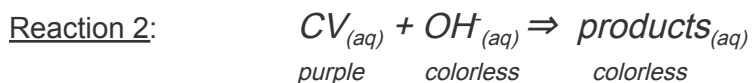
MAKE A COPY OF THIS DOCUMENT FOR YOUR GROUP TO BE SUBMITTED VIA GOOGLE DOCS/EMAIL

In this experiment, the rates of two different reactions will be compared by measuring and graphing the change in a property of each system over time. Based on the graphs produced, you will be asked to draw conclusions and make predictions regarding how the rate of each reaction and the amounts of reactants and products change over time.

In system 1, the combustion between the wax in a candle and oxygen will be studied by measuring the mass of the candle over time as it burns.

In system 2, the reaction between crystal violet reacting with sodium hydroxide will be studied by measuring how the absorbance of the solution changes over time. In this reaction, crystal violet, which is a purple solution, is bleached by the hydroxide solution. The color, and thus the absorbance, fades over time. This can be measured using a spectrometer.

Purpose: To determine the rate law and rate constant for the reaction between crystal violet and sodium hydroxide using spectrophotometric measurements and Beer's Law.



Materials

0.100M NaOH solution	graduated cylinders	candle
50 μ M crystal violet solution	Beakers	lighter
DI water	Spectrometer	electronic balance
disposable pipettes	Cuvette	timer (phone)

Procedure Part 1

- Place an unlit candle on an electronic balance and record its initial mass in the table below.
- Light the candle and start your timer.
- Record the mass of the candle every minute for 10 minutes.
- Use Google sheets to create a graph of candle mass vs. time. Add a best fit line and the equation for the line.
- Insert a screenshot of your graph in the space below.

Time (minutes)	Mass of candle (grams)	Graph of mass vs. time
0		
1		
2		
3		
4		
5		
6		
7		
8		
9		

Procedure Part 2

- Connect the spectrometer to the computer.
- Open Logger Pro on the computer.
- Calibrate the instrument with a blank (water filled) cuvette.
- Put enough crystal violet in the cuvette to fill it $\frac{3}{4}$ and get a full spectrum to select an appropriate wavelength for measuring the absorbance.
- On the menu bar, click Experiment and select Data Collection. Fill in the settings as shown below then click Done.

The screenshot shows the 'Data Collection' dialog box with the following settings:

- Collection Tab:**
 - Mode: Time Based
 - Duration: 600 seconds
 - Sampling Rate: 0.2 samples/second (5 seconds/sample)
 - Samples to be Collected: 121
 - Continuous Data Collection:
 - Oversampling:
- Triggering Tab:**
 - Repeat:
 - Sample at Time Zero:
 - Triggers: (empty list)
 - Triggers is disabled

Buttons: Help, Done, Cancel

- Add 1 pipette stem (approx 1 mL) of crystal violet to cuvette; add 1 pipette stem (approx 1mL) OH⁻
- Stir and observe the mixture, then quickly place the cuvette into the spectrometer.
- Start data collection.
- Allow the experiment to run until the absorbance has dropped to $\frac{1}{4}$ its original value.
- Stop data collection. Remove and observe the cuvette - record your observations.
- Insert a screenshot of your graph in the space below.

Analysis and Conclusions

Based on the graphs you created in parts 1 and 2, compare how the amounts of reactants change over time.

1) Which reaction is happening faster? Use the data/graphs and your observations of each system to support your conclusion.

2) How does each reaction rate change over time? In other words, do the reactions run at a constant rate or changing rate (getting faster or slower)? For each case, explain why you think this is happening.

3) Based on your graph for part 1, try to predict how many grams of wax will burn after 60 minutes. Show all your work and explain your reasoning.

4) Based on your graph for part 2, how many seconds will it take for the absorbance to drop to 10% of its original value? Show all your work and explain your reasoning.