

KINETICS USING A V-SPEC SPECTROMETER

From *Vernier Spectrometer User's Guide*

INTRODUCTION

This lab will investigate the relationship between absorbance and time of the reaction between sodium hydroxide and crystal violet. This data could lead to the determination of many things such as Rate of the reaction, rate constant, activation energy and order of the reaction. Knowing these things chemists can control an industrial process in order to maximize the profit to their company by using this particular reaction.

PURPOSE

The purpose is to learn as much as possible about the reaction of sodium hydroxide and crystal violet. Another purpose is to learn how to conduct a kinetics lab using a Vernier V-SPEC spectrometer.

MATERIALS

Vernier V-SPEC Spectrometer
0.10 M sodium hydroxide solution
 5×10^{-6} M crystal violet solution

Two 10 ml graduated cylinders
Plastic Beral pipets
curettes

PROCEDURE

PART I SET UP THE SPECTROMETER

1. Connect the spectrometer to the power hub using an USB cable. The cuvette holder /light source must be attached to the Spectrometer.
2. Connect the power hub to the spectrometer and to a power outlet.
3. Start the Logger Pro software.
4. If the ROY G BIV background does not appear, select the Connect Interface → Spectrometer → Scan for Spectrometer from the experiment menu.
5. To calibrate the Spectrometer, chose Calibrate → Spectrometer from Experiment menu. Follow the instructions in the dialog box to complete the calibration.
6. Run Crystal Violet full spectrum to determine wavelength (λ) of maximum absorbance.

PART II CONDUCT THE KINETICS EXPERIMENT

1. Click the Configure Spectrometer Data Collection icon.
2. Click Abs. vs. Time (under Set Collection Mode). The wavelength of maximum absorbance will be selected in the right column. You may change it if you think it should be changed.
3. Select Data Collection from the Experiment menu. The default is -10 sample per minute. This will work well for this experiment. Click Done.
4. Measure out 10 ml each of the crystal violet and sodium hydroxide. Mix in a small beaker and transfer ~2 ml to a cuvette and place the cuvette in the spectrometer. Immediately click the collect icon.
5. Analyze the graph. Click Examine tool, then Linear Fit (both from tool bar) to calculate a function for your data.
6. Print or draw a copy of your graph and write a description of your analysis.

PART III THE TEMPERATURE EFFECT

1. Repeat the necessary steps to conduct the reaction at two different temperatures

QUESTIONS

1. How does the absorbance change as the reaction proceeds and why?
2. What type of function did you use to fit the data?
3. Can you state any of the following;
 - a) the reaction rate
 - b) the rate constant
 - c) the activation energy
 - d) order of the reaction
4. What effect did temperature have on the reaction?
5. Optional – Can you write a complete and balanced equation for the reaction?