

Lab 3: What Is the Relationship Between the Concentration of a Solution and the Amount of Transmitted Light Through the Solution?

Background:

In a colorimeter a beam of light is shined into a solution containing the sample, and the amount of light that comes out of the other side of the solution is detected and measured. By comparing the amount of light transmitted by the pure solvent to the amount transmitted when the sample is dissolved in it, a quantity called absorbance can be calculated. In this investigation, the relationship between absorbance and concentration of solution will be studied.

A stock solution of known concentration has been prepared by dissolving blue #1 dye (Brilliant Blue) in water. The blue #1 dye molecule is the only chemical species in solution. The absorbance of light by the solution will be measured using a colorimeter.

Purpose:

To explore the relationship between concentration of a solution and absorbance of light. To gain skills in using a colorimeter and Microsoft Excel.

Safety:

All waste can be disposed of down the drain and flushed with plenty of water.

Materials:

Colorimeter	Plastic pipet	Glass stirring rod
Vernier LabQuest	10 mL graduated cylinder	40 mL of stock solution
Plastic cuvette with lid	6 test tubes	10 mL of Gatorade
KimWipes	Test tube rack	

Procedure:

1. Setup and calibrate a colorimeter.
2. Using the colorimeter, collect and record absorbance data for each solution in Data Table 1.
3. Measure the absorbance of the Gatorade solution. Record this value in Data Table 2.
4. Wash all glassware and cuvettes. Return all equipment. Wash your hands with soap and water.
5. Determine the concentration in μM of each diluted solution in the data table.

Remember, $M_1V_1 = M_2V_2$.

6. Using Microsoft Excel, create a calibration line by graphing Absorbance vs. Concentration.
 - i. Label Column A as Concentration and Column B as Absorbance.
 - ii. Enter your data into each respective column.
 - iii. Highlight cells A1 through B9.
 - iv. Click the **Insert tab** from the top menu then **Scatter**. Choose the first Scatter plot (top left of the choices).
 - v. Right click on any point in the scatter plot and select "Add Trendline".
 - vi. Select Linear Trend, Automatic Trendline Name, and Display Equation on chart. Click Close.
 - vii. Format the graph to include a title and axis labels. (Click on the graph, go to **Chart Tools** from the **Layout tab**, then select **Chart Title** and **Axis Titles**)
 - viii. Save your Excel file to the desktop and upload it to class website.
 - ix. Email yourself and your lab partner(s) the Excel file.
 - x. Print your graph and staple it to your lab.

Post-lab and Data Analysis:

1. Determine the concentration of the diluted solutions. Show work for at least the 8mL/2mL dilution. You need not show work for the remaining dilutions. Record all answers in the table below.

Dilution Ratio mL stock/mL water	Molar Concentration (μM)
10 mL/0 mL	
8 mL/2 mL	
6 mL/4 mL	
4 mL/6 mL	
3 mL/7 mL	
2 mL/8 mL	
1 mL/9 mL	
0 mL/10 mL	

2. Analyze your calibration curve. Is the relationship between concentration and absorbance direct or inverse? Explain your reasoning.

3. What is the equation of your calibration line? Write the equation in $y = mx + b$ format.

4. Using the calibration line equation and the absorbance value of Gatorade, determine the concentration in μM of blue #1 dye in the Gatorade solution.

