The Visible Spectra of Soda Pops

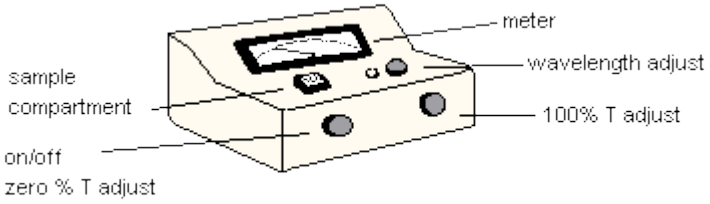
Purpose: The purpose of this experiment is twofold: the first part is designed to determine the origin of the color of a soda pop .In the second part you will determine by how much a sample of grape soda has been diluted. Be specific, which soda are you measuring?

Materials: Things **for each group** to borrow and return on the same day.

- Spec 20
- 8 cuvettes filled and labeled as follows:
  - Unknown—U
  - Distilled Water—DW
  - 10% Solution—10
  - 20% Solution—20
  - 30% Solution—30
  - 40% Solution—40
  - 50% Solution—50
  - 60% Solution—60

General Information & Procedure: The spectrum of a soda pop is obtained by measuring the absorbance of a sample of the pop at different wavelengths using a spectrophotometer. This spectrum can then be related to the color of the pop. Next a calibration curve is prepared by measuring the absorbance of different dilutions of grape soda at a single wavelength. The absorbance of the unknown solution can then be measured at the same wavelength and compared to the calibration curve to determine its concentration.

Part I. Measuring the Spectrum:



Sample Preparation: Pour about 15-20 mL of grape soda into a beaker and stir to remove the carbonation. Dilute it to 50% by pouring 10 mL into a graduated cylinder and add an equal volume of water. Stir. (Any waste in this experiment can be poured down the drain).

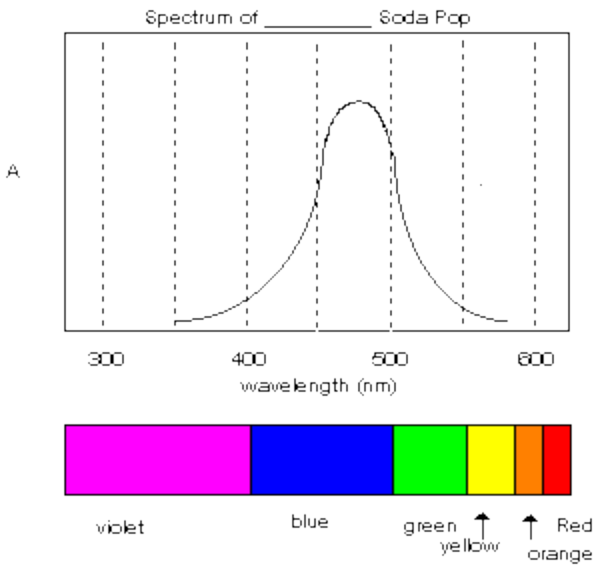
1. Be sure the spectrophotometer is turned on and has warmed up for 15-20mins.
2. Set the wavelength knob and filter switch to 600 nm.
3. Using the zero adjust knob on the left side, set the needle to read 0% transmittance (%T) on the top of the meter. (Nothing should be in the sample compartment.)
4. Clean and insert the cuvette filled with distilled water in the sample compartment with the line facing the front. Close the top.
5. Use the 100% adjust knob on the right hand side to set the needle to 100%T with the water-containing cuvette in the holder. Remove the cuvette and set it aside without emptying it.
6. Obtain the "50% Grape Soda Solution" cuvette.
7. Insert it in the instrument and close the cover. Read the absorbance from the bottom scale on the meter. Record in Table 1 the wavelength and absorbance readings. Be sure to indicate which sample you are using.
8. Remove the cuvette, close the top and change the wavelength to a setting which is 20 nm lower.
9. Reset the 0%T if it has changed. (Nothing should be in the sample compartment.)
10. Insert the cuvette of distilled water and reset the 100%T using the 100%T Adjust knob.
11. Replace the water cuvette with your sample-containing cuvette and read the absorbance again recording your results.
12. Repeat steps 8 through 11 until you reach 360 nm.

Part II. Quantitative Analysis of the Grape Soda:

1. Set the spectrophotometer wavelength to 500 nm using the wavelength adjustment knob.
2. Using the zero adjust knob on the left side, set the needle to read 0% transmittance (%T) on the top of the meter. (Nothing should be in the sample compartment.)
3. Clean and insert the cuvette filled with distilled water in the sample compartment with the line facing the front. Close the top.
4. Use the 100% adjust knob on the right hand side to set the needle to 100%T with the water-containing cuvette in the holder. Remove the cuvette and set it aside without emptying it.
5. Measure the absorbance of each of the six standard solutions of grape soda provided (10%-60% solutions). Record the absorbance and the solution concentration in Table 2.
6. Measure the absorbance of the unknown solution of grape soda provided. Record the absorbance and the solution concentration in Table 2.

Part III.

Plot the visible spectrum of the soda from Part I on graph paper. Your graph should fill the entire page and use accurate markings. All graphs should contain a title and appropriate labels on the axes. An example is shown below. Include the diagram indicating the wavelength regions and the corresponding colors of visible light.



Use this diagram and plot to **explain** the origin of the color of the soda in your conclusion.

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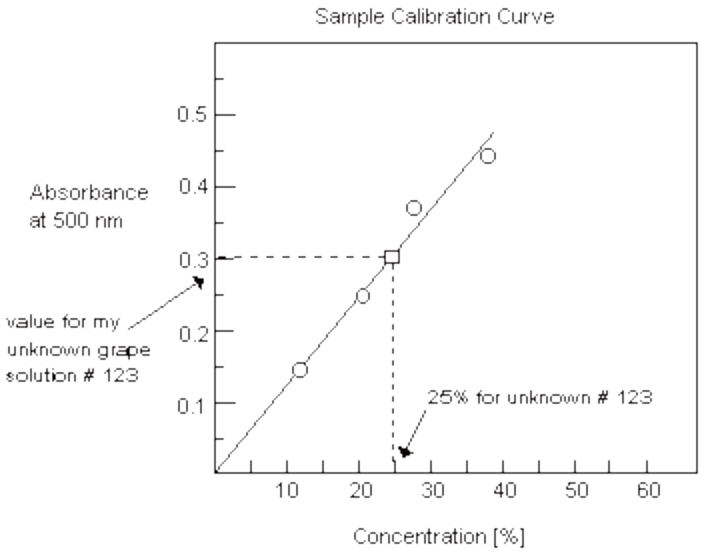
Make a plot of the absorbance of the different standard grape pop solutions versus their concentrations, where four open circles indicate the measurements of the four known concentrations. Draw one single straight line that comes the closest to all these circles. See below for an example. Note the equally spaced divisions, the straight line through the points and the title on the top.



Now you can use this calibration plot to determine the concentration of your unknown grape pop solution. Find the concentration of your unknown by determining where its absorbance crosses the calibration line on your graph.

Note in the example, the student created a fifth point--the one with the square--for the unknown which read 0.31. Following the line straight down from this point, the concentration for the unknown is determined (for the example, this was 25%).

What is the concentration of your unknown? _____

Table 1: Absorbance of Grape Soda at Various Wavelengths

Wavelength (nm)	Absorbance
600	
580	
560	
540	
520	
500	
480	
460	
440	
420	

400
380
360

Table 2: Absorbance and Solution Concentration at 500 Nanometers

Concentration (%)	Absorbance
10	
20	
30	
40	
50	
60	
Unknown	

Pre-Lab Prep Dilutions

Concentration	Volume of Grape Soda (mL)	Volume of Distilled Water (mL)
10%	2	18
20%	4	16
30%	6	14
40%	8	12
50%	10	10
60%	12	8
Unknown (27%)	5.4	14.6