

Absorption Spectroscopy
Food Dyes in Kool-Aid

Modified procedure for use of the UV/Visible Spectrometer instead of the Measurenet system.

Protocol

Your instructor will have you work in teams.

1. Obtain a packet of Kool-Aid from your instructor and prepare a solution. Using the chart below, mass the required amount of Kool-Aid on the analytical balance in a small beaker, record the exact mass of powder used. Add the powder to a 100.00 mL volumetric flask, rinse out the beaker with deionized water and add the rinse water to the volumetric flask. Fill the volumetric flask with deionized water to approximately 2 cm below the inscribed mark on the neck of the flask. Stopper, invert 10 times and then fill to the mark by adding deionized water by drops.

Kool-Aid	Mass \pm 0.0001 g
Berry Blue	0.40
Black Cherry	0.20
Cherry	0.11
Grape	0.35
Lemon Lime	0.68
Orange	0.27

2. Using a Mohr pipet that has been primed with your Kool-Aid solution, add 1.00, 2.00, 3.00, 4.00, 5.00 and 6.00 mL of the solution to each of six test tubes. Record the exact volumes transferred.

3. Using a Mohr pipet that has been rinsed and primed with deionized water, add enough water to each test tube in part 3 to achieve a final volume of approximately 6.00 mL. Again record the exact volume transferred.

4. Transfer a small amount of each solution into a cuvette. Make sure you keep these in order of highest concentration (the original) to the most dilute solution. Save all solutions until after the unknown has been diluted.

6. Obtain an unknown solution from your instructor that contains the same kind of Kool-Aid that you have been studying. You will have to dilute this solution. Place 1.00 mL of your unknown solution in each of three test tubes. To the first test tube add 6.00 mL of water, to the second add 8.00 mL of water and to the third 10.00 mL of water. Make sure you record the volumes of the solution and water used. **Pour each of these solutions into a cuvette. Keep in order of highest to lowest concentration.**

Take all of your solutions to the UV/Visible spectrometer and record the spectrum for each solution according to the following instructions. Make sure all previous data has been cleared. If not go to clear and click on samples.

- a. Place blank (a cuvette filled with deionized water) into the slot and at the upper toolbar under Measure click on measure blank. You may X out the blank.
- b. Place the cuvette containing your most concentrated sample in the slot and click measure sample.
- c. To find the wavelength of maximum absorbance move the cursor to the top of the highest peak and right click the mouse. Read and record the wavelength at the bottom of the screen. Right click again to exit this mode.
- d. To record all absorbance values at this wavelength, go to Method and click on Set Up Analysis. Type in the wavelength of maximum absorbance in the Use Wavelength box and click on OK.
- e. In order of decreasing concentration, place each sample in the slot and record the absorbance spectrum by clicking on measure sample. All spectra will appear on the same screen with the absorbance values listed below. Note how the absorbance decreases as the concentration of your Kool-aid decreases.
- f. Finally, record the absorbance spectra of the diluted unknowns in order of decreasing concentration. It is important that the absorbance values of the unknown solutions fall within the values of the known solutions.

Note: If you have to do any more dilutions (if the concentrations of the first 7 do not decrease as expected or your unknown solutions are too concentrated, you will need to run all of the spectra again. So do not discard your solutions until you are certain you are done. Consult with your instructor if you have any questions.

- g. After you have finished, print out your spectra (all on the same page) by going to File, Print and Current View.

7. Next you will try to find candies that use the same kind of dye that was used in your Kool-Aid sample. Pick one sample of Skittles and one sample of M&Ms that you think may contain the same dye. Place each sample in a small beaker and add 10 mL of water. Stir gently for about one minute and then remove the candy. Pour each sample in a cuvette and take it to the **UV/Visible Spectrometer** and collect its absorbance spectrum. If the absorbance is above 1, you may have to dilute your sample and take the spectrum again. **Follow step c above to find the wavelength of maximum absorbance, record this value. Print these spectra in the same method as described above.** Compare these to your Kool-Aid graph.

8. You will also need to obtain from your classmates the wavelengths of maximum absorption for all colors of Kool-Aid used in this experiment. On the back of each container of Kool-Aid you will find a list of the food dyes it contains, record these as well.