

DETERMINATION OF WAVELENGTH OF MAXIMUM ABSORBANCE

Introduction:

Colored solutions are colored because they absorb certain wavelengths of light while allowing other wavelengths of light to pass through. As observers, we see the wavelengths of light that are not absorbed. By measuring the amount of light absorbed, we can find the concentration of solutions. Before doing this type of spectral analysis, the wavelength at which absorbance is greatest needs to be determined. The spectrophotometer is more sensitive to absorbance changes at this wavelength.

The purpose of this experiment is to demonstrate the procedure to find the wavelength of maximum absorbance for any colored solution. The process involves recording the absorbance over the range of 350 nm to 650 nm, usually in intervals of 25 nm. The data can be graphed to visualize the highest absorbance or the data pairs can be examined to determine the wavelength.

Water with food color added works very well to teach this procedure. Alternatively, solutions of colored ions may be used.

Purpose:

To find the wavelength of maximum absorbance of a colored solution using a spectrophotometer.

Equipment / Materials:

spectrophotometer	150 mL beaker
2 cuvettes	food coloring (red, blue, yellow)
small test tube rack	DI water

Safety:

- Always wear goggles and an apron in the lab.
- Gloves may be preferred to keep coloring from staining hands.

Procedure:

1. Add one drop of food coloring to 100 mL of water and mix well.
2. Rinse the cuvette with a small amount of colored solution and then fill the cuvette 3/4 full.
3. Fill the second cuvette with deionized water to be used as a blank.
4. Set the spectrophotometer to 350 nm.
5. With the sample compartment empty, set to 0% transmittance using the left knob (omit this step for spec 21).
6. Wipe the blank cuvette with a Kimwipe. Place the blank into the unit so that the white line of the cuvette matches the notch in the sample compartment. Set to zero absorbance (100% transmittance) using the right knob.
7. Remove the blank, wipe the sample cuvette, and place the colored solution into the spectrophotometer. Record the absorbance on the data sheet.
8. Reset the wavelength to 375 nm and repeat steps 6 and 7.
9. Repeat steps 6 and 7 recording absorbances at every 25 nm using this technique until you reach 650 nm.
10. Locate the reading with the highest absorbance. Record the absorbance at ± 10 nm and ± 20 nm around this reading.
11. Graph the data to determine the wavelength of maximum absorbance.

Questions:

1. What is the wavelength of maximum absorbance for each colored solution tested?
2. What color of light corresponds to the wavelength of maximum absorbance for each colored solution tested?
3. Why is it necessary to wipe the cuvettes?

Teacher Notes

Lab Time: about 25 minutes

Considerations:

This is a very simple lab that will give the students practice using a spectrophotometer and knowledge of determining maximum wavelength of and colored solution.

It may be a good idea to suggest that the student split up the tasks of reading and recording data. The data collected could be graphed for a more precise determination of the wavelength of maximum absorbance. Interesting results could be obtained by repeating the experiment using green food coloring. Sample graphs are included on the following page.

Answers to Questions:

1. What is the wavelength of maximum absorbance for each colored solution tested?

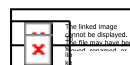
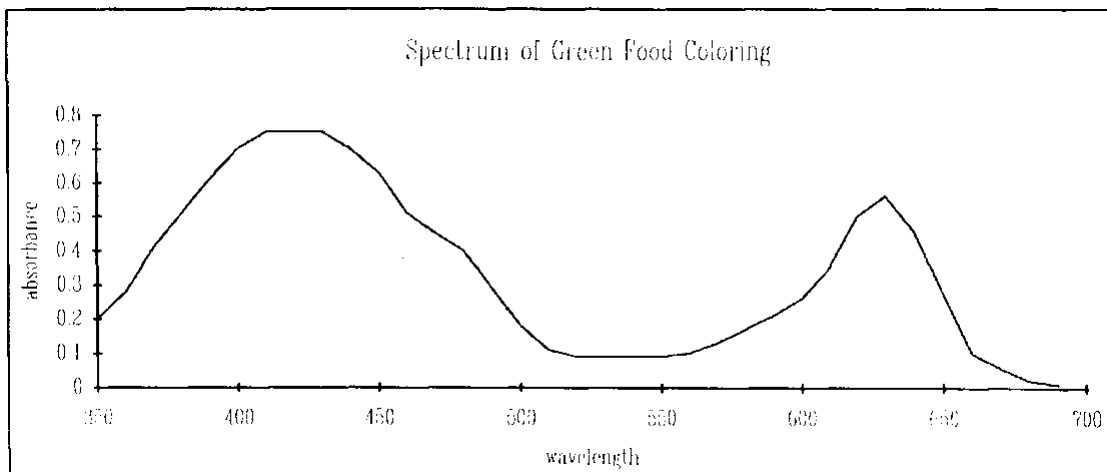
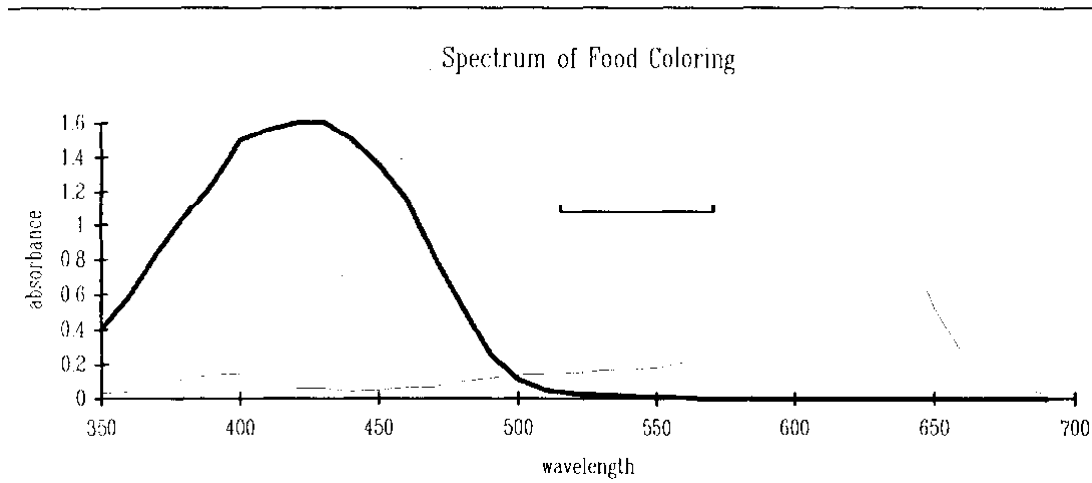
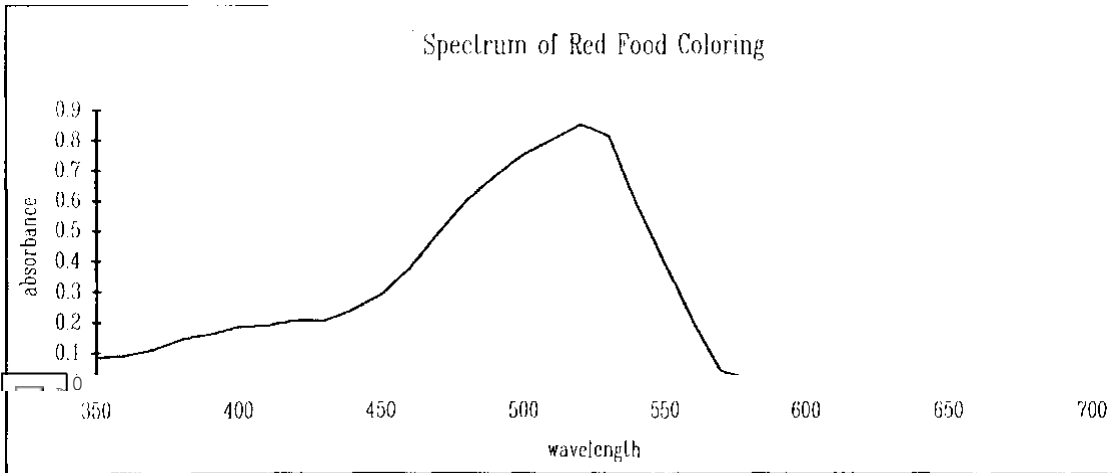
Answers will vary.

2. What color of light corresponds to the wavelength of maximum absorbance for each colored solution tested?

Answers will vary.

3. Why is it necessary to wipe the cuvettes?

Wiping the cuvette removes fingerprints that may interfere with the absorption of light.



Name: _____

Name: _____

Period: _____

Date: _____

DETERMINATION OF WAVELENGTH OF MAXIMUM

Data Table:

Color of solution _____

wavelength (nm)	absorbance
350	
375	
400	
425	
450	
475	
500	
525	
550	
575	
600	
625	
650	

wavelength (nm)	absorbance