

## THE HIDDEN COLORS OF AUTUMN

### Purpose:

1. Explain why leaves are green in relation to the light spectrum, plant pigments, and the process of photosynthesis.
2. Predict why leaves change colors in the fall and relate this to the function of a leaf and rate of photosynthesis.

### Background Information:

The specific structure of a leaf relates directly to its function and determines the specific properties it possesses. A leaf has evolved, chemically and structurally, in a manner that enhances its ability to perform photosynthesis. Photosynthesis is the process in which light energy is absorbed and converted into chemical energy that can be utilized by the plant. Plants have special pigments that enable them to absorb light from specific ranges of the light spectrum. Figure 1 represents different pigments and indicates the colors of the light spectrum that are absorbed.

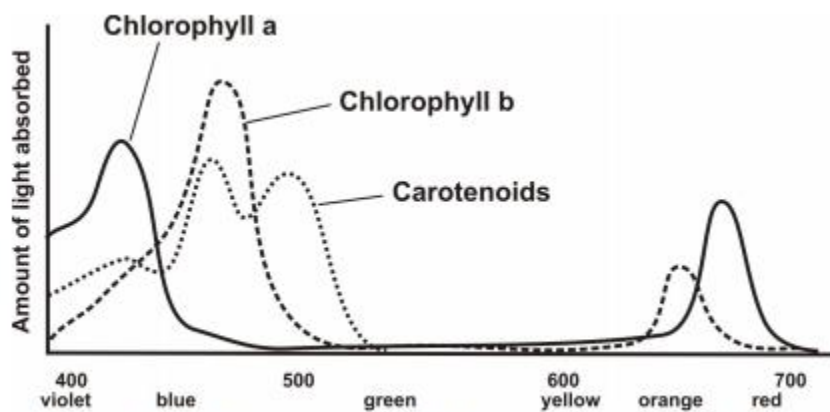


Figure 1. Absorbance spectrum of different photosynthetic pigments.

Chlorophyll is the primary pigment utilized by plants in the process of photosynthesis, but plants also have accessory pigments. The function of accessory pigments, carotenoids, is to absorb the wavelengths of light that are not effectively absorbed by chlorophyll. Plants have another group of pigments, anthocyanins, but these pigments are not involved in photosynthesis. Anthocyanins are the pigments that primarily produce color in flowers and fruits, but can also be seen in leaves.

### Pre-lab Questions:

1. Which colors of the light spectrum are absorbed by each of the plant pigments in figure 1?

a.) Chlorophyll a: \_\_\_\_\_

b.) Chlorophyll b: \_\_\_\_\_

c.) Carotenoids: \_\_\_\_\_

2. What is the primary plant pigment utilized in photosynthesis?

\_\_\_\_\_

3. When we see color, do you think we are seeing the colors of the light spectrum that are absorbed or the colors that are reflected?

\_\_\_\_\_

**Lab Essential Questions:**

1. Why are leaves green?
2. Why do leaves change color in the fall?

**Materials:**

- Test Tubes
- Filter Paper
- Spinach leaf
- Chromatography Solvent
- Ruler
- Scissors
- Pencil
- Coin

**Part 1--Procedure:** Complete *each* step below. Check off each step as you work.

- Obtain all of your lab materials.
- Measure **3 cm** from the pointed end of your filter paper. Draw a light line with pencil.
- Measure **2cm** from the flat end of your filter paper. Draw a light line with pencil.
- Place a spinach leaf on top of your filter paper and use a coin to break open the leaf and deposit the plant pigment onto the filter paper. Allow the plant pigment to dry. **Be sure to have a dark pigment line.**

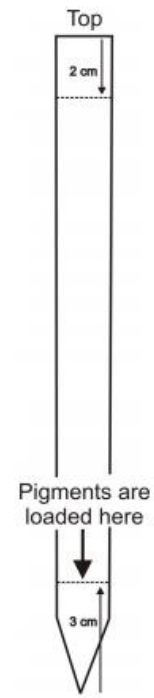


Figure 3. Where to draw lines on chromatogram.



- Place 2ml of solution into your test tube.
- Add your filter strip to the test tube. The pointed end (with the pigment) should be in the solution. **Be sure your pigment line IS NOT in the solution (it will dissolve away).**
- Leave your strip in the test tube undisturbed until the solvent reaches the top pencil line.
- Remove your chromatography strip (filter paper) and place it on a paper towel to dry.

**Part 2--Procedure:**

- Tape your chromatography strip in the space provided.
- Measure the distance the solvent traveled in centimeters (cm).
- Number each pigment line that you are able to see.
- Indicate the color of the band in the data table.
- Mark and measure the distance each pigment traveled on your chromatography paper
- Using the equation below calculate the Rf value.
- Compare the calculated Rf value to the table of known Rf values to determine the type of pigment.

$$\text{Rf Value} = \frac{\text{Distance Moved by the Pigment}}{\text{Distance Moved by the Solvent}}$$



**Analysis and Conclusion:**

**Claim:** *Leaves are green because* \_\_\_\_\_

**Evidence:** (data to support your claim—Rf values/graph information/qualitative data is needed)

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

**Reasoning:** (Explain WHY each evidence supports the claim.)

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

**Claim:** *Leaves change color in the fall because* \_\_\_\_\_

**Evidence:** (data to support your claim—Rf values/graph information/qualitative data is needed)

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_

**Reasoning:** (Explain WHY each evidence supports the claim.)

1. \_\_\_\_\_

2. \_\_\_\_\_

3. \_\_\_\_\_