

Colors in the Leaves

An Educator's Reference Desk Lesson Plan

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Grade Level: 1, 2, 3, 4

Subject(s):

- Science/Botany
- Science/Chemistry

Duration: 2 days

Description: Where do the brilliant colors of fall come from? Most leaves appear green. In the fall, leaves turn orange, yellow, and red. Most leaves aren't changing colors. The pigments are always present in the leaves. The green pigment overpowers the other colors during spring and summer. Using chromatography, students will be able to see the colors always present in a leaf, even if the only color they can see is green.

Goals: National Science Education Standards (NSES) :

Content Standard C: As a result of activities in grades K-4, all students should develop understanding of:

- The characteristics of organisms
 - Each plant has different structures that serve different functions in growth, survival, and reproduction.
 - The behavior of individual organisms is influenced by internal cues and by external cues.
- Life cycles of organisms
- Organisms and environments

Objectives:

1. Students will identify the many colors in leaves by making chromatography strips.
2. Students will change their ideas about seasonal changes through guided scientific inquiry.

Materials:

- Why Do Leaves Change Color? By Betsy Maestro
- Autumn Across America by Seymour Simon
- students' science journals (teacher-created)
- variety of fall leaves
- fresh spinach leaves and beet leaves
- porcelain or stoneware coffee mugs
- smooth, round rocks
- spoons
- fingernail polish remover (distributed by the teacher)

- safety scissors
- round coffee filters
- Q-tips with an end cut off
- measuring cup
- rubbing (isopropyl) alcohol (distributed by the teacher)
- clear plastic cups
- tape
- rulers
- pencils
- [Rubric](#)

Vocabulary:

1. *pigments* - Coloring matter in animals, plants, or paint.
2. *chromatography* - A method scientists use to separate materials that are different.

Procedure:

[Authors' Note: Prior to beginning our lesson, we posted and discussed "Things Good Scientists Do." These included:

1. Listen to directions
2. Never put things near our mouth or eyes
3. Write down observations (what we see)
4. Wait for the teacher's instructions before touching materials.]

Focus Phase:

Place some leaves up on the board. "Something has been happening to the trees outside. Has anyone else noticed?" Show students the photograph of fall leaves from Autumn Across America. Then pose the question, "What do you know about leaves?" (students describe on page 1 in their science journal). Place a large leaf-shaped paper on the board. Ask students to share with the class what they wrote in their journal about leaves; write down their insightful contributions on the large leaf. Then ask students, "What do you want to learn about leaves?" Hopefully, one student will suggest, "Why do leaves CHANGE color in the fall?" The teacher may direct students toward this question if none of the students comes up with it. Divide the class into small groups of about five students. Give each group one specific type of leaf. For example, one group observes spinach leaves, while another group works with beet leaves, another group could use red maple leaves, etc. Students talk about the leaves in their group and record their observations in their journals. Ask students to specifically answer and draw, "What colors are in the leaf?" (page 2 in their science journal, record/draw observations).

Challenge Phase:

Show students the bottle of acetone fingernail polish remover. Use the acetone to remove your nail polish (optional). Ask students, "Knowing that acetone removes my nail polish, how could we design an experiment to test our question?" Students discuss methods in their group. Have the students make predictions before testing (page 3 of science journal). If they suggest using the acetone directly on the leaf, have them write in their journal what might happen. The students will try swabbing the outside of the leaf with the acetone. The students will discover that the color is not removed. However, if the leaf is torn the green

color will appear on the cotton swab. Students should try another method. If the students don't come up with breaking the leaf, teacher could suggest, "Is the color on the outside of the leaf or on the inside?"

Students break up the leaves and put the pieces into the mug. Using a smooth, round rock, students grind and squish the leaves into smaller pieces. Before adding the acetone, have students observe the clear color in the bottle. Walk around to each group and add a spoonful of fingernail polish remover to extract the pigment from the leaves. Students keep grinding the leaves with the stone until they see that the liquid has gained some color from the spinach. Let the liquid sit for 1-2 minutes. Students use the safety scissors to cut the coffee filter into a 2" x 8" rectangle. Students use a Q-tip to pick up a drop of the colored liquid from the leaf grinding. Students place the drop one inch from the end of the coffee filter rectangle. (Teachers can draw a pencil circle to assist students with placement.) Let it dry. Then the Q-tip is used again to add a few drops to the same spot. Students should let each drop dry before adding the next drop. The teacher puts $\frac{1}{4}$ cup of alcohol in the clear plastic cup. Students carefully put the end of the filter paper strip—the end with the drops of dried leaf extract on it—into the alcohol, but do not let the colored drop touch the alcohol. Teachers may use paper clips in order to secure strips to the side of the cup. The alcohol will travel up the filter paper, separating the different colors in the leaf. (This could take up to an hour, or let them sit overnight.) In their science journals, students write out and draw the experiment steps (page 4).

Day 2:

Once the color has stopped moving, remove the filter paper from the alcohol, let dry, and observe the different colors that were in the leaves (page 5 of the science journal - tape the chromatography strip and record observations).

Concept Introduction Phase:

Groups select one or two people to present what they discovered about colors in the leaves and show their chromatography strip to the entire class. Then read Why Do Leaves Change Color? by Betsy Maestro. Students summarize their findings and draw a picture in their science journals (page 6). As a class, discuss and record on the board, "What did we learn?" with students' ideas coming from what they recorded in their journals.

Concept Application:

Have each group of students find a tree near the school that still has green leaves on it. Based on what they've just learned about the pigments in the leaves, have them predict what colors will appear in the leaves. Student should record in their journals predictions and observations for their tree. Observations of pine trees could lead to more in-depth exploration of the difference between evergreen and deciduous trees. If a tree turned an unexpected color, have students share their results.

Assessment: Students will discuss in their science journals what they predicted, what they observed (draw pictures), and what they learned from their experiments, the book, and group discussions. The Rubric (see **Materials**) can be used to assess students' science journals.

Useful Internet Resource:

- National Science Education Standards (NSES)
- <http://books.nap.edu/html/nses/>

Special Comments: We used this lesson plan with first graders, and they were well supervised. Before beginning the lesson, we talked with them about things good scientists do, such as not putting their hands in their mouths or eyes while working and being very

careful with the substances we were using. The teacher was in control of the substances at all times. We added the nail polish remover to their cups for them in small amounts. We also added the rubbing alcohol to their cups for them, and they never had contact with that substance. When we taught this lesson, there were no complications with students using the chemicals.

Other References:

1. Dorros, A. (1997). A Tree is Growing . New York: Scholastic.
2. Gold-Dworkin, H., Ph.D. (2000). Little Scientists A "Hands-on" Approach to Learning: Learning About the Seasons . New York: McGraw-Hill.
3. Maestro, B. (1994). Why Do Leaves Change Color? New York: HarperCollins.
4. Simon, S. (1993). Autumn Across America . New York: Hyperion.