

<b>Lesson Title:</b>	The Colors of Fall (Science Lesson 1)
<b>Grade(s):</b>	9-12 (Could be adapted for Middle and Elementary classes)
<b>Appropriate Science Areas:</b>	Environmental, Biology
<b>Science Concept(s):</b>	Basic understanding of photosynthesis and its influence on seasonal changes in trees.
<b>Lesson Objective:</b>	<ul style="list-style-type: none"> <li>• Students will be able to define the terms deciduous and evergreen.</li> <li>• Students will be able to identify three types of deciduous trees.</li> <li>• Students will be able to define three types of evergreen trees.</li> <li>• Students will be able to describe some differences between deciduous and evergreen trees.</li> <li>• Students will be able to identify some patterns in the changing season.</li> <li>• Students will be able to understand why the leaves of deciduous trees change colors in the fall.</li> <li>• Students will be able to explain the benefit a deciduous tree gains by losing its leaves in the fall.</li> <li>• Students will be able to recognize leaves with palmate, parallel and pinnate veining patterns.</li> </ul>
<b>Georgia QCC Standards:</b>	<p><b>Environmental:</b></p> <ul style="list-style-type: none"> <li>• Inquiry, Process and Problem Solving: Uses science process skills in laboratory or field investigations, including observation, classification, communication, metric measurement, prediction, inference, collecting and analyzing data.</li> </ul> <p><b>Biology:</b></p> <ul style="list-style-type: none"> <li>• Research: Demonstrates appropriate use of reference sources to access, analyze, evaluate, and present information related to research problems.</li> <li>• Biochemistry (Photosynthesis and Respiration): Explains the processes of photosynthesis and respiration.</li> <li>• Classification: Discriminates relationships when using a classification model to group living things.</li> <li>• Diversity of Life (Kingdom Plantae: Seed Producers): Describes the similarities and differences of seed producing plants.</li> </ul>
<b>Background:</b>	Some trees have leaves that change colors in the fall. The leaves change from green to shades of red, orange, or yellow. The leaves fall off the trees after the changes in color. Changes

	<p>in light and temperature are responsible for these responses.</p> <p>Pigments are the colored substances found in plants. Green, blue, yellow, orange, and red pigments are found in leaves. The green pigment, chlorophyll, is used by the leaf to make food (sugars) from the sun's trapped energy. Leaves contain more than one color of pigment. The color of a leaf depends on the amount of each color pigment it contains. The pigments found in the greatest number give the leaf its color. These pigments mask the color of the other pigments contained in the leaf.</p> <p>Many changes occur in the fall. The length of day-light becomes shorter, the rays of the sun become less direct, and the temperatures drop. Leaves stop producing chlorophyll because of these changes and it breaks down and fades away. As the green pigments fade, the other color pigments are unmasked. The colors of fall appear.</p> <p>Trees that lose their leaves in the fall are known as deciduous trees and trees that remain green the year round are known as evergreen trees. The dropping of leaves of the deciduous tree is controlled by hormones. Fewer hormones are produced when daylight shortens and the temperature drops. A layer of dead cells develops where the leaf is attached to the tree. Eventually, the leaf falls to the ground and decomposes. The soil becomes richer and the tree loses less water through transpiration during the dry, cold months.</p>
<b>Materials:</b>	<p>Each group of students will need:</p> <ul style="list-style-type: none"> <li>• a field guide</li> <li>• worksheet</li> <li>• pencil</li> <li>• illustrations of leaf vein patterns</li> <li>• a clipboard</li> </ul>
<b>Preparation Time:</b>	Time to gather materials.
<b>Teaching Time:</b>	30-45 minutes
<b>Procedures:</b>	<ol style="list-style-type: none"> <li>1. Review/discuss the background information with the students.</li> <li>2. Divide students into groups and distribute the materials. Allow students time to become familiar with the field guides and questions on the worksheet.</li> <li>3. Take students on a walk through a wooded area containing</li> </ol>

	both deciduous and evergreen trees. Instruct the students to fill out the worksheet while observations are being made.
<b>Key Questions:</b>	<ol style="list-style-type: none"> <li>1. What part do pigments play in photosynthesis?</li> <li>2. Why would a tree need different pigments?</li> <li>3. What causes color change in fall leaves?</li> </ol>
<b>Student Evaluation:</b>	Observation and completion of worksheet by each group of students.
<b>Related Activities:</b>	<ul style="list-style-type: none"> <li>• Leaf Scavenger Hunt</li> <li>• Colors of the Fall Science Lesson 2</li> <li>• Colors of the Fall Language Arts Lessons 1 &amp; 2</li> </ul>
<b>Suggested Extensions into Other Curriculum Areas:</b>	See Colors of the Fall Language Arts Lessons 1 & 2.

### **Colors of the Fall**

Names of the Group Members: \_\_\_\_\_

1. Find three leaves from different deciduous trees. Identify the leaves using the field guide.

a. \_\_\_\_\_

- b. \_\_\_\_\_
- c. \_\_\_\_\_
2. Find three leaves or needles from an evergreen tree. Identify them.
- a. \_\_\_\_\_
- b. \_\_\_\_\_
- c. \_\_\_\_\_
3. Find a tree with yellow leaves and identify the tree.
- a. \_\_\_\_\_
4. Find a tree with red leaves and identify the tree.
- a. \_\_\_\_\_
5. Find a tree with dark green leaves and identify the tree
- a. \_\_\_\_\_
6. Find a leaf with a palmate veining pattern and identify it.
- a. \_\_\_\_\_
7. Find a leaf with a parallel veining pattern and identify it.
- a. \_\_\_\_\_
8. Find a leaf with a pinnate veining pattern and identify it.
- a. \_\_\_\_\_
9. What causes the leaves that have fallen from the trees to break down into small bits? \_\_\_\_\_
- \_\_\_\_\_
10. Do all trees lose their leaves at the same time? \_\_\_\_\_
11. How do some trees benefit by losing their leaves in the fall? \_\_\_\_\_
- \_\_\_\_\_
12. List any changes you notice in the weather and any animal signs that indicate that it is fall: \_\_\_\_\_

<b>Lesson Title:</b>	Colors of the Fall (Science lesson 2)
<b>Grade(s):</b>	9-12 (Could be adapted for Middle and Elementary students)
<b>Appropriate Science Areas:</b>	Life and Environmental
<b>Science</b>	Basic understanding of photosynthesis and its influence on

<b>Concept(s):</b>	seasonal changes in trees.
<b>Lesson Objective:</b>	<ul style="list-style-type: none"> <li>• Students will be able to observe the color pigments extracted from leaves.</li> <li>• Students will be able to compare the colors of the pigments with that of the original leaf.</li> <li>• Students will be able to record their observations.</li> <li>• Students will be able to infer why all the pigment colors are not visible in the leaf.</li> </ul>
<b>Georgia QCC Standards:</b>	<p><b>Environmental:</b></p> <ul style="list-style-type: none"> <li>• Inquiry, Process and Problem Solving: Uses science process skills in laboratory or field investigations, including observation, classification, communication, metric measurement, prediction, inference, collecting and analyzing data.</li> </ul> <p><b>Biology:</b></p> <ul style="list-style-type: none"> <li>• Research: Demonstrates appropriate use of reference sources to access, analyze, evaluate, and present information related to research problems.</li> <li>• Biochemistry (Photosynthesis and Respiration): Explains the processes of photosynthesis and respiration.</li> <li>• Classification: Discriminates relationships when using a classification model to group living things.</li> <li>• Diversity of Life (Kingdom Plantae: Seed Producers): Describes the similarities and differences of seed producing plants.</li> </ul>
<b>Background:</b>	See Science Lesson 1
<b>Materials:</b>	<p>For each group gather:</p> <ul style="list-style-type: none"> <li>• two small jars</li> <li>• two different kinds of leaves</li> <li>• scissors</li> <li>• rubbing alcohol</li> <li>• a metal spoon</li> <li>• two strips of white filter paper</li> <li>• tape</li> <li>• plastic wrap</li> <li>• two rubber bands</li> <li>• two pencils</li> <li>• data sheets</li> <li>• safety goggles</li> </ul>
<b>Preparation Time:</b>	Time to gather materials.
<b>Teaching Time:</b>	Approx. 60-75 minutes.
<b>Procedures:</b>	1. Cut each leaf into small pieces with the scissors. Put one

	<p>kind of leaf into each jar. Record the color of the leaves on the data sheet.</p> <ol style="list-style-type: none"> <li>2. Rub the leaf pieces against the sides of the jar with the back of the spoon.</li> <li>3. Pour enough alcohol into each jar to cover the leaf.</li> <li>4. Secure plastic wrap tightly over the top of the jars with the rubber bands. Let the mixture stand for at least 15 minutes.</li> <li>5. Tape one end of each filter paper strip to the center of a pencil.</li> <li>6. Remove the plastic wrap and hang a strip in each jar so that the end of the strip just touches the alcohol.</li> <li>7. Put the jars aside for 30 minutes.</li> <li>8. Remove the strips and let them dry for approximately 10 minutes. The students will now record their results onto the data sheet.</li> </ol>
<b>Key Questions:</b>	<ol style="list-style-type: none"> <li>1. What observations did you make on your data sheet?</li> <li>2. What can you infer from these observations</li> </ol>
<b>Student Evaluation:</b>	Data sheet and/or lab report.
<b>Related Activities:</b>	<ul style="list-style-type: none"> <li>• Leaf Scavenger Hunt</li> <li>• Colors of the Fall Science Lesson 1</li> <li>• Colors of the Fall Language Arts Lessons 1 &amp; 2</li> </ul>
<b>Suggested Extensions into Other Curriculum Areas:</b>	See Colors of the Fall Language Arts Lessons 1 & 2