

Colouring with Chlorophyll		Grade 3 Growth and Changes in Plants
<b>Lesson Plan</b>	<b>Safety Notes</b>	Ask an adult for help and use gloves when using rubbing alcohol.
<p><b>Description</b>            In this lesson, students will learn what makes leaves green, and what makes them change colours, especially in the fall. They will understand the basic characteristics of plants and what makes them grow.</p>		
<p><b>Materials</b></p> <ul style="list-style-type: none"> <li>• A glass or jar</li> <li>• A spoon or mortar and pestle</li> <li>• Rubbing alcohol</li> <li>• White coffee filters</li> <li>• Leaves or spinach leaves</li> <li>• Scissors</li> </ul>		
<p><b>Science Background</b></p> <p>All plants and animals have their own unique colour, and that is due to something called their <b>pigment</b>. A pigment is the natural coloured matter of the animal or plant tissue. Plants typically have a green pigment, which is called <b>chlorophyll</b>, and that is why most plants are green or have green parts. Chlorophyll is extremely important in <b>Photosynthesis</b>, which is the process in which plants turn energy from the sun into food. Chlorophyll allows the plants to actually absorb energy from the Sun's light. The chlorophyll is then able to transport this energy to reaction centres within the plants, where photosynthesis can begin.</p> <p>Photosynthesis is like a math equation:</p> $  \begin{array}{ccc}  \text{Carbon Dioxide} & & \\  \text{(the air we breathe out)} & + & \text{Water} \\  & \xrightarrow{\text{Sunlight}} & \\  & & \text{Glucose (sugar)} + \text{Oxygen} \\  & & \text{(the air we breathe in)}  \end{array}  $ <p>Plants take the air we breathe out, Carbon Dioxide, and water, and using the light from the sun, they are able to turn those into sugar and oxygen, which is the air we breathe in. Plants are extremely important in creating oxygen and therefore helping us breathe. As long as a plant can get enough light energy from the Sun, it is able to photosynthesize and stay green.</p> <p>So why do leaves change colour and fall off trees as winter approaches?            We have two different types of trees: <b>Deciduous</b> and <b>Coniferous</b>. Coniferous trees have cones and needle-like leaves. These are also known as evergreen trees, and are what we use as Christmas trees.</p>		

They stay green all winter. But Deciduous trees, like birch or maple, change the colour of their leaves in fall, and then lose them completely during winter. This is because during the winter, there is less sunlight during the day, and their leaves are more prone to frost damage. Which means that plants can't properly photosynthesize. Coniferous trees have a different leaf shape, which is more needle like. It is like a leaf rolled up really tight into this shape. This lets the tree conserve, or keep water. It also has a waxy coating on the outside of the needle to help protect it. Deciduous trees cannot do this, and so they cannot survive in the winter and must lose their leaves and lay dormant. This is almost like hibernating.

But that still doesn't answer the question of why trees change colour in the fall?

Remember that these leaves need sunlight to photosynthesize, and it is like a food source for them. So as the daylight gets less and less as winter approaches, there isn't enough sunlight for plants to photosynthesize. Because of this, it's harder for the chlorophyll to keep the plant green, and the chlorophyll starts running out. So essentially the leaf begins dying. They have to start eating the plant's stored food (glucose) instead of making more. It's as if the plant is hungry, and needs to eat the glucose to keep living. As the chlorophyll drains out of the leaf, the other pigments that produce reds and oranges, are visible. These pigments are in the plant all the time, but there is too much chlorophyll for them to be visible. The green colour is too strong for other colours to come through. Eventually, the glucose/food source will run out, and all the colours drain from the leaf, leaving it brown and dead. This will then detach, or break away from the tree, and fall to the ground.

### Activity Procedure

1. Collect 10 leaves. These leaves must be green. Use leaves growing on the trees. Spinach from your grocery store will work just as well.
2. Crush half (5) of your leaves with your spoon or pestle, until you start to see some juices/liquids coming from the leaves.
3. Once finished, place the crushed bits and juice into the glass
4. With the help of an adult place about 4-5 teaspoons of rubbing alcohol into the glass (about 20 – 25ml)
5. Use the scissors to cut out 1 inch by 5 inch strip of the coffee filter. This will be our chromatography paper. This does not have to be exact, but you want a long rectangle that will fit in the glass.
6. Place the strip with one end in the glass making sure it's in the plant and alcohol solution. Drape the other end so it hangs out of the cup.
7. Now all you have to do is wait! (It takes about 1-2 hours before results can be seen)
8. After about 2 hours come back to your chromatography experiment. Take out the coffee filter and look at the colours. You should be able to see different coloured bands. These colours are actually different types of chlorophyll located inside the plant!

\*While you are waiting for our chromatography reaction, you can do some fun colouring with chlorophyll. Using the extra leaves, try to colour on your page (handout) using the plants chlorophyll. You can either place a leaf down and press hard/rub it with your spoon, or bunch a few leaves

together and rub it on the page. The chlorophyll will get rubbed off and colour your page!

### **Debrief**

All plants have special adaptations that help them survive. The one thing that all plants have in common is the process of photosynthesis. They need to photosynthesize in order to stay green, and keep their chlorophyll, however it is natural for deciduous trees, and very few coniferous trees, to change colour and lose their leaves in order to survive the winter.

## Handout

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### Chromatography Experiment

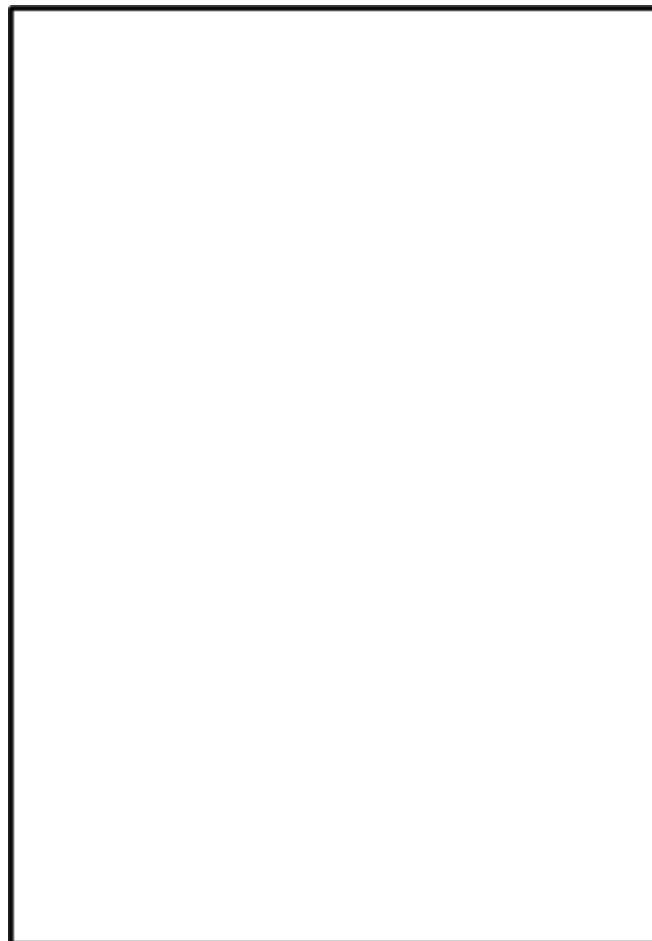
1a) What colour or colours do you see on the coffee filter?

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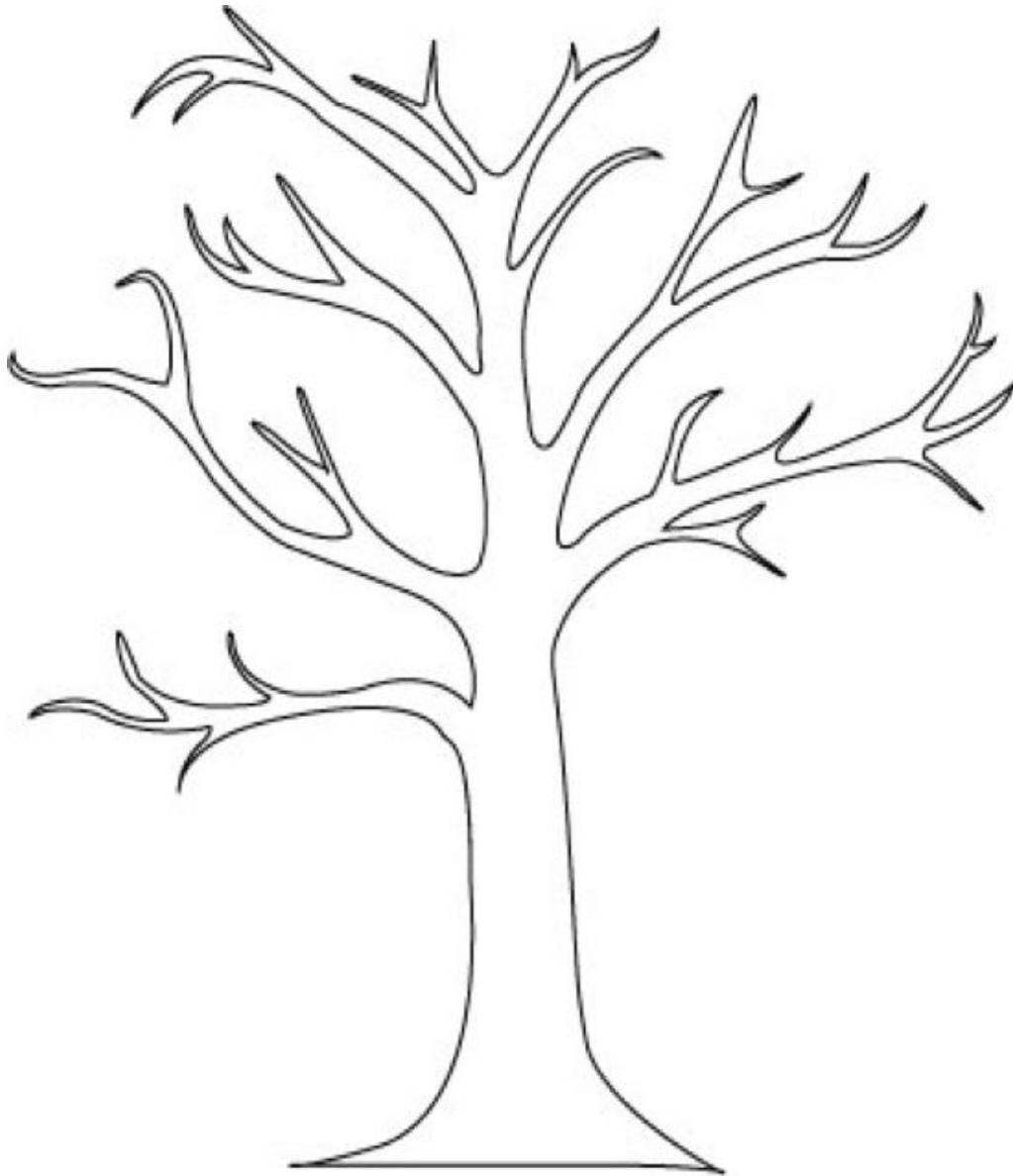
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1b) Draw out your coffee filter. Make sure you get all the different coloured bands. Use colours if you like.



## Colouring with Chlorophyll

Use the chlorophyll from your leftover leaves to colour the tree.



## Answers

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### Chromatography Experiment

1a) What colour or colours do you see on the coffee filter?

You should be able to observe different coloured bands of green from the different types of chlorophyll inside the plant.

1b) Draw out your coffee filter. Make sure you get all the different coloured bands. Use colours if you like.

Results will vary but should show the different coloured bands on the coffee filter.

