Tim Dowd
Hui Tang
EDSC 5543
12/6/06

Name:_____

A Pigment of your Imagination (Teacher's Guide)

Exploration

Materials Needed for one class with 24 students:

12 Green Leaves, of various trees
12 Turned Leaves, of the same trees so each group gets the same tree
Isopropyl Alcohol
12 Jars
12 Stirring Rods
2 Aluminum baking pans
12 Straws
12 Strips of Filter Paper
Tape
Refrigerator
Source of Hot Water

Safety

This lab uses isopropyl alcohol. It should be stressed to students that this is poison, and under no circumstances should they try to drink it (it is NOT the alcohol some adults drink.) Furthermore, it is flammable. The only appropriate heat source for this lab is a hot water bath. The students also need to wear goggles

This activity does not align with any of the PASS content standards for grade 3; it does, however, fall under Process Standard 4. It allows students to interpret data:

Process Standard 4.2: Recognize and Describe Patterns, then make predictions based on patterns.
Process Standard 4.3 Communicate the results of a simple investigation using drawings, tables, graphs and/or written and oral language.
(Oklahoma State Department of Education, 2002)

It also touches on standard C for grades K-4 in the National Science Education Standards:

As a result of activities in grades K-4, all students should develop an understanding of life cycles of organisms.

(National Research Council, 1996.)
The students only address this very briefly and it is not the central concept.

We did not assess this learning cycle and have not included an assessment. Teachers should consider whether this is truly appropriate for this age.

Procedure:

This lab is adapted from the original provided by a biological supply company (we aren't sure which one.) It may directly quote from it. The original lab was intended for 7-9th Graders. In short, the colored compounds are extracted from green leaves and from fall leaves using isopropyl alcohol. Filter paper is used to separate the colorful compounds by having them "climb" the paper using capillary action. The purpose of this original lab has been modified, it is now only so that students can see that there are things that are different colors in both green and fall leaves. They are not expected to know what capillary action is or that certain compounds move faster than others.

When we field tested the worksheet below, we ended up reading the directions to the students rather than have them using the worksheet. This made the lab more teacher centered, but we felt it was necessary due to the mixture of abilities that we had in the class. We also stopped and asked students to predict what would happen at various times, as we saw our teacher use this technique effectively.

Standards

Oklahoma Pass Standards:
Okalahoma State Department of Education. *Priority Academic Student Skills, 2002.* *http://www.sde.state.ok.us/home/defaultns.html*. *Accessed 11/7/2006*

National Science Education Standards:
National Research Council. *National Science Education Standards*
http://www.nap.edu/readingroom/books/nses/ Accessed 11/7/2006

--
Have you ever wondered about how a leaf that is green all summer long can turn into something red, or yellow, or even purple in the fall? The fall is one of the prettiest times of year, and today we're going to learn about where the leaf colors come from.

We are going to work in groups of four today. Each group will get 4 leaves. Two of your leaves will have changed color, and two will still be green. We are going to take some of the colorful chemicals out of the leaves so that we can look at these closer.

Step 1:

You need to tear up your leaves into very small pieces. Make them all smaller than your fingernail. Put the green leaves into one jar, and the colorful leaves into another.

{After reading this step and step 3 but before doing them is a good place to ask the students to predict what will happen}
Step 2:

Raise your hand and a teacher will come pour some rubbing alcohol into your jars. Please be careful with this- it is poisonous and could cause a fire. You cannot fool around with it at all.

Step 3:

Take your glass rod, and mash your leaves into the bottom of the jars. Keep doing this for 5 minutes. Everything that you are going to do to the jar is to make the color from the leaf go into the alcohol.

Step 4: Put the cap on your jars and twist a little, but don't close the jar all the way.

Step 5: Bring your jars up to the pan of water near the sink. They will stay there for 30 minutes.

The hot water bath should be a pan full of water that is refilled when it gets cool. The hotter the water is, the better. See http://www.sciencemadesimple.com/leaves.html for more information.

Step 6: Screw the cap onto the jar, put your name on a post-it note, and stick this to the jar. Give the jar to your teacher. By now, the color from the leaves should be in the alcohol!

You will do Step 7 the next day: {This is another good place to ask students to predict what the jars will look like}

Get a piece of filter paper and put it into the jar so it is standing up. Leave this alone for 90 minutes or more. {You need to explain this to the students. A good analogy as to what will happen is to ask if they have ever stepped into a puddle of water and noticed that the wetness crept up their pants}

Step 8: Draw what you see in the space below. Include a drawing for the paper from the green leaves and for the paper from the yellow leaves

1.) How are your two pieces of filter paper different? How are they the same?

They have similar lines, but the green lines are a lot brighter for the green leaves.

2.) Are any of the lines different from the green leaves and the colorful leaves?

The lines other than green should be the same, but the green should be a lot smaller in the colorful ones.

3.) Go to the whiteboard and write your names, and what color lines you saw in the table that is drawn there. Here is in an example of what you should write:

Names	**Green Leaves**	**Fall leaves**
Mr. Dowd and Mr. Tang	2 thick green lines-very dark 1 small red line	The green lines aren't as bright 1 small red line

A Pigment of your Imagination (Teacher's Guide)

Getting the Idea

1.) What happened when you put your leaf in the rubbing alcohol?

The rubbing alcohol started to become the color of the leaf.

2.) What happened when you put the filter paper into the rubbing alcohol?

The rubbing alcohol started to move up the paper.

3.) Where did the leaf color end up on the filter paper? Was it all together, or did it spread out?

It spread out into some different color lines.

4.) Every group has a leaf that was green, and one that had changed. These leafs came from the same tree. Looking at all of the groups, do you see one thing that was different between the green leafs and the fall leaves?

Lead them to the idea that all of the lines are the same between the two, but that the green ones are less bright in the fall ones.

5.) Except for the green ones, are the color lines the same between the leaves?

This depends on the leaf, but many of the lines will be.

6.) Why might the other colors besides green be hard to see in the summer?

All you can see is the green. Only one student was able to get to this point in our field trial.

7.) Why do leafs turn different colors in the fall?

This is because the green goes away.

8.) All of these colors come from different chemicals that are part of the plant. The green comes from a chemical called chlorophyll, which the plant needs to make food for itself. Is the plant making food in the fall as the leaves change? Why do you think this?

No, it isn't.

Concept Application name:_____

A Pigment of Your Imagination

Materials:
18 small jars
18 strips of filter paper- small enough to fit into the jars
Crayola markers of various colors
water

Safety:

This lab is expected to pose no safety risks other than those generally associated with 3rd graders.

In the last laboratory, you found out that the colors in leaves come from a number of different color chemicals, some of which are hidden by the summer green of the leaves.

This leads to an interesting question: are other colorful things in our lives made up of more than one color?

Let's think about a black Crayola marker. Do you think that this is made up of one color, or of more than one?

Using the same methods that we used with the leaves the other day, we can find this out.

{As in the previous step, we had to read the directions aloud as the students did each step. We did not follow the procedure exactly; whether the dot is 1.5 cm or near the middle is not very important. It just has to be out of the water}

Procedure

Your group will need the following materials:

Three (3) small jars
Three (3) Pieces of filter paper
1 black Crayola marker
2 other color Crayola markers (pick your favorite colors!)
A graduated cylinder for pouring water
A centimeter ruler

1.) On each piece of filter paper, put a big dot about 1.5 cm from the bottom of the paper. Use a different marker on each piece.
2.) Pour enough water into each jar so that it rises to 0.5 cm from the bottom of the jar.
3.) Put your filter paper in and let the water creep up the paper. What colors do you see?

This will be different for each color marker used. Black works the best, as there are purples, blues, yellows, and reds in it. Some other colors also separate into their components.

4.) Record your data in the table below:

Color of maker	Color of stripes on filter paper
Black	*Blue, purple, yellow, red*

5.) Go up to the big table on the whiteboard and record your data there so the whole class can see it.

6.) Are any of the colors made up of more than one hidden color?

Yes, several of them are.

7.) Are some colors just made up of one color?

Whether this was true will depend on what markers used. We cannot recall if we saw any in our field test.

8.) Let's say you had a chemical that was red, and another chemical that was yellow. How could you make a third color with this?

Mix the two chemicals together.

9.) In the space below, draw a yellow stripe. On top of that stripe, draw a red stripe.

Depending on what color markers are available, one could try red and blue as well. This doesn't make the most appealing color purple, however.

Name:_____

A Pigment of your Imagination

Exploration

Have you ever wondered about how a leaf that is green all summer long can turn into something red, or yellow, or even purple in the fall? The fall is one of the prettiest times of year, and today we're going to learn about where the leaf colors come from.

We are going to work in groups of four today. Each group of four will get 4 leaves. Two of your leaves will have changed color, and two will still be green. We are going to take some of the colorful chemicals out of the leaves so that we can look at these closer.

Step 1:

You need to tear up your leaves into very small pieces. Make them all smaller than your fingernail. Put the green leaves into one jar, and the colorful leaves into another.

Step 2:

Raise your hand and a teacher will come pour some rubbing alcohol into your jars. Please be careful with this- it is poisonous and could cause a fire. You cannot fool around with it at all.

Step 3:

Take your glass rod, and mash your leaves into the bottom of the jars. Keep doing this for 5 minutes. Everything that you are going to do to the jar is to make the color from the leaf go into the alcohol.

Step 4: Put the cap on your jars and twist a little, but don't close the jar all the way.

Step 5: Bring your jars up to the pan of water near the sink. They will stay there for 30 minutes.

Step 6: Screw the cap onto the jar, put your name on a post-it note, and stick this to the jar. Give the jar to your teacher. By now, the color from the leaves should be in the alcohol!

You will do Step 7 the next day:

Get a piece of filter paper and put it into the jar so it is standing up. Leave this alone for 90 minutes or more.

Step 8: Draw what you see in the space below. Include a drawing for the paper from the green leaves and for the paper from the yellow leaves

1.) How are your two pieces of filter paper different? How are they the same?

2.) Are any of the lines different from the green leaves and the colorful leaves?

3.) Go to the whiteboard and write your names, and what color lines you saw in the table that is drawn there. Here is in an example of what you should write:

Names	**Green Leaves**	**Fall leaves**
Mr. Dowd and Mr. Tang	2 thick green lines-very dark 1 small red line	The green lines aren't as bright 1 small red line

A Pigment of your Imagination

Getting the Idea

1.) What happened when you put your leaf in the rubbing alcohol?

2.) What happened when you put the filter paper into the rubbing alcohol?

3.) Where did the leaf color end up on the filter paper? Was it all together, or did it spread out?

4.) Every group has a leaf that was green, and one that had changed. These leafs came from the same tree. Looking at all of the groups, do you see one thing that was different between the green leafs and the fall leaves?

5.) Except for the green ones, are the color lines the same between the leaves?

6.) Why might the other colors besides green be hard to see in the summer?

7.) Why do leafs turn different colors in the fall?

8.) All of these colors come from different chemicals that are part of the plant. The green comes from a chemical called chlorophyll, which the plant needs to make food for itself. Is the plant making food in the fall as the leaves change? Why do you think this?

Concept Application name:_____

A Pigment of Your Imagination

Let's think about a black Crayola marker. Do you think that this is made up of one color, or of more than one?

Using the same methods that we used with the leaves the other day, we can find this out.

Procedure

Your group will need the following materials:

Three (3) small jars
Three (3) Pieces of filter paper
1 black Crayola marker
2 other color Crayola markers (pick your favorite colors!)
A graduated cylinder for pouring water
A centimeter ruler

1.) On each piece of filter paper, put a big dot about 1.5 cm from the bottom of the paper. Use a different marker on each piece.
2.) Pour enough water into each jar so that it rises to 0.5 cm from the bottom of the jar.
3.) Put your filter paper in and let the water creep up the paper. What colors do you see?

4.) Record your data in the table below:

Color of maker	Color of stripes on filter paper
Black	*Blue, purple, yellow, red*

5.) Go up to the big table on the whiteboard and record your data there so the whole class can see it.

6.) Are any of the colors made up of more than one hidden color?

7.) Are some colors just made up of one color?

8.) Let's say you had a chemical that was red, and another chemical that was yellow. How could you make a third color with this?

9.) In the space below, draw a yellow stripe. On top of that stripe, draw a red stripe.